March 2003

# AMATEUR RADIO



 ICOM IC-2720H dual-band FM transceiver

 Alinco DJ-S40T
 UHF handheld transceiver

Cardboard Box Antennas for OSCAR 40 Build a High-Performance Mic

Official Journal of

The national association r AMATEUR RADIO



Digital audio broadcasting arrives

# **New IC-R5**

Get winning performance with ICOM's new IC-R5. Crisp, clear audio. Super wide tuning range. A large, easy-to-read LCD display with the visual information you need — like operating status, signal strength, battery indicator, and alphanumeric naming for the 1250 memory channels (including 200 autowrite scan memories, and 25 scan edge pairs). Weather Alert keeps you informed of any weather emergencies. All in a compact, weather resistant package. ICOM. Setting a new standard in monitoring technology. See your authorized ICOM dealer today and join the winning team.

#### Wide Band Receive 495 kHz - 1309.995 MHz\*

Performa

AM/FM/WFM. Preprogrammed TV and HOT 100 Shortwave memories. Listen to AM & FM broadcast radio stations, police, fire, military, aircraft, various amateur bands, and more.

Weather Alert A first in handheld receivers! The weather alert function helps keep you informed of any weather emergencies, so you can respond fast. Great for when you're out in the field! (USA version only)

1250 Memory Channels With alphanumeric naming 1000 memory, 25 scan edge pairs, 200 auto-write scan memory channels (Max.100 x 18 banks). Quickly tune to your favorite frequencies!

Large Backlit Display Shows the receive frequency, battery indicator, relative signal strength, etc...

oad frequen

www.icomreceivers.com

Bhe from the

COM

COMMUNICATIONS RECEIVER IC-R5

## am/fm/wfm

#### IC-R5. Join the winning team.

100 kHz - 1309.995 MHz\* • 1250 Memory Channels with Alphanumeric Naming • CTCSS &

DTCS Decoder • Weather Alert • External Power Terminal • Internal Bar Antenna • Ni-Cd Power

• Weather Resistant Construction • Auto Squelch • PC Programmable (Optional Equip. Req.)

- External DC Jack For simultaneous charging and AC operation

> - Large Speaker For crisp, clear audio



ICOM

Small, Take-Anywhere Size Dimensions: 2<sup>1</sup>/4"W x 3<sup>3</sup>/4"H x 1"D Weight: 6 oz. approx.

Setting a new standard www.icomamerica.com

Connect to your PC for programming & cloning

Optional software (CS-R5) & cable (OPC-474) are required. USB type cable (OPC-478U) is also ovailable.

Rugged Construction Weather resistant construction makes the 'R5 great for active outdoor operation

Large Function Keys -For user friendly operation

> Internal Bar Antenna · For improved AM sensitivity

This device has not been approved by the FCC. This device may not be sold ar leased, or affered for sole or lease, until approval of the FCC has been obtained. \*Cellular frequencies blocked; unblocked versions available to FCC approved users. @2002 ICOM America, Inc. 2380 116th Ave NE, Bellevue, WA 98004, 425-454-8155. The ICOM logo is a registered trademark of ICOM, Inc. All specifications are subject to change without notice or abligation. RSOST1102

#### **K-746PRO.** Save \$20 1 get a FREE PS-125 Power COM HEAVHE TRANSCEIVE IC-746PRO 3.5 2 7 TUNER ANT USB 7.17 TUNE 6 NR-S-NOTCH TRANSMIT 28 🗐 SAL MW 144 EN A/B V/M M-CL 99.04 999 PHONES TS AGC A/NOTCH VOX BBK-IN P.AMP NR PILTER Inci 110 ELEC-KEY S-RE/SOL 4.20300 **M**1 DUP SCP ATX CLEAR AGC CMF TELL RIT/ATX MIC

Supercharged Performance!

AM/FM

FILTER

Purchase an IC-746PRO and SAVE \$200, *PLUS* receive a FREE PS-125 power supply. With 25 amps continuous, quieter RF operation, and a look matching the latest ICOM rigs, the PS-125 is the perfect companion to the '746PRO. Better hurry though, a deal this good won't last too long. See your participating ICOM dealer for more details.

MENU

CW PITCH KEY SPEED P AMP/ATT

SSR

CW/RTTY

#### **IC-746PRO** Features

- 32 BIT FLOATING POINT DSP & 24 BIT AD/DA CONVERTER. At the heart of the '746PRO, the DSP is an
  incredible tool for handling the QRM found on the bands.
- SELECTABLE DIGITAL IF FILTER SHAPES FOR SSB & CW. Tailor the filter shape & bandwidth to your personal operating preferences or band conditions. Sharp for selectivity and signal fidelity or soft for readability.
- AGC LOOP MANAGEMENT. Multiple AGC loops, controlled by the 32 bit DSP, filter out unwanted interfering signals, eliminating pumping of the AGC.
- AUTOMATIC NOTCH FILTER. Perfect for SSB operation to eliminate annoying heterodynes and "tune up", without effecting the receive audio.
- MANUAL NOTCH FILTER. Perfect for CW or digital operations, the 70db manual notch filter eliminates unwanted signal without effecting the actual passband of your filters.
- DIGITAL TWIN PASSBAND TUNING. Great for crowded bands, or contests, eliminates interfering signals by narrowing or or shifting the IF passband.
- BUILT-IN RITY DEMODULATOR & DECODER. External units or PCs are no longer required for RITY decoding. Twin peak audio filter, using the DSP unit, significantly reduces interfereing signals overlapping the tones.
- TWIN PEAK AUDIO FILTERS. Peak the signal audio used in the digital modes.
- DIGITAL RF SPEECH COMPRESSOR. Utilizes the 32 Bit DSP to provide the maximum punch without the fuzzy sound.
- MICROPHONE EQUALIZER. A total of 121 varieties of equalized audio can be set with the built-in microphone audio equalizer, tailored to operating style & microphone characteristics.

\*Limited time offer. See your participating authorized Icom dealer for details. \*\*\$400 MSRP (Manufacturer Suggested Retail Price) ©2002 ICOM America, Inc. 2380 116th Ave NE, Bellevue, WA 98004, 425-454-8155. The ICOM lago is a registered trademark of ICOM, Inc. All specifications are subject to change without notice or obligation. AM-5930 746PR0QST103

#### IC-746PRO. Leave the competition in the dust.

HF/6M/2M • 100W • All Mode • Enhanced Rx • 9600 Baud Ready • 32 Bit IF-DSP & 24 Bit AD/DA Converter • Independently Selectable IF Filter Shapes For SSB & CW • SSB/CW Synchronous Tuning • Built-in RTTY Decoder • Variable Level Noise Blanker • Auto & Manual Notch Filter • Digital Twin Passband Tuning • Mic Eaualizer • CW Memory Kever • VOX • Auto Antenna Tuner

#### FAST AND EASY FILTER SHAPING!



CHANGE FILTER SHAPES WITH THE PUSH OF A BUTTON AND THE TURN OF A KNOB - IT'S THAT EASY!

- TX AUDIO PASSBAND. Great for the "Perfect Audio" you are looking for by selecting from 2.2, 2.4, & 2.8 kHz bandwidths.
- RECEIVE AUDIO EQUALIZER. Allows you to set the audio style to ease listening fatigue during long hours of operation.
- SSB/CW SYNCHRONOUS TUNING. You no longer have to worry about changing from SSB to CW, the radio automatically shifts the VFO without losing the CW station you were copying.
- ADJUSTABLE NOISE BLANKER. Adjustable in 101 steps, this gives you control of the level of the noise blanker, to eliminate distortion of the desired signal.





Get in the drivers seat www.icomamerica.com



## **GET SUPERCHARGED**





### MH-C401FS

- **ADVANTAGES**
- Coolly charged in 100 minutes.
- > FLEX negative pulse algorithm allows the batteries to be complete charged.
- > Four independent charging circuits.
- Manually switch between 100 minute fast charge and 5 hour gentle charge.
- > Car kit included. Optional international travel adapter available.
- Take hundreds of photos 3 before recharging.

**ADVANTAGES** 

2000mAh.

batteries.

5

3.

Ultra high capacity

Last up to twice as lon

as ordinary rechargeable

- Battery carrying case 2 included.
  - Memory free operation.



MH-C777PLUS-II Universal Charger & Analyzer

MH-C204F Charger / Conditioner

## WWW.MAHAENERGY.COM

Maha, PowerEx are registered trademarks of Maha Energy Corporation. All other trademarks belong to their respective owners.







## DIAMOND'S STATE-OF-THE-ART

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

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



- 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

MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
NR72BNMO*6	2m/70cm	100	NMO	13.8	1/42, 1/22
NR73BNMO	2m/70cm	100	NMO	33.5	1/22, 1-5/82
NR770HA <sup>7</sup>	2m/70cm	200	UHF	40.2	1/2λ, 2-5/8λ
NR770HNM08	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	1/42, 6/82
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	7/82, 3-5/82

Not recommended for Magnet Mount

7

NR770HB same specifications but in black finish.

9 52-54MHz only

8 NR770HBNMO same specifications but in black finish.

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	1/22+3/82
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	1/42, 1/2+1/42/
CR627BNM0*6,9	70cm	120	NMO	60	2-5/82

& NR770SA.)

Patented One-Touch Fold-over Feature

(Not available on NR72BNMO, NR73BNMO,

 $1/4\lambda$  rated in dBi

#### www.rfparts.com/diamond

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

<sup>6</sup> Grounding required.



Mark J. Wilson, K1RO Publisher Steve Ford, WB8IMY Editor Joel P. Kleinman, N1BKE Managing Editor Stuart A. Cohen, N1SC Technical Editor Larry D. Wolfgang, WR1B; Dean Straw, N6BV; Robert Schetgen, KU7G Senior Assistant Technical Editors Ed Hare, W1RFI: Zack Lau, W1VT: Mike Tracy, KC1SX; Al Alvareztorres, AA1DO; Mike Gruber, W1MG Laboratory Staff Brennan Price, N4QX Product Review **Rick Lindquist, N1RL** Senior News Editor Dave Hassler, K7CCC Assistant News Editor Steve Ewald, WV1X Public Service Dan Henderson, N1ND Contests Mary E. Lau, N1VH At the Foundation Dave Patton, NT1N Amateur Radio World Bernie McClenny, W3UR How's DX? Bill Moore, NC1L DX Century Club Eileen Sapko VHF/UHF Century Club John Troster, W6ISQ; Diane Ortiz, K2DO; Stan Horzepa, WA1LOU; Paul L. Rinaldo, W4RI; Al Brogdon, W1AB; John Dilks, K2TQN; Rich Arland, K7SZ; H. Ward Silver, NØAX; Kirk Kleinschmidt, NTØZ; Tom Williams, WA1MBA; Gene Zimmerman, W3ZZ Contributing Editors Michelle Bloom, WB1ENT Production Supervisor Jodi Morin, KA1JPA Assistant Production Supervisor/Layout Sue Fagan Graphic Design Supervisor David Pingree, N1NAS Senior Technical Illustrator Michael Daniels Technical Illustrator Joe Shea, Paul Lappen Production Assistants Ed Vibert Proofreader Dennis Motschenbacher, K7BV Sales & Marketing Manager Joe Bottiglieri, AA1GW Advertising Sales Representative Carol Patton, KB1GAT Advertising Traffic Coordinator Debra Jahnke Circulation Manager Kathy Capodicasa, N1GZO Senior Fulfillment Supervisor In order to ensure prompt delivery, we ask that

you periodically check the address information on your mailing label. If you find any inaccuracies, please contact the Circulation Department immediately. Thank you for your assistance. See page 15 for detailed contact information. **Telephone: 860-594-0200 Fax: 860-594-0259** 

#### 4 March 2003 **Q5**∓∡

## March 2003 Volume 87 Number 3 CONTENTS Technical

- **28** Digital Audio Broadcasting Has Arrived—the Story of WOR Now that digital AM is a reality on the broadcast *Steve Ford, WB8IMY* bands, what does it mean for Amateur Radio technology?
- 32 Of Mics and Men

Tom Morton, W5TOM

Take advantage of the author's experimentation with home-brew microphone designs and roll your own.

**36** Beginners' Computer Programming for Ham Radio Steve Gradijan, WB5KIA Part 2—Ready to put what you've learned about *Delphi* and *Visual Basic* to work?

#### 68 Product Review

ICOM IC-2720H dual-band FM transceiver; Alinco DJ-S40T UHF handheld transceiver. Brennan Price, N4QX





## News and Features

9 "It Seems to Us..." Pride in Belonging

#### 12 ARRL in Action

Dave Hassler, K7CCC

DXCC's Moore discusses DXCC, Logbook of the World in Spain; new ARRL flyer for youngsters; updates on the Amateur Auxiliary and The Big Project; more.

#### 43 The 2003 Annual Meeting of the ARRL Board of Directors

Dave Patton, NT1N, and Dave Hassler, K7CCC Meeting January 17-18 in Connecticut, the ARRL Board addressed membership development, WRC-03 and more.

#### 47 The ITU 2002 Plenipotentiary Conference

Jon Silverling, WB3ERA, and Larry E. Price, W4RA Where does Amateur Radio fit in when the world's telecommunications planners get together to set policy?

#### 50 The ARRL Field Organization: Something for Everyone

Have an Amateur Radio-related skill? You can put *Dave Hassler, K7CCC* it to good use in the professional network of hams who are serving Amateur Radio and their communities in the ARRL Field Organization.

#### 73 Happenings

Rick Lindquist, N1RL

Amateur Radio's been good to WB6CUA, hence a donation to The Big Project; UTC grant engenders trained emergency communicators; proposed 5 MHz band could be on the horizon; more.

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

## **OST Workbench**

#### 55 The Doctor is IN

Calculating RF exposure for multi-transmitter stations; delving into key clicks.

57 Work OSCAR 40 with Cardboard Box Antennas! Anthony Monteiro, AA2TX Some satellite antennas are marvels of sophisticated technology. The pyramidal horn isn't among them.

50

- 63 Short Takes AALoa
- 64 Hands-On Radio Experiment #2-The emitter-follower amplifier.

Steve Ford, WB8IMY

H. Ward Silver, NØAX

RACES

Robert Schetgen, KU7G

#### 66 Hints & Kinks

An improvised resistor; an insulator for whip dipoles.





## Operating

102 2002 September VHF QSO Party Results 105 The 2002 ARRL 10 GHz and Up Contest

Departments

e 21:53

Continent ?? Distance ??

Band 432

Mode

Time (UTC)

UTC 02:53

B Report sent

Callsign

Report (cvd
 Name

🖸 ат<u>н</u>

ote time 21:53

Save

State

ITIL 22 CD 22 Beam heading 22

Gene Zimmerman, W3ZZ

Dan Henderson, N1ND

Grid

IOTA

OSL via

X Close ? Help

?

63

Amateur Radio World 9	3
Amateur Satellites 8	6
At the Foundation 10	1
Coming Conventions 9	6
Contest Corral 9	9
Correspondence 2	4
Digital Dimension	2
Feedback 4	9
Ham Ads 13	8
Hamfest Calendar 9	6
How's DX?	4
Index of Advertisers 15	8
Microwavelengths 8	2

New Books 100
New Products54, 89, 101
Old Radio 90
Public Service
QRP Power 80
Silent Keys
Special Events 100
Strays
Up Front in QST 20
W1AW Schedule
We're at Your Service 15
The World Above 50 MHz 87
75, 50 and 25 Years Ago 95



#### **Our Cover**

Build your own station microphone and amaze your friends with your fidelity-and your frugality. Photos by Tom Morton, W5TOM.

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

#### International

To compensate for additional postage for mailing outside the US, the following rates apply:

**Canada:** Membership in the ARRL, including a one year subscription to QST, \$49, payable in US funds. Life Membership, including a subscription to QST is available at \$1225.\* Libraries and institutions, \$49 per vear.

All Other Countries: Membership in the ARRL, including a one year subscription to *QST*, \$62, pay-able in US funds. Life Membership, including a subscription to QST is available at \$1550.\* Libraries and institutions, \$62 per year.

\*Payment arrangements available. Please write for details.

Membership without QST is available to the immediate family of a member living at the same address, and to anyone who is legally blind, for \$8 per year.

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

Copyright © 2003 by the American Radio Relay League Inc. Title registered at the US Patent Office. International copyright secured. All rights reserved. Quedan reservados todos los derechos. Printed in the USA.

QST<sup>®</sup>, DXCC<sup>®</sup>, VUCC<sup>®</sup>, DX Century Club<sup>®</sup>, ARES<sup>®</sup> and Amateur Radio Emergency Service® are registered trademarks of the American Radio Relay League, Inc.

The ARRL and QST in no way warrant the products described or reviewed herein.

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

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



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 21/16 inches diameter. Rotator size is 131/2Hx8D 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 21/16 inches diameter. Rotator size is 141/16Hx93/16D 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 snapaction brake and rotation control switches with disc brake release. Accepts mast sizes up to 21/8 diameter. Includes light duty lower mast support, Rotator size is 173/8Hx8 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<sup>1</sup>/<sub>8</sub> diameter. Includes light duty mast support. Rotator size is 17<sup>3</sup>/<sub>8</sub>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.



# hy-gaĭn. HF BEAMS...

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



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

The choice of top DXers. With 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is the "Big Daddy" of all HF beams! Handles 2000 Watts con-

tinuous, 4000 Watts PEP.

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

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

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

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

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

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

and trapped parasitic elements give you an excellent F/B ratio. Includes Hy-Gain's diecast

aluminum, rugged boom-to-mast clamp, heavy gauge element-toboom brackets, BN-86 balun. For high power, upgrade to BN-4000.

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

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

Separate air dielectric Hy-Q traps let you adjust for maxi-

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

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

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

Fits on average size lot with

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

The 2-element TH-2MK3 is Hy-Gain's most economical full power

(1.5kW PEP) full size tri-bander. For just \$339.95 you can greatly increase your effective radiat-

ed power and hear far better!

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

Hy-Gain's patented broadbanding Para Sleeve gives you clamps and BN-86 balun. room to spare -- turning radius is just 15.3 feet. Four piece boom is ideal for DXpeditions. Rotates with

mum F/B ratio on each band.

Also standard is Hy-Gain's

exclusive BetaMATCH™, stainless

steel hardware and compression

CD-45II or HAM-IV rotator. Features Hy-Gain BetaMatch™ for DC ground, full power Hy-Q<sup>™</sup> traps, rugged boom-to-mast bracket and mounts on standard 2"O.D. mast. Stainless steel hard-

ware. BN-86 balun recommended.

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

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

less than 2:1 VSWR. 1.5kW PEP. BetaMATCH<sup>TM</sup> provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled. Truly competitive against giant tri-banders at half the cost! QK-710, \$179.95. 30/40

Meter option kit for EXP-14.

Compact 3-element 10, 15, 20 Meter Tri-Bander For limited space . . . Installs anywhere . . . 14.75 ft turning radius . . . weighs 21 lbs . . . Rotate with CD-4511, HAM-IV TH-3JRS, \$359.95. Hy-Gain's most



popular 3-element 10, 15, 20 Meter tribander fits on most lots! Same top performance as the full power TH3MK4 in a compact 600 watt PEP design. Excellent gain and F/B ratio let you

ompete with the "big guns".

*Fits on light tower, suitable* **Tooled** manufacturing gives you *Hy-Gain* guyed *TV pole, roof tri-pod* durability with 80 MPH wind survival.

Model No.	No. of elements	avg Gain a dBd	dB	MaxPwr watts PEP	Bands Covered	Wind sq.ft. area	Wind (mph) Survival	Boom (feet)	Longest Elem. (ft)	Turning radius(ft)	Weight (lbs.)	Mast dia O.D.(in.)	Recom. Rotator	Retail Price
TH-11DX	11	For Gain	n and	4000	10,12,15,17,20	12.5	100	24	37	22	88	1.9-2.5	T2X	\$1159.95
TH-7DX	7	F/B ratio-	-See	1500	10, 15, 20	9.4	100	24	31	20	75	1.5-2.5	HAM-IV	\$869.95
TH-5MK2	5	- number of	ain aam	1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	\$759.95
TH-3MK4	3	• www.ny-ga	am.com	1500	10, 15, 20	4.6	95	14	27.42	15.33	35	1.9-2.5	CD-45II	\$469.95
TH-3JRS	3	•Hy-Gain c	atalog	600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-4511	\$359.95
TH-2MK3	2	<ul> <li>Call toll-fr</li> </ul>	ree	1500	10, 15, 20	3.25	80	6	27.3	14.25	20	1.9-2.5	CD-45II	\$369.95
EXP-14	4	800-973-	6572	1500	10,15,20	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM IV	\$599.95

#### Tooled Manufacturing . . . Highest Quality Materials

1. Hy-Gain's famous super strong tooled die cast Boom-to-Mast Clamp

2. Tooled Boom-to-Element Clamp

3. Thick-wall swaged aluminum tubing



Tooled manufacturing is the difference between Hy-Gain antennas and the others they just don't have it (it's expensive!).

Die-cast aluminum boom-to-mast bracket and element-to-boom compression clamps are made with specially tooled machinery.

Hy-Gain antennas feature tooled swaged tubing that is easily and securedly clamped in place. All tubing is deburred and cleaned for smooth and easy assembly.

Durable precision injection molded parts. Hy-Gain antennas are stronger, lighter, have less wind surface area, better wind survival, need no adjustments, look professional and last years longer.



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

## AMERITRON *True Legal Limit*™ Tuner

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

Call your dealer for your best price!



- Handles 1500 Watts carrier
- Super High Current edge-wound silver plated Roller Inductor
- 500 pf tuning capacitors with 6:1 vernier reduction drives
- 3 core choke balun
- 6 position antenna switch
- True peak reading meter

**AMERITRON's** ATR-30 True Legal Limit<sup>™</sup> roller inductor antenna tuner is ham radio's toughest! It'll handle 1500 Watts continuous carrier output on all modes and all HF bands into most antennas -- even on 160 Meters where most antenna tuners fail.

It's perfect for Ameritron's most powerful amplifiers where the ATR-30 just loafs.

All band coverage lets you operate 1.8-30 MHz including all MARS and WARC bands.

Super High Current Roller Inductor You'll see Ameritron's new super high current air core roller inductor. It's edge

wound from a thick solid copper strip and silver plated. This produces a large surface area and a massive conductor. It can carry huge circulating RF currents and withstand



tremendous heat that'll melt or burn ordinary roller inductors.

A gear driven turns counter and crank knob gives you precise inductance control.

#### **Two 500 pf Tuning Capacitors**

Two 500 pf -- the highest of any antenna tuner -- variable transmitting capacitors give you no-arc wide range impedance matching for true high power performance.

6:1 vernier reduction drives makes capacitor tuning smooth and easy.

Super Balun, 6 position Antenna Switch Super heavy duty three core choke balun lets you match virtually any balanced feedline antenna without core saturation.

A 6 position antenna switch lets you select your desired operating antenna.

#### Read true Peak Power

Ameritron's active electronic true peak reading meter accurately reads forward and reflected power and SWR simultaneously on a lighted Cross-Needle meter.

#### **Roomy Cabinet maintains High-Q**

Roomy extra-strong .080 inch thick aluminum cabinet gives highest efficiency and lowest loss. 13<sup>1</sup>/<sub>4</sub>Wx5<sup>5</sup>/<sub>8</sub>Hx17<sup>1</sup>/<sub>2</sub>D inches.

**AMERITRON ATR-15 Antenna Tuner** 



ATR-20, \$459. Handles a full 1.2 kW SSB and 600 Watts CW. It's designed to safely handle the full SSB

power of Ameritron's AL-811/811H/80B, ALS-500M/600 and other 1.2 kW SSB amplifiers. Compact all metal cabinet.

## Ameritron has the best selection of TrueLegalLimit<sup>TM</sup> HF Amplifiers

AMERITRON's legal limit amplifiers use Peter Dahl super heavy duty Hypersil power transformer capable of 2500 Watts! Ameritron's classic Amp Ameritron's toughest Amp Ameritron's most powerful Amp

with Eimac<sup>R</sup> 8877 ceramic tube



the herculean Eimac<sup>R</sup> 8877 ceramic tube. It's so powerful that 65 Watts drive gives you the full output power -- and it's just loafing because the power supply is capable of 2500 Watts PEP. All HF bands, all modes. 77 pounds, 181/2Dx17Wx10H in.

1.5 plus kW SSB HF Amp NearLegalLimit<sup>™</sup> Amp with four Svetlana<sup>R</sup> 572B tubes with 2 Eimac<sup>R</sup> 3CX800A7 tubes



AL-800H, \$2595 suggested retail. Two Eimac<sup>R</sup> 3CX800A7 tubes produces 1500 plus Watts SSB PEP with 55 Watts drive. 52 lbs., 81/2Hx161/2Dx141/4W in. AL-800, \$1775 suggested retail, single 3CX800A7, 1250 Watts out with 70 Watts drive.



AL-572, \$1395 suggested

Legal Limit<sup>™</sup> amplifier gives

retail. New class of Near

vou 1300 Watts SSB PEP

drive) for 65% of price of

3-second warm-up. 40 lbs.

full legal limit amps! Instant

81/2Hx151/2Dx141/2W inches.

power output (70 Watts

with Eimac<sup>R</sup> 3CX1200A7 tube AL-1200



Suggested Retail Get ham radio's toughest tube with AL-

1200. The Eimac<sup>R</sup> 3CX1200A7 has a 50 Watt control grid dissipation and the lowest history of field replacement of any modern transmitting tube that we use. 90 Watts in gives you full power out. All HF bands, all modes. 76 pounds, 181/2Dx17Wx10H in.

#### 1 kW Desktop HF Amp with Amperex<sup>R</sup> 3-500ZG tube



AL-80B, \$1299 suggested retail. Gives you full kilowatt SSB PEP output (85 Watts in) from a whisper quiet compact desk- top linear. 81/2 x14x 151/2 in. Plugs into 120 VAC outlet. Graphite plate Classic<sup>R</sup> 3-500Z tube. Nearly 70% efficiency. Weighs 48 lbs.

with 2 graphite plate Amperex<sup>®</sup> 3-500ZG tubes



AL-82 \$2495 Suggested Retail Most linears using 3-500s can't give you

1500 Watts because their lightweight power supplies can't use these tubes to their full potential. AL-82 is ham radio's only super 3-500 amp! 100 Watts in gives you full power out. All HF bands, all modes. Hefty 76 pounds, 18<sup>1</sup>/<sub>2</sub>Dx17Wx10H inches.

#### **Precision SWR/Wattmeter**

AWM-30, \$149 suggested retail. Active circuit gives true peak/average readings on lighted Cross-Needle meter. 3000/300 Watt ranges. Remote sensor.





the world's high power leader! 116 Willow Road, Starkville, MS 39759 TECH (662) 323-8211 · FAX (662) 323-6551 8 a.m. - 4:30 p.m. CST Monday - Friday For power amplifier components call (662) 323-8211 http://www.ameritron.com Prices and specifications subject to change without notice. '2000 Ameritron

#### THE AMERICAN RADIO RELAY LEAGUE INC

The American Radio Relay League Inc is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communication in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fratemalism and a high standard of conduct.

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.

#### Founding President (1914-1936) Hiram Percy Maxim, W1AW

#### Officers

President: JIM D. HAYNIE,\* W5JBP, 3226 Newcastle Dr, Dallas, TX 75220-1640; (214-366-9400); w5jbp@arrl.org First Vice President: JOEL M. HARRISON,\*

W5ZN, 528 Miller Rd, Judsonia, AR 72081; w5zn@arrl.org *Vice President:* KAY C. CRAIGIE, WT3P,

5 Faggs Manor Ln, Paoli, PA 19301; (610-993-9623); wt3p@arrl.org

Vice President: FRIED HEYN, WA6WZO, 962 Cheyenne St, Costa Mesa, CA 92626; (714-549-8516); wa6wzo@arrl.org

International Affairs Vice President: RODNEY STAFFORD, W6ROD, 5155 Shadow Estates, San Jose, CA 95135; (408-274-0492);

w6rod@arrl.org Chief Executive Officer: DAVID SUMNER,\* K1ZZ Secretary: DAVID SUMNER K1ZZ

Treasurer: JAMES McCOBB Jr. W1LLU

Chief Financial Officer: BARRY J. SHELLEY, N1VXY

Chief Operating Officer: MARK WILSON, K1RO Chief Development Officer: MARY HOBART, K1MMH

#### Staff

Technical Relations Manager Paul Rinaldo, W4RI General Counsel Christopher Imlay, W3KD Production & Editorial Department Manager: Steve Ford, WB8IMY Sales and Marketing Manager: Dennis Motschenbacher, K7BV Debra Jahnke, Sales/Circulation Manager Bob Inderbitzen, NQ1R, Marketing Manager Membership Services Department Manager: Wayne Mills, N7NG Field & Educational Services Department Manager: Rosalie White, K1STO

Volunteer Examiner Department Manager: Bart Jahnke, W9JJ

#### **Business Staff**

Business Manager: Barry J. Shelley, N1VXY Comptroller: LouAnn Campanello Information Services: Don Durand, Manager Office Manager: Robert Boucher \*Executive Committee Member

## "IT SEEMS TO US..."

### Pride in Belonging

Every meeting of the ARRL Board of Directors covers a myriad of topics ranging from weighty long-range issues to matters of esoteric detail. As is true during any meeting, the energy level in the room goes through peaks and valleys. A routine presentation on one subject may be followed by an emotionally charged debate on another—and once in a while something happens that makes everyone in the room glad to be there.

The 48 people who were in the Board Meeting room on Friday morning, January 17, will long remember six minutes of President Jim Haynie's report as the undisputed high point of the meeting. Jim, W5JBP, unveiled a project he had been working on for several months with volunteers and staff. During his visits on Capitol Hill, Jim had been frustrated that his "leave-behind" material was not more effective in continuing to sell Amateur Radio after the visit. Awardwinning television producer Dave Bell, W6AQ, agreed to accept the task of telling Amateur Radio's public service communications story in a few memorable minutes of video that could be put on a CD and distributed on the Hill and to other non-amateur audiences. With assistance from Bill Baker, W1BKR, arrangements were made for Walter Cronkite, KB2GSD, to provide the narration.

Simply put, the results are stunning. The principal focus of the video, called *Amateur Radio Today*, is on last summer's Hayman Fire in Colorado and the support provided by radio amateurs to the firefighters and other personnel. That riveting story is put in context with amateurs' responses to other disasters, including the World Trade Center attacks. Walter Cronkite, who became KB2GSD in order to have back-up communications from his sailboat, concludes by noting that Amateur Radio is probably the only fail-safe communications system in the world.

Today's Amateur Radio is multi-faceted and cannot be fully described in just six minutes. *Amateur Radio Today* concentrates on those aspects that are likely to be immediately understood by non-amateurs: providing public service communication and communication between students and the astronauts on board the International Space Station. But although we amateurs aren't the intended audience, any amateur who sees the video will feel great pride in belonging to the community of volunteers that makes these wonderful things happen.

Much has been written in recent years about the growing tendency for Americans *not* to belong. Increasingly, the landscape of American society is dotted with isolated islands of family and close friends. The memberships of traditional organizations are aging and shrinking. We define ourselves less and less through our voluntary associations with others. Belonging to a group that is greater than ourselves helps make life worth living. More and more, as a society and as individuals, we are missing out.

We can correct that, but let's be honest with ourselves. It takes more than a piece of paper with a call sign on it to make us a part of Amateur Radio's public service team. That's too passive. Belonging requires action. It takes commitment. It takes training.

A good place to start is with ARRL membership, an action you probably have already taken if you are reading these words. If you have not already made the commitment of becoming a volunteer in the ARRL Field Organization, read Dave Hassler's article beginning on page 50 of this issue. The title, *The ARRL Field Organization:* Something for Everyone, says it all.

If you act soon the third step, training, won't cost you anything but your time thanks to the grant to the ARRL from the Corporation for National and Community Service (CNCS). This federal grant to enhance homeland security already has funded the certification of hundreds of amateurs through the ARRL Amateur Radio Emergency Communications Course. As a result, the Amateur Radio community is better prepared than ever to heed the call whenever and wherever a natural disaster or other catastrophe may strike. The significance of the grant should not be lost on any of us. It is tangible evidence that the federal government sees us as partners in the effort to ensure the security of our nation and its citizens.

By the time this issue is in print, Amateur Radio Today should be widely available for use in promoting Amateur Radio to nonamateur audiences throughout the country and the world. Find a copy and take the six minutes to watch it. (Check the ARRL Web site, www.arrl.org/ARToday/, for the latest news on availability.) You will swell with pride as you watch and hear one of the most respected and recognized Americans of all time extol the virtues of Amateur Radio, which means so much to all of us.

But don't stop there. As you watch the sailboat in the closing scene, imagine that it represents Amateur Radio and think about where you are on the screen. Are you helping trim the sails? Are you helping maintain a steady hand on the tiller? Or are you out of sight beneath the surface, a barnacle perhaps, not impeding progress very much but just along for the ride while others do the work?

Amateur Radio has been given an incredible billing. Now we must live up to it. —David Sumner, K1ZZ









Yagis, Quads, Loops and other Beam Antennas

Contents -

Monobanders: Beams for your favorite band

The "WOW" Factor: Can you believe this?

Multibanders: Beams that cover two or more bands

HF, VHF and UHF Beams: From 80 meters to 2304 MHz

Computer Modeling: Optimize your beam's performance

Towers, Masts and Guys: Your beam needs solid support

#### Nine chapters cover some of the most effective antennas...Yagis, Quads, Loops, and other Beam Antennas

Enjoy this collection of some of the very best articles from QST, QEX, NCJ and other ARRL publications. The beam antennas covered in this book will provide the reader with a historical perspective, new and ambitious ideas, and computer-optimized designs for all-around best performance.

Read about beams or actually build one of your own! Discover a wealth of ideas from some of the leaders in antenna design and experimentation of the last 70 years. See classic ads and photos from the pages of QST.

#### **ARRL's Yagi Antenna Classics** ARRL Order No. 8187...\$17.95\*

\*Shipping and handling charges apply. Sales tax is required for orders shipped to CA, CT VA, and Canada.

Prices and product availability are subject to change without notice.



SHOP DIRECT or call for a dealer near you. ONLINE WWW.ARRL.ORG/SHOP ORDER TOLL-FREE 888/277-5289 (US)

OST 3/2003

from

vour ARRL

ublication Dealer!

# NO COOLING FAN COOL AND QUIET 65 W OPERATION

Yaesu's FT-2800M, the most ruggedly-built 2-meter amateur transceiver ever, provides 65 Watts of power along with Yaesu's renowned bullet-proof receiver front end. Direct keypad frequency entry, Alpha-Numeric Memory System, the high power output, and unsurpassed ergonomics make the FT-2800M an operator's dream come true!



The all-new heat sink of the FT-2800M provides more effective cooling than any other design, allowing long transmission periods without dangerous heat build-up or power reduction due to thermal protection. High power output, a huge, easy-toread display, and one-touch WIRES<sup>™</sup> Internet Linking Access capability are yours with the exciting new FT-2800M.

On transmit, the 65 Watts of true FM power output provides you with excellent coverage and superb voice clarity. On receive, you get extended coverage of 134-174 MHz, with a special memory bank dedicated to the NOAA Weather Broadcast Channels (U.S. version only).

Built to the exacting requirements of both the commercial radio industry, as well as the U.S. military's MIL-STD 810, the FT-2800M is constructed using an aluminum diecast chassis/heatsink assembly, providing outstanding mechanical and thermal stability for the internal components.

With superb ergonomics to go along with its stout RF design, the FT-2800M is ready for action, at home or away!

## HEAVY-DUTY VHF FM TRANSCEIVER

ACTUAL SIZE

23

For the latest Yaesu news, visit us on the Internet: http://www.vxstdusa.com pecifications subject to change without notice. Some accessories and/or options may be andard in certain areas. Frequency coverage may differ in some countries. Check with our ional Yaesu Dealer for specific details. Specifications guaranteed only in 2-meter

- M TRANSPORT

DW

83

REV

A/N

LOW

BUSY

SET

MHz



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

**99** 

MW

D/MR



### Moore addresses DXCC, QSL future in Spain

Bill Moore, NC1L, ARRL DXCC Manager, traveled to Spain December 7 to give a talk to the Unión de Radioaficionados Españoles (URE) convention on the DXCC Award and the future of electronic QSL cards. "The award's very popular in Europe and we get a lot of support from foreign members," said Moore, who was given an hour and a half to speak. He covered DXCC administrative procedures and newly approved operations during the URE-financed trip. In a question-and-answer session, electronic QSLing and the forthcoming ARRL Logbook of the World were the hot topics. "They wanted to know the status of the project and they're very understanding of why we don't [currently] accept electronic QSL cards for DXCC," he said.

The Logbook of the World (LOTW) is cur-



Moore had time for a day trip to Morocco, where he got a chance to consider options in transportation.

rently in beta test and will likely be available for general use later this year, said ARRL Special Assistant to the Chief Executive Officer David Patton, NT1N. LOTW is an electronic alternative to traditional QSLing designed mainly for the purpose of obtaining operating award credit without having to obtain paper QSLs or ship QSL cards to sponsors.

Moore said the DXCC presentation was well received at the convention and that the Spaniards "really extended themselves in making me feel welcome. You can check cards anytime, but at conventions you get to actually meet people, shake hands and break bread with the people who you've corresponded and worked with on DXCC for years."

#### Youth-oriented television PSA available

A public service announcement called "The High-Tech World of Amateur Radio" is now available from the ARRL. The 30-second spot, produced by the San Francisco chapter of the International Television Association (ITVA), features teenage actors promoting the various facets of ham radio. ITVA granted ARRL permission to duplicate and distribute the spot, and ARRL member Bill Pasternak. WA6ITF. added appropriate League contact information. The spot, in Beta-SP format, is available upon request by contacting Media Relations Manager Jennifer Hagy, N1TDY, at 860-594-0328, or by e-mail at jhagy@arrl.org. Members are asked to determine media interest before requesting a copy.

#### New flyer urges kids to "Leap into Amateur Radio"

A colorful new kid-tested ham radio brochure aimed at elementary school-age children is available from ARRL Headquarters. "Leap into Amateur Radio" is a full-color, tri-fold flyer that introduces youngsters to the hobby.

There were two objectives in designing the new brochure, said Mary Lau, N1VH, who headed the team that made it. "There was a desire to specifically target 8 to 11 year olds as well as the need to supply a youth-oriented handout to replace the Archie comic book that is no longer published."

The brochure is comprised of colorful graphics, pictures of children enjoying ham radio and several boxes containing text that explains what Amateur Radio is and does. There's also room on the back for a local club or organization to affix its contact information for children and their families who wish to follow up.

Lau said the effort to produce the new brochure began last September. She was aided by ARRL Educational Program Coordinator Jean Wolfgang, WB3IOS; Educational Correspondent Marjorie Bourgoin, KB1DCO, and Field and Educational Services Assistant Linda Mullally, KB1HSV.

After assembling the material for the flyer and putting a prototype together, Lau and her staff got the brochure into the hands of a number of area kids for some product testing. The final layout and design was put together by Cameo Hill, a graphic artist based in Arizona, who also designed the brochure for ARRL's Education and Technology Program. Hill is the daughter of ARRL staffer Jerry Hill, KH6HU.

The new brochure is available to any Amateur Radio operator in limited quantities of 25 to 100. The only charge is \$4 for the cost of postage. To order, interested clubs or individual hams should contact Linda Mullally, tel 860-594-0292, or **lmullally@arrl.org**. The brochure is also available on the ARRL Web site in PDF format at **www.arrl.org/FandES/ead/materials/Leap-into-AR.pdf**.



This colorful new flyer is aimed at kids age 8-11.



Bill Moore, NC1L (far right), checks out operation at the EA QSL Bureau during a trip to Spain to speak to the URE National Convention on the DXCC Award and the future of electronic QSLing.

#### Amateur Auxiliary Helps with Interference Issues

ARRL Field and Regulatory Correspondent Chuck Skolaut, KØBOG, contacted a number of Official Observer Coordinators (OOC) in December and January after the FCC's Field Operations Bureau requested the help of the Amateur Auxiliary. Interference to running nets and inappropriate language has cropped up on specific frequencies on the 75 and 20 meter phone bands, Skolaut said, with the appropriate section OOCs mobilizing their cadre of Official Observers to monitor and document the alleged problems. Problems in the Midwest in regard to 2 meter FM simplex operation are also being monitored.

Interference in the form of possible harmonics from a broadcast station have been showing up in the vicinity of 14.300 MHz, especially on the east coast of North America, and Skolaut said IARU monitors (who are responsible for cases involving nonamateur-to-amateur interference) and their staffs are keeping an ear out. "We really try to limit the response to the specific area of the problem," he said. "If you send out a blanket request [to monitor] over regular channels, it can sometimes cause the perpetrator to stop operating for a while, or move to a different frequency."

The Official Observer program, a 54-year-old effort of the ARRL, helps hams who may be operating outside of good operating practice or FCC rules before they come to the attention of the FCC. This help is in the form of a simple and friendly postcard. In the case of repeated violations, the Amateur Auxiliary may be called upon to document specific occurrences for the FCC.

Skolaut said the on-line reporting system the ARRL has in place for OOCs and OOs has greatly shortened the time between identifying an ongoing problem and having the FCC do something about it. Normally, documentation obtained by OOs is forwarded to ARRL HQ for review. If it appears warranted, the information is then passed on to the FCC for its review and possible action. There are over 750 OOs nationwide, with 30 added to the ranks in the past few months. Information about the program and an application are available on the ARRL Web site at **www.arrl.org/FandES/field/org/oo.html**.

#### Kid's Day Certificate Available on the Web

ARRL Field and Education Services helped sponsor another successful winter Kid's Day on January 4. Over 900 youngsters participated, with the 8-12 age range the most represented. ARRL Educational Program Coordinator Jean Wolfgang, WB3IOS, responded to numerous pre-event e-mails and phone calls, and made a Certificate of Participation available on the ARRLWeb so that kids can get them as quickly as possible. The questionnaire and certificate are available at www.arrl.org/FandES/ead/kids-day-survey.html.

"The comments are always fun to read and I can almost see the hams smiling as they type them in," Wolfgang commented.

Rodger Alexander, KK7LK, of Bellingham, Washington, helped supervise seven children, who made 19 contacts from the Mt Baker Amateur Radio Club station, K7SKW, located at the Whatcom County Search and Rescue Building. "The final contact was to Tokyo," Alexander commented. "There were high-fives all around from the kids when the Japanese station came back to their CQ. The kids were very excited and want to do it again."

#### The Big Project curriculum, number of schools grow

It was a busy winter for ARRL Education and Technology Program Coordinator Jerry Hill, KH6HU. In December, 13 new pilot schools and one progress grant school were added to the program, also known as "The Big Project," raising the total to 40 participating schools. Hill bundled up station packages for the pilot schools for delivery in January and donated a number of his lunch breaks to serve as net control for a Big Project net on Tuesday and Thursday afternoons.

"The students get real world lessons on the air," Hill said. "They see the need for clear speech and phonetics when they talk to each other, and they learn about propagation when they can hear one station and not another in the roundtable. When they're talking with other kids, the reality of it all hits them."

Hill has also hit the books, delving into the new Technician class question pool and making appropriate changes to the progression of the program's curriculum. Further, Hill has been updating the Education and Technology Program so it can provide a better offering to teachers and students. The first major effort is to branch out from the curriculum, evolving appropriate middle school-level material from the current draft now being tested by the pilot schools. A curriculum aimed at older elementary school students is in the early planning stages. Also, Hill has added material on other wireless technologies that make up a part of the students' world: satellite radio and television, cellular telephone



Josh Reisenauer, KD7TCK, gets in some soldering practice as part of the Amateur Radio License Class at University High School in Spokane, Washington. The class, run by instructor Steve LaLonde, WA7WKX, got a big boost with the donation of a number of 2 meter FM handheld radios from Gary Webbenhurst, AB7NI.



Neill Horstmann, KF6OWB, takes in the action as Robbie Calvert, KD7OMS, operates his packet station. Both boys have taken and passed Elements 1, 2 and 3 to earn General class licenses.

service, Family Radio Service (FRS) and RF remote control.

"The curriculum is a foundation to keep building upon," he said. "It's a living document. We can add new lessons and take old ones out. It will continually evolve."

In that same vein of growth, Hill said the Education and Technology Program e-mail reflector is proving to be a fountain of ideas for building an "on-line sourcebook" for the program, scheduled to be on the Internet June 1. "One real advantage of the sourcebook being on the Web is that homeschoolers can access the material," he said. "To be in the Big Project, with all its resources, it takes a full school. But from the Web, all students have equal access to the material."

## **Guide to ARRL Member Services**





### www.arrl.org/services.html/



#### Technical and Regulatory Information Services

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

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

#### **ARRLWeb** www.arrl.org

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

#### **ARRL E-mail Forwarding**

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

#### **ARRL News**

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

#### **QSL Service**

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

#### Write for **QST**

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

#### **Educational Materials**

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

#### Insurance

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

#### DXCC/VUCC

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

#### Volunteer Examiner Coordinator (VEC)

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

#### **Trust in Advertising**

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

#### **ARRL Foundation**

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

#### Interested in Becoming a Ham?

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

#### We're at your Service

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

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

*Telephone* 860-594-0338

860-594-0338

860-594-0355

860-594-0222

860-594-0236

860-594-0300

860-594-0267

860-594-0232

860-594-0214

860-594-0234

860-594-0288

860-594-0397

860-594-0207

860-594-0328

860-594-0274

860-594-0230

860-594-0265

860-594-0267

860-594-0262

860-594-0273

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

Joining ARRL **QST** Deliverv Publication Orders **Amateur Radio News Regulatory Info** Exams **Educational Materials** Contests **Technical Questions** DXCC Awards/VUCC **Development Office** Advertising Media Relations **QSL** Service Scholarships **Emergency Comm** Clubs Hamfests Write for 057-

Contact Membership Desk Circulation Desk Sales Desk Rick Lindquist, N1RL John Hennessee VEC **Educational Services** Dan Henderson ARRL Lab Bill Moore Eileen Sapko Mary Hobart Advertising Desk Jennifer Hagy Martin Cook Mary Lau Steve Ewald **Field Services** Gail Iannone

Joel Kleinman

Electronic Mail membership@arrl.org circulation@arrl.org pubsales@arrl.org n1rl@arrl.org reginfo@arrl.org vec@arrl.org ead@arrl.org contests@arrl.org tis@arrl.org dxcc@arrl.org awards@arrl.org mhobart@arrl.org ads@arrl.org newsmedia@arrl.org buro@arrl.org foundation@arrl.org emergency@arrl.org clubs@arrl.org hamfests@arrl.org gst@arrl.org

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

## **ARRL** Division Directors

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

#### **Atlantic Division**

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

#### **Central Division**

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

#### **Dakota Division**

JAY BELLOWS, KØQB 997 Portland Ave, St Paul, MN 55104 (651-983-2420); k0qb@arrl.org Vice Director: Twila Greenheck, NØJPH 3333 Owasso Heights Rd, Shoreview, MN 55126 (651-483-1214); n0jph@arrl.org

#### **Delta Division**

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

#### **Great Lakes Division**

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

\*Executive Committee member

#### **Hudson Division**

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

#### **Midwest Division**

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

#### **New England Division**

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

#### **Northwestern Division**

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

#### **Pacific Division**

JIM MAXWELL, W6CF PO Box 473, Redwood Estates, CA 95044 (408-353-3911); w6cf@arrl.org Vice Director: Bob Vallio, W6RGG 18655 Sheffield Rd, Castro Valley, CA 94546 (510-537-6704); w6rgg@arrl.org

#### **Roanoke Division**

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

#### **Rocky Mountain Division**

WALT STINSON, W0CP 5295 E Evans Ave, Denver, CO 80222-5221 (303-770-3926); w0cp@arrl.org Vice Director: Warren G. "Rev" Morton, WS7W 1341 Trojan Dr, Casper, WY 82609 (307-235-2799); ws7w@arrl.org

#### **Southeastern Division**

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

#### Southwestern Division

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

#### **West Gulf Division**

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



Once you have provided

for the people you love,

we hope you'll consider

a bequest to the American

Radio Relay League, Inc.

Become a member



#### Mary M. Hobart, K1MMH Chief Development Officer ARRL 225 Main Street Newington CT 06111-1494 Telephone: 860-594-0397

Telephone: 860-594-0397 Email: mhobart@arrl.org



## **ARRL Section Managers**

The 15 divisions of ARRL are arranged into 71 administrative sections, each headed by an elected section manager (SM). Your section manager is the person to contact when you have news about your activities, or those of your club. If you need assistance with a local problem, your section manager is your first point of contact. He or she can put you in touch with various ARRL volunteers who can help (such as technical specialists). Your section manager is also the person to see if you'd like to become a section volunteer. Whatever your license class, your SM has an appointment available. Visit your section page on the Web at www.arrl.org/sections/.

Atlantic Division (DE, EPA, MDC, NNY, SNJ, WNY, WPA) Delaware: Randall K. Carlson, WB0JJX, 121 Scarborough Park Dr, No. 10, Wilmington, DE 19804 (302-655-6179); wb0jjx@arrl.org

*Eastern Pennsylvania*: Eric Olena, WB3FPL, 284 Blimline Rd, Mohnton, PA 19540 (610-775-0526); wb3fpl@arrl.org Maryland-DC: Tom Abernethy, W3TOM, PO Box 73, Accokeek, MD 20607

(301-292-6263); w3tom@arrl.org

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

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

Western New York: Scott Bauer, W2LC, 1964 Connors Rd, Baldwinsville, NY 13027 Western Pennsylvania: John V. Rodgers, N3MSE, 803 S Main St, Butler, PA 16001-6326 (724-287-0424); n3mse@arrl.org

#### **Central Division (IL, IN, WI)**

Illinois: Sharon Harlan, N9SH, 5931 Alma Dr, Rockford, IL 61108 (815-398-2683); n9sh@arrl.org Indiana: James S. Sellers, K9ZBM, 54676 County Road 8, Middlebury, IN 46540-8710 (574-825-5425); K9zbm@arrl.org Wisconsin: Donald Michalski, W9IXG, 4214 Mohawk Dr, Madison, WI 53711 (608-274-1886); w9ixg@arrl.org

Dakota Division (MN, ND, SD) Minnesota: Randy "Max" Wendel, KMØD, 8539 Bryant Ave S, Bloomington, MN 55420-2147 (952-888-5953); km0d@arrl.org North Dakota: Kent Olson, KAØLDG, 7702 Forest River Rd, Fargo, ND 58104-8004 (701-298-0956); ka0ldg@arrl.org South Dakota: Richard L. Beebe, NØPV, 913 S Gordon Dr, Sioux Falls, SD 57110-3151 (605-332-1434); n0pv@arrl.org

#### Delta Division (AR, LA, MS, TN)

Arkansas: Bob Ideker, WB5VUH, 103 Duquesne Ct, Little Rock, AR 72223 (501-868-8847); wb5vuh@arrl.org Louisiana: Mickey Cox, K5MC, 754 Cheniere-Drew Rd, West Monroe, LA 71291 (318-397-1980); k5mc@arrl.org Mississippi: Malcolm Keown, W5XX, 14 Lake Circle Dr, Vicksburg, MS 39180 (601-636-0827); w5xx@arrl.org Tennessee: Terry Cox, KB4KA, 110 Fisherville Rd, Collierville, TN 38017 (901-854-4191); kb4ka@arrl.org

#### Great Lakes Division (KY, MI, OH)

Kentucky: John D. Meyers, NB4K, 218 Cory Ln, Butler, KY 41006-9740 (859-472-6690); nb4k@arrl.org Michigan: Debbie Kirkbride, KA8YKK, Apt 1, 1315 Center Ave, Bay City, MI 48708-6107 (989-892-1212); ka8ykk@arrl.org Ohio: Joseph J. Phillips, K8QOE, 2800 Jupiter Dr, Fairfield, OH 45014-5022 (513-874-0006); k8qoe@arrl.org

Hudson Division (ENY, NLI, NNJ) Eastern New York: Pete Cecere, N2YJZ, 378 Ohayo Mtn Rd, Woodstock, NY 12498 (845-679-9846); n2yjz@arrl.org NYC-Long Island: George Tranos, N2GA, PO Box 296, Bellport, NY 11713 (631-286-7562); n2ga@arrl.org Northern New Jersey: William Hudzik, W2UDT, 111 Preston Dr, Gillette, NJ 07933 (908-580-0493); w2udt@arrl.org

#### Midwest Division (IA, KS, MO, NE)

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

*Kansas*: Ronald D. Cowan, KB0DTI, PO Box 36, LaCygne, KS 66040 (913-757-4455); **kb0dti@arrl.org** *Missouri:* Dale C. Bagley, K0KY, PO Box 13, Macon, MO 63552-1822 (660-385-3629); **k0ky@arrl.org** 

(402-734-3316); ke0xq@arrl.org

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

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

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

Maine: William Woodhead, N1KAT, 68 Madison St, Auburn, ME 04210

(207-782-4862); n1kat@arrl.org

(20/-782-4862); n1kat@arri.org New Hampshire: AI Shuman, N1FIK, PO Box 119, Goffstown, NH 03045-0119 (603-487-3333); n1fik@arrl.org Rhode Island: Bob Beaudet, W1YRC, 30 Rocky Crest Rd, Cumberland, RI 02864 (401-333-2129); w1yrc@arrl.org Vermont: Paul N. Gayet, AA1SU, 124 Macrae Rd, Colchester, VT 05446 (802-860-1134); aa1su@arrl.org Western Massachusetts: William Voedisch, W1UD, 240 Main St, Loomischer MA 01452 (273 6270 Main St, M140 Carel are

Leominster, MA 01453 (978-537-2502); w1ud@arrl.org

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

Alaska: David Stevens, KL7EB, PO Box 113242, Anchorage, AK 99511 (907-345-6506); kl7eb@arrl.org Eastern Washington: Kyle Pugh, KA7CSP, 5006 W Houston Ave, Spokane, WA 99208 (509-327-5039); ka7csp@arrl.org Idaho: John J. Cline, K7BDS, 1475 Oriole Way, Boise, ID 83709 (208-376-6045); k7bds@arrl.org Montana: Darrell Thomas, N7KOR, 743 33rd Ave NE, Great Falls, MT 59404 (406-453-8574); **n7kor@arrl.org** *Oregon:* Marshall D. Johnson Sr, KK7CW, 1645 9th Ave SE #171, Albany, OR 97322 (541-990-3127); **kk7cw@arrl.org** Western Washington: Harry Lewis, W7JWJ, 10352 Sand Point Way NE, Seattle, WA 98125 (206-523-9117); w7jwj@arrl.org Pacific Division (EB, NV, PAC, SV, SF, SJV, SCV) East Bay: Andy Oppel, N6AJO, 1308 Burbank St, Alameda, CA 94501-3946 (510-864-2299); n6ajo@arrl.org Nevada: Dick Flanagan, W6OLD, 2851 Esaw St, Minden, NV 89423 (775-267-4900); w6old@arrl.org Pacific: Bob Schneider, AH6J, PO Box 131, Keaau, HI 96749 (808-966-8146); ah6j@arrl.org Sacramento Valley: Jettie Hill, W6RFF, 306 Saint Charles Ct, Roseville, CA 95661-5008 (916-783-0383); w6rff@arrl.org San Francisco: Leonard Gwinn, WA6KLK, 2960 Blackhawk Dr,

Willits, CA 95490-9704 (707-459-1871); wa6klk@arrl.org Willis, CA 93595704 (7074351671), waakike arri.org San Joaquin Valley: Charles P. McConnell, W6DPD, 1658 W Mesa Ave, Fresno, CA 93711-1944 (559-431-2038); w6dpd@arrl.org Santa Clara Valley: Glenn Thomas, WB6W, 502 Walnut Dr, Milpitas, CA 95035-4133 (408-263-9450); wb6w@arrl.org

#### Roanoke Division (NC, SC, VA, WVA)

North Carolina: John Covington, W4CC, PO Box 1604, Belmont, NC 28012 (704-577-9405); w4cc@arrl.org South Carolina: James F. Boehner, N2ZZ, 525 Barnwell Ave NW, Aiken, SC 29801-3939 (803-641-9140); n2zz@arrl.org Virginia: Carl Clements, W4CAC, 4405 Wake Forest Rd, Portsmouth, VA 23703 West Virginia: Hal L. Turley, KC8FS, 6 Ives Dr, Huntington, WV 25705 (304-736-2790); kc8fs@arrl.org

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

Colorado: Jeff Ryan, KØRM, 6721 Northface Ln, Colorado Springs, CO 80919-1508 (719-260-6826); k0rm@arrl.org New Mexico: Joe Knight, WSPDY, 10408 Snow Heights Blvd NE, Albuquerque, NM 87112 (505-299-4581); w5pdy@arrl.org Utah: Mel Parkes, AC7CP, 2166 E 2100 North, Layton, UT 84040 (801-547-1753); ac7cp@arrl.org Wyoming: Robert Williams, N7LKH, PO Box 130, Wapiti, WY 82450 (307-527-7758); n7lkh@arrl.org Southeastern Division (AL, GA, NFL, PR, SFL, VI, WCF)

Alabama: Bill Cleveland, KR4TZ, 2113 Wildwood PI, Mobile, AL 36609-2583 (334-661-3892); kr4tz@arrl.org Georgia: Susan Swiderski, AF4FO, 772 Camelot Way, Norcross, GA 30071 (770-449-0369); af4fo@arrl.org

(7/0-449-0369); at4fo@arrl.org Northern Florida: Rudy Hubbard, WA4PUP, PO Box 843, Milton, FL 32572-0843 (850-626-0620); wa4pup@arrl.org Puerto Ricc: Victor Madera, KP4PQ, PO Box 191917, San Juan, PR 00919-1917 (787-789-4998); kp4pq@arrl.org Southern Florida: Sharon T. "Sherri" Brower, W4STB, 736 34th Ter, Vero Beach, FL 32968-1226 (772-562-3240); w4stb@arrl.org Virgin Junder Jaho Elin NBPB DO Bear 04400. Christiansted St Crain, VI 00922

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

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

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

Arizona: Clifford Hauser, KD6XH, 8741 N Hollybrook Ave, Tucson, AZ 85742 (520-744-9095); kd6xh@arrl.org Los Angeles: Phineas J. Icenbice Jr, W6BF, 19323 Halsted St, Northridge, CA 91324 (818-349-3186); w6bf@arrl.org Orange: Joe H. Brown, W6UBQ, 5444 La Sierra, Riverside, CA 92505 (909-687-8394); w6ubq@arrl.org San Diego: Kent Tiburski, K6FQ, 1405 Greenbay St, San Diego, CA 92154 (619-575-1964); k6fq@arrl.org Santa Barbara: Robert Griffin, K6YR, 1436 Johnson Ave, San Luis Obispo, CA 93401-3734 (805-543-3346); k6yr@arrl.org

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

North Texas: Larry Melby, KA5TXL, 8841 Lavalle Ln, Dallas, TX 75243 (214-348-5283); ka5txl@arrl.org Oklahoma: Charlie Calhoun, K5TTT, 16101 E 98th St N, Owasso, OK 74055 South Texas: E. Ray Taylor, N5NAV, 688 Comal Ave, New Braunfels, TX 78130 (830-625-1683); n5nav@arrl.org

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

# ALINCO Unleash The Power

### DR-620T VHF/UHF Dual-Band Mobile/Base First Amateur Twin Band Mobile To Support Optional Digital Voice Communications\*

- RX-VHF 108-173.995 MHz, UHF 335-480 MHz
- TX-VHF 144-147.995 MHz, UHF 430-449.995 MHz
- Receives Airband and Wide FM
- Front control unit separation (optional EDS-9 kit required)
- Advanced 10F3 digital mode with speech compression technology (EJ-47U required)\*
- 200 memory channels
- Advanced EJ-50U TNC (optional) supports digi-peat mode
- Remote control features including parameter setting and direct frequency entry through the microphone
- Dual-Band receiver with V/U, V/V, U/U capability
- CTCSS/DCS encode/decode and European Tone-bursts
- OUTPUT: H/M/L-50/10/1 watts VHF
- OUTPUT: H/M/L-35/10/1 watts UHF

#### Ask your dealer about the full line of Iron Horse antennas & accessories!

### DR-605TQ VHF/UHF Dual-Band Mobile/Base Full 2 Meter/440 Performance

13300

- 100 memory channels, + a "call" channel for each band
- CTCSS encoded+decoded and tone scan
- · Cross-band repeat and full duplex capability
- 9600 bps packet ready with dedicated terminals
- Internal duplexer one easy antenna connection
- RX-VHF 136-173.995 MHz, UHF 420-449.994 MHz
- TX-VHF 144-147.995 MHz, UHF 430-449.994 MHz
- MARS capability (permit required)
- OUTPUT H/L 50/5 watts VHF, 35/5 watts UHF
- Time-out timer (ideal for repeater and packet operation)

### DJ-V5TH VHF/UHF Dual-Band FM Transceiver

5 watts of output power, in a compact package.

- Alphanumeric Display, up to 6 characters
- TX-VHF 144-147.995 MHz, UHF 420-449.995 MHz
- 200 memory channels plus two call channels
- Full VHF + UHF Amateur Band Coverage
- Receive Range, (76 999MHz) includes Wide FM capability
- Up to 5 watts output, 3 output settings
- CTCSS encode+decode DTMF squelch and European Tone bursts
- 4 scan modes, 5 programmable scan banks
- MARS capability (permit required)



- Full 4.5 watts output VHF/4w UHF
- Powerful NiMH battery
- 100 memories in any combination of VHF or UHF channels
- Direct frequency input from keypad
- Each memory capable of "odd split" operation.
- Alphanumeric channel labels
- CTCSS/DCS encode+decode plus tone bursts
- Full 2m and 440 band coverage
- Accepts 6 to 16 VDC direct input
- Illuminated Keys and display
- Wide and narrow FM modes
- 10 autodial memories
- Theft alarm feature
- Optional EJ-40U Digital Voice Board!\*
- Programming/Clone software available



Distributed in North America by Amateur Distributing LLC • 23 S. High St., Covington, OH 45318 • (937) 473-2840 Specifications subject to change without notice or obligation. \*Digital communications require at least two similarly equipped transceivers. Digital mode may not be legal in some countries. See FAQ on digital at www.alinco.com. Products intended for use by properly licensed operators. Permits required for MARS use. Specifications subject to change without notice or obligation.



# **ARRL CD-ROM Collections**



#### Acrobat Reader - [q200204.pdf]

Document Tools View Window Help

s C. Garland, WSZR

#### ARRL Periodicals

on CD-ROM are fully-searchable collections of popular ARRL journals. Every word and photo published throughout the year is included!

**SEARCH** the full text of every article by entering titles, call signs, names—almost any word. **SEE** every word, photo (including color images), drawing and table in technical and general-interest features, columns and product reviews, plus all advertisements. **PRINT** what you see, or copy it into other applications. **WEB LINKS** appearing in any article can be used to launch your existing Web browser to view additional information (feature available for versions beginning with 1996).



林倉・圖 ドイトド キキ 行気・光・斑 @ 160%

Part 1-Could this be one of the most versatile n tuners ever created? Let's take a closer look at the

A though antenna tuncers have adverse orige, their opplarity has soared in recent years thanks to the development of automatic tuncers. In fact, convenient, limited-range automers are now standard deduces of most HF transceivers and are a blessing for analaziers who live in antenna-restricted neighborhords.

The content of the second seco

System Requirements: Microsoft *Windows*<sup>™</sup>. 1999, 2000, 2001, and 2002 editions support *Windows* and Macintosh systems, using the industry standard Adobe *Acrobat Reader*<sup>®</sup> (included).



#### **Communications Quarterly CD-ROM**

This CD-ROM collection covers volumes of *Communications Quarterly* published from 1990-1999. Gain access to advanced technical topics in articles which cover transmitter, receiver and transceiver projects, theory, antennas, troubleshooting and much more. High quality black-and-white page scans can be read on your computer screen or printed. Quickly **search** for articles by title and author, **select** specific year and issue, and **browse** individual articles and columns. Requires Microsoft *Windows*<sup>™</sup>.



........

Featuring

on CD-ROM!

#### **ARRL CD-ROM** Collections

ARRL Periodicals CD-ROM (includes *QST*, *QEX*, *NCJ*) #8632 Year 2002 \$19.95 #8632 Year 2001 \$19.95 #8209 Year 2000 \$19.95

#7881 Year 1999 **\$19.95** #7377 Year 1998 **\$19.95** #6729 Year 1997 **\$19.95** #6109 Year 1996 **\$19.95** #5579 Year 1995 **\$19.95** 

QST View CD-ROM #7008 Years 1915-29 \$39.95 #6710 Years 1930-39 \$39.95



www.arrl.org/shop 1-888-277-5289 (US) QST View CD-ROM (cont.) #6648 Years 1940-49 \$39.95 #6435 Years 1950-59 \$39.95 #6443 Years 1960-64 \$39.95 #6451 Years 1965-69 \$39.95 #5781 Years 1975-79 \$39.95 #5773 Years 1975-79 \$39.95 #5765 Years 1980-84 \$39.95 #5749 Years 1990-94 \$39.95 #8497 Years 1995-99 \$39.95 #QSTV (all 12 sets) \$399 #8780 Communications Quarterly CD-ROM (1990-1999) \$39.95

Ham Radio Magazine CD-ROM\* #8381 Years 1968-76 \$59.95 #8403 Years 1977-83 \$59.95 #8411 Years 1984-90 \$59.95 #HRCD (all three sets) \$149.85

#7660 QEX Collection CD-ROM (1981-1998) \$39.95

#7733 NCJ Collection CD-ROM (1973-1998) **\$39.95** 

\*Ham Radio CD-ROM, © 2001, American Radio Relay League, Inc. Ham Radio Magazine © 1968-1990, CQ Communications, Inc.

Shipping & Handling charges apply: US orders add \$5 for one CD, plus \$1 for each additional CD (\$10 max.). International orders add \$2.00 to US rate (\$12.00 max.) Or, contact ARRL to locate a dealer. Sales Tax is required for orders shipped to CA, CT, VA, and Canada.

# upiter + www. Studio One 800-833-7373 \$1189

NEV Acres AS

#### MIADE IN USA

Thousands of Jupiter owners already know that they have the best priced, best sounding HF rig available today.

SWEEP VOX TUNE

206.000 Run

The best just got even better with the new STUDIO ONE microphone, manufactured to exacting standards for Ten-Tec by Heil Sound. STUDIO ONE features a brand new exclusive Heil element, sleek black casing, and is only available direct from Ten-Tec. Let's have audio guru Bob Heil tell it in his own words:

"This new STUDIO ONE microphone definitely has smoother sound over the Heil GOLDLINE element."

On-air results have been nothing but spectacular. While designed specifically for superior audio response from the Jupiter and the upcoming Orion HF transceiver, STUDIO ONE is also suitable for other HF transceiver brands. Visit our web site at www.tentec.com or call (800) 833-7373 for more info.



**1185 Dolly Parton Parkway** Sevierville, TN 37862 Sales Dept: 800-833-7373 Sales Dept: sales@tentec.com Monday - Friday 8:00 - 5:30 EST

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

Also available: 701 Hand Mic (\$28) and 538AT Internal Automatic Antenna Tuner (299) (not shown)



Illinois ham N9VV knows it's no dream. He sounds great with STUDIO ONE and his Jupiter!











\$139.00



705 Desk

Microphone

\$99.95

963 Switching **Power Supply** \$169.00





\$129<sup>95\*</sup>





Georges Ringotte, F6DFZ, an ARRL member for more than 25 years, recently built an antenna tuning unit with a distinctive Collins look. It includes a noise bridge, switching for three antennas and three rigs, and a 200 W dummy load. Georges, who lives in Morieres Les Avignon, France, is a lieutenant colonel in the fire department.



This radio's output is measured in calories: Birthday greetings for 20year-old Chris Edwards, AE4XO, of Byron, Georgia, came recently in the form of a 15-inch chocolate cake baked and decorated as a replica of Chris' hand-held transceiver. The antenna and volume/squelch knobs were made of oversized pretzel sticks coated in chocolate icing. Chris and his wife, Wendy, KG4CVY, received the cake from Jean and Mark Swann, KE4GRO and KR4YH. All are members of the ARRL and the Middle Georgia Radio Association.



And in his spare time . . . Geoff Cook, KE6IKD, of Foster City, California, is, at 90 years of age, an active member of the Foster City ARES group sponsored by the police department. He's also chair of the Foster City senior citizens advisory committee and a member of the Lions Club. The volunteers' cubicle at the police department consists of a 144/440 FM transceiver, a 144 MHz packet transceiver, a 28 MHz transceiver and Family Radio Service radios used for callouts when the volunteers on hand are not licensed.



Who needs a crane? Doug Weaver, KD8KX, of St Marys, Ohio, used this 120 foot bucket truck to replace one antenna with another atop his 80 foot tower. The photo shows the old antenna on its way down. The trick was to avoid the guy wires.



Happy birthday! The St Cloud ARC, WØSV, of Waite Park, Minnesota, recently celebrated its 80th birthday with a party held in conjunction with their annual meeting. Rich in history, the club continues to strive to serve the communities around it with member participation in classes for aspiring hams, SKYWARN, ARES, contesting, Field Day and various other events throughout the year. Mike Disher, NØMY, writes: "When you hear WØSV on the air, stop by and give us a contact, and become part of the operating log of one of the oldest active radio clubs in the country."



How cold was it? Joe Hannigan, WL7M, of Fritz Creek, Alaska, sent us this photo of an antenna with the case of the bends. "We recently had a severe ice storm resulting in up to 4 inches of ice on all the tower cables, supports and antennas," he explains. "The strength of the Mosley Pro57B-40 multiband Yagi was severely tested, but it survived. My 80 and 160 antennas, which I had worked on all summer so I could use them this winter, were not so fortunate."



In case you don't recognize it, this sign is on a road near the HSØAC Club Station in Pathum Thani, Thailand. Writes Ray, HSØZDZ: "Thailand has a place for jammers, slims, pirates and pileup policemen!"



Congratulations! Dick Freeling, W5TIZ, one of the founders of the Arkansas DX Association, was made an **Honorary Life Member** of the ADXA recently. From the left: Dennis Schaefer, W5RZ, ADXA president; W5TIZ, and **Rick Roderick, K5UR,** ARRL Delta Division director. Dick, who was blinded in WW II. is a long-time DXer who has been at the top of the Honor Roll. The ADXA requires 100% ARRL membership.

VALERIE MOORE, KC2AZX



Plantenna: Tom Hart, AD1B, of Dedham, Massachusetts, is justly proud of his unique MFJ 2-meter J-pole antenna. As he tells it: "There is a wooden base with a 1 inch PVC pole that is painted green. A dowel standoff at top holds the antenna in free space. I painted the base green and taped some plastic decorative leaves on the PVC. It sits in the corner and works fine, all the while looking like a plant. I hope to find more leaves at some point ... '

AD1B



Tom Nicastri, KB2ZZP, of Midland Park, New Jersey, enjoys a clean-signal QSO with his friend W2PQK—using his waterproof radio.

#### SHOP DIRECT or call for a dealer near you.

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

#### What's New!

ARRI

**Experimental Methods in RF Design** 

Immerse yourself in the communications experience by building equipment that contributes to understanding basic concepts and circuits. (See next page). Order No. 8799 ..... \$49.95

#### License Study Materials

#### **Technician Class**

Exam:

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

Now You're Talking!- 4th edition. Amateur Radio's most popular FIRST license manual. Order No. 7970 ..... \$19

ARRL's Tech Q&A-2nd edition. Review from the entire Technician guestion pool. Brief explanations follow each question. Quick & Easy! \$12.95 Order No. 7873 .....

ARRL Technician Class Video Course.

Ace your first license exam-the fast. easy, fun way! Complete course includes 3 videotapes, coursebook, and practice exam software (CD-ROM, requires Microsoft Windows).

Order No. 8330 ...... \$149 plus \$8 s&h

#### General Class (upgrade from Technician) Exams:

35-guestion General test (Element 3)

5 WPM Morse code test (Element 1)

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

#### **Operating and Reference**

ARRL Repeater Directory @- 2002/2003 edition.
Order No. 8640
TravelPlus for Repeaters <sup>™</sup> - 2002-2003 edition.
Map your travel route, locate repeaters, and tune in! CD-ROM. Sup-
ports GPS. Order No. 8675 \$39.95
The Radio Amateur's World Atlas. Full-color maps showing country boundaries, CQ zones, and more. Order No. 5226 \$9.95
The ARRL Operating Manual—7th Edition
Turn to your copy anytime you need information about a new band, mode, or activity. Includes a pull-out Ham Desktop Reference booklet.
Softcover book, #7938 \$25
Library Edition book, leather hardcover, #L793 \$70 \$50
ARRL Operating Manual CD-ROM 1.0, #8098 \$39.95
On the Air with Ham Radio. Your guide to the fascinating ways hams communicate. FM and repeaters, worldwide HF operating, digital, and more. Get radio-active! Order No. 8276
NØAX's Radio Puzzler. Order No. 8225 \$7.95
The ARRL DXCC List (February 2002 ed.) Order No. 8578 \$4
ARRL's FCC Rule Book-12th Edition. Order No. 7857 \$12

#### Electronic Publication Library

QST View CD-ROM includes back issues of QST in convenient, space-OST on CD-ROM!

#### \$39.95 per set!

1970-74 Order No. 5781

Years 1995-99 Order No. 8497 1990-94 Order No. 5749 1960-64 Order No. 6443 1985-89 Order No. 5757 1950-59 Order No. 6435 1980-84 Order No. 5765 1940-49 Order No. 6648

1965-69 Order No. 6451 1975-79 Order No. 5773 1930-39 Order No. 6710 1915-29 Order No. 7008



QST on CD-ROM. Browse ARRL's popular magazines on a fully-searchable CD-ROM. The 2002 ARRL Periodicals CD-ROM includes the entire previous year's worth of QST, NCJ, and QEX. Order No. 8802 ..... \$19.95

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

#### **ARRL General Class Video Course.**

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

Your Introduction to Morse Code. Pass the 5 WPM code test. Set includes two cassette tapes or two audio CDs with nearly 2-1/2 h

2 hours of practice.	
cassettes #8322	. \$14.95
audio CDs #8314	\$14.95

Ham University. Learn Morse code with this feature packed easyto-use software (for Microsoft Windows 95-XP). Includes a written exam quiz generator with all three question pools.

Order No. 8735 ..... \$39.95 Extra Class (upgrade from General) Exam: • 50-question Extra test (Element 4)

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

The ARRL Net Directory-2001/2002 Edition. Order No. 8357 \$5
ARES Field Resources Manual. Order No. 5439 \$8.95
The ARRL Emergency Coordinator's Manual. Order No. FSD9 \$5
Best of the New Ham Companion. Order No. 6001 \$12
Stealth Amateur Radio. You can operate from anywhere! Order No. 7571 \$14.95
DXing on the Edge—The Thrill of 160 Meters. Operating tips and fascinating history. Book with audio CDI Order No. 6354 \$29.95
The ARRL RFI Book. Real Answers and Real Cures to your radio frequency interference problems. Order No. 6834
RF Exposure and You. Meet the FCC RF exposure regulations. It's not complicated! Order No. 6621\$19.95
QRP Power shows just how much fun it is to operate with 5 W or less. Order No. 5617\$12
Hints & Kinks for the Radio Amateur—15th Edition.
Order No. 7903
Ham Radio FAQ. Order No. 8268
Your Mobile Companion, Order No. 5129 \$12

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

ARRL Periodicals CD-ROM is a	a compilation of all QST, QEX and
NCJ issues on one CD	\$19.95 per set.
2002 Edition. Order No. 8802	1998 Edition, Order No. 7377
2001 Edition. Order No. 8632	1997 Edition, Order No. 6729
2000 Edition, Order No. 8209	1996 Edition, Order No. 6109
1999 Edition, Order No. 7881	1995 Edition, Order No. 5579





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

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

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

#### Antennas and Transmission Lines

#### The ARRL Antenna Book—19th Edition

The ultimate reference for antennas, transmission lines and propagation. Construction projects for all types of high performance antennas. Book includes CD-ROM with antenna-related programs and propagation forecasts. Softcover, #8047 ... \$30

Library Edition book, leather hardcover, #L804 \$70 ..... \$50

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

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

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

#### Practical Circuits and Design •



The ARRL Handbook-2003. The comprehensive RF engineering reference. Always revised! 80th Edition.

Softcover, Order No. 1921 ..... \$34.95 Hardcover, Order No. 1948 ...... \$49.95

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

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

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

#### Digital and Image Communications

ARRL's HF Digital Handbook. 2nd Edition. Operate PSK31 and MFSK16-and many of the other popular digital modes. You probably have the equipment it takes to get started, today! Order No. 8233 ..... \$17.95

Space and VHF/UHF/Microwave Communications

The Radio Amateur's Satellite Handbook. The most complete b	ook
for every satellite operator and beginner! Station setup, antennas, tra	ack-
ing, and operating details for active ham satellites.	
Revised First Edition. Order No. 6583 \$24	.95
Tune in the Universe! Amateur Radio and the Search for Extra restrial Intelligence (SETI). Interactive book on CD-ROM.	ter-
Order No. 8543 \$24	.95
The ARRL Satellite Anthology - 5th Edition. Includes specific	sat-
ellite operating details. Order No. 7369	\$15

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

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

4. Visit our World Wide Web site: http://www.arrl.org/shop

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

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

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

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

Simple and Fun Antennas for Hams. Order No. 8624 \$2	22.95
ARRL's Yagi Antenna Classics. Yagis, Quads, Loops and other Antennas. Order No. 8187	Beam 1 <b>7.95</b>
ARRL's Wire Antenna Classics. Order No. 7075	. \$14
More Wire Antenna Classics—Volume 2. More dipoles, more more collinears, and more wire beams and verticals!	oops,
Order No. 7709	. \$14
Vertical Antenna Classics. Order No. 5218	. \$12

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

Volume 7, Order No. 8608 \$24.95 Volume 6. Order No. 7431 \$22.95 Volume 5. Order No. 5625 \$20

Volume 3. Order No. 4017 \$14 Volume 2. Order No. 2545 \$14 Volume 1. Order No. 0194 \$10

Digital Signal Processing Technology-Essentials of the Communications Revolution. DSP explained with special emphasis on its applications in communications. Order No. 8195 ...... \$44.95

Introduction to Radio Frequency Design. The fundamental methods of radio frequency design using mathematics as needed to develop intuition for RF circuits and systems. CD-ROM Included. Order No. 4920 ..... \$39.95 ARRL's Low Power Communication - The Art and Science of QRP. Everything for the low power operator: kit sources, gear, antennas and more! Order No. 7334 ..... \$14.95 W1FB's QRP Notebook is packed with construction projects for QRP transmitters, receivers and accessories. Order No. 3657 ...... \$10

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

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

Weather Sa	tellite Handbook. C	order No. 4483	\$20
The ARRL	UHF/Microwave I	Experimenter's	Manual includes
information	on design and fab	rication techniqu	les, propagation,
antennas an	d much more. Order	No. 3126	\$20
Internetion	Microweve Hone	heek Deference	information and

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

#### Shipping and Handling Information

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

Amount of Order	Add	Amount of Order	Add	
\$10.00 or less	\$4.00	40.01 - 50.00	8.00	
10.01 - 20.00	5.00	50.01 - 75.00	9.00	REI
20.01 - 30.00	6.00	Over \$75.00	10.00	1 ÷
30.01 - 40.00	7.00	CD-ROM only	5.00	1
ARE CONTRACTOR ARE NOT A PROVIDENT.	And and and a second and a second	and the second se		v

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

## CORRESPONDENCE

Your opinions count! Send your letters to "Correspondence," ARRL, 225 Main St, Newington, CT 06111.

You can also submit letters by fax at 860-594-0259, or via e-mail to qst@arrl.org.

We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and to fit the available page space. Of course, the publishers of *QST* assume no responsibility for statements made by correspondents.

#### PERSPECTIVE

♦ [Re "It Seems to Us," Jan 2003, p 9]: Wonderful article; couldn't agree more!

As I read through I was praying that you were the young man with the beginner's question.

When I started as a Novice in 1973 at the age of 15 my first 40 meter dipole was solid 14 gauge house wire fed with 75 ohm RG-59 TV coax. My 1972 *ARRL Handbook* said that "the feed-point impedance of a dipole is 73 ohms." That was good enough for me! My DX-60 transmitter and SX-28 receiver didn't know the difference!

I still have that block of wood with the wires and 75 ohm coax cut off short as a memento of what was. Back then I didn't have a clue what I was doing, but I was and still am having a blast!

There are no stupid questions; only newcomers coming up through the ranks. The message is clear, Elmer—"Give them a hand." Thanks again for the great article.—*Clay Melhorn, N9IO, Bonfield, Illinois* 

♦ Greetings from Ecuador. Your January editorial reminded me immediately of my dad helping me get started with my first Heathkit receiver back in junior high school. Although not a ham himself, he encouraged me as much as he knew how to explore my newly found fascination with electronics and radio. I only used the preamble, "This may be a dumb question, but..." once or twice, because his immediate interruption would be, "Son, there is only one dumb question—the one that goes unasked. Keep asking as long as you live."

Thanks for the jogging of that precious memory.—John E. Beck, HC1QH/ WBØRXL, Quito, Ecuador

#### THE PROMISE OF EXPERIMENTATION

♦ *QST* published an article in October 2002 titled "Linux, Software Radio and the Radio Amateur" written by Mike Marcus. Mike pointed something out to me that was the first thing to really, truly excite me about ham radio since I became a ham in 1992: Software radio brings the promise of experimentation back to the amateur world. For the past decade, radio technology has advanced so much that the cost of coming up with anything new has been prohibitive for an amateur. Companies like Motorola and Qualcomm have been com-

ing up with all the good ideas and commercializing them before hams have a chance to play with them. Now, when someone like Alinco comes out with a digital 2 meter radio, my response is, "So? Cell phones have been digital for over 5 years now. What took you so long?" The reason for this is that it's just too expensive for hams to experiment with things like Time Division Multiple Access (TDMA) or Code Division Multiple Access Spread Spectrum (CDMA); the equipment required to build and test this stuff is way out of the ballpark for most amateurs.

GNU Radio (and similar projects) provide free tools for experimenting again. The computer is a commodity, less than \$1000 in many cases. The Operating System is totally free, many different Linux distributions, the different BSD variants and Darwin (from Apple), just to name a few. Thanks to the Free Software Foundation (www.fsf.org), all the tools needed, like compilers, debuggers and, of course, the GNU Radio project itself, are all free. The only piece of specialized hardware is a downconverter/ADC board, an inexpensive version of which the GNU Radio folks are developing. Currently, there exist industrial solutions for about the price of the PC. With these tools, an amateur can put down his soldering iron and pick up a compiler and take a good idea and turn it into a new mode, a new filter design, a better audio DSP, or ... The possibilities are literally endless. With the continued growth in the speed and power of commonly available PC hardware, the DSP is no longer a limiting factor in what we can do, and this will only continue to get better.

Anyone who is worried about the continued integration of the PC into ham radio is not seeing the full potential and should keep looking. I think the future holds much of what made ham radio so great in the past.—*Mark Smith, KR6ZY, Arroyo Grande, California* 

#### A HARD TO BEAT THRILL

♦ 11-23-02 Saturday night, dark, cold, windy and a heavy overcast as I hoist my 80 meter dipole up between the tops of two tall pine trees 140 feet apart. Then running 100 feet of ladder line in through the attic window, across the attic and into my shack with the anticipation of the excitement and thrill of working another ham in some far corner of the world. After two years of studying, passing four tests and refurbishing an old Yaesu FT-901DM HF transceiver, the day is here—my first HF QSO!

11-24-02 Sunday afternoon, tense with the hope of success, I connect the ladder line to an old borrowed Murch manual antenna tuner and the Murch to the Yaesu with some RG-8.

Now I'm supposed to know how to tune all this—the radio's preselect, loading control and plate control; the tuner's 38 turn roller inductor and two very large air capacitors. Yeah, right—I hope the neighbors aren't planning on watching any TV this afternoon!

Squeezing the neck of an old Astatic D104 microphone, CQ CQ KB3FDQ KILO BRAVO 3 FOXTROT DELTA QUEBEC...THIS IS VE9JCT QTH NEW BRUNSWICK CANADA YOU ARE 5X9 AND YOUR AUDIO IS EXCEL-LENT...

Okay, it wasn't some far corner of the world but a greater thrill and feeling of accomplishment I have never experienced! This is what Amateur Radio is all about.—*Den Moran, KB3FDQ, North Abington, Pennsylvania* 

#### **DECEMBER 7, 1941**

♦ Here at 10 PM on December 7, 2002, I sit listening to a contest on 160 meters. At this time in 1941, I was on 160 meters working a few friends to say goodbye as "official" stations came on the ham bands telling us to cease operation. We realized it might be a long time before we would again talk to each other, if ever again, by ham radio.

As though someone was going throughout the house turning off lights room by room, stations left the air, the bands became quiet, and we entered the darkness of war with the uncertainty of it all. Many of us lived to again turn on the lights and come back to our beloved ham radio...all the while remembering the goodbye we said that night to those friends who never came back.—Don Richards, W7UPF, Tucson, Arizona

#### THE RISE OF SSB

♦ "Amateur Radio and the Rise of SSB" [Jan 2003, page 45] brought back memories. In 1956 I was in Greenland for 5 months as communications officer for an army unit operating on the Icecap east of Thule. (I was KG1AX.) One day I got a call on the telephone from the Thule communications officer, also a ham, inviting me to come down to Thule Air Base and have lunch with Art Collins and General "Butch" Griswold and visit Griswold's plane and see a demo of single sideband. (That trip was made with Griswold, not LeMay. LeMay was on the US end of the circuit.)

I got in my jeep and drove to Thule, and the first stop was the plane. The cabin was fixed up like a living room with a desk that had a Collins KWM-1 bolted to it. The antenna was strung to the tail. Both men were sitting in "long johns" and Collins put out a call (20 meters) and was answered in succession by LeMay, Goldwater, and some other AF brass. During lunch Collins gave the pitch for the change from AM to SSSC for all AF tactical communications. After lunch I went back to my station on the edge of the icecap, turned on my Collins 51J (R-388) and listened as they flew from Thule to Elmendorf Air Force Base in Alaska. From there to the Far East, and around the world back to the US. We never lost them as they worked hams worldwide. I have to admit that conditions that summer were perfect. We had paths to all over the world almost 24 hours a day from the northern arctic. But AM would not have done as well even with the good conditions.

In 1948 I had been one of the operators of K2UN (a world class "killer" station) at UN Hq at Lake Success, Long Island, and I recalled how terrible the AM phone bands were. Even with that sort of station, AM was no pleasure what with all the heterodynes. From my home station in NYC with a 30 W rig, AM on 20 or 75 was a waste of time. It was clear that SSSC would change that.—David Wiesen, K2VX Reston, Virginia

♦ I just read the article and could not help but think of the days in 1957/58 when I went to Wyoming to work for an oil company. I was the Instrument Man in a place table survey mapping surface geology, and we moved every six months or so.

I had permission to set up my rig in a motel because it belonged to the cousin of the geologist I was working with. I put a 20 meter doublet in back of my motel unit. I was W5LQV/7.

Almost every day I heard three guys on 20 meters talking to each other. They were Herb, Curt and Butch, and were usually about on the same frequency I had been on. One day one of them, I believe it was Butch, spoke to me and asked what someone with such a southern accent would be doing in Casper, Wyoming. I replied that I was an instrument man in a plane table survey. Herb said, "Boy, in 1926 I must have plane table mapped half the coast of California." Well, I talked a bit and checked out and when I looked 'em up in my Callbook I learned I had been talking to Herbert Hoover, Jr, General Curtis LeMay and General Butch Griswold.

Art Collins and the SAC folks put SSB on the air and had fun doing it!—*Dwight M. Brown, Jr, W5WE, Shreveport, Louisiana* 

#### WHO'S LISTENING?

◆ I read KI4TG's letter ["Who's Listening on 146.520?" Jan 2003, p 25] with interest.

On this side of the Atlantic, depending on band, we have either a calling frequency or a center of working. I still have to work out the reason for having a center of working. With a fixed calling frequency a QSO is established and then QSYs to a free frequency, leaving the calling frequency free for other people to meet up. If anyone is looking for an established QSO to join they can easily scan up or down the band and then break in.

As I understand the center of working frequency, contacts are made on or about the CoW and remain there. This sounds fine for an underused band, but although you may call CQ on an apparently free CoW, it does not mean that a station you could otherwise have contacted has not moved elsewhere because they can hear an established QSO on the CoW.

From my experience a dedicated calling frequency is preferable to a center of working. Everyone knows the frequency to call or listen on; after all, we all like to meet new people occasionally, and if you want to join an established QSO the option is still there to look for one.—*Les Featherstone, G6UBM, Tonbridge, Kent, England* 

#### **NEW VIDEO A HIT**

Today as usual I checked the ARRL Web site to find out the latest news about our hobby and was pleased to find the CD ROM presentation, Amateur Radio Today. I quickly downloaded the MPEG file and was very impressed. I believe that all elected officials should see this, as they may be voting on amateur issues such as tower laws. The fact that it is narrated by the "most trusted man in America," former CBS news anchorman Walter Cronkite, KB2GSD, adds credibility and punch. I not only will order one for showing to non-hams as well as hams, I'll order two because I plan to show it often and may wear the first one out! Great job-can't wait to see the second edition!—Efrem Acosta, W2CZ, Yonkers, Q57~ New York

### From MILLIWATTS to KILOWATTS<sup>™</sup>



#### TRANSMITTING & AUDIO TUBES Immediate Shipment from Stock

	-		
3CX400A7	3CX6000A7	4CX1600B	811A
3CX400U7	3CX10000A3	4CX3000A	833A & C
3CX800A7	3CX10000H3	4CX3500A	6146B
3CX1200A7	3CX10000A7	4CX5000A	6146W
3CX1200Z7	3CX15000A3	4CX7500A	8560AS
3CX1500A7	3CX15000A7	4CX10000A	3-500Z
3CX2500A3	4CX250B & R	4CX10000D	3-500ZG
3CX2500F3	4CX350A & F	4CX15000A	3-1000Z
3CX2500H3	4CX400A	5CX1500A & B	4-400C
3CX3000A7	4CX800A	6JB6A	4-1000A
3CX3000F7	4CX1500A & B	572B	4PR1000A

- Motorola RF Transistors
  - Japanese Transistors
     RF Power Modules
- Toshiba RF Transistors
   Door Knob Capacitors
   RF Power Modules
   Broadband Ferrite Xmfrs
- Semco Metal Clad Micas

• Vacuum Relays

- Power Tube Sockets
- Bird Meters & Elements



# ARRL Resources for RF, DSP, and Design

## Your Communications Journey Begins Herel



#### 

Immerse yourself in the communications experience by building equipment that contributes to understanding basic concepts and circuits. Explore wide dynamic range, low distortion radio equipment, the use of direct conversion and phasing methods, and digital signal processing. Use the models and discussion to design, build and measure equipment at both the circuit and the system level. Laced with new unpublished projects and illustrated with CW and SSB gear. **CD-ROM included** with design software, listings for DSP firmware, and supplementary articles.

#### **Contents:**

Basic Investigations in Electronics Chapters on Amplifiers, Filters, Oscillators, and Mixers Superheterodyne Transmitters and Receivers Measurement Equipment Direct Conversion Receivers Phasing Receivers and Transmitters DSP Components DSP Applications in Communications Field Operation, Portable Gear and Integrated Stations



#### Introduction to Radio Frequency Design, includes software, ARRL Order No. 4920........ \$39.95\*

The fundamental methods of radio frequency design using mathematics as needed to develop intuition for RF circuits and systems. Simple circuit models are used to prepare you to actually design HF, VHF and UHF equipment. Book includes a CD-ROM with ARRL MicroSmith Smith<sup>®</sup> Chart simulation software, and a suite of design and analysis software (for IBM PCs and compatibles).

First ARRL Edition, third printing, © 1994-2000.

#### **Contents:**

Low Frequency Transistor Models Filter Basics Coupled Resonator Filters Transmission Lines Two-Port Networks Practical Amplifiers and Mixers Oscillators and Frequency Synthesizers The Receiver: an RF System

#### Contents:

Introduction to DSP Digital Sampling Computer Representations of Data Digital Filtering Analytic Signals and Modulation Digital Coding Systems for Speech Direct Digital Synthesis Interference Reduction Digital Transceiver Architectures Hardware for Embedded DSP Systems DSP System Software Advanced Topics in DSP......and more

Digital Signal Processing Technology



## Digital Signal Processing Technology—Essentials of the Communications Revolution,

ARRL Order No. 8195 ..... \$44.95\*

A comprehensive, readable work for anyone interested in Digital Signal Processing (DSP). The book begins with basic concepts, details digital sampling including fundamental and harmonic sampling, aliasing and mechanisms at play in real data converters, digital filter design, mathematics of modulation and demodulation, digital coding methods for speech and noise-reduction techniques, digital transceiver design, and other current topics. Sufficiently analytical for the advanced engineer or experimenter (with a working knowledge of algebra), while simultaneously affording an understandable picture of this exciting technology.

\*Shipping and Handling charges apply. Sales Tax is required for orders shipped to CA, CT, VA, and Canada.



**RL** The national association for AMATEUR RADIO

Prices and product availability are subject to change without notice.

SHOP DIRECT or call for a dealer near you. ONLINE WWW.ARRL.ORG/SHOP ORDER TOLL-FREE 888/277-5289 (US)

## **1.8-170 MHz** plus **415-470 MHz** MFJ HF/VHF/UHF Antenna Analyzer

All-in-one handheld antenna test lab lets you quickly check and tune HF, VHF, UHF antennas anywhere. Covers 1.8-170 MHz and 415-470 MHz Measures: SWR...Return Loss...Reflection Coefficient...Antenna Resistance(R), Reactance(X), Impedance(Z) and Phase Angle(degrees) ... Coax cable loss(dB) ... Coax cable length ... Distance to short or open in coax ... Inductance ... Capacitance ... Resonant Frequency ... Bandwidth ... Q ... Velocity Factor ... Attenuation ... Has: LCD readout ... frequency counter ... side-by-side meters ... Ni-MH/Ni-Cad charger circuit ... battery saver ... low battery warning . . . smooth reduction drive tuning . . . One year No Matter What<sup>™</sup> warranty . . .

MFJ-269 5095 You can instantly

get a complete picture, check and tune any antenna from 1.8 to 170 MHz and 415 to 470 MHz -- an MFJ-269 exclusive -- with this rugged easy-to-use handheld antenna test lab! You can measure virtually every antenna parameter.

You won't believe its capability and versatility. This rugged handheld unit literally replaces a workbench full of expensive delicate test equipment.

#### SWR Analyzer

You can read SWR, return loss, reflection coefficient and match efficiency at any frequency simultaneously at a single glance.

**Complex Impedance Analyzer** 

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp) -- an MFJ-269 exclusive!

#### Coax Analyzer

You can determine velocity factor, coax loss in dB, length of coax and distance to short or open in feet (it's like a built-in TDR).

CoaxCalculator<sup>™</sup> lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- an MFJ-269 exclusive!

#### Use any Characteristic Impedance

You can measure SWR and loss of coax with any characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- an MFJ-269 exclusive!

Inductance/Capacitance Meter Measures inductance in uH and capacitance in pF at RF frequencies, 1.8-170 MHz.

Frequency Counter/Signal Source You can also use it as a handy frequency

counter up to 170 MHz and as a signal source for testing and alignment. Digital and Analog displays

A high contrast LCD gives precision read-

antenna adjustments smooth and easy. 415 to 470 MHz Range features

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency. You can adjust UHF dipoles, verticals,



yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks lyzers. Save \$ and RF amplifiers without applying power. Has easy-to-read LCD logarithmic SWR

bargraph and SWR meter for quick tuning. Much Better Accuracy

New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- an MFJ-269 exclusive!

#### Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting frequency easy.

#### Take it anywhere

Take it anywhere - to remote sites, up ings and two side-by-side analog meters make towers, in cramp places. Fully portable -battery operated, compact 4Wx2Dx634 in., weighs 2 lbs. Free "N" to SO-239 adapter.

Has battery saver, low battery warning and built-in charging circuit for rechargeables.

Use 10 AA Ni-MH or Ni-Cad or alkaline batteries (not incl.) or 110VAC with MFJ-1315, \$14.95.

#### MFJ SWR Analyzer Accessories



MFJ-39C, \$24.95. Tote your MFJ-269 anywhere with this genuine MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fab-

ric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends.

Has clear protective window for frequency display and cutouts for knobs and connectors -- use your MFJ SWR Analyzer™ without ever taking it out of your case. Authentic MFJ leather logo distinguishes the real thing from imitators!

MFJ-66, \$19.95.

Plug these MFJ dip meter coupling coils into your MFJ SWR Analyzer™ and turn it into a sensitive and accurate band switched dip meter. Set of two coils cover 1.8-170 MHz depend-

ing on your MFJ-269 SWR Analyzer<sup>TM</sup> MFJ-99C, \$34.95.

SWR Analyzer Power Pack. 10 Pack MFJ SuperCell<sup>IM</sup> Ni-MH batteries, and MFJ-1315 Power supply for MFJ-269 SWR ana-

#### MFJ-98, \$54.85.

MFJ-269 Accessory Pack. MFJ-39C custom Carrying Pouch, MFJ-66 dip coil adapters, MFJ-1315 power supply for MFJ-269. Save \$5.

#### MFJ-98B, \$77.85.

MFJ-269 Deluxe Accessory Pack. Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. Save \$7!



http://www.mfjenterprises.com for instruction manuals, catalog, info

# Digital Audio Broadcasting Has Arrived—the Story of WOR

In October 2002 a prominent commercial AM station in New York City, WOR, began broadcasting in a new digital format. That's right... *digital audio within the bandwidth of an AM broadcast signal.* Discover how this technological feat was achieved, and learn what it may mean for the future of broadcasting and Amateur Radio.

October 10, 2002, the Federal Communications Commission finally authorized a digital audio format for radio broadcast stations. Known as In-Band On-Channel, or *IBOC*, this technology was developed by iBiquity Digital to allow broadcast stations to transmit digital information and analog audio simultaneously within their existing analog bandwidths.

The engineering staff at WOR— 710 kHz in New York City—had been eagerly preparing for the FCC's decision. Within 24 hours after the announcement, a new WOR was on the air: WOR-*HD* (High Definition). Since that time they have been conducting tests and tweaking the system in anticipation of consumer IBOC receivers scheduled to hit store shelves late summer or fall.

In early November, I contacted Tom Ray, Certified Senior Radio Engineer and

Corporate Director of Engineering for Buckley Broadcasting/WOR Radio, concerning WOR-HD. In the weeks that followed, I quizzed Tom about WOR's new broadcast technology. Our e-mail exchanges were compiled to create this "interview" for *QST*.

## Q: How would you describe IBOC as it is used at WOR?

A: Think MP3s on steroids. The actual data rate on the AM is around 96 kbps; it amounts to a large modem on the air. The smoke and mirrors part is that unlike a 96 kbps MP3 file, AM digital sounds great. The signal is divided into three sets of digital carriers: the secondary carriers occupy about 5.1 to 10 kHz, the primary carriers spread from 10 to 15 kHz and the tertiary carriers are phase modulated and are within the audio passband, 90 degrees out of phase (quadrature modulation). So,

if you look at the transmitted spectrum, you have the carrier surrounded by its sidebands. You have the analog audio in the sidebands at  $\pm 5$  kHz. The remaining sidebands contain the digital information out to  $\pm 15$  kHz at -30 dBc. The FCC allows -25 dBc in the "outer" portion of this transmitted spectrum as it relates to the carrier. See Figure 1.

#### Q: How are the data streams and amplitude-modulated audio combined to achieve such a narrow bandwidth?

A: Take a look at the block diagram in Figure 2. The audio from WOR's studio is brought to the transmitter site via an STL (studio-to-transmitter link). From the STL receiver the analog audio is fed to an analog-to-digital converter. The output of the A/D converter is an Advanced Encryption Standard (AES) data stream, which goes to an EASU (Exciter Auxil-



Figure 1—This is the WOR spectrum with IBOC on. The rise at the left of the screen is the beginning of the spectrum analyzer's sweep. iary Service Unit) and finally to our audio processors. Our analog processor generates a 5-kHz-wide analog audio signal as an AES stream. Our digital processor produces a full-bandwidth (20 kHz) stereo signal in AES format. Both signals are combined at the exciter, which is really a computer running Linux and the IBOC program. The exciter creates an amplitude and phase-modulated signal. The amplitude component consists of the 5-kHz processed analog audio and the IBOC carriers from 5 to 15-kHz in audio form. The phase-modulated signal consists of the 710-kHz RF carrier modulated by the IBOC carriers. There is more detail on iBquity's Web site at www.ibiquity. com/. They even have samples of on-air signals. It's an impressive Web demo!

## Q: If an AM station wants to upgrade to digital broadcasting, what hardware does it need to purchase?

A: The station first needs a transmitter that is capable of passing the IBOC waveform. Plate modulation won't work. PDM (Pulse Duration Modulation) will work, providing the modulator has at least a 50-kHz bandwidth. A tube PDM transmitter probably won't be stable enough to properly pass the phase-modulated signal. The transmitter needs to be fairly linear with the ability to pass a broad audio signal.

The antenna system needs to be as flat as possible, both resistance and reactance, symmetrical at  $\pm 15$ -kHz from the carrier. The IBOC signal is 30-kHz wide. Any substantial increase or decrease in resistance or reactance will result in one of the sideband levels being reduced in amplitude, and this will result in data errors in the radios, effectively reducing your digital coverage.

To get IBOC on the air, you need to purchase an IBOC exciter and a stereo audio processor, preferably one suited for digital transmission. The processor must have AES data output. If this is not available, you would need to purchase AES converters as required.

At WOR we connected our IBOC exciter to the transmitter through an interface box sitting on top of the cabinet. The connections to the interface box from the exciter are through shielded CAT-5 cable. The connection from the interface box to the external RF input of the transmitter is RG-58 coax terminated in BNC connectors. The connection to the audio input of the transmitter is from a Phoenix connector on the interface box to the input terminal strip in the transmitter. We added a terminal strip in the transmitter to take the "normal" output of the audio processing and divert it to the interface box, where it



Figure 2—A block diagram of WOR's AM digital system.



The equipment racks at the WOR transmitter site. The IBOC exciter is at the lower right of the racks.

can be connected to the transmitter should the exciter fail, or if the exciter is put into bypass mode for any reason.

Once the exciter was installed, we had to adjust the phasing of the IBOC carriers through the transmitter system to minimize data errors. We also needed to fine adjust the delay of the analog audio signal through the system so that it matches the delay of the digital channel. You need to set the internal AM generator in the exciter to 100% negative modulation, then adjust the magnitude pot on the interface so that 100% modulation of the exciter's internal AM generator matches 100% modulation of the transmitter. This helps ensure the correct amplitude of the IBOC sidebands. All this connecting and tweaking isn't as hard as it sounds. We were finished in 3 hours.



The IBOC hardware. From the top down, the reference receiver, exciter and control unit.

*Q:* With the typically tight SWR bandwidths that some broadcast antenna systems employ, has this been a problem? Did you have to retune the WOR antenna system?

A: We ripped apart the WOR antenna system five years ago. It favored the lower sideband and was terrible. The problem is all the filtering and detuning we need to do to protect WOR from several other stations, and the other stations from WOR. We redesigned the coupling networks for the three towers, added line stretchers in each tuning house and redesigned the phasor. This gave us a common-point impedance that is flat  $\pm 15$  kHz from the carrier. Unfortunately, some stations may need to do substantial work on their antenna systems to pass the IBOC waveform.

*Q: Does the application of IBOC differ* **Q5T-** March 2003 29



Tom Ray checks out the WOR transmitter.



This is the interface box, which lives on top of the WOR transmitter.

## for FM broadcast stations as opposed to AM broadcast?

A: With the current software we're seeing 60 dB stereo separation on AM with the audio bandwidth to 15 kHz. That makes the quality of our AM digital signal comparable to an analog FM broadcast audio. It's amazing to listen to the 15-kHz audio on WOR and realize it is coming from the AM transmitter!

The FM version takes you out to a 20 kHz audio bandwidth and a faster data rate with greater separation because you have more bits to play with. The data rides around the FM stereo signal in the outer reaches of the spectrum assigned.

Both AM and FM digital stations will have auxiliary data that can be utilized in various forms. At WOR-HD, for instance. we have a text-based data stream that puts our call letters and station slogan on listeners' radios, and we can put up song titles or a text-based advertisement during talk or music programming. For FM stations, the best example I've seen involves a small video screen, something you could put in the back of a taxi cab or mount in a bar or restaurant. The demonstration I witnessed was baseball play-byplay on the air. The screen showed a diamond, game stats, and who was on what base. When someone new came to the plate, his face appeared on the screen along with his stats. When he hit the ball, you could watch the players advance.

#### Q: Let's talk about this new technology from the receiver's point of view. How does WOR's signal sound on a normal analog AM radio?

A: There is no difference for most listeners—it sounds the same as it always has.

You can't hear evidence of the digital components unless you are using a wideband AM receiver, and most people are not. The FCC mandated that the new technology wouldn't leave analog AM listeners out in the cold. It's similar to what they did when color television broadcasting was implemented. Broadcasters still had to generate a signal that could be received on monochrome TVs. Even with a wideband receiver, all you hear is a little "hash."

### *Q*: When do you expect consumer receivers to be available?

A: Receivers are expected to be available late summer or early autumn, but the timetable is dynamic at the moment. Prices should be about \$100 more than a comparable analog-only radio. So, if you're looking at a car stereo today for \$350, expect to pay \$450 for the IBOCcompatible model. You will also see these radios as options in 2004 model year Ford and GM vehicles.

# *Q:* Does the receiver buffer the incoming data before running it through the D-to-A stage to convert to analog audio? If so, how much is buffered?

A: Yes, it does buffer. The actual delay time is about 8.5 seconds. What the listener is hearing was actually broadcast more than 8.5 seconds ago.

## *Q:* How well does the digital format handle noise, fading and interference on the receiving end?

A: It handles noise well. We've driven around areas where the WOR analog signal has issues (under bridges and such) and the signal is solid. Q: What happens when the digital signal degrades to the point where it cannot be consistently decoded? Does the audio become "choppy"? Does the receiver automatically switch to analog?

A: The receiver will automatically blend to analog. It won't allow the audio to become choppy.

## *Q:* How does WOR's digital signal survive the vagaries of skywave propagation at night?

A: This is the \$64,000 question. There isn't enough information on nighttime propagation yet. WOR-HD is our "daytimer" now—we turn it on at sunrise, off at sunset. iBiquity will be using WOR and WLW (700 kHz in Cincinnati) to check interference contours and see what happens during nighttime hours. My guess is that it would survive certain aspects of propagation, but we won't know until we complete our nighttime testing. Worst case is that we should have coverage at least to our 2-mV signal contour, which goes to the city limits of Philadelphia.

## *Q*: Any results for the skywave testing so far?

A: The tests have been fascinating. We were 52 miles from the WOR transmitter off I-78 near the Pennsylvania border. WOR's groundwave signal at that point was about 0.75 mV/M. WLW's was about 0.5 mV/M on skywave. The spectrum analyzer was set to show from 660 to 770 kHz, with us in the middle. At this point, WOR was affected little by skywave, so our signal remained constant. Just watching how a single signal would change, while nothing else changed, was amazing. At times, WLW had a hotter sig-

nal than WOR (by almost 10 dB). At other times, they disappeared.

Bottom line is that in ground wave coverage area the WOR signal is hardly affected by WLW's IBOC carriers. When their carriers came up, you could hear some noise under WOR, but it was far from objectionable. On WLW's skywave, if their signal was greater than -10 dB from WOR's, their signal was more than listenable. Obviously, if their signal became equal or exceeded WOR's, there was no problem. If their signal dipped to -15 dB or less, their signal became unlistenable. But it was interesting to note that during these periods when WOR's IBOC carriers went off, with the normal interference on the band (particularly from a station at 690 kHz), the WLW signal wasn't listenable, anyway. So, the WOR IBOC carriers were inconsequential.

We also monitored beyond Bethlehem, Pennsylvania, 72 miles from the WOR transmitter. Here, WOR had some skywave. The results were very similar, but when both stations were being received via skywave, the IBOC adjacentchannel noise was no more objectionable than the normal interference on the band.

Long-range skywave tests haven't been as promising, but the research continues. Signals received from WLW appeared to be too unstable to lock the radio in the New York metro area.

#### Q: How do you think IBOC technology will shape the future of AM and FM broadcasting?

A: I don't foresee any real changes to FM broadcasting. The IBOC technology gives FM stations CD quality, while present FM technology gives audio bandwidth to 15 kHz. On AM, however, I can easily see stations putting music formats back on the AM band. Let's face it, with the noise on the AM band, the limited audio bandwidth transmission (10 kHz) and average radios not being able to demodulate anything above 3-4 kHz, many AM stations abandoned music formats in favor of talk or all news. Having audio parity with FM stations, and in stereo, gives AMers reason to return to music formats. There are also avenues for "nontraditional" revenue for AM and FM stations by selling data capacity (similar to SCAs on FM stations). Overall, I think AM stations have the most to gain.

#### Q: Do you have any Amateur Radio operators on your staff?

A: Well, I'm not licensed, but I am seriously considering it. In the past, my problem was that I never had the money for the gear. Now I have the money, but I don't have the time! I'd like to get my 14-year-old son involved, and my 8-yearold daughter, too. Amateur Radio is fas-

#### **Digital Voice for Amateur Radio**

By Doug Smith, KF6DX

Broadcasters aren't alone in the use of digital audio and video—we hams are doing it, too! One of the duties of the ARRL Digital Voice Working Group has been to organize and participate in digital voice experiments over Amateur Radio. At various times over the last two years, we have used the G4GUO/G4JNT system, Thales Communications software and the ARD9800 from AOR Japan on HF; and Motorola APCO 25 units and Alinco DJ596 handhelds on VHF and ICOM D-Star on UHF. Read about details of those and other systems in the articles posted at **www.arrl.org/tis/info/digivoice.html**. The systems conform to international standards of one type or another.

While some of the goals of two-way digital phone and image are identical to those of broadcasting, some are quite different. The advantages of digital transmission apply equally well to all radio services. Those include noise-free, error-free reception and the potential for simultaneous audio, video and data. Broadcasters, though, must concern themselves with the reproduction of music. That naturally takes more bandwidth than a single voice requires. Music listeners are unlikely to enjoy digital audio if they can hear that it has been coded.

Hams are used to somewhat less-than-perfect sound reproduction and for most, getting the message across is the important thing. About 3 kHz of bandwidth is enough for SSB phone and many rigs will not pass anything more. So 3 kHz is the target bandwidth for digital voice systems in Amateur Radio. Digital audio broadcast signals occupy 10 kHz or more.

The popularity among hams of medium- and high-speed digital voice modes will evidently depend on the robustness of signals that can be transmitted and received through existing rigs. A data rate of at least 1200 bits/s is required to get acceptable voice quality with contemporary coding algorithms. However, 3600 bits/s and even higher rates are preferred. Rather sophisticated modulation formats such as orthogonal frequency-division multiplexing (OFDM), combined with error detection and correction, seem to constitute the best way to achieve those rates. That is especially true of dispersive media such as HF. OFDM employs multiple subcarriers, each of which is modulated at a relatively low bit rate using phase-shift keying (PSK), quadrature amplitude modulation (QAM) or the like. Work that has been done on OFDM systems applies to data modes, as well. Imagine—5400 bits/s on HF!— *Doug Smith, KF6DX, Chair, ARRL Digital Voice Working Group* 



This map shows the results of preliminary tests in the coverage of WOR-HD. This radial was driven from the WOR transmitter location in Lyndhurst, New Jersey, to Philadelphia. The green portion of the path indicates digital coverage; yellow is digital blend to mono; red is analog only. This path was run with a prototype consumer automotive HD radio with a 31-inch whip antenna. In this instance, it shows the digital blending to analog at about 72 miles from the site.

cinating and fun! I know hams are already pioneering digital audio formats of their own and it would be fun to be involved (see the sidebar, "Digital Voice for Amateur Radio"). Being a native of the Hartford area and former Chief Engineer of WTIC, I feel a certain closeness to the ARRL. I've toured Headquarters and W1AW several times.

If your readers want more information, or wish to follow our adventures, our in-

dustry IBOC page is www.wor710.com/ Engineering/iboc/hdindex.htm. They may also feel free to contact either myself at tomray@wor710.com, or our Chief Engineer Kerry Richards at krichards@wor710.com.

*Our thanks to Doug Smith, KF6DX, and Tom Ray for their help during the preparation of this article. Steve Ford, WB8IMY, is the Editor of QST. You can contact him at* **sford@arrl.org.** 

# Of Mics and Men

With an inexpensive piezoelectric crystal element and some household parts you can build a microphone that rivals many commercial offerings.

rince the early days of radio, hams have been challenging every aspect of the communication art. It's no different today; despite the fact that modern transceivers leave little room for improvement, when the covers are removed, experimenters are left with whatever is connected to the magic box. Some of those connected devices-microphones in this case-have recently been the focus of a lot of attention as hams try to improve the quality of their transmitted SSB signals. You only have to tune the HF SSB subbands to find hams trying to make 3 kHz of transmitted bandwidth sound like a broadcast station.

The original SSB "sound" (300 to 3000 Hz) can certainly be improved upon and the first step in that direction often involves the use of a full-range studio or broadcast microphone. Immediately, most users recognize that the resulting audio, when connected to a typical Amateur Radio transmitter, is *very* bassy and needs equalization (frequency tailoring).

Enter professional audio gear. Although some hams arrive at the sound they're looking for, it's often at considerable expense and frustration. The equipment is simply not designed for a "communications quality" 3 kHz bandwidth and an RF environment. Like many others, I chased my tail playing the microphone and equalizer game, but my thirst for simplicity, coupled with a dose of good old ham radio curiosity, led me to find out what was really happening.

It seemed logical to suspect that if I used a microphone that had a flat response across the desired passband, I'd get a flat response in my transmitted audio. But something was happening to those high and low frequencies. There was a steady slope to the spectrum, and the highest frequency was 10 to 20 dB down from the lowest. I suspected that the nature of sideband formation and reconstruction was the culprit. To get some hard data, I ran a simple band noise test with *Hamalyzer*...audio spectrum analyzer software that runs on a computer and receives radio audio through a PC sound card. This showed that the receiver, in SSB mode, received all frequencies within that 3 kHz passband at equal levels. So...I surmised that the problem must be with the transmitter.

My next test used a signal generator to put a constant voltage into my transmitter's microphone input jack for all frequencies from 10 to 3000 Hz. I ran the output of my transceiver through a Bird peak-reading wattmeter and then into a dummy load. To my surprise, the output was a constant 100 W across the entire passband, except for the part below 100 Hz, which rolled off a few decibels.

An engineer and frequent on-air contact, Rod, KQ6F, ran a similar test using a spectrum analyzer and found similar results. He suspected the human voice to be the culprit. Because, apparently, it wasn't the microphone *or* the transceiver, I reluctantly accepted his hypothesis.

#### The Mystery is in the Voice

I continued my research on the Internet, where I discovered a paper from



Figure 1—The microphone element assembly, showing the basic features of the jar lid configuration including the crystal, fulcrum and diaphragm. Great precision is not necessary and ordinary hobby tools and glues are all that are needed.



Figure 2—The actual jar lid crystal element before its diaphragm is installed. In the foreground is the FET with its load resistor and coupling capacitor. The 40 M $\Omega$  resistor is ready to bridge the crystal output.

<sup>1</sup>Notes appear on page 35.



Figure 3—The SMC1 about to be assembled. The electret FET, resistors and capacitor are shown before they are encased in heat-shrink tubing. The glue attaching the fulcrum to the diaphragm can also be seen. The insulation padding is cut and ready for placing in front of the element.

Purdue University dealing with the nature of the human voice. Purdue researchers wanted to design a mechanical device that would accurately reproduce that voice. Needless to say, our primary modulator is a very complex device and what it does to air after it passes through the vocal cords is quite remarkable.

It seems that the low frequency percussive consonants and vowels actually produce a pressure vortex as they leave the mouth. Because that vortex is the movement of a package of air, it has great energy and thus the lower frequency sounds also have high energy. Conversely, pinching off the airflow with the tongue, teeth and lips forms high frequency sounds that produce eddy currents in the moving air. These eddy currents substantially destroy the waveform (and the energy striking a microphone diaphragm). This justified the test results-the voice was definitely the problem!

Being a firm believer in simplicity, I wanted a great-sounding communications microphone that could be plugged straight into the microphone jack with no additional equalization. The microphone I needed would have to have a high frequency boost of considerable magnitude and a bit of a boost below 150 Hz. The Astatic D104 seemed to have some of the characteristics I needed, but it still lacked the necessary low frequency response.

A trip to the local CB shop (where used mics are common) was in order, where I discovered a new D104 microphone head at a bargain price. It included a spec sheet with a frequency response graph. I was amazed to discover that the response was flat from 50 Hz to 1 kHz and that it had a 12 dB increase from that point to 3 kHz. The only catch was that the microphone needed to work into a very high impedance. The higher the impedance, the better the low-frequency response.

The Astatic D104 was designed by two hams, C. M. Chorpening, W8WR, and F. H. Woodworth, W8AHW, back in the early AM tube days of 1933. It was a microphone that added to the foundation of the Astatic company's beginnings. The microphone broke new ground by using a Rochelle Salts crystal (sodium potassium tartrate) as a transducer. In its original application, it looked into the high impedance grid of a vacuum tube and it performed very well, producing high output over the voice frequency range.

#### Sound Experiments

Some of the amplified D104s in use today transform the microphone's high source impedance to the 600  $\Omega$  preferred by most modern radios-with mixed results. Because I didn't have an FET input device handy, I liberated one from a cheap electret microphone I had. The input impedance was on the order of 100 M $\Omega$ . I connected the D104 cartridge straight into the FET, just as the electret element had been. The operating voltage was supplied by the radio, through a 10 k $\Omega$  resistor, and the output was coupled through a 4.7 µF capacitor. The FET source was grounded and the hot mic lead went to the gate. The load resistor and output capacitor were connected to the drain of the FET.

I made this into a small package and



Figure 4—The finished SMC1 microphone in its shock mount. The housing is made from a kitchen strainer and measuring cup with the handles removed.

placed it inside the microphone enclosure. The electret FETs give a very linear, low-noise response, making them ideally suited for the job. Because the graph for the D104 specified 5 M $\Omega$  for the best low frequency response, I put a 5 M $\Omega$  resistor directly across the element.

The results were very good, but the lows still weren't there. So I kept increasing the parallel resistor value until I stopped at 50 M $\Omega$ , which produced the best response. I also noticed that the element had internal padding that was in direct contact with the diaphragm, without which the mic sounded very sharp and "tinny." After playing with the padding I found that I could control the mic's high frequency response and, with the parallel resistor, I could control the low frequencies. My brain flashed—I could equalize a microphone internally! Simplicity was just around the corner.

Not wanting to destroy the D104 that I had working well, I thought about playing with some cheap crystal microphone elements. I had a couple in my bottomless junk box and I ordered two more from Mouser Electronics<sup>1</sup> in the \$3 to \$4 price range. Realizing (tongue in cheek) that the most important thing about a mic is how it looks (you don't have to listen to it, but you do have to look at it), I wanted to have a nice housing for the elements.

My collection sported a Shure 520D (the "Green Bullet") microphone that looked a lot better than it sounded. I emptied its guts into the trash, only to discover that my new crystal elements wouldn't fit.

I tore one element apart and realized how simply they were constructed. I mounted the crystal in a jar lid I had on hand that fit the 520D housing. I used a small nail for the fulcrum and aluminum foil for the diaphragm. The new cocktail onion jar lid element and the electret FET were packed into the housing with a 40 M $\Omega$  shunt with quilt padding on the diaphragm. Figure 1 shows how the components were assembled and Figure 2 shows the actual assembly.

I was totally amazed by this sound! I had expected it to sound rather "tinny," but it was smooth...it sounded far better than most elements manufactured for Amateur Radio use. I began experimenting with the padding and the tension on the diaphragm. I found that I could tighten the diaphragm by running my fingernail carefully around the edge and I could loosen it by running my finger halfway between the edge and the center. The tighter it was, the higher the frequency shift and vice versa. More padding restricted the highs, while more pressure increased them. Now I had complete control of the spectral response of my experimental communications microphone, even if it was more art than science.

The foil was much thinner than the diaphragms of commercial microphone elements and its use seemed to aid the low frequency response. And, using household aluminum foil in an actual working microphone certainly de-mystified the commercial manufacturing art!

## On-the-Air Success met with Guffaw!

After careful tweaking, I worked a few hams on 17 meters and told them I was using a microphone element I had made from a jar lid, aluminum foil and the FET from a cheap electret microphone, with the assembly plugged directly into the radio. No one believed me; it sounded like I was using a studio microphone with broadcast equalization gear! Apparently, few folks had tried to homebrew microphone elements since the early days of Chorpening and Woodworth. I wanted to see if I could repeat that experiment, but I didn't want to disturb the mic that worked so well in that Green Bullet housing. A new platform was needed for my test cartridges.

I began searching the wares at the discount and hardware stores for something that could be used as an attractive housing. At Wal-Mart, I bought a set of measuring cups to get one that was the right diameter. At Target, I scored with a stainless-steel powdered sugar shaker. I now had the raw materials for the two platforms featured here, the SMC1 and the SS1 (Strainer/Measuring Cup and Sugar



Figure 5—The completed SS1 microphone. The yoke supports the mic on soft rubber grommets to isolate the housing from shock and vibration. The grill is cut from an old RadioShack speaker and backed with a piece of paper towel.



Figure 6— In keeping with a *QST* tradition...the Tuna Tin 1 microphone. Enclosures don't have to be costly!

Shaker). After a little work with a hacksaw, a drill press, a few screws and some miscellaneous hardware, the housings were ready for my new microphone elements. Figures 3 and 4 show the SMC1 microphone before and after assembly, respectively. Figure 5 shows the completed SS1 microphone. And...in keeping with *QST* tradition, a tuna-tin version is shown in Figure 6.

Now that I had respectable-looking

housings, I was interested in making the elements from readily available parts. I had everything but the piezo crystal. I tried the crystals from sounders and transducers (such as those found in smoke alarms), phono pickup cartridges, cigarette lighters, piezo audio tweeters and everything that RadioShack had that was piezo active. Although they all produced *reasonable-sounding* elements, none had the bass needed that I found with the first element, scavenged from that cheap crystal microphone.

#### Not all Piezos are Created Equal

It was now evident that crystal microphone elements differed, in some way, from the other piezo materials. I researched the Rochelle Salts crystal and found a lot of information and some interesting photomicrographs, but no possible sources. About that time the elements arrived from Mouser...one crystal and one ceramic. I tried the ceramic element, but it had only a moderate low frequency response. The crystal element<sup>2</sup> worked quite well and it found its way into a cherry jar lid and the SMC1 mic. The SS1 received an element made from another old crystal mic that had been lurking in my junk box. Now I had three great-sounding mics-and not an equalizer in sight!

I wanted to see exactly what my microphones were doing, so I connected one directly to the computer (running *Hamalyzer*) and placed it in front of my stereo system. Because FM stations broadcast signals that are heavily equalized and/or compressed-and pretty much flat from dc to daylight—this setup is actually quite useful as an ad hoc wideband audio source! Using my reference microphone, a Rode NT3 with a response from 30-20,000 Hz ±3 dB, I adjusted the equalizer on the stereo for a flat trace on a rock station. I then replaced the NT3 with the SS1 and observed the difference. You can do likewise with a mic whose frequency response you can document.

Figure 7 shows the response of a fullrange studio microphone. As you can see, it's flat, but it lacks the necessary frequency peaks for good SSB audio. Figure 8 shows the SS1 with its high and low-frequency characteristics. Its builtin response reflects the traditional "smiley face" shape dialed in by most hams using graphic equalizers...a boost in frequency at the bottom and a likewise boost at the top. Note that the frequency response drops substantially after 3 kHz, but that's outside the passband that we're concerned about.

Throughout this process I learned a




n

-20

-40 貿

-60



Figure 8-The SS1 response. Notice the tailored low and high frequency boost. There is no active equalization.

<sup>3</sup>n4pv@earthlink.net.

4www.hamalyzer.com/.

2

kHz

lot, had fun and produced three "custom EQed" microphones that do the job with nothing but an audio cable between the mics and the transceiver...no equalizer. Each was tuned by hand and has its own character, which unfortunately can't be duplicated. My transceiver is a Ten-Tec Pegasus controlled by a laptop computer running N4PY software<sup>3</sup> and Hamalyzer.4

I encourage you to try this; it's easier than you think. I didn't have much luck with piezos that weren't designed for

microphone applications, but those crystals that were so designed were quite effective. Consider experimenting...with a little tweaking, you'll end up with a superior ham radio microphone that you can proudly say you built yourself!

#### Notes

- <sup>1</sup>Mouser Electronics, Inc, 1000 N Main St, Mansfield, TX 76063-1514; tel 800-346-6873; www.mouser.com/.
- <sup>2</sup>Crystal element #25LM024, \$4.17, Mouser Electronics, Inc.

(Eta Kappa Nu Association). First elected to

ADAM SCULL, KG4PSN

Signal Corps from 1959 to 1962. He was a freelance photographer and writer, and has owned and operated a hobby shop specializing in radio controlled equipment. Tom, who

2.5

3.5

4

3

retired in 1996, can be reached at w5tom@ houston.rr.com and at home.houston. rr.com/w5tom/index.html.htm/. 05T~

Tom Morton, W5TOM, of Missouri City,

Texas, was first licensed in 1977. He received

the Amateur Extra Class license in 1997. Tom

has a degree in Mechanical Engineering from

Vanderbilt University and was with the US

### **STRAYS**

#### I would like to get in touch with ...

◊ WW II veterans who were stationed at the vast US Army Calais Staging Area in the south of France. Contact Gerard Valadier, F/N2BFL, at gerardvaladier@aol.com.

 $\diamond$  anyone with a lid and meters for a Hallicrafters DD-1 receiver. I am willing to purchase a unit in good condition, but I would also very interested in receiving precise dimensions of the unit so that I could possibly build one myself.—Walter Williams, GØXEM, Marchwood, Bounder Treath, Coverack, Helston, Cornwall TR12 6TP, United Kingdom

◊ anyone who has a QSL card from my father, Cliff Robertson, K5OZM. He was active from the 1950s through 1980s.-Margaret Martin, 2517 Winterstone Dr, Plano, TX 75023; wmartin3@verizon.net.

 $\diamond$  anyone with information on the military use of the BC-611 walkie-talkie during WW II. -Louis D'Antuono, WA2CBZ, 8802 Ridge Blvd, Brooklyn, NY 11209

#### QST congratulates...

♦ ARRL Life Member Tom Rothwell, K6ZT,

of Los Alamitos, California, who has been elected president of The National Honor Society for Electrical and Computer Engineering membership when he was a junior at the University of Southern California in 1953, Tom is a retired Group Vice President and Division Manager from the Hughes Aircraft Company.



Ronnie Haik, KG4DBI, of Coral Springs; Robert Cruz, KE4MCL, and Jeff Garnett, KG4CNM, both of Miami, were awarded a Certificate of Appreciation from the American Red Cross recently "in recognition of your valuable service in response to the events of September 11, 2001." The certificates were given out at a meeting of the South Florida FM Association.



Well known East Coast contester Barry Gross, N1EU, of Delmar, New York (right), proves that even die-hard contesters occasionally take time to chew the fat. To prove it, he went out and earned the coveted ARRL Rag Chewers Club award. W2GDJ did the honors at a recent Albany (New York) ARA meeting.-Ed Gosch, W2UV

# Beginners' Computer Programming for Ham Radio

Part 2—Have your compiler yet? Fire it up and let's tackle some simple ham radio programs in *Delphi* and *Visual Basic*.

Radio amateurs have used computers for several decades to enhance their operating activities. Simple programs calculate engineering values, log contacts, calculate beam headings, and track awards and QSLs. More complicated programs control packet, RTTY or other digital modes, predict radio propagation conditions and make forecasts and track Amateur Radio satellites.

I rarely find a commercial program that does exactly what I would like it to do or one that has the features that I want. Any conceivable process or mathematical relationship can be described or calculated by a PC program. If you have a copy of the *Delphi* or *Visual Basic* programming languages on your computer, you can start writing *Windows* programs for ham radio using the simple programming projects described in this article. If you do not yet have programming software, the first article in this series shows what to look for in a *Windows* program compiler and where to find the one right for you.<sup>1</sup>

Review the software examples shown here, input the code and you can create several neat utilities to use in your shack. Later, you can use these examples as a model to write *Windows* programs to calculate or plot just about anything. I have embedded comments in the source code to help you understand what the code is doing. Duplicating the functionality of a fullfeatured commercial quality program, however, requires learning more about *Visual Basic* or *Delphi* than is discussed in this article. Nevertheless, the concepts presented here will help you develop your ideas into a working ham radio program.

The example programs and their source code is available on the ARRLWeb.<sup>2</sup> The *Visual Basic* programs



Figure 1—The *VB3* development screen shows the *Dipole* program visual objects placement prior to compilation.

#### Table 1

```
Source Code for the Length of a 10-Meter Dipole
```

In Delphi, the source code for the calculation might look like:

```
procedure TForm1.Button1Click(Sender: TObject);
var // variables need to be declared
  Length : real;
  MHz : real;
begin
    MHz := 28.50
    Length := 468/ MHz
end;
In Visual Basic the comparable source code might look like:
Sub Command1_Click()
    Mhz = 28.50
    Length = 468/MHz
    Text2.txt = Length
End sub
```



were coded with Visual Basic 3 and 5. The Delphi programs were coded with Delphi 5. The Visual Basic 3\*.exe files require the Visual Basic runtime module vbrun300.dll while the Visual Basic 5 \*.exe files require msvbvm50.dll (download the files from the Internet if your computer does not have them), while the *Delphi* \*.exe files do not require any additional files. It is possible to

P Databi 5	Declaret 1						
en pedim a -	FIUJECIZ						
<u>Eile E</u> dit <u>S</u> e	arch <u>V</u> iew <u>B</u>	Project	<u>Run Component Database</u>	🛛 Iools Help 🚽 🗗 🖧			
	🕞 🚓 - 🔲 🛤 🕫 🕫 🖉 🕼 Standard Additional Win32 Sustem Data Access Data Controls InterBase Internet FastNet 💙						
D P Ti		• 11					
	110) 70	unt					
Object Inspecto	01"	×	IDipole1				
Edit2: TEdit		-	Fraguanau MHa				
Properties Eve	nts		riequency Minz				
ImeMode	imDontCare		:::: Edit1	Butten1			
ImeName	moontCale		Dipole length in feet				
Left	32	en X	· · · · • • • • • • • • • • • • • • • •				
MaxLength	0		Edit2				
Name	Edit2						
OEMConvert	False		Contraction of the second s				
ParentBiDiMod	True		🗎 Unit1.pas	_ C 🗙			
ParentColor	False		×	Unit			
ParentFont	True		🖅 📢 TForm1				
ParentShowHir	True		🖅 🧰 Variables/Constants	unit Unit1;			
PasswordChar	#0		🕀 🧰 Uses				
PopupMenu	and the second s	÷ =		interface			
ReadUnly	False	÷					
ShowHint	raise	÷		uses			
TabSton	True	÷.,		Windows, Messages, SysUtils, Classes, Graphics, Co			
Tag	nae						
Text	Edit2	-		type			
2 hiddon	5			TForm1 = class(TForm)			
2 Hidden		11.		Edit1: TEdit;			
				EditZ: TEdit;			
				Button1: TButton;			
				Labell: TLabel;			
3 Start 2 2 Delphi 5 3 17:01 PM							

Figure 4—The Delphi development screen during development of the Dipole program.



Figure 5—*Dipole* code window for *Delphi* with the code described in the text entered into the code window.

load the Visual Basic 5 code with a Visual Basic 6 compiler as described in the download package.

If you are not into programming yet or do not have a *Windows* language compiler, you can use the executable files for the featured utilities, which are also available. Once you try the resulting programs, you may decide to get your own copy of *Delphi* or *Visual Basic*. Regardless, I hope these programs and the ones in a future article are useful in your shack.

Additional algorithms to help you program more difficult ham-radio tasks will be described in Part 3 of this series. If you know something about programming, you may want to read my *QEX* article;<sup>3</sup> it will direct you to many useful resources. With a bit of thought and a toolbox of coding tricks provided in this series, it really isn't difficult to make your *Visual Basic* and *Delphi* projects "talk" ham radio.

#### **Easy Programming Tasks**

Executing standard electronic or mapping formulas on your computer is the most common task you will have as a programmer. Assuming you are familiar with your programming language and compiler, code the following examples with your compiler and discover how relatively simple Windows programming can be. The following text will walk you through the coding process. If you make mistakes keyboarding the code, your language compiler is fairly forgiving and will usually complain. Often the compiler will show you what is wrong so you can fix it right away. Most beginners will find it useful to code these examples by hand. If you get stuck, consult "Loading Delphi and Visual Basic Source Code" in the download package.

#### The Length of a Dipole

From a formula in *The ARRL Handbook for Radio Amateurs* (2003, p 20.4):

Length (ft) =  $492 \times 0.95$  / f (MHz) = 468 / f (MHz) (Eq 1)

Table 1 shows the code in Visual Basic

#### Listing 1 Write the Simple Dipole Program Step by Step

Visual Basic 3/5

- 1. Start *Visual Basic* and select File —> New Project. *Visual Basic* displays a New Project dialog box.
- 2. Drag a text box onto the form from the tool bar. VB calls the box "Text1".
- 3. Drag a second box onto the form. VB automatically calls it "Text2".
- 4. Drag a button onto the form. VB calls it "Command1" Figure 1 shows what your *Visual Basic* screen should look like at this stage.
- 5. On the Properties form, change the caption from Form1 to VBDipole.
- Above the Text1 box, place a Label. Use the Properties form to change its caption from Label1 to Frequency MHz.
- 7. Place a second Label above Text2 box and label it Dipole length in feet.
- 8. Select the Command1 button on the VBDipole form. Use the Properties form to change its name to Calculate.
- 9. Double-click the Calculate button. A code window appears. Between the existing code:
- Sub Button1\_Click()

End Sub

- Type in the following code manually:
  - MHz = Text1.text

Length = 468/MHz

- Text2.text = Length
- The code box should look like Figure 2.
- 10. Save this. From the main toolbar, select File —> Save Project As, and give it a name.
- 11. Answer "Yes"
- 12. Change Form1.FRM to VBDIPOLE.FRM and click "OK".
- 13. Change PROJECT1.MAK to VBDIPOLE.MAK (change
- PROJECT.VBP to VBDIPOLE.VBP for Visual Basic 5 or 6).
- 14. From the Main tool bar, RUN —> Start. The program should be running.
- 15. To save the program as an executable file, from the tool bar, select File —> Make EXE File. The executable file is created and placed in the same directory in which you placed your source code.

Figure 3 is a screen shot of what the *Visual Basic* 3 program looks like when completed.

#### Delphi 5

- 1. Start *Delphi*. Select File —> New Application. *Delphi* displays Form1 on the screen.
- 2. Drag an edit box onto the form from the tool bar. *Delphi* calls the box "Edit1".
- 3. Drag a second box onto the form. Delphi calls it "Edit2"
- Drag a button onto the form. *Delphi* calls it "Button1". Click on the Object Inspector form, change the caption from Form1 to Dipole.
- Above the Edit box, place a Label. Use the Object Inspector form to change its caption from Label to Frequency MHz.
- 6. Place a second Label above Text2 box and label it "Dipole length in feet." Figure 4 shows what your *Delphi* design screen should look like at this stage.
- 7. Select the Button1 button on the VBDipole form. Use the Object Inspector form to change its name to Calculate.
- 8. Double-click the Calculate button. A code window appears. Between the existing code lines:

begin

- end; Type in the following code manually:
  - MHz = StrToFloat(Edit1.text);
  - Length = 468/MHz;

Edit2.text = FloatToStr(Length);

- Above the code begin, type in the following code manually:
  - Var MHz : Real;
  - Length : Real
- The code box should look like Figure 5.
- 10. Save this. From the main toolbar, select File —> Save As 11. Change the file name from Unit1.pas to Ddipole2, then
- click "Save". 12. From the Main tool bar, RUN —> Run. The program should be running.
- 13. Delphi automatically generates the executable code and places it in the same directory with the source code.

Figure 6 is a screen shot of what your program looks like when completed.



and *Delphi*. The code is similar for both languages. To connect the code to the real world, you need to provide a way to input the dipole's design frequency (MHz) and a place to output the calculated antenna length (Length). Listing 1 contains detailed *Visual Basic* and *Delphi* instructions for coding the *Dipole* program algorithm. Two visual object boxes (called "text boxes" in *Visual Basic* and "edit boxes" in *Delphi*) and a button (called "Command" in *Visual Basic* and "Button" in *Delphi*) are linked to the form and provide the means of input and output.

You can replace the dipole algorithm within the button-click routine with a different formula to calculate anything that requires a single input variable and results in a single output variable. In the Dipole example the input variable is frequency, *MHz*, the output variable is *Length*). If you are at loggerheads as to what you could code as a substitute, review the *BASIC* source code included in the file HCal-10.zip at **www.arrl.org/files/qst-binaries**. *Hcal* is a free program written in *GWBasic* by George Murphy, VE3ERP. *Hcal* has formulas to calculate almost anything you might need to in the way of ham radio electronics. By itself,

*Hcal* is a neat little program, but the formulas VE3ERP has collected could be used more effectively with the more efficient *Windows* interface. Isolate the code you are interested from one of the many sub programs in *HCal*, change the coding to the correct format, and put the new code in place of the Dipole code in your *Windows* program.

# Determine Bearing and Distance to a Particular DXCC Location

Listing 2 is the complete code needed to calculate bearings and distance using *Delphi* 5. Listing 3 is the *Visual Basic* code that has to be linked to the program's "Calculate" button. The formula to calculate bearing and distance were derived from many sources including an old edition of *The ARRL Antenna Book*.

You can upgrade the *Bearing/Distance* program shown in Figure 7. Give it the capability of picking a country's coordinates from a list. Save your own station's coordinates to a file; and/or use an algorithm to find coordinates based on an entered call sign instead of typing the actual latitude and longitude. Adding functionality is not hard, but it requires learning to use data lists, files and such with your compiler. Most programming texts describe the techniques you need to add the enhancements to the utility. You will also need a list of DXCC entities with their corresponding latitude and longitude coordinates. Files with this information can be found on the Internet, or you can develop your own. The resources described in Part 1 of this series can be used to get a head start figuring out how to do these tasks, or you can wait and read about the solutions in Part 3 of this article. Part 3 will describe more algorithms to get you started writing more complicated programs.

#### Plot a Map of the World

If your program uses coordinate information, it would be nice to be able to view it on a map. Images make a program's form attractive and you probably would like to plot certain information onto the map including your location and those of DX stations.

A world map is relatively easy to plot in a form or "picture box" if you have a listing of coastline coordinates like those available from the *CIA Factbook* (www. cia.gov/cia/publications/factbook). The World Map example provides the tools to construct a map from digital data. I made a condensed version of the huge CIA world coordinates public domain database that allows you to plot coastlines quickly on slow computers. The map data



Figure 8—*Delphi* World Map shows one how to use both simple digital map data and bitmaps in your programs. The upper map is plotted from digital data; the lower map is a bitmap.



Figure 9—The *Visual Basic* World Map is similar to the *Delphi* program. Both upper maps are made from digital data; one is plotted on a form and the other on a picture control. The lower map is a bitmap.

#### Listing 2

#### Complete Delphi 5 Code to Calculate Bearing and Distance

unit Azimuthl;

interface 11565 Windows, Messages, SysUtils, Classes, Graphics, Controls, Forms, Dialogs, StdCtrls: type TForm1 = class(TForm) distance private Private declarations } public Public declarations } end: Form1: TForm1; implementation {\$R \*.DFM} function Sgn (X: Real): Real; // type these 7 lines of code directly into the // code window
begin // at this location (following the {\$R \*.DFM}). if abs(x) > x then result := -1.0 else if abs(x) = x then result := 1.0; end: procedure TForm1.Button1Click(Sender: TObject); // code becomes available // when the 1st button is placed on the form var JJ, W1, W2, Wr, WT, L1, L2: real; Lt, LR, W3, HH, GG, H0, H9 : real; Bearing : real; Distance : real; begin //L1 := 33.01; // WB5KIA's latitude and longitude for reference //W1 := 96.892; L1 := StrToFloat(Edit3.text); //your latitude W1 := StrToFloat(Edit4.text); //your longitude in degrees west //L2 := 35.1; //W2 := 96.1; //W2 := yo.1; L2 := StrToFloat(Edit5.text); //other latitude W2 := StrToFloat(Edit6.text); //other longitude W2 := StrToFloat(Edit6.text); // IF (L1 = 0) and (L2 = 0) then L1 := L1 + 0.00001; //prevent program crash if both L1 and L2 are 0 JJ := PI/180; Wr := -(Wl - 180\*(1+ Sgn(Wl-0.001))) \* JJ ; WT := -(W2 - 180\*(1+ Sgn(W2-0.001))) \* JJ ; := ArcTan(Sqrt(1-HH\*HH)/HH)+PI/2\*(1-Sgn(HH)); GG H0 := int(1.59 \* GG) + 1; H9 := (Sin(Lr) - HH\*Sin(Lt))/sin(GG)/Cos(Lt);begin; If H9 < -0.9999999 then H9 := ArcTan(PI/2\*(1-Sgn(H9))) Else H9 := ArcTan(Sgrt(1-H9\*H9)/H9)+PI/2\*(1- Sgn(H9)); end; H9 := H9\* Sgn(W3-PI)\* Sgn(PI - GG); H9 := H9 + PI \* (1- Sgn(H9)); Bearing := INT(H9/JJ + 0.5); Distance := INT(6356.775\* GG + 0.5); Edit1.text := FloatToStr(Bearing); Edit2.Text := FloatToStr(Distance); //this is the calculated bearing
//this is the calculated distance in kilometers end; end.

The code in **boldface** type is the code you need to add manually to the code window. Code in the lighter typeface is automatically generated as the button, edit and label objects are put on the form. Text preceded by "//"are comments that are informational statements not executed in *Delphi* 5. If you load this with *Delphi* 1, the comment statements are not recognized and will need to be removed before the code can be compiled. The comments tell you what controls you need to out on a blank form to get the program to work.

#### Listing 3 Visual Basic 3 Code to Calculate Bearing and Distance

Sub Command1 Click () Dim JJ As Double Dim W1 As Double Dim W2 As Double Dim Wr As Double Dim Wt As Double Dim L1 As Double Dim L2 As Double Dim Lt As Double Dim Lr As Double Dim W3 As Double Dim HH As Double Dim GG As Double Dim H0 As Double Dim H9 As Double Dim Bearing As Double Dim Distance As Double L1 = Val(Text1.Text) 'vour latitude W1 = Val(Text2.Text) 'your longitude in degrees west L2 = Val(Text3.Text) `other latitude W2 = Val(Text4.Text) 'other longitude If (L1 = 0) And (L2 = 0) Then L1 = L1 + .00001 'prevent program crash if both L1 and L2 are 0 End If PT = 3.141592JJ = PI / 180 Wr = -(W1 - 180 \* (1 + Sgn(W1 - .0001))) \* JJWt = -(W2 - 180 \* (1 + Sqn(W2 - .0001))) \* JJLt = L1 \* JJLr = L2 \* JJW3 = Wr - Wt + .0001W3 = PI \* (1 - Sgn(W3)) + W3HH = Sin(Lt) \* Sin(Lr) + Cos(Lt) \* Cos(Lr) \* Cos(W3)GG = Atn(Sqr(1 - HH \* HH) / HH) + PI / 2 \* (1 - Sqn(HH)) H0 = Int(1.59 \* GG) + 1H9 = ((Sin(Lr) - HH \* Sin(Lt)) / Sin(GG) / Cos(Lt))If H9 < -.9999999 Then H9 = Atn(PI / 2 \* (1 - Sgn(H9)))Else H9 = Atn(Sqr(1 - H9 \* H9) / H9) + PI / 2 \* (1 - Sqn(H9))End If H9 = H9 \* Sgn(W3 - PI) \* Sgn(PI - GG)H9 = H9 + PI \* (1 - Sgn(H9))Bearing = Int(H9 / JJ + .5) Distance = Int(6356.775 \* GG + .5)'this is the calculated bearing Text5.Text = Str\$(Bearing) Text6.Text = Str\$(Distance) 'this is the calculated distance in kilometers End Sub Remember to place the six text boxes and Command button on the form before you enter the above code in the Command1\_click()

event handler.

is loaded from the database at lightning speed on newer machines. The small database is provided with the source-code listing on the ARRLWeb. The map database can be converted into a standard mapping projection, but that requires quite a bit of mathematical manipulation. For most Amateur Radio purposes, however, plotting latitude and longitude on an equally spaced grid to create a cylindrical map projection works fine, so we will ignore the standard map projections for now. It is very easy to plot additional information, such as a location based on a latitude and longitude, on the digitally drawn map.

Even on a very fast computer, the digital map file takes a few seconds to load. Is there any way to load a map faster? An alternative to using digital map files is to place an existing map image on a form. *Delphi* and *Visual Basic* both have a tool to place a bitmap into your program easily. Additional information, like your location, can be placed on the map if you scale the bitmap in pixels, the little dots that comprise your screen.

World Map is *not* a complete program. It displays a map and lets you plot other information using coordinates on the map. It does provide, however, most of the essential code to create a program of your own that would be enhanced by the use of maps. The maps were designed for a  $600 \times 800$  screen resolution.

Dave Pape has free digital map data at different resolutions and geographical map bitmaps for download on his site at **www.evl.uic.edu/pape/data/Earth/**. The digital data is a cut-down version of the *CIA Factbook* files and they are rather large, but they are the largest, free public mapping data set available.

It would take an article longer than the space available to describe all the neat things that can be done with digital or bitmap maps using your PC and *Windows*. The comments in the source code for World Map describe the program's operation. Both the digital and bitmap versions of the world map made using the worldmap data set are shown on Figures 7 and 8. You may want to read *Using Maps with Delphi to Create a New World View* by J.W. Rider. His article (available on-line from **Borland.com**) discusses techniques to get your map into different projections in *Delphi*.

The source code for *Dipole* and *Bearing/Distance* utility programs is available in versions for *Delphi* 5 and *Visual Basic* on the ARRLWeb as described in the sidebar "Loading *Delphi* and *Visual Basic* Source Code." Both projects result in small, Amateur Radio useful utilities for your shack. The World Map source code, free world coordinates database

**Source-Code Compatibility** 

The source code provided on the ARRLWeb will load, as is, with *Delphi* 5, *Delphi* 1, *Visual Basic* 3 and *Visual Basic* 5 or 6. The code should also work with *Delphi* 3, 4 and 6. Using the code with *Delphi* 2 might require minor modifications. Although the source code was developed with the "professional" versions of these compilers, only tools that are available on the Standard or Beginners versions of these software products were used.

Visual Basic 3 \*.MAK files will not load on the 32-bit versions of Visual Basic. Visual Basic 4, 5 and 6 use project files (\*.vbp) that instruct the compiler to look for the source code in particular places (the 32-bit equivalent of MAK files). Visual Basic 5 source code and executable files have also been provided on the ARRLWeb. The Visual Basic 5 code will load with Visual Basic 6 without difficulty. and a cylindrical-projection world-map bitmap compatible with *Visual Basic*, *Delphi* and other programming languages are also in the package.

#### What's Coming Next

The logic and calculations necessary to achieve a desired result is called an algorithm. The example code described here uses algorithms. The neat *Windows* program you will soon be developing involves combining several algorithms or more to work together to produce a desired response.

Part 3 of this series will direct you to articles in various magazines that discuss useful Amateur Radio related mathematical routines or provide *BASIC* code listings that can be used to develop additional algorithms for your programs. The code included with most of these referenced articles is written in *BASIC*. The language is sufficiently similar to *Visual Basic* and *Delphi's Pascal* that you can easily mine the algorithms and convert the logic into your own programs. Part 3 will include the algorithms and source code for four *Windows* projects that involve calculating grid squares from coordinates, determining distance between grid squares and calculation of sunrise/ sunset times for those of you interested in low-band DXing.

#### Notes

- <sup>1"</sup>Beginners' Computer Programming for Ham Radio, Part 1," QST, Feb 2003, pp 32-37.
- <sup>2</sup>You can download this package from the ARRLWeb; www.arrl.org/files/qst-binaries/. Look for 0303Grad.ZIP.
- <sup>3</sup>S. Gradijan, WB5KIA, "Amateur Radio Software: It Keeps Getting Better," *QEX*, Sep/ Oct 2002, pp 19-29.

A ham since 1963, Steve Gradijan, WB5KIA, is a geological consultant in the Dallas, Texas, area. He holds an Extra class license. Computer programming has been his second hobby since the late '70s. He was previously licensed as WA8KBK and LAØDY. His wife Chris is WD5EML (ex-LAØDZ) and 16-year-old son Francis is KD5HTB. You can contact Steve at wb5kia@arrl.net. Steve has answers to some questions about his articles at www.qsl.net/wb5kia/index.html.

### STRAYS



This colorful booth at the 2002 San Diego County Fair was staffed by members of the Coronado Emergency Radio Operators CERO (an ARRL Affiliated Club). From the left: George Grant, K3EJ, Russ Downer, KA6INT, and Glenn Gerbrand, WM6B. The club holds regular free Amateur Radio classes and has added many new hams to the local San Diego area.

# The 2003 Annual Meeting of the ARRL Board of Directors

The Year of the Member.

et's make 2003 the 'Year of the Member" declared President Jim Haynie, W5JBP, as he opened his comments during the first day of the ARRL's Annual Meeting held January 17 and 18, 2003 in Windsor, Connecticut. Over the last year membership has continued to slip slowly: A dues increase, a poor economy worldwide and increased joblessness have all contributed to difficulties signing up and retaining members. Then, with profound confidence, Havnie unveiled Amateur Radio Today, a short documentary video that tells Amateur Radio's public service story to nonhams. The video presentation, directed by Dave Bell, W6AQ, and narrated by former CBS news anchorman Walter Cronkite, KB2GSD, runs approximately six minutes.

"We wanted to have something for people to take to nonhams and civic clubs," said Haynie. He also anticipates that the CD-ROM production will come in handy during his visits to Capitol Hill. The presentation focuses on Amateur Radio's role in emergency communications. And in the long run, Haynie and the Board hope that production of this video and others in the chute for future release will help drive membership and improve Amateur Radio.

The Board also created a new *ad hoc* committee to focus on the recruitment

AMATEUR RADIO TODAY



and retention of members. "The *ad hoc* committee is for the near term to explore ways to entice people to join the organization," Haynie said. "What can we do to make the ARRL more attractive to potential members? The committee will

explore the various avenues to answer this question." ARRL International Affairs Vice President Rod Stafford, W6ROD, chairs the Recruitment and Retention Ad-Hoc Committee. Members include Dakota Division Director Jay Bellows,



The new Great Lakes Division leadership at their first Board Meeting: (L-R) Vice Director Dick Mondro, W8FQT, and Director Jim Weaver, K8JE.

NT1N



After President Haynie announced the instant availability of the new Amateur Radio Today CD, he had to fend off a pile-up of meeting attendees!



Radio Amateurs of Canada's President Bill Gillis, VE1WG, is flanked by (L-R), President Jim Haynie, W5JBP, IARU President Larry Price, W4RA, and International Affairs Vice President Rod Stafford, W6ROD, each wearing the RAC ball cap Bill presented to them.



Chief Development Officer Mary Hobart, K1MMH, and President Haynie happily display donations presented by Dakota Division Director Jay Bellows, KØQB. The checks (\$500 for Defense of Frequencies Fund and \$500 for the ARRL Education Project) were from the estate of the late WØQIK, Thor Lyford. Thor's sons asked that his equipment be sold and the proceeds donated to the League.

#### The 2002 Bill Leonard, W2SKE, Professional Media Award

The 2002 Bill Leonard, W2SKE, Professional Media Award honors a group project this year. The winners are Assistant News Director Jill Valley and News Director Greg Schieferstein, of KPAX-TV in Missoula, Montana. This award is given annually to a professional journalist (or group) for outstanding coverage of Amateur Radio in TV, radio, print or multimedia. The winner receives an engraved plaque and a check for \$500.

KPAX-TV's winning submission was a news segment featuring Jenna Rettenmayer, KD7MAD, a Missoula high school senior on the air making a moonbounce contact with her Elmer looking on. Rettenmayer decided to get her Amateur Radio license for her senior project. Members of the ARRL's Public Relations Committee, who judge the nominations each year, were particularly impressed with the

KPAX-TV piece. Not only did it feature a young woman who is interested in ham radio, it captured the moonbounce contact, something fairly rare.

NT1N

The Board of Directors ratified the PR Committee's decision shortly after its January meeting. Nine other



nominations were received for the 2002 award program.

In Amateur Radio circles, Bill Leonard is remembered for his 1958 contribution to *Sports Illustrated*, "The Battle of the Hams," which describes the "sport of DXing." In November of 1996, Leonard was inducted into the Broadcasting and Cable Hall of Fame. Leonard became a Silent Key in 1994.

Nominations are now being accepted for the 2003 Bill Leonard, W2SKE, Professional Media Award. The deadline for entries is December 5, 2003. For more information, including rules for entry and nomination forms, contact Jennifer Hagy, Manager of Media Relations at 860-594-0328 or send e-mail to **jhagy@arrl.org**.

KØQB; Midwest Division Director Wade Walstrom, WØEJ; West Gulf Division Director Coy Day, N5OK; Dakota Division Vice Director Twila Greenheck, NØJPH; Delta Division Vice Director Henry Leggette, WD4Q; New England Division Vice Director Mike Raisbeck, K1TWF, and Hudson Division Vice Director Steve Mendelsohn, W2ML.

#### **Honorary Vice Presidents**

It is not often that the Board elects an Honorary VP, so it was quite the event when the Board elected two at this meeting! John Kanode, N4MM, and Tod Olson, KØTO, were both elected into the ranks of Honorary Vice Presidents. Both Kanode and Olson served on the ARRL Board for more than 20 years—Kanode rising to Vice President after a long-term residency as the Roanoke Division Director, and Olson to International Affairs Vice President—in between two stints as Dakota Division Director.

#### Membership Services

The Membership Services Committee (MSC) was busy over the last six months-and at its "pre-Board" meeting. The Committee designated a subcommittee, Chaired by Tom Frenaye, K1KI, along with Joel Harrison, W5ZN, Wayne Mills, N7NG, and Ward Silver, NØAX, to evaluate ARRL's VHF/UHF contest and award programs. The group's tools included surveys, interviews and assessments of present and past activity. Among the recommendations developed from this work is a new award for working and confirming grid squares on 6 meters and above that is similar to the DXCC Challenge. The MSC also decided to remove mode restrictions from the EME contest, acknowledging the growing interest in new digital modes being used on the Earth-Moon-Earth circuit. And the status of the 2 meter National Simplex frequency, 146.52 MHz, remains unchanged for the future as a "no-contest zone." The group also recommends further study of the prospect of adjusting the starting and ending times for the VHF/UHF contests. The VHF/UHF study subcommittee will remain in force continuing its work through the near future.

In other operating news, the MSC voted to add club competition to the RTTY Roundup, while continuing to study the possibilities of extending club competition to additional contests. The MSC also voted to define the standard off-time increment for all ARRL contests to be a minimum of 30 minutes, and evaluated the performance and value of Field Day's popular new GOTA—Get on the Air station. The MSC reduced

#### FRIED HEYN, WA6WZO

#### **ARRL Honorary Vice Presidents**

Current Honorary Vice Presidents, with the year of election:

John Kanode, N4MM—2003 Tod Olson, K0TO—2003 Evelyn Gauzens, W4WYR—2002 Edmond A. Metzger, W9PRN—2001 Marshall Quiat, AG0X—2000 Hugh Turnbull, W3ABC—2000 Jay Holladay, W6EJJ—1996 George Hart, W1NJM—1984 Robert York Chapman, W1QV—1975

Past Honorary Vice Presidents, all Silent Keys, with the year of election: Paul Grauer, WØFIR-1993 L. Phil Wicker, W4ACY-1988 Vic Clark, W4KFC-1980 J. L. McCargar. W6EY-1980 John Griggs, W6KW-1980 J. A. "Doc" Gmelin, W6ZRJ-1979 David H. Houghton-1976 Robert W. Denniston, WØDX-1974 Roemer "Doc" Best, W5QKF-1974 Charles G. Compton, WØBUO/WØAF-1974 Wavland G. "Soupy" Groves, W5NW-1974 F. E. Handy, W1BDI-1966 Alex Reid, VE2BE-1966 For more information about ARRL's Honorary Vice Presidents designation, see www.arrl.org/announce/reports-02/ exechvp.html.

the number of QSOs required by the GOTA station in order to earn the bonus points to 100 QSOs. The GOTA station can still make up to 400 QSOs for point credit to the "mother" station, but now the bonus points can be earned more readily.

## 2003 World Radiocommunication Conference

The Board also spent a fair amount of time discussing strategy for pursuing Amateur Radio's interests at WRC-03 to be held in Geneva, Switzerland from June 9 to July 4. The hottest topic concerning ham radio is 7 MHz and the objective of a worldwide 300-kHz harmonized amateur allocation. Dr Larry Price, W4RA, President of the International Amateur Radio Union and past President of ARRL, attended the Board meeting at the invitation of President Haynie, and delivered a detailed, multimedia presentation to the Board on Thursday evening. Dr Price outlined each step of the process for achieving the best possible outcome for Amateur Radio at WRC-03, and how the many volunteers from IARU have pursued these goals. He related that there are at least six competing methods of dealing with the 40 meter band, and that some of them are in line with IARU's goals



The Orange County's Hospital Disaster Support Communications System was awarded the prestigious ARRL National Certificate of Merit.

while some are quite counter.

Chief Executive Officer Sumner said the immediate need is to get the government side of the US administration to support realignment of the amateur band and the shortwave broadcasters in ITU Regions 1 and 3, to which the FCC has already agreed. "The National Telecommunications and Information Administration (NTIA), which oversees the federal government's use of radio spectrumthinks that Region 1 and 3 administrators should take the leadership role on this issue and that we [in Region 2] should make no proposal. We're trying to change that view. The US has a responsibility to represent the interests of its amateur licensees whose operation in the 40-meter band is severely impacted by the high-power broadcasting stations in the other Regions. The US did so in 1979 and 1992 and should do so again in 2003."

In other governmental arenas, the Board updated ARRL's positions for the 108th Congress. ARRL will work for a reintroduction of HR-4720, The Amateur Radio Emergency Communications Consistency Act of 2002. The bill was originally sponsored by Rep Steve Israel (D-NY) and co-sponsored by Rep Greg Walden (R-OR), WB7OCE, and Rep Pete Sessions (R-TX). The legislation, which will receive a new number upon reintroduction, would require private land-use regulators-such as homeowners' associations-to "reasonably accommodate" Amateur Radio communication consistent with the PRB-1 limited federal preemption. PRB-1 now applies only to states and municipalities.

#### National Certificate of Merit

The Board honored the Hospital Disaster Support Communications System (HDSCS) of Orange County, California, with an ARRL National Certificate of Merit for 23 years of service to its community. The HDSCS is a group of about 90 Amateur Radio operators who have volunteered to provide backup internal and external communications for critical medical facilities in Orange County, California whenever normal communications are interrupted for any reason. HDSCS was formally organized in 1980 at the request of hospitals in north Orange County who hold drills together each year for disaster preparedness. It came about as the result of a phone outage at a large hospital in Fullerton in 1979 that resulted in an impressive response by Amateur Radio operators to that emergency. Beginning with seven at inception, the list of HDSCS-supported facilities has grown to include all of the acute care receiving hospitals in the county, plus other critical medical facilities. And more facilities-especially outside of the county-are clamoring to be included. The founder and leader of HDSCS is April Moell, WA6OPS, a registered occupational therapist.

In addition to communications within and between hospitals, the group assists with communications between staff, suppliers and outside agencies (such as blood banks, Red Cross and county Emergency Medical Services agency). Most of the hospitals have installed dedicated rooftop VHF/UHF antennas and some have installed Amateur Radio stations for HDSCS use. However, this equipment may not be available or accessible in disaster situations. Therefore, each HDSCS member is prepared to bring battery-operated personal equipment to provide both internal and external communications. You can

#### read more about HDSCS at their Web site, members.aol.com/emcom4hosp/.

#### Other Matters

The Board resolved to vote for the admission of Georgia. Armenia and Vietnam to the International Amateur Radio Union.

#### Summary of Major Board Actions

The Minutes of the Second Meeting of the Board, Moved and Seconded are published at the ARRLWeb, www.arrl.org/announce/board-0301/. If you do not have Internet access you may request a written copy of the Minutes by writing to ARRL Secretary, 225 Main St, Newington CT 06111.

Minute	Purpose	Action
<i>Organiz</i> 16	zational ARRL Legislative Positions for the 108th Congress Defines objectives for ARRL's efforts on Capitol Hill.	Adopted
25	ARRL's Defined Benefit Pension Plan Adapts ARRL's plan to new IRS regulations.	Amended
26	<b>2003 Plan/Budget</b> Board approves the work of the Administration and Finance C	Approved committee.
38, 49	<b>Committee Appointments</b> The President names members for 15 ARRL Committees.	Announced
40	<b>Strategic Planning</b> Board approves resumption of strategic planning.	Approved
46	Affirmative Vote for National Association Radioamateurs of Georgia Entry into IARU ARRL will vote in favor of Georgia's entry into IARU.	Approved
47	Affirmative Vote for Federation of Radiosport of the Republic of Armenia Entry into IARU ARRL will vote in favor of Armenia's entry into IARU.	Approved
48	Affirmative Vote for Vietnam Amateur Radio Club Entry into IARU ARRL will vote in favor of Vietnam's entry into IARU.	Approved
49	<b>Ad-Hoc Recruitment and Retention Committee</b> A special committee is created to develop and test methods for increasing ARRL membership and retaining existing membership and membership and retaining existing membership and retaining existing membership and membership and retaining existing membership and member	Authorized
Election	าร	
8	Honorary Vice Presidents John Kanode, N4MM, and Tod Olson, KØTO, elected as Hono Vice Presidents.	Elected prary
9	<b>Executive Committee</b> The four Director positions on the Executive Committee are el Board. Tom Frenaye, K1KI, Bernie Fuller, N3EFN, Jim Maxwe Rick Roderick, K5UR are elected.	Elected ected by the ell, W6CF, and
10	<b>ARRL Foundation Directors</b> The charitable arm of the ARRL is run by volunteer Directors year terms are staggered. Tom Frenaye, K1KI, Tom Comstock Roger Franke, K9AYK, are re-elected for three-year terms.	Elected whose three k, N5TC, and
<i>Regula</i> 31	tory Petition FCC for Temporary Relief from Automatic Power Control for Spread Spectrum at 2.4 GHz The proposed, two-year <i>temporary</i> relief action will allow over experiments to take place, under the control of ARRL's High S Multimedia Working Group, for the purpose of supporting futur changes if necessary.	Authorized -the-air peed Digital & re rules
Awards		
22	ARRL National Certificate of Merit to Orange County's Ho Disaster Support Communications System	spital Conveyed

The HDSCS is recognized for its exemplary support provided to all

35 acute-care receiving hospitals in Orange County, California.

Each time an Amateur Radio society applies to its respective IARU region, and after eligibility is determined, each IARU member society is solicited to cast a vote for or against the application. Societies from Cameroun. Macau, the Pitcairn Islands and New Caledonia have most recently been elected into IARU membership.

The Great Lakes Division elected its new leaders in elections held last November. Director Jim Weaver, K8JE, and Vice Director Dick Mondro, W8FOT, attended their first Board meeting in January. Director Weaver was pressed into service immediately, as he was appointed by President Haynie to the Membership Services Committee.

The minutes of the January 17-18 ARRL Board of Directors meeting have been posted on the ARRL Web site, www. arrl.org/announce/board-0301.

The next Board meeting will be held in July in Connecticut. There won't be any snow for the southern delegates to enjoy, but there will be a whole new agenda of challenges and work waiting to be tackled.

Dave Patton, NTIN, is Special Assistant to the ARRL Chief Executive Officer. He can be reached at dpatton@arrl.org. Dave Hassler, K7CCC, is ARRL Assistant News Editor. He can be reached at Q57dhassler@arrl.org.

#### **STRAYS**

#### SENIOR HAMS SOUGHT FOR **EMERGENCY COMMUNICATIONS**

♦ ARRL is seeking Corporation for volunteers to par- NATIONAL ticipate in the Level COMMUNIT



munications on-line course. Under the federal Homeland Security grant from the Corporation for National and Community Service, which began last August, seniors are encouraged to get involved. Such participation results in a win-win situation for everyone. The benefits for seniors include opportunities to add new skills to a lifetime of experience and knowledge and provide meaningful volunteer service to their communities through Amateur Radio. Communities-and our nation-benefit by seeing increased numbers of volunteers actively preparing for the next emergency situation. Course description and details can be found on-line at www.arrl.org/cce/ courses.html#ec001. More information about the Certification and Continuing Education Program can be found at www.arrl.org/cce and the CCE Links found there. For more information, contact Dan Miller, K3UFG, Emergency Communications Course Manager, k3ufg@arrl.org, tel 860-594-0340.

# The ITU 2002 Plenipotentiary Conference

The most significant policymaking body of the International Telecommunication Union discussed the ITU's future in Marrakech, Morocco, this past fall, and Amateur Radio was there.

The 16th Plenipotentiary Conference of the International Telecommunication Union (ITU) was held at the Palais des Congrès in Marrakech, Morocco from September 23 to October 18, 2002. More than 1700 top-ranking delegates from all regions of the world attended, including several who represented the interests of the Amateur Radio and Amateur Satellite Services.

The Plenipotentiary Conference, called the Plenipot for short, is the top policymaking body of the ITU. Held every four years, the Conference sets the Union's general policies, adopts fiveyear strategic and financial plans and elects the senior management team of the organization, the members of Council and the members of the Radio Regulations Board. It is the key event at which ITU Member States decide on the future role of the organization, thereby determining the organization's ability to influence and affect the development of issues such as convergence of services, tariffs, the Internet, universal service and electronic commerce. Some Sector Members also attend as observers, including IARU.

#### Amateur Radio Represented Throughout

International Amateur Radio Union President Larry Price, W4RA, and Region 2 Director Tim Ellam, VE6SH, represented the interests of the Amateur and Amateur-Satellite Services. Jon Siverling, WB3ERA, from the ARRL Technical Relations Office in Washington, DC, was a member of the US Delegation. In addition to this core team, numerous other amateurs participated in various capacities.

#### **CN8UIT**

Roberto Cabanillas-Moyano, LU3HAK, from Cordoba, Argentina, helped to set up and manned the PP-02 special event station, CN8UIT. (The abbreviation for the French name of the ITU is UIT.) Also, the Association Royale des Radio Amateurs du Maroc (ARRAM) operated six Moroccan Amateur Radio stations from September 23 through October 18. They were CN8UIT (Marrakech), CN8YR (Casablanca), CN8YZ (Settat), CN8NK (Rabat), CN8MC (Rabat Radio Club) and CN8VW (Laayoune).

#### Secretary-General and Deputy Elected for Second Term

Both Mr Yoshio Utsumi and Mr Roberto Blois were re-elected for a second term as ITU Secretary-General and Deputy Secretary-General, respectively. Following the vote, Mr Utsumi addressed the delegates from 158 countries saying he was thankful for their vote of confidence in his ability to complete the ITU reform process begun four years ago. He added, "The decisions that you will adopt here in Marrakech will mark the begin-



From the left: Bob Jones, VE7RWJ/VE3CTM, outgoing ITU Radiocommunication Bureau Director; Jon Siverling, WB3ERA, and Valery Timofeev, newly elected director of the ITU Radiocommunication Bureau.

#### The ITU and the IARU

The International Telecommunication Union, headquartered in Geneva, Switzerland, is an international organization within the United Nations System where governments and the private sector coordinate global telecom networks and services. You can find more information at www.itu.int/home/index.html.

An organization of international Amateur Radiosocieties (including the ARRL), the International Amateur Radio Union has been the watchdog and spokesman for the world Amateur Radio community since 1925. The IARU Constitution organizes the Union into three Regional Organizations that correspond to the three radio regions of the ITU. The IARU Constitution also provides for an IARU Member Society to serve as the Union's International Secretariat. ARRL currently serves in that capacity. See www.iaru.org/ for more information. ning of a new era where ITU can truly be an effective force that can steer the telecoms industry at large towards the common goal of reaching the unreached."

#### Secretary-General Yoshio Utsumi

Mr Utsumi has been in the field of telecommunications for more than 30 years. He has a Bachelor of Law degree from the University of Tokyo and a Master of Arts in Political Science from the University of Chicago. In 1972, Mr Utsumi was nominated professor of public administration at the Ministry of Posts and Telecommunications (MPT) Postal College. From 1986 to 1988, he led the investment fund at the Postal Life Insurance Bureau of the MPT. In 1988, he moved to broadcasting as the Head of the General Affairs Division, the Broadcasting Bureau of MPT. His experience in international affairs include three years in Geneva where he served as First Secretary of the Permanent Mission of Japan in charge of ITU affairs and two years as Director-General of International Af-



The Venezuelan delegation: Jesse Chacón of CONATEL addresses the Plenipot, with Maria Dolores Peña (left) and Layla Macc Adan.

fairs of the Ministry of Posts and Telecommunications. In 1994, he was elected Chairman of the ITU Plenipotentiary Conference. At the senior policymaking level, he served as MPT Director-General, assistant Vice-Minister and Deputy Minister until his election as SecretaryGeneral of ITU in October 1998 by the Minneapolis Plenipotentiary Conference.

#### Deputy Secretary-General Roberto Blois

Mr Roberto Blois Montes de Souza, from Brazil, obtained his Engineering de-

#### **Timofeev Elected Director of the Radiocommunication Bureau**

After two rounds of voting at the Plenipotentiary Conference, Mr Valery Victorovich Timofeev, of the Russian Federation, was elected Director of the Radiocommunication Bureau of the ITU. Mr Timofeev has been the Deputy Minister for Communications and Informatization of the Russian Federation since 1999, and the Deputy Chairman, State Radio-Frequency Commission, of the Russian Federation, since 1992.

Well known to the international communications community, Mr Timofeev is a specialist in satellite and terrestrial radiocommunications, radio and television broadcasting and spectrum management.

#### International Experience

Mr Timofeev has been very active in the ITU since 1968 and has served as the head or deputy head of national delegations at several ITU conferences and meetings.

In 1993, he was the Chairman of the World Radiocommunication Conference and Vice Chairman of the Radiocommunication Assembly, in Geneva. He was elected to serve on the 12-member ITU Radio Regulations Board at the 1994 Plenipotentiary Conference, and was reelected as a member of the RRB in 1998. He was Vice Chairman of the RRB in 1997 and Chairman in 1998. He has served two terms on the International Frequency Registration Board. Mr Timofeev has been awarded the ITU Silver Medal and the CCIR Honorary Diploma.

#### Professional experience—State Radio Research Institute

While with the State Radio Research Institute, Mr Timofeev gained valuable experience in areas such as radio-wave propagation, spectrum management, EMC standards as well as satellite communications, and television and radio broadcasting systems. He was responsible for the international coordination of satellite communication systems and headed national delegations at frequency assignment coordination meetings with other administrations.

In his present position as the Deputy Minister for Commu-

nications and Informatization of the Russian Federation, Mr Timofeev is directly responsible for matters pertaining to effective radio frequency spectrum management, the development of television and radio broadcasting and the deployment and operation of the national satellite communication and broadcasting system. He is also responsible for the Russian Administration's participation in the work of various international bodies, including the International Telecommunication Union (ITU), the European Conference of Postal and Telecommunications Administrations (CEPT), INTERSPUTNIK, Intelsat and Eutelsat.

The Russian government has awarded Mr Timofeev the "Order of International Friendship" and "Distinguished Communications Worker of the Russian Federation" awards in recognition of his major contribution to the development of cooperation with international organizations and of his high level of professionalism.

#### **Amateur Radio**

In an interview conducted this past fall, he recognized the role that Amateur Radio played in the development of radio technologies. He said, "Not to be forgotten, the first research was done by amateurs." He sees Amateur Radio playing a key role in the development and promotion of new technologies.

A second key role for the amateur services he described as the very practical assistance that amateurs have done in emergency service. He recalled the horrible damage done when an earthquake struck Armenia. He remembers the wide use of the amateur services and the role that amateurs played in providing disaster communications following the earthquake.

"A third area should be mentioned," said Mr Timofeev, "that is, Amateur Radio provides the possibility for people to enjoy themselves—it is a fun hobby!" He added that it is a very good educational tool—he remembers this from seeing young boys and girls studying Amateur Radio technology in Russia.

Mr Timofeev holds a Doctor of Science degree from the State Radio Research Institute (NIIR) and has a large number of scientific publications and inventions to his name.

gree in Electronics and Telecommunications from the University of Brasilia in 1974. Upon graduation, he joined the Brazilian Broadcasting Services Secretariat at the Ministry of Communications, where he worked for more than 20 years at both policy and technical levels. From 1979 to 1994, Mr Blois was Director of the Broadcasting Division of the National Telecommunication Department, Director of the National Telecommunication Department and Director of the Department of Private Telecommunications Services. Mr Blois was the representative of Brazil in the ITU Administrative Council from 1990 to 1993. He was also the representative of Brazil in the Permanent Executive Committee of the Inter-American Telecommunication Commission (COM/CITEL), Organization of American States, from 1991 to 1993. He was the CITEL Executive Secretary from 1994 to 1999. Mr Blois was elected to the post of Deputy Secretary-General of the ITU in February 1999 at the 1998 ITU Plenipotentiary Conference held in Minneapolis.

# Election of the ITU Bureau Directors

Each of the three branches of ITU is called a Bureau and is headed by an elected Director. Directors are not permitted to serve more than two terms for a total of eight years. Thus, a new Director was required for the Radiocommunication Bureau, Bob Jones, VE7RWJ/VE3CTM, having reached his limit of eight years.

Mr Houlin Zhao of China and Mr

Hamadoun Touré of Mali were elected for second terms as Directors of the Telecommunication Standardization Bureau and Telecommunication Development Bureau, respectively. After two rounds of voting, Mr Valery Victorovich Timofeev, of the Russian Federation, was elected Director of the Radiocommunication Bureau. Mr Timofeev has been the Deputy Minister for Communications and Informatization of the Russian Federation since 1999, and the Deputy Chairman, State Radio-Frequency Commission, of the Russian Federation, since 1992. Other candidates for the position of Director of the Radiocommunication Bureau were Mr Kavous Arasteh (Iran), Mr Fabio Bigi (Italy), and Mr Malcolm Johnson (United Kingdom). Mr Arasteh had withdrawn his candidacy following the first round of balloting.

Unlike past Directors of the Radio Bureau, Mr Timofeev is not a licensed amateur.

#### **ITU's Financial Problems**

For decades, the ITU has been running on the concept of "zero real growth (ZRG)," which means holding the line on budgets. The Union's income sources are Member State and Sector Member (industry) dues, publication sales, proceeds from TELECOM trade shows and more recently cost recovery. ZRG had been largely successful until recent years. World Radiocommunication Conferences every 2 or 3 years, new ITU initiatives, translation and interpretation costs, paperwork costs, processing of a backlog of satellite notifications and reduced income from a general slump in the telecommunications industry have combined to force some belt-tightening. A substantial part of ITU costs is payroll. The ITU has cut positions before to save money but has not found it necessary to terminate employees, which is now the case. In addition, meetings are being reduced in length and some are being canceled to keep expenses down.

#### **USTTI Celebrates 20th Anniversary**

On October 9, 2002, the United States Telecommunications Training Institute (USTTI) celebrated its 20th anniversary with a reception hosted by Chairman Michael R. Gardner and the US Head of Delegation Ambassador David Gross. More than 150 USTTI alumni attended. The Amateur Radio Administration Course taught each year at ARRL Headquarters is one of the courses offered to government regulators through the USTTI. The ITU formalized training to developing countries by signing an agreement with the USTTI during the conference. As a result, the ITU will now include USTTI courses in its annual operational human capacity-building plan.

Dr 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.

#### **FEEDBACK**

♦ A news item, "New All-Ham Crew Settles In Onboard International Space Station" [Happenings, Feb 2003, p 81] incorrectly identified one of the Expedition 6 crew members and included an outdated NASA crew photo. The correct lineup is crew commander Ken Bowersox, KD5JBP; cosmonaut Nikolai Budarin, RV3FB, and astronaut Don Pettit, KD5MDT. The accompanying NASA photograph depicted Don Thomas, KC5FVF, who had been slated to be on the Expedition 6 crew but was replaced last summer by Pettit due to an undisclosed medical issue.

♦ The correct telephone number for Datamatrix [New Products, Feb 2003, p 107] is 800-373-6564.

♦ In "The DBJ-1: A VHF-UHF Dual-Band J-Pole" [Feb 2003, p 40], replace "VHF" with "UHF" in the headings of Table 2, columns 1 and 2. Column 3 remains "VHF," as it refers to the use of a 2 meter VHF J-Pole on its third harmonic. Also, the area immediately to the left of the RG-174 stub should not be shaded. The decoupling stub is in series with two separate pieces of twin-lead.

♦ In "A 222 MHz Transverter for the Yaesu FT-817" [Jan 2003, pp 31-38], the sidebar "Why dBm?" contains an error. A signal level of +12 dBm is 16 mW (actually 15.85 mW), not 13 mW, as stated. (Thanks to Dr H. Paul Shuch, N6TX, for calling this to our attention.) Power is nearly doubled every 3 dB, so +3 dBm = 2 mW; +6 dBm = 4 mW; +9 dBm = 8 mW and +12 dBm = 16 mW. Or...dB (power) = 10 log [P<sub>out</sub> / P<sub>in</sub>], so 12 dBm = 10 log P<sub>out</sub>/1, so P<sub>out</sub>= log<sup>-1</sup> (1.2) = 15.85 mW. Note that log<sup>-1</sup> (1.2) is *not* the same as [log (1.2)]<sup>-1</sup>. Read this as "The number whose log<sub>10</sub> is 1.2 = 15.85" or "10 raised to the 1.2 power = 15.85."

Also, note the following errors in Figure 3, the schematic diagram:

U4A and U4B have the pins swapped (the two sections are interchangeable); the red LED, D12, is connected to +8 V in the photo, near RY1; there are two components labeled C47 on the schematic—the one near J3 becomes C51 (0.01  $\mu$ F); there are also two components labeled 247 and 251 (0.01  $\mu$ F); there are also two components labeled 251 (0.01  $\mu$ F); the component 251 (0.01  $\mu$ F);

beled C48—the one near J3 becomes C50 (0.01  $\mu$ F); C49 is missing from the parts list (0.01  $\mu$ F), and C79 is missing from schematic (0.1  $\mu$ F)—in parallel with C17.

The sentence on page 35, under the heading "The Receive Circuit," should read, "A tuned circuit, L6 and C5..."

Q2, the 2N6660, may be hard to find. The IRF510 (Digikey IRF510-ND) is a good, inexpensive substitute. Almost any N-channel power FET will work, however.

J3 clarification—the connections are to the 8-pin ACC jack on the FT-817. BANDDATA and GND go to the same pins, while PTT connects to the TX GND pin.—*tnx K2QO*, *KA7EXM*, *W4YN and N9MNP* 

The latest corrections and updates can be found on the author's Web site, **www.w1ghz.org**/.

 $\diamond$  "Amateur Radio and the Rise of SSB" [Jan 2003, p 45], states: "...vestigial sideband (VSB) has been developed for digital television." In fact, television broadcasting has been using VSB to transmit video since way back when TV first came on the air.—*Ed Padget, KKSWT* 

# The **ARRL** Field Organization: Something for Everyone

With so many section-level public service positions in the ARRL Field Organization, it might be hard to choose the one with the most appeal.

ARRL Headquarters, it is often said that "the Members are the League." With that in mind, there's no better time to get involved and steer a course for ARRL and Amateur Radio in the 21st century. "But how?" you might ask. "How can one ham make any kind of difference? Where does one even begin?" Yet, after a little study and thought, the question becomes, "With so many opportunities, how do I choose?"

From the very beginning in 1914, ARRL, by its very nature, has been a participatory organization. The need to relay messages took—and still takes—organization and synchronization. From those early days, the ARRL Field Organization emerged and grew into the multifaceted body we have today. The Field Organization, particularly at the section level, is where you can find a home for your interests in a number of different activities.

ARRL Field and Educational Services Manager Rosalie White, K1STO, comments, "One thing about the Field Organization is it builds into so many areas. Every ham has expertise in at least one area, and there are tons of areas. I think just about every ham wants to give something back to the hobby."

Regardless of one's talents and time, there's a position for just about everyone. White points out that an ARRL member doesn't need a great deal of experience to get involved at the section level. Figure 1 depicts the section-level structure of the ARRL Field Organization. While a Section Manager's job, or that of Section Emergency Coordinator, may require a lot of experience and hefty chunks of time to be done right, there are a number of positions within the Field Organization that can be filled with much less of a time commitment and a lower profile.

White says that all some hams want is to interface at a local level, in their own communities. "You can start by writing press releases to the local paper, work as a club liaison or help pass traffic," she says. "There's a place for everybody, and it takes everybody pulling together to make the hobby-service as great as it is."

#### **E Pluribus Unum**

The membership in each section elects a Section Manager once every two years. He or she is responsible for managing the Field Organization programs in the section. The Section Manager is not responsible for League policy-making (although he or she may have a strong voice in such matters)this is a function reserved for the Division Director. The Section Manager's main job is to recruit, through several subordinate program managers or coordinators, League volunteers to staff eight crucial program areas: emergency communications, message traffic, volunteer monitoring, RFI problem-solving, support of affiliated clubs, government liaison, encouragement of technical activities and dissemination of on-the-air bulletins. In addition, the SM can



Figure 1—The ARRL Field Organization is set up so that local members and affiliated clubs have access to Section-wide and League-wide resources for pursuing all sorts of Amateur Radio activities.

From March 2003 QST © ARRL

#### COURTESY OF CLIFF HAUSER, KD6XH

ILSE HINE, KAØYEC



Arizona Section Manager Cliff Hauser, KD6XH, operates from a well-equipped communications van in June 2002 in support of fire fighting efforts in the Rodeo-Chediski fire in the Southwest.

appoint one or more Assistant Section Managers as needed.

Steve Ewald, WV1X, Leader of the ARRL Field Organization/Public Service Team, says the top items on every SM's to-do list is to "stay informed and keep everyone under them informed. There are a number of ways to do that. The Section Manager-only Web pages and the SM e-mail reflector allow them to discuss what's happening in their sections and get feedback from other SMs. They get a chance to share ideas and learn from each other. It's a good give-and-take."

The SM must be a resident of the section, hold a Technician or higher license, and have been a full ARRL member for at least two years prior to nomination. He or she oversees the nine section-level appointments, liaises with the Division Director and keeps up-to-date with League policy, handles correspondence, recruits new hams and ARRL members, and writes *Section News* for the section.

A Section Manager has to know the state—or section, as the case may be and possess excellent communication and organizational skills. With that must go the ability to delegate effectively. Good leadership skills and motivating others to assist are must-haves in the SM's tool kit.

Joe Phillips, K8QOE, the two-term SM of Ohio, says remembering that the section is made up of *people* is crucial to his position: "The most important thing is to make sure people-oriented hams run the programs for which the Section Manager has authority... I remember when attending [new] Section Manager School in September 1998, my instructor, Rick Palm, K1CE, taught me about perspective in dealing with appointments. He said, 'They are volunteers; you are volunteers. This is not life and death here.' I keep that in mind every day."

# Coordinating Emergency Communication

In recent months, there has been a lot



of focus on emergency communications in Amateur Radio, and rightly so. Three of the most vital positions in the ARRL Field Organization are Section Emergency Coordinator (SEC), District Emergency Coordinator (DEC) and Emergency Coordinator (EC).

"The DEC and SEC positions are big jobs," Ewald says. "The DEC oversees a number of SECs, and the Section Emergency Coordinator maintains contact with all the Emergency Coordinators in the section."

In addition to overseeing three District ECs, Tom Carrubba, KA2D, New York City-Long Island SEC, says he has his ear to the radio more often than not—although ECs and assistant ECs run the nets—and monitors several Internet reflectors daily. There are also policy, appointee and general Amateur Radio Emergency Service (ARES) questions to answer. Carrubba also has a solid slate of ARES, hamfest and club meetings to attend, in addition to a frequent speaking schedule. Finally, there are monthly reports to both the Section Manager and ARRL Headquarters to be filed.

Ewald says every Field Organization volunteer—and indeed, everyone—involved with public service has had 18 months to understand that emergency communication is not something that just happens.

"I think September 11 [2001] put a jolt into everybody's preparedness," he says. "Some section volunteers found they had to go back to the fundamentals of emergency training. SECs and ECs take that basic training and then customize it to their area."

#### **Building Relationships**

For example, sections in the Southeast are concerned with hurricanes and tropical storms, the Midwest with floods and tornados, and the West with forest fires and earthquakes. Of course, any number of disasters can strike an area, but SECs can help tailor drills to prepare for emer100 Run in Silverton, Colorado. The extreme altitudes and rough terrain of the run add a different dimension to providing public service communication for athletic events.

Runners come into the finish line of the Hardrock

gencies that are most likely to occur.

A typical month—if there is such a thing—finds Sacramento Valley SEC Dave Thorne, K6SOJ, coordinating on-the-air training for his section's ECs and all emergency communicators, publishing a weekly newsletter and running a weekly net on some facet of EC leadership or section business, collecting reports and data from around the section and then reporting his findings monthly back to ARRL HQ and Section Manager Jettie B. Hill, W6RFF. There are also annual events to plan for such as Field Day, the Simulated Emergency Test and EmComm-West, a multi-section convention in Reno, Nevada.

One of the other things SECs handle, along with Section Managers, is building good working relationships between ARES groups and local agencies such as area food banks and branches of county government and public safety. That way, when called upon, ARES volunteers and agencies know just what to expect from each other and exactly what is needed. New Mexico SEC Bill Kauffman, W5YEJ, works with a number of county Emergency Managers (several of whom are hams) to ensure emergency communication needs will be met.

Kauffman emphasized the fact that the Section Emergency Coordinator is just that—a coordinator—while DECs, ECs and their groups are the backbone of every ARES system. "I work to keep DECs and members around the state informed; I'm just the cohesion that keeps them together and on track," Kauffman says.

The EC is often one of the most visible hams in the community, and possibly the busiest; the EC is often the ARES point person with local and served agencies.

The Emergency Coordinator works with local government and private agencies to determine communication needs, plans and maintains emergency nets, coordinates with the NTS for welfare traffic, helps provide for emergency training and promotes ARES and Amateur Radio



Mark Ketchell, K5ER, gets interviewed by **KNOE-TV** about Northeast Louisiana ARES's plans for action during a possible landfall of Hurricane Isidore in 1996. Emergency communication planning and participation is one facet of Amateur Radio public service; another involves getting the word out and interfacing with the local media.

in general. That's a large list! And it's just the beginning for many ECs.

Carrubba summed up the necessary requirements, saying a good EC is "[a] person who loves Amateur Radio and is dedicated to emergency communications. The EC has to have an open mind, loads of patience and plenty of common sense. The EC has to be a combination of father/mother, drill sergeant, teacher and cheerleader.'

Outside of a leadership role, there's room for those who just want to help in a time of crisis as an ARES operator. One doesn't need to be a firefighter, doctor or helicopter pilot to be an effective emergency communicator; productive, specific training in emergency communications is available through all ARRL sections. Thorne points out that it's not ARES's job to fight a fire or provide medical care, but to do what it can do best. "When called upon, we provide trained, disciplined, capable, proficient and equipped radio communicators to the agencies that perform such functions," he states.

Those ARES members showing expertise in emergency communication and wishing to take on a deeper commitment than those in the rank-and-file may be appointed as an Official Emergency Station (OES) by their SEC or SM, at the recommendation of the local EC. The operator of an OES must be a full ARRL member and have displayed the highest standards of ARES membership and operation. After considering the appointee's talents and strengths, the OES appointee and the EC together develop a plan of specific duties in some or all of the following areas: operation, administration, liaison, logistics, management and/or consultation.

#### Moving Mountains of Messages

do that many private or governmental





Figure 2—The National Traffic System (NTS) and the Amateur Radio Emergency Service (ARES) have an efficient and structured relationship when it comes to handling messages in an emergency. From the ARES station taking Welfare traffic in the field to the Area Net Managers, it takes everyone working together to get the job done.

agencies cannot is pass health and welfare traffic out of a disaster area. That's where the National Traffic System (NTS) comes in. Many ARES groups will interface with the NTS so that loved ones cut off from everyday methods of communication can let others know they are okay. Figure 2 shows the multileveled relationships between NTS and ARES.

"The National Traffic System is a changing thing," Ewald says of the 54year-old amateur message-handling radio network. "E-mail is a factor, but the NTS

still has a solid foundation as an avenue for emergency communication."

There are over 500 NTS-member nets and a number of independent nets that handle thousands of pieces of traffic each year. The content ranges from "Having fun at the fair, wish you were here" to "Family okay and in ARC shelter in Claraville" and everything in between. In every section, the Section Manager appoints a Section Traffic Manager (STM). The STM is, ideally, a coordinator of traffic and emergency nets who strives to achieve a high

level of efficiency. That efficiency comes from having section-wide outlets for traffic, says Southern Florida STM Jan Scheuerman, WA2YL.

In traffic handling, it's not all about having a bone-crushing, globe-spanning signal on HF. "Having stations on the nets with VHF capabilities is very important in having outlets for moving traffic to its destination," she advises. Clearly, there's a vital place for everyone—old salt Extra and out-of-the-gate Technician—in the National Traffic System.

Scheuerman notes a number of the STM's duties, which include completing several reports for the SM and ARRL HQ, filling in as a Net Control Station, attending club meetings to promote traffic handling and recruit new operators to traffic handling, appointing Net Managers, recommending operators for Official Relay Station (ORS) appointments and-of course-handling some traffic. The ORS position is open to any full ARRL member of any license class who displays solid operating skills, has a reliable station and has demonstrated good traffic handling ability. Official Relay Stations are drawn from the ranks of net members. Often, all it takes to get started in traffic handling is to find a net that matches your time schedule, check in to the net and start swimming. There are slow-code nets, SSB nets, packet nets and every other mode imaginable on every band.

The most important part of her job as STM is informing those involved with traffic handling of the rules and etiquette of the NTS, Scheuerman says.

"I feel education is one of the most important parts of any of the NTS volunteer's job, no matter what position he or she holds. In NTS, educating people on proper net procedures, proper format for NTS traffic, etc, is important, so that in the event of an emergency, trained amateurs are ready to answer the call," she says. "It's also important to encourage new and prospective hams to join the ranks of NTS and ARES, thereby ensuring that there will be an adequate supply of amateurs in the years ahead to continue providing communications when necessary."

## We Know you have a Parachute, but What's its Color?

Emergency communication and traffic handling make up a big part of the traditional ways League members have actively participated in their sections. Still, there's a lot more to be done to have an effective section organization in the field. Have a flair for politics and an interest in local affairs? Maybe an appointment to a government liaison's position suits your inclination. Or perhaps you've been involved with microwave commu-



Steve Faulkner, KF6OCE, is ready to roll to any emergency communication site with an award-winning setup in the back of his Jeep, complete with sleeping and personal gear in addition to radio equipment.

nication technology for some time or have experience with RFI problems how about being a Technical Specialist? Or maybe something else sparks your interest? Check out the possibilities:

• Observing the richest tradition: The Official Observer (OO) program is one of the oldest in the League. The idea behind the program is that one amateur can help another before a signal or procedure irregularity draws the attention of the FCC. An Official Observer, appointed by a section Official Observer Coordinator (OOC), listens rather than transmits, and his job is done after sending a small, official card to the station in question. It's not about being a "radio cop"; it's about being a trustee of the rich tradition of Amateur Radio. Holding OOs and a section's OOC to the highest standards ensures this. OOs must complete rigorous Amateur Auxiliary training and must have held a Technician or higher ticket for four years. The OOC must hold a General class or higher license, in addition to meeting the OO requirements. The Official Observer program requires exemplary standing in the amateur community and a sincere desire to help one's fellow amateurs; only the very best are approved for appointment.

• The local club scene: Most sections have dozens of ARRL-affiliated Amateur Radio clubs, totaling many hundreds of members. To help keep these club members plugged in to the latest information and current opportunities, each Section Manager appoints an Affiliated Club Coordinator (ACC), who can be any

ARRL member with any class of ticket. The ACC serves as the top resource for each club in the section and as such spends a lot of time at club meetings, both speaking and getting to know members; a love of one's fellow hams and enthusiasm for the task are a must for the position. Learning the strengths and interests of a given club helps the ACC to provide the best possible support for a club. If a local club wants to adopt the mantle of ARRL Special Service Club, the application goes through the Affiliated Clubs Coordinator. Also, the ACC exists to inspire affiliated clubs to become more active in general, and to encourage new or non-affiliated clubs to take on the benefits of ARRL affiliation.

• Extra! Extra! Hear all about it: One of the cornerstones of newspaper reporting is that the news be timely. In the ARRL Field Organization, the section Bulletin Manager is the person who ensures that area amateurs are kept up-todate with the latest League and Amateur Radio news. Aside from ARRL bulletins from W1AW, the BM can include local, section and regional news for dissemination. The Bulletin Manager recruits and manages a team of Official Bulletin Stations, which get the message out locally to major repeaters, VHF/UHF nets and packet bulletin boards. With news, time is of the essence, and successful Bulletin Managers and OBSs must be well-organized and effective communicators. Bulletins of major importance are e-mailed to each Bulletin Manager and OBS, although ideally an OBS should be able to copy directly from a W1AW bulletin transmission for such things as Friday's DX bulletin. The BM needs to be a Technician class licensee or higher and an ARRL member, while the OBS must possess a Novice class ticket or better.

• Keeping an eve on government: Hundreds of bills go through state legislative committees each year, some with potential consequences for Amateur Radio. Local ordinances can also crop up that can affect the way hams can-or can't-operate. The ARRL Washington, DC office and Headquarters staff in Newington, Connecticut keep tabs on what's happening in the nation's capital, but it's at the Section level where two key positions monitor state and local governments, and a law degree is not a prerequisite. The State Government Liaison (SGL) is an appointee of the Section Manager who collects and communicates information on state law and proposed bills affecting Amateur Radio. Words in legislation like antenna, tower, mobile radio, scanner and radiation draw an SGL's attention faster than DXers to a P5 pileup. The SGL needs to interface with a number of section-level officials, but often works especially close with SECs and Public Information Coordinators. On the local scene, Local Government Liaisons carefully monitor city, county, planning commission and local district dockets, organize support when necessary and make themselves known and available to area amateurs. The LGL, a full member of ARRL, is appointed either by the SGL, or a Section Manager directly.

• Bringing Amateur Radio to the public: For those wanting to get right out in front and lead in promoting Amateur Radio and the ARRL at the section level, there is the SM-appointed Public Information Coordinator (PIC) position, and the local Public Information Officer (PIO). The PIC should have a background in public relations or journalism so that the mission of getting ham radio's story out to the general public is done as effectively as possible. When ARES is called to action, PICs and PIOs are often right there in the mix, collecting information and getting the story back to section and division leaders, as well as serving as spokespersons for Amateur Radio to the local media. Public relations activities also need to be well timed in order to coincide with follow-up opportunities. It's the PIC's job to make sure the section's activities and goals get attention in the public eye. At the local level, PIOs typically come out of a club, and are appointed by a PIC. Aside from the local papers or broadcast radio and TV stations, there are fairs, school/classroom programs, Lions and Rotary lunches and other avenues for publicity. Full ARRL membership is needed for both positions.

• Getting under the hood: At the bottom line, Amateur Radio is a technical hobby. Sure, you push the PTT and modulate, but as any automobile enthusiast will confirm, it's what's under the hood that makes the car interesting. Driving is certainly fun, but tinkering with the engine to get a bit more performance is fun, too! A love of the technical aspects of radio equipment, propagation, modes, computers, construction and/or electronics in general just touches the tip of the iceberg for a prospective section Technical Coordinator (TC). The TC encourages technical experiments and exploration in the section, and serves as an advisor and speaker at radio clubs. He or she also conveys views about technical articles in QST and other ARRL publications back to HQ's technical staff. To help the TC, either the SM or the TC can appoint Technical Specialists (TS) in the areas of RFI and general technical information. A TS's specific knowledge in a mode or field is welcome, as is general technical experience. He or she needs to be available for local hams to call, e-mail or write with questions and make appropriate referrals. The TS can also speak at clubs and represent ARRL at technical symposiums in industry or government technical committees. All classes of licensees are welcome to apply for these positions.

#### Making a Difference is a Word Away

Many of us have Amateur Radio to thank for our livelihoods; for all of us, ham radio is an enjoyable part of our lives. Clearly, there are so many options for rendering public service that every League member, regardless of length of membership in ARRL or the ham fraternity, can find a place to give something back to the hobby through the various levels of the ARRL Field Organization. Even more information about the Field Organization can be found on the Web at www.arrl.org/FandES/field/org/.

"Look over the list of ways to serve," Ohio SM Joe Phillips advises. "If you can see a role to play, ask for an appointment. We need to keep reminding ourselves that our continued privileges come from the confidence of the general public. This only comes by using our skills and equipment for public good."

If you don't know whom to contact, call or send an e-mail to your Section Manager, who will be more than happy to refer you to the right person to get started. Every SM's address, phone number and e-mail address is listed on page 16 of this issue of *QST*. Also, a full list of ARRL sections with complete contact information can be found on the ARRLWeb at **www.arrl.org/sections/ index.html**. Making a difference for Amateur Radio is just a call or a click away.

Dave Hassler, K7CCC, is the Assistant News Editor of QST and the ARRLWeb. He can be reached by e-mail at k7ccc@arrl.org, or by telephone at 860-594-0240.

### **NEW PRODUCTS**

#### UPGRADE CPU FROM POWERLEAP

♦ If you have an older Pentium II, Pentium III or Celeron-based computer in your shack and want significantly more processing power, you may not have to upgrade your PC's motherboard to achieve a noticeable performance improvement. Powerleap's PL-iP3/T upgrade CPU adapter lets you add a variety of P-III processors (including a 1.4-GHz Intel Tualatin



CPU) to your existing 266-1000 MHz PC—with no other component changes required. The Powerleap CPU adapter works

with most PCs based on the above-mentioned CPUs, and installation is as simple as setting a jumper and replacing your existing CPU. The company's Web site, **www. powerleap.com**, details all available adapter/CPU combinations and shows stepby-step installation instructions.

Price: \$159 (PL-iP3/T adapter and a 1.4-GHz Celeron CPU). For more information on Powerleap's complete line of upgrade CPUs and adapters, see your favorite PC parts retailer or contact Powerleap at 1370 Main St, Millstone, NJ 08844; tel 866-757-2537, fax 908-431-7760, www. powerleap.com.

#### **PROJECTS AND INFORMATION FOR THE ACTIVE AMATEUR**

WORKB

# The Doctor is IN

QJohn Van Walleghen, NØUBQ, asks, "I am in charge of setting up a club station for the Wichita Amateur Radio Club. I have read your publication, *RF Exposure and You*, www.arrl.org/catalog/6621/, and have a question that appears to not be covered in the book. How do you calculate exposure for multi-transmitter stations? We plan to expand our station to three HF radios, VHF voice & packet and one or two VHF repeater inputs. Our station is on the third floor of an aviation museum, so there are few people about. There are no nearby structures, as we are on the edge of a runway.

A The actual calculations for multiple transmitters are a bit more complicated than for a single station, but nothing past some simple math is needed. This actually is covered in the book *RF Exposure and You*, on pages 5.22-5.24. What you have to do is to calculate the percentage of exposure from each transmitter and add them all up. This is done on a timeaveraged value of the power densities involved, or the squares of the fields.

For example, let's assume that you are simultaneously operating a 1500 W SSB station on 10 meters and a 50 W VHF packet station on 2 meters. The 10 meter antenna has a gain of 7.5 dBi and is 50 feet, diagonally, from the operator. The 2 meter antenna has a gain of 5 dBi and is 40 feet from the operator. The permitted exposure levels are time averaged—using 30 minutes for uncontrolled (general public) exposure levels or 6 minutes for controlled exposure. This applies to single or multi-transmitter operation. (You can apply a controlled exposure calculation to the amateurs operating the station and their guests if they have been given information about RF exposure.)

The easiest way to time average the exposure is to time average the transmitter power and use that power level in subsequent calculations. This is done by taking your PEP transmit power, multiplying it first by the duty factor of the mode being used and then by the maximum percentage of time the transmitter *could* be on the air during the averaging period.

For example, an SSB transmission that doesn't use a speech processor would conservatively have a 20% duty factor—the average power while the transmission is occurring is 20% of the peak-envelope power. If your station uses a 1500 W PEP amplifier, 1500 W PEP SSB  $\times$  20% duty factor  $\times$  1.0 (100% on/off time) = 300 W average power in a 6 minute period. [The Doctor used a 100% (multiplicative factor of 1.0) on/off time because the station could be transmitting continuously for 6 minutes at a time.]

Next, determine the distance from the antenna to areas where people might be exposed. If the antenna were 55 feet in the air—directly over a first-floor station on a concrete slab, the distance from the operators or to people walking on the ground would be about 50 feet.

The calculation for exposure can be done using any method that the operator chooses, although one convenient way is to use the RF calculator at the University of Texas Web site, **n5xu.ae.utexas.edu/rfsafety/**.



Figure 1-Hams aren't the only ones that have to do **RF** exposure evaluations. This broadcast installation on Mount Wilson in California is a lot more complicated than the ham station described in this answer.

The Doctor used that calculator and obtained:

300 W at 50 feet at 28.5 MHz = 23.6 V/m. On 28 MHz, the permitted controlled exposure is 64.7 V/m. Remember, we need to square the fields to compare the exposure limits, so this station is:

% Exposure =  $100 [(23.6)^2 / (64.7)^2] = 13.3\%$ 

This station is exposing the operators of the station (a controlled exposure) at 13.3% of the limit.

The 2 meter packet station is expected to be transmitting no more than half the time (a conservative estimate for most DX-cluster type operating) so its average power is:

50 W PEP FM  $\times$  0.5 (50% on/off time) = 25 W

Running this through the RF calculator, I got:

25 W at 40 feet at 146 mHz = 6.4 V/m

The % exposure is:

% exposure =  $100 [(6.4)^2 / (64.7)^2] = 1\%$ 

To calculate the exposure from these multiple stations, all we do is add up the percentages of exposure. This is a handy way of taking into account the way RF exposure limits vary with frequency.

Adding up the percentages, this station is at 14.3% of the controlled exposure for the operators.

Repeating this for the 27.5 V/m uncontrolled exposure, if the same average power was assumed, this would be:

% Exposure (10 M) = 100 [  $(23.6)^2 / (27.5)^2$  ] = 73.5%

% Exposure (2 M) = 100 [  $(6.4)^2 / (27.5)^2$  ] = 5.4%

So, the total uncontrolled exposure in this case is at 78.9% of the limit.

See the ARRL RF Safety Committee Web site, www.arrl.org/ rfsafety/, for links to the ARRL FAQ, the University of Texas site and other useful sites. One of those links is to a comprehensive article written by Greg Lapin, N9GL, the Chairman of the ARRL RF Safety Committee. His column, N9GL's RF Safety Column: The Multiple Transmitter Question, covers the subject in some detail. Another good article to read is "RF Safety at Field Day," QST, Jun 1999, pp 48-51; www.arrl.org/tis/info/ pdf/9906048.pdf/.





A If a constant carrier is transmitted, it occupies only one frequency. Even a few Hz away, there is no signal. However, a carrier is not very useful because it doesn't contain any information. If that carrier is modulated, however, it does contain information that permits hams to communicate. The term "CW," or continuous wave, is somewhat of a misnomer for a Morse-code signal. The act of turning the carrier on and off is indeed modulation. The process of modulation creates sidebands—the modulated signal occupies a band of frequencies, the nature of which depends on the modulation.

In the case of an on/off keyed CW signal, the modulation is contained in the code elements and spacing. If the carrier were turned abruptly on and off, it would be modulated by a slow square-wave, at the "dit" and "dah" element rate. A square-wave contains a fundamental signal and all odd harmonics; therefore, transmitting a perfect square-wave requires infinite bandwidth. So, if that on/off keying is not shaped in some way, the keyed CW signal will take up lots of room (bandwidth). Each time the carrier turns on or off, the modulation process creates modulation sidebands up and down the band. This will sound like a click each time the carrier is turned on or off. If a ham tells you that your signal has key clicks, it means that those signals are loud enough to be objectionable.

Most of the modulation (and consequent RF energy) contained in these key clicks is wasted because it can't be heard by a receiver tuned to the desired signal. It is, in fact, more than wasted, because the clicks can interfere with other communications taking part elsewhere on the band. Fortunately, if the keyed signal is filtered (to "soften" the rise and fall times) so that it is no longer a "hard" square-wave, the level of the modulation sidebands is greatly reduced.



Figure 2A shows the square-wave modulation that results from an unfiltered key line. The waveform rise and fall times are very short; this signal has key clicks. A properly shaped keying line results in the signal shown in Figure 2B. Notice the longer rise and decay times.

Figure 3A shows how the strong key clicks generated by unfiltered keying take up unnecessary spectrum space. In B, proper transmitter design results in much less noise up and down the band.

The OO listens up and down the band and when clicks are heard, he or she can quickly tune around and find the signal that is generating the clicks. However, if you ask most hams to listen for clicks, they don't know that they need to tune away from your signal to hear them. If you ask them for a click report, they will listen to your signal and won't hear any clicks when you transmit, so they will tell you that your signal is fine. The OO and the one ham who told you that you had clicks did it right and listened above and below your frequency.

It may not be possible for operators to do much about key clicks if the internal transmitter design does not properly shape the keying waveform. In some modern rigs, the selection of CW rise and fall time can be controlled through a menu selection. In some equipment, the transmitter ALC is active in the CW mode at high drive levels. This can clip the keyed waveform, generating clicks. Turning down the drive control to just below the point where the ALC is active may help. If adjusting the drive control or the rise ane fall times (for rigs with this capability) doesn't help, the internal circuitry may have to be modified. In most cases, this is a job for the equipment manufacturer...if they have developed a cure for the key click problem.

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/



# Work OSCAR 40 with Cardboard-Box Antennas!

Are you interested in working the AMSAT-OSCAR 40 satellite but intimidated by the cost and complexity of the special antennas required? Parabolic dishes, axial-mode helices, circularly polarized Yagi arrays...NOT!

a recent ARRL convention, several complaints were heard at the AMSAT booth from potential new OSCAR 40 satellite operators. Their concern was that a big, up-front commitment to antennas was required just to try this communications mode. Well, don't despair, potential satellite user...there's help around the corner; if you live near a grocery store, you're in luck! These antennas for working OSCAR 40 are made primarily out of cardboard cartons and aluminum foil and they are designed to be cheap and simple to build. There are no adjustments to make; no test equipment is required and you can leave the soldering iron off. Although they are made out of cardboard, these antennas are no paper tigers when it comes to performance. They perform like the typical antennas used by veteran OSCAR 40 operators.

OSCAR 40 is the satellite formerly known as Phase 3D and it carries lots of transmitters, receivers and transponders in its payload. While not all of these are functional, the mode U/S linear transponder is operating well and it facilitates the most popular operational mode. To access it, you'll need an S band (2.4 GHz) downlink antenna and a UHF (435 MHz) uplink antenna.

#### **Downlink Antenna**

OSCAR 40 is in a highly elliptical orbit that, at apogee, has a maximum range beyond 60,000 km. In order to hear the satellite at this distance, a high gain, low-noise antenna is needed. Eighteen to 20 dB of antenna gain is required to get the signal strength high enough to hear over your downconverter's front-end noise. The antenna must also have a clean radiation pattern with minimal side-lobes, coupled with an excellent front-to-back ratio. Otherwise, it will pick up thermal noise from the warm earth as well as interfering signals from cordless telephones and wireless networks that also operate on S band.

Parabolic dish antennas are by far the most popular type used to receive OSCAR 40. They provide the needed gain while maintaining a clean radiation pattern, but are tricky to set up and very sensitive to surface irregularities.

Fortunately, there is a type of antenna that can provide the needed gain and pattern but is much more forgiving of construction tolerances—the *pyramidal horn*, shown in Figure 1. The pyramidal horn looks a lot like a megaphone. If you have ever held a megaphone to your ear, you would have noticed how much louder sounds are through it. That is because the horn shape collects a lot more sound energy than your ear would by itself. The pyramidal horn works in much the same way. It



Figure 1—The basic pyramidal horn used for the downlink antenna.

#### Table 1 **Downlink Antenna** Performance Specifications Operating frequency 2.4 GHz (S band) > 23 dB @ 2.4 GHz Return loss (SWR < 1.2:1)Gain 20 dBi Polarization Vertical ±9° at -3 dB Elevation beamwidth Azimuth beamwidth ±8° at -3 dB List of Materials (Quantity-2) Shipping carton, 16 × 22 × 22 inches of 1/8 inch cardboard Roll of 18 inch wide aluminum foil Roll of 2 inch wide clear packing tape 5/8 × 24 nut 15/8 inch length solid, bare #14 AWG copper wire

collects lots of microwave signal energy and funnels it to a small antenna, called a probe, at the back of the horn. The probe then feeds the signal to your downconverter.

This OSCAR 40 downlink antenna was designed to have a gain of around 20 dBi, which is comparable to the 19-21 dBi gain of popular 2 foot dish antennas. It provides plenty of signal strength, even with the satellite at apogee. The complete technical specifications for the antenna are given in Table 1. Before

starting construction on any of these antennas, it's a good idea to familiarize yourself with the tables, specifications and assembly details first—in order to understand the complete procedure.

#### **Constructing the Downlink Antenna**

As mentioned previously, the physical structure of the antenna is made of cardboard. A very inexpensive source of cardboard shipping cartons is the corner grocery store; these are generally free for the asking. The large size standard carton is around  $16 \times 22 \times 22$  inches and 1/8 inch thick. This is the size you ideally want, although the exact size is not critical. Two cartons are needed. One carton is cut up to make the horn panels and is covered with aluminum foil. The other carton is used to support the horn structure. Packing tape, the type used to wrap packages for mailing, holds everything together.

In order to eliminate the need for any connectors or soldering, the downconverter is directly mounted to the horn using a  ${}^{5}/{s} \times 24$  nut. The nut fits the threads of the female N-connector on the downconverter. This size nut is supplied with single-hole, chassis-mount, coaxial connectors (N or UHF types) and other types of round connectors. If your junk box doesn't have one of these nuts, they are readily available new from coaxial connector suppliers for about 50 cents each.

The only other component required is a straight length of solid, bare, #14 AWG copper wire, used to make the coaxial coupling probe inserted into the center pin of the downconverter's female N-connector. You need to cut this as carefully as possible to 1<sup>5</sup>/<sub>8</sub> inches long. Since the diameter of #14 wire is the same as the center pin of a male N connector, it will fit snugly yet not deform or damage the connector on your downconverter. The complete list of materials is shown in Table 1.

To start construction, carefully unfold one of the cardboard cartons. If you have a carton sized differently than that specified, be sure that the resulting panel pieces have the correct dimensions. You will need all of the sides plus the top or bottom flaps of each side to make the horn panels as shown in Figure 2. Use the 22 inch wide sides to make the top and bottom horn panels and the 16 inch wide sides to make the two side panels. The top and bottom horn panels are the same, except that a 5/8 inch hole in the top panel will be used to mount the downconverter. Draw the horn panels on the cardboard as carefully as possible and then cut them out using either a utility knife or scissors. Be careful to make straight cuts and not bend or crimp the cardboard. After cutting out the horn panels, you may find it helpful to apply some tape along the edges or across the flat surfaces to strengthen them.

Apply the aluminum foil to one side of each horn panel, rolling it over the edges of the panel, and taping it snugly on the back to hold it in place. The foil needs to cover all of the edges of the cardboard panels. Do not tape over the foil on the edges of the panels; the edges of the foil must make electrical contact between panels.

The horn side panels are only 15<sup>1</sup>/<sub>4</sub> inches wide, so a single piece of 18 inch wide aluminum foil can be run lengthwise to cover the entire panel. The top and bottom panels are too wide for this, so instead, place one piece of foil across the front 20 inch edge and cover the remainder of the panel with a second piece. Leave an inch or so of overlap between the pieces. You do not need to tape them together. Carefully cut and push back the foil through the  $\frac{5}{8}$  inch hole in the top panel, again keeping tape off the edges of the hole so that good contact will be made with the connector.

After you have created the four panels, you need to tape them together. The easiest way to do this is to place all four panels on a flat surface, *foil side down*, and align the long edges together. Make sure to place the side panels between the top and bottom



Figure 2-Dimensions for the downlink horn antenna panels.



Figure 3—The final downlink antenna assembly showing how the horn fits into the supporting carton.

panels. This will then look like an unfolded, flat horn. The long edges are all 27 inches long, so all the panel lengths should match. You will be taping the three long sides that are touching. Separate the edges from each other by one cardboard thickness  $(\pm^{1}/_{8} \text{ inch})$  using a scrap piece of cardboard for spacing and then tape the backs, *not the foil side*, of the panels together. This is important, as the long panel edges need to be one cardboard thickness from each other before folding, in order to make good electrical contact when the horn is assembled.

When the panels are taped together, carefully pick them up and fold them so the aluminum foil is on the inside. Form the pyramid shape, and tape the remaining edge tightly. When you form the pyramid, the cardboard on the edges will crush slightly, holding the aluminum foil covered edges together to make good electrical contact. After taping the fourth edge, hold the horn up to a light to see if there are any gaps between the edges. There will probably be a few. The design can tolerate linear gaps <sup>1</sup>/<sub>4</sub> to <sup>1</sup>/<sub>2</sub> inch long without problems. Carefully use tape to pull the larger gaps together. If you have any really large gaps, patch them with foil and tape on the inside.

The remaining cardboard carton will be used to hold the horn, providing both structure and protection, as shown in Figure 3. The mouth of the horn will be centered in the supporting carton.



Figure 4—Front view of the downlink pyramidal horn showing how it is mounted in the support carton. Notice the coax probe at the back of the horn.



Figure 5—Side view of the downlink pyramidal horn showing the elevation control supports and how the downconverter is attached to the horn. The downconverter is pulled forward by the tape to align the probe wire parallel to the rear surface of the horn.

The top and bottom panels of the horn are  $15\frac{1}{2}$  inches apart at the mouth and will fit nicely into the 16 inch wide opening on the carton.

The horn is about 25 inches deep from front to back, which is too long to fit inside the carton. Cut a hole in the bottom of the carton to allow the back of the horn to fit through the bottom. The hole should be in the center of the bottom of the carton and will need to be about 5 inches wide by 3<sup>3</sup>/<sub>4</sub> inches high. You will need to trim the hole to fit the horn.

Align the front of the horn flush with the open end of the carton and tape the top and bottom edges of the horn to the carton opening. There will be a gap between each horn side and the carton side. Secure the back part of the horn to the hole in the back of the carton with tape.

Now it is time to mount the downcon-verter. Cut four  $2 \times 2$  inch pieces of cardboard from the left over scrap pieces and

cut a  $\frac{5}{8}$  inch hole in each piece. These are stacked to make a mounting shim for the downconverter. Slip the shim over the N-connector on the downconverter. Next, take the  $1\frac{5}{8}$  inch piece of #14 AWG wire and gently push it into the center hole of the N connector until it will not go in any further. It should stick out  $1\frac{1}{4}$  inches from the connector, making a probe. Do not bend the wire!

Being careful not to rip the aluminum foil in the hole, push the end of the N connector through the 5/8 inch hole in the top panel at the back end of the horn and secure the downconverter with the  $5/8 \times 24$  nut. You will need to compress the cardboard shim a bit to do this. The top of the N connector should be just about flush with the top of the nut when it is secured. The springiness of the cardboard shim will hold the downconverter in the hole. The connector should not protrude very much into the horn.

The downconverter will still have a fair amount of play in the hole. Hold the downconverter so that the wire probe is parallel with the back plane of the horn and tape the downconverter in place. Finally, use a piece of aluminum foil to cover the back end of the horn and apply tape to hold it taut. Congratulations...your downlink antenna is complete! Figure 4 shows a front view of the completed pyramidal horn and Figure 5 is a side view.

#### **Downlink Operation**

The easiest way to test your new downlink antenna is to powerup the downconverter, point the antenna at the satellite and tune around for the beacon. You will need to know the position of AO-40 in order to point the antenna. There are many satellite tracking programs available, including some that are free, on AMSAT's Web site, **www.amsat.org/**; it's a good source for general information on satellites and tracking. Another useful Web site, specifically about AO-40, is **ao40.homestead.com**/.

The antenna has a beamwidth of around  $17^{\circ}$  in both azimuth and elevation, so pointing is not critical. Use a compass to set the antenna azimuth. You will need to include the magnetic declination in your area, which is the difference between compass north and true north.

For elevation control, it may be helpful to tape some additional pieces of scrap cardboard to tilt up the outer carton as can be seen in the photographs. You can also just prop up the carton with a heavy object. A protractor will be helpful for setting the elevation angle. A certain amount of trial and error will be needed to find the satellite beacon the first time but with a little experience this will be a snap. The satellite beacon is easy to hear and will be a very strong signal, even with the satellite at apogee.

After you find the beacon, you should tune around and listen for CW and SSB signals. You can get a good sense for how to operate on OSCAR 40 by monitoring contacts and nets that use the satellite.

Another activity you can try with your new antenna is decoding the satellite telemetry that is transmitted on the beacon. A convenient way to do this is by using the *ao40rcv* program (available free) at **www.qsl.net/ae4jy/ao40rcv.htm/**. This program uses a PC sound card to demodulate the signal, decode the telemetry and display the results on your PC screen. The program works well with the cardboard-box downlink antenna.

#### Uplink Antenna

Monitoring the satellite is entertaining, but once you listen a few times you will want to join in the fun and make your own contacts! In order to access the AO-40 satellite on the UHF uplink, an effective radiated power of 100 to 500 W is required.

This depends on the mode (CW or SSB) and distance to (or range of) the satellite. Remember that at apogee the range of the satellite can be over 60,000 km. Since the UHF output of a typical transceiver is only 10-50 W, a fair amount of gain is required of the uplink antenna.

Most OSCAR 40 operators use some form of Yagi antenna to get the required gain. A Yagi is, however, hard to construct out of cardboard! Instead, we use a dipole-fed corner reflector. The basic corner reflector antenna is shown in Figure 6.

Corner reflectors are simple to build and are very forgiving of mechanical tolerance errors. The gain of the corner reflector is mostly a function of its size. For more gain, just make it bigger! This means you can get started with a small and really simple corner reflector and make it bigger if you want better performance. With this in mind, two designs are presented here: a simple version and a larger, high-performance version.

The simple version is made from a single cardboard box and has about 9 dBi gain. When fed with 50 W, it will provide a solid SSB uplink signal to OSCAR 40 out to a 30,000-km range and a solid CW signal all the way out to apogee. This is a great way to get started on OSCAR 40, as the antenna is so easy to build.

The high-performance version provides over 14 dBi gain, equivalent to an 8 element optimized Yagi, and will provide solid SSB or CW signals all the way out to apogee. It uses the same construction style, but it is bigger; it takes longer to build, and it requires two to three cardboard boxes. The complete technical specifications for both versions of the uplink antennas are given in Table 2.

#### **Constructing the Uplink Antennas**

As with the downlink antenna, you can get all the cardboard

you need from grocery store cardboard shipping cartons sized about  $16 \times 22 \times 22$  inches and  $\frac{1}{8}$  inch thick, although exact sizing isn't critical.

The dipole-feed is the same for both versions and is made from  $\frac{3}{4}$  inch aluminum tubing and black PVC insert couplings of the type used in lawn sprinkler systems. The coupling is used as a center insulator for the dipole; two more are used on the ends to hold the dipole in place over the reflector. The dipole presents a 50  $\Omega$  impedance when used with the corner reflector. No balun transformer or other matching network is required.

A short length of RG-58 or RG-8X type coaxial cable with a suitable connector is used to connect the dipole to your transmitter. Most UHF transmitters have an N-connector. A premade jumper cable can be used...just cut off one end. A minimum of 5 feet of cable is required. The list of materials for the dipole feed can be found in Table 2.



Figure 6—The basic corner reflector used for the uplink antenna. Note the dipole feed.



Figure 7-Dimensions for the corner reflector dipole feed.





Figure 9—The completed simple uplink corner reflector.

#### Table 2

#### **Uplink Antenna Specifications and Materials**

Performance Specifications, Simple Version		
Operating frequency SWR Reflector size Gain Polarization Elevation beamwidth Azimuth beamwidth	425-465 MHz < 1.5:1 22 × 22 × 16 inches 9 dBi Horizontal ±13° at -1 dB; ±23° at -3 dB ±26° at 1 dB; ±43° at 3 dB	
Performance Specifica Operating frequency SWR Reflector size Gain Polarization Elevation beamwidth Azimuth beamwidth List of Materials (Quantity 1-3) Cardboard <sup>1</sup> / <sub>8</sub> inch cardboard. Roll of 18 inch wide alum Roll of 2 inch wide, clear 12 inch length of ¾ inch (Quantity 2) #8 × ½ inch (Quantity 3) ½ inch black 5 ft length of RG-58 or R leads.	tions, High-Performance Version 425-465 MHz < 1.5:1 $27 \times 27 \times 38$ inches 14 dBi horizontal $\pm 8^{\circ}$ at $-1$ dB; $\pm 13^{\circ}$ at $-3$ dB $\pm 13^{\circ}$ at 1 dB; $\pm 24^{\circ}$ at 3 dB d carton, $16 \times 22 \times 22$ inches of hinum foil. packing tape. aluminum tubing. sheet-metal screws. < PVC insert coupling. iG-8X with N-connector and ½ inch	



Figure 10—Cutting instructions for the high-performance corner reflector surfaces.

To construct the dipole-feed, cut two pieces of aluminum tubing with a pipe-cutter or a hacksaw, cach  $5^{1}/_{16}$  inches long. Push the two aluminum tubes onto one of the PVC insert couplings, leaving a  $\frac{1}{4}$  inch gap in the center, as shown in Figure 7. This will require filing down the insert coupling using a grinding tool, a file, or coarse sandpaper. The tubes should fit snugly on the insert coupling. Note that the  $\frac{1}{4}$  inch gap is a critical dimension, so measure this carefully.

With the tubes  $\frac{1}{4}$  inch apart on the insert coupling, drill a  $\frac{3}{16}$  inch diameter hole through the top of each aluminum tube and into the insert coupling,  $\frac{1}{8}$  inch from the end of the tube. Insert a #8 sheet-metal screw and thread each hole, backing off two turns. Wrap the center conductor around one screw and the shield around the other and tighten. Make sure there are no short circuits. Push an insert coupling into the other end of each aluminum tube so it sticks out about  $2\frac{3}{4}$  inches and tape it in place. Set this aside while making the reflector.

#### Simple Corner Reflector

The simple version of the antenna is made from a single cardboard box. The bottom and narrow side of the box should each be about 16 inches wide and 22 inches long. Cover the bottom and one of the narrow sides of the box with a single piece of aluminum foil and tape in place.

To mount the dipole, cut a <sup>5</sup>/<sub>8</sub> inch hole on each side of the box, 7 inches from the bottom and 7 inches from the foilcovered side, as shown in Figure 8. Cut a hole in the center of the reflector for the coax. Mount the dipole by pushing the insert couplings through the holes in the sides of the box and hold it in place with tape. Push the coax connector and cable through the hole in the center of the reflector and tape the cable to the box to hold it in place. That's it! Your completed antenna should look like the photograph of Figure 9.

#### **High-Performance Corner Reflector**

The high-performance version of this antenna is just a bigger version of the simple one. The reflector sides are lengthened, from 22 inches long in the simple version, to 27 inches in this version. The reflector width is expanded from 16 to 38 inches wide. These dimensions are not critical; they were selected based on readily available cardboard box sizes.

To make the high-performance reflector, carefully unfold a  $22 \times 22 \times 16$  inch cardboard carton including the top and bottom flaps. This results in a piece of cardboard roughly 38 inches wide by 76 inches long with a fold in the center. Cut 11 inches from each end to make the piece 27 inches on each side of the fold. This will be the reflector surface shown in Figure 10. Cover it with aluminum foil and tape in place.

Flip the reflector over so the aluminum foil side is down. Using the leftover pieces of cardboard and tape, reinforce the reflector so it will hold its shape but make sure the center will still fold. Cut a hole in the center of the reflector surface for the coax connector.

Get another  $22 \times 22 \times 16$  inch cardboard box. Remove one of the narrow  $22 \times 16$  inch sides and then cut the box in half down the long dimension, leaving two identical 8 inch wide corners. Bend the reflector surface along the centerfold, so the aluminum foil side is inside and tape it into the two corners to hold the corner reflector shape. You may need to do more reinforcing with cardboard and tape.

Finally, make a holder for the dipole out of cardboard and tape. The holder needs to position the dipole so it is held 7 inches from each of the reflector surfaces just as in the simple version. An easy way to do this is to cut out the corner from yet another box, punching holes in the sides to hold the PVC insulators and, in the bottom, for the coax connector. If you made the simple version first, just peel off the aluminum foil and cut the corner out with the dipole mounting holes already present. Mount the dipole in the holder and fasten with tape, as shown in Figure 11. Push the coax through the hole in the center of the reflector and again fasten with tape. When completed, the antenna should look like the one in Figures 11 and 12.

#### **Uplink Operation**

As shown in Table 3, the azimuth beamwidth of the uplink antennas is fairly wide, so the azimuth angle will usually not require frequent adjustment. Elevation positioning is even easier. With one of the reflector sides horizontal and the other one vertical, the antenna radiation pattern points up at about a  $45^{\circ}$  angle. To lower the radiation angle, raise the back of the antenna. Since the elevation beamwidth is quite high, it may be possible to set the antenna to an angle where no additional elevation positioning is required, depending upon your station location. For example, at my location in Massachusetts, setting the elevation angle to  $20^{\circ}$  provides good coverage for all AO-40 passes with no other elevation pointing. To set the angle to  $20^{\circ}$ , raise the back of the antenna until the bottom reflector



Figure 11—The completed high-performance corner reflector. Note how the box corners hold the reflectors and dipole feed in place. The rear legs set the antenna elevation to 20°—this gives good coverage at the author's latitude.



Figure 12—A close-up of the high-performance corner reflector dipole feed.



Figure 13—The complete satellite station with the tracking laptop, FT-847 transceiver, and both downlink and uplink antennas. [Recognize that key? It's a J-38 from 1944, bridging a gap of almost 60 years!–*Ed.*]

makes a  $25^{\circ}$  angle with the ground. This can be done by adding "legs" to the back of the high-performance antenna, as seen in the photograph of Figure 11. Locations that are closer to the equator will require a higher elevation angle.

#### On the Air

To transmit on the OSCAR 40 uplink you will need to first find your own downlink. This is not as hard as it sounds, after you have done it a couple of times. You need to find the beacon and then tune up or down 100 kHz or so to get away from the popular frequencies and not cause interference. Use your tracking program to tell you the downlink Doppler shift. The uplink shift is roughly one-sixth that of the downlink. Set your VFO to the uplink frequency and send a couple of Morse characters. Tune around your expected downlink frequency until you find the signal. You will need to adjust your transmit power until your signal is 10 dB weaker than the beacon. If the satellite is not all the way out at apogee, you will probably need to cut back the power quite a bit to prevent triggering LEILA (an uplink power limiting program that ensures that you are not putting an excessive signal into the satellite and thus reducing power available for other contacts). This is true for both versions of the antenna, as even the simple antenna has ample gain when the satellite range is less than 30,000 km.

For more information about working OSCAR 40, check AMSAT's Web site, **www.amsat.org**/. Steve Ford, WB8IMY, has written an excellent article on getting started with OSCAR 40.<sup>1</sup> It includes a list of satellite resources.

The author has used these antennas on several occasions on OSCAR 40. The complete station uses an AIDC-3731AA downconverter and a Yaesu FT-847 transceiver. A laptop computer running *Instant*Track and *Instant*Tune software is used to locate the satellite and auto-tune the FT-847.<sup>2</sup>

As you can see in Figure 13, the complete satellite station easily fits on a picnic table. The laptop computer and the FT-847 are in front of the downlink antenna and the simple version of the uplink antenna. The downconverter can be seen sticking up out of the back end of the downlink antenna and is connected to the FT-847 with a short piece of RG-6 coaxial cable. The uplink antenna is connected directly to the FT-847 UHF output. When the high-performance uplink antenna is used, it is set up next to the picnic table, on the ground.

Do these antennas really work? The answer is a resounding yes! With this simple arrangement, I made several dozen SSB and CW contacts through OSCAR 40. These included DX contacts when the satellite was over the Atlantic. Solid signals can be heard on the downlink antenna and good signal reports were received with both versions of the uplink antenna. Many ragchew sessions ensued when the author mentioned that his antennas were made of cardboard boxes covered with aluminum foil. I'll see you on the bird!

#### Notes

<sup>1</sup>S. Ford, WB8IMY, "OSCAR 40 on Mode U/S—No Excuses!," *QST*, Sep 2001, pp 38-41.

<sup>2</sup>InstantTrack and InstantTune are available from AMSAT at www.amsat.org.

A version of this article originally appeared in the *Proceedings of the AMSAT-NA 20th Space Symposium, 2002.* 

Tony Monteiro, AA2TX, has been a ham since 1973 and is a member of AMSAT, TAPR, ARRL and QCWA. Interested primarily in the technical aspects of Amateur Radio, he can often be found on the satellites. Tony was a member of the technical staff at Bell Laboratories and has held senior management positions at Cisco Systems and several high-tech start-ups. He can be reached at 25 Carriage Chase, North Andover, MA 01845; aa2tx@amsat.org.

# SHORT TAKES

# AALog

The "AA" in AALog stands for Alexander Anipkin, RZ4AG, the author of the program. What Alex has developed in AALog is a shareware logging package that tries to be all things to all hams at an affordable price. I've been using AALog for a year and I'd have to say that Alex has gone a long way toward his goal.

#### **Features**

AALog allows you to create multiple logs for different applications. You can switch between logs via a drop-down menu. At my station I have set up separate logs for RTTY, PSK31, phone, CW, 6 meter and satellite contacts. Each line in the log is color-coded to indicate the QSL status. For my setup, a powder-blue coloring indicates a QSL has been sent; green indicates a OSL has been received. You can change the colors to suit your taste. You can also select which fields display in the logging window.

By clicking on the awards manager, I get an instant tally of DXCC entities worked, states worked or my qualifications of several other awards. The tally also indicates the bands on which I've worked various entities, and the list can be sorted by mode.

In addition to keeping multiple logs under your call sign, you can also set up logs for different call signs. This is particularly convenient if you have other hams under your roof, or if you need to log under a different call for a contest.

AALog will import and export in ADIF format. To test this function, I imported a log created in WriteLog during a recent RTTY contest. The file imported smoothly with all the con-

tact data lining up under the correct headers.

I enjoy AALog's QSO entry window. It has fields for all the necessary information and an interface to a CD-ROM database (such as Buckmaster, HamCall, QRZ, etc). When you enter the call sign, AALog immediately shows the DXCC entity name, dis-



The AALog award tracker.



AALog's QSO entry window.

0 3 8 8 0 8 9 More BST set BST row CTH State Grd 1014 05

tance and heading. I have a devil of a time remembering which call sign prefixes go with which DXCC entities. A month before this review was written, I heard S9MX on RTTY. Where was S9? Since I was already perched at the keyboard, I brought up the AALog QSO entry window and typed in S9MX. Sao Tome! That was a new one for me, so I jumped into the pileup (and worked him, too).

AALog can print QSL labels as well as paper logs. AALog was built with a Borland database engine and sorts records smoothly by time, call sign, frequency and mode. Just a mouse click at the top of a column is all it takes.

Like many sophisticated logging programs, AALog can interface with other ham software packages. For instance, AALog can work with HamPort to control your radio or DXAtlas to create world maps. AALog can also be married to TrueTTY for RTTY and PSK31, CWType/CWGet for CW and AAVoice for voice keying.

#### Conclusion

Logging programs *can't* be all things to all amateurs, try as they may, but AALog strikes an attractive balance between price and functionality. My only wish for AALog is that it could alert me to duplicate grid-square contacts in the QSO entry window. When competing for new contacts during a 6-meter band opening, it would be nice to know if I have already worked (and received a QSL from) a station in a particular grid square. The most recent version of AALog is compatible with eQSL, but I hope that new versions will also be compatible with the ARRL Logbook Of The World when it comes on-line later this year.

You can download the shareware version of AALog free of charge, but several important functions are disabled until you register. Registration is quick and easy on the Web and \$49 seems more than reasonable for the benefits, which include free lifetime upgrades.

Manufacturer: Alexander Anipkin, RZ4AG. System requirements: Windows 98/2000/NT/XP. Distributor: DXSoft, www.dxsoft.com/miaalog.htm. Registration: \$49. Q57~

Steve Ford, WB8IMY QST Editor sford@arrl.org





# HANDS-ON RADIO

# Experiment #2—The Emitter-Follower Amplifier

ur second experiment will again focus on a transistor amplifier-the emitter-follower. This handy amplifier doesn't offer much in the way of voltage gain (it has none), but it provides buffering or isolation for sensitive amplifiers and muscle to output circuits for driving loads like headphones or coaxial cables. It has relatively high input impedance with low output impedance and good power gain, as we'll see later.

#### Background

The emitter-follower (EF) amplifier configuration, also called the common collector, is found in applications where an amplifier must have both high input impedance (to avoid loading a sensitive or low-power circuit) and low output impedance (to drive a heavy load).

The EF provides no voltage gain; in fact, its voltage gain is always less than 1. The collector of the transistor is connected directly to the power supply, without a resistor and the output is taken across the emitter resistor. There is no 180° phase shift as seen in the common-emitter configuration of experiment #1---the output signal follows the input signal with 0° phase shift. This is the origin of the name--the emitter voltage "follows" the input signal voltage.

Why does the EF configuration have a high input impedance? Let's start by looking directly into the base of the transistor at base voltage, V<sub>b</sub> and base current, I<sub>b</sub>. Remember that  $\beta$  is the transistor current gain, or the ratio of collector to the base current.

$$\beta = I_c / I_b \text{ so } I_c = \beta I_b$$

$$I_e = I_b + I_c$$
Therefore,  $I_e = I_b + \beta I_b = I_b (\beta + 1)$ 

$$V_b = V_{be} + I_e R_e = V_{be} + [I_b (\beta + 1)] R_e$$
[1]

The base impedance,  $Z_b$ , is the ratio of the change ( $\Delta$ ) in V<sub>b</sub> to the resulting change in I<sub>b</sub>. Biasing will keep the transistor current "turned on" so V<sub>be</sub> doesn't change much and can



Figure 1—The common emitter circuit. This is a current or power amplifier, offering high input impedance and low output impedance. It is useful for driving low impedance loads, buffering and isolation.

be treated as constant. So, small changes in  $V_{\rm b}$  due to the input signal will cause a corresponding change in I<sub>b</sub>.

$$\Delta V_{b} \approx \Delta I_{b} \ (\beta + 1) R_{e} \text{ and...}$$
[2]

 $Z_{\rm b} = \Delta V_{\rm b} / \Delta I_{\rm b} \approx (\beta + 1) R_{\rm e}$ [3]

This equation shows that the small changes in I<sub>b</sub> amplified by  $\beta$  effectively also multiplies R<sub>e</sub> by the same amount. The base impedance (not counting the biasing network R1 and R2) is essentially the current gain,  $\beta$ , multiplied by the emitter resistor, Re.

The input source doesn't just drive the base, of course; it also has to drive the combination of R1 and R2, the biasing resistors. From an ac point of view, both R1 and R2 can be considered as connected to "ac ground" (the power supply supplies a constant dc voltage; it should present a low impedance, which is effectively an ac short) and they can be treated as if they were connected in parallel. When R1 // R2 are considered along with the transistor base impedance, Z<sub>h</sub>, the impedance the input signal source "sees" is:

$$Z_{in} = R1 // R2 // Z_b = 1 / [1/R1 + 1/R2 + 1/R_e (\beta + 1)]$$
 [4]

Let's figure the output impedance, Z<sub>out</sub>, too. Looking back into the connection between the transistor emitter and R<sub>e</sub>, Z<sub>out</sub> is made up of three components. The first is R<sub>e</sub>, which is connected to ground. The second, Z<sub>e</sub>, is the series combination of the transistor's internal emitter impedance,  $r_{e}$ , (note the lowercase "r" which distinguishes it from the external resistance,  $R_{e}$ ) and the combined impedance of the signal source,  $R_{s}$ , and the biasing resistors R1 and R2. Using the same explanation of current gain's effect on input impedance-in reverse this time—the impedance presented at the emitter,  $Z_e$ , is:

$$Z_{e} = (R_{s} // R1 // R2) / (\beta + 1) + r_{e}$$
[5]

From the physics of silicon transistors, at room temperature,  $r_e = 25 \text{ mV} / I_{eq}$ , where  $I_{eq} \approx I_{cq}$  in mA, so, for most designs,  $r_e$  will be much less than 50  $\Omega$ . Similarly, in our experiment, R1 and R2 are likely to be much higher than R<sub>s</sub>, the signal source impedance—which is usually less than 1 k $\Omega$ . When R<sub>e</sub> and Z<sub>e</sub> are combined, the output impedance of the circuit becomes:

$$Z_{out} = Z_e // R_e$$
[6]

We see, therefore, that our emitter follower has a relatively high input impedance and a low output impedance, making it ideal for driving low-impedance loads.

#### Terms to Learn

Input (Output) Impedance-the equivalent ac impedance looking into the input (output) of a circuit.

Cascade--two circuits connected such that the output of the first is connected to the input of the second.

Power Gain--the ratio of output power to input power.

Buffer-an amplifier used to provide isolation between two circuits.

//---in parallel with.

#### **Key Equations**

$I_c \approx I_e, I_c = I_b \beta$	[7]
$V_{cc} \approx V_{ce} + I_c R_e$	[8]
$V_{b} \approx V_{be} + I_{c} R_{e}$	[9]



Figure 2—This photo shows the construction of the EF (emitter follower) circuit. Note that the input connection is on the right and the output connection is on the left. This keeps the input and output leads away from each other and helps prevent oscillation. All ground leads (black clips) are connected together at a single point.



Figure 3-An oscillating circuit-with a 1 kHz sine wave input, both the input (top) and output (bottom) signals show significant oscillation at more than 1 MHz. Experiment with lead placement and circuit component placement to learn what causes and prevents oscillation

#### Designing the Amplifier

Choose the circuit's operating requirements:

 $V_{cc} = 12 V (our power supply voltage)$ 

Q-point of  $I_{cq} = 5$  mA and  $V_{ceq} = 6$  V (rule of thumb,  $\frac{1}{2} V_{cc}$ allows the maximum output voltage swing)

Assume the transistor's  $\beta$  is 150 and base-to-emitter voltage,  $V_{be} = 0.7 V$ 

1.  $R_e = (V_{cc} - V_{ceq}) / I_{cq} = 1.2 \text{ k}\Omega (Eq 8)$ 2. Base current,  $I_b = I_{cq} / \beta = 33 \text{ }\mu\text{A} (Eq 7)$ 

3. Current through R1 and R2 = 10 I<sub>b</sub> = 330  $\mu$ A (a rule of thumb simplifying calculations and keeping  $I_b$  stable with a "stiff" bias supply).

4. Voltage across R2 =  $V_{he} + I_c R_e = 0.7 + 5 \text{ mA} (1.2 \text{ k}\Omega) =$ 6.7 V (Eq 9)

 $R2 = 6.7 \text{ V} / 330 \ \mu\text{A} = 20.3 \ \text{k}\Omega \ (\text{use } 22 \ \text{k}\Omega). \ (Ohm's \ Law)$ 5. Voltage across  $R1 = V_{cc} - 6.7 V = 5.3 V.$  (Voltage divider) R1 = 5.3 V / 330  $\mu$ A = 16.06 kΩ (use 15 kΩ). (*Ohm's Law*)  $Z_{in} = 1 / [1/R1 + 1/R2 + 1/R_e (\beta + 1)] \approx 8.5 \text{ k}\Omega (Eq 4)$ 

Assuming  $R_s = 50 \Omega$ ,  $Z_{out} \approx r_e //R_e = 5 \Omega //1.2 k\Omega \approx 4.99 \Omega$ (Eq 5 and 6)

That's where our emitter follower shines!

#### Testing the Amplifier

Connect the power supply after double-checking all connections, especially the transistor leads. Figure 2 shows the breadboard circuit.

1. Use a VOM to measure the dc voltage from collector to emitter (it should be about 6 V), from base to emitter (0.6 -0.7 V) and from emitter to ground (6 V). Replace R1 with a 100 k $\Omega$  potentiometer, set to 15 k $\Omega$ . Start with a value of 10 k $\Omega$  for R<sub>load</sub>.

2. Set the signal generator to output a 1 kHz sine wave at 1  $V_{p-p}$ , then connect it to  $C_{in}$ . You should see a sine wave at the output of  $C_{out}$  with an amplitude of about 1  $V_{p-p}$  and in phase with the input. (A VOM measuring ac voltage will show 700 mV rms at the input and output.)

3. You will find later that the emitter follower has a very high bandwidth. This can lead to oscillation at several hundred kHz or higher, if you're not careful. This instability is visible as the "fuzzy" oscilloscope trace shown in Figure 3. Those of you using voltmeters only might see intermittent or jumpy ac signal voltages. It's important to keep input leads away from output leads and use the single-point ground as shown in the breadboard circuit of Figure 2. Sometimes, just moving the leads around will cause the oscillation to start and stop, so don't be afraid to experiment.

4. Increase the input signal to 5  $V_{p-p}$ . Adjust R1 in each direction and observe the output signal with the oscilloscope. As you lower the collector current (V<sub>b</sub> decreasing), you will see the output waveform clip on negative peaks as the collector current is cut off. Raising collector current will eventually result in distortion on positive peaks as the transistor enters saturation.

5. Substitute 1 k $\Omega$ , 100  $\Omega$ , and 10  $\Omega$ resistors for R<sub>load</sub>, reducing the input voltage at each value, so that the output waveform remains undistorted. Lower resistance loads can only be driven at lower voltages because the ac currents in the transistor are much higher at lower values of load resistance. You can read about ac load lines in the reference texts for a detailed explanation. You'll also see the output signal begin to "lag" behind the in-

put signal at these low load values. Why? The impedance of the output coupling capacitor at 1 kHz becomes significant for loads below 100  $\Omega$ , introducing phase shift in a series RC circuit.

6. If the input power is  $(V_{in})^2 / Z_{in}$  and the output power is  $(V_{out})^2 / R_{load}$ , compute the power gain of the amplifier for the maximum undistorted values of input and output voltage at the different loads.

Power Gain = 
$$P_{out} / P_{in} = [(V_{out})^2 / R_{load}] / [(V_{in})^2 / Z_{in})]$$
 [10]

If  $V_{in} \approx V_{out}$ , then power gain =  $Z_{in} / R_{load}$ ! See how closely this approximation agrees with your measurements.

7. Now that you have a working circuit—experiment with it!

• Rework the math for a Q-point with 5 times more and 10 times less collector current. Calculate Zin and Zout for those currents.

• Raise the input frequency to see if you can find where the gain drops to 70% of the peak value; this is the upper -3 dB frequency of the amplifier.

• Drive both the CE and EF amplifiers with a square-wave at the highest frequency your generator can reach, using a 1  $k\Omega$  load resistor. Use the 'scope to determine which circuit will follow the input more accurately thus indicating wider bandwidth.

#### Suggested Reading

• "Transistor Amplifier Design-A Practical Approach" in Chapter 8 of The ARRL Handbook.

• "Low-Frequency Transistor Models" in Chapter 10 of The ARRL Handbook.

• For a more complete discussion of the Emitter-Follower amplifier, check out Chapter 2 of The Art of Electronics, by Horowitz and Hill.

#### Shopping List

You'll need the following components:

• 100 k $\Omega$  potentiometer.

• <sup>1</sup>/<sub>4</sub> W resistors of the following values: 10  $\Omega$ , 100  $\Omega$ , 1 k $\Omega$ , 1.2 k $\Omega$ , 10 k $\Omega$ , 15 k $\Omega$ , 22 k $\Omega$ .

• 2-10 µF capacitors with a voltage rating of 25 V dc or more (electrolytic or tantalum are fine).

2N3904 transistor.

#### Next Month

We shift gears next month to operational amplifiers-usually known by their nickname "op amps." Be prepared to buffer, invert, add and subtract! 05T~

# **HINTS & KINKS**



#### AN IMPROVISED RESISTOR

◊ A week or so before Field Day, I decided that I wanted to try something other than a dipole as an antenna. Living in the Pacific Northwest, I recognized that the vast majority of my QSOs would occur to my east and south. With limited time and a limited budget, construction of a multiband Yagi wasn't feasible.

Looking through a 1965 antenna guide, I came across a seemingly suitable design for a long-wire, terminated V antenna. The radiation pattern for this antenna consisted of a long main lobe and a virtually nonexistent rear lobe. On 20 meters, using leg lengths of 2  $\lambda$ , the guide estimated power gains of around 8 dBd. Further, because this antenna is terminated (a "traveling wave" design), exact radiator lengths are not critical, giving it a fairly broad bandwidth.

So, I built the antenna, coiled my coax to form a balun and went in search of terminating resistors. The article suggested using non-inductive terminating resistors of about 500  $\Omega$ , each capable of dissipating <sup>1</sup>/<sub>3</sub> of the transmitter power. Another article I read on this design suggested using resistors between 600-1000  $\Omega$ . To play it safe, I looked for 750- $\Omega$  resistors. My old Yaesu FT-107 can produce a maximum output of about 120 W, so the resistors must sink 40 W each.

With time running out, I searched RadioShack and local home-improvement stores for a resistor matching these specifications. Woe, my efforts were in vain.

The Army Ranger Handbook<sup>1</sup> discusses improvising resistors for long-wire antennas by putting a saltwater solution into an earplug case. Saltwater is a decent conductor whose resistance can be altered by changing the salinity of the solution. With this idea, I set out to build my own power resistors.

My main concern was the power capacity of the resistors. I wasn't concerned about burning out the resistors because (1) saltwater is cheap to replace, (2) destruction of the resistors would be immediately noticeable by a dramatic change in SWR, and (3) water doesn't burn. However, water *does* boil, and this could change the resistance or cause the enclosures to explode. Because of this, I decided to make the resistors with a much larger power-handling capacity than necessary.

One gram of water requires one calorie of heat to increase its temperature by one degree Celsius. One calorie is equal to 4.186 Joules. A watt is 1 J/s, or 4.186 cal/s.

Assuming that the temperature of the resistor starts at  $20^{\circ}$ C (about 70°F) and it boils at 100°C, its temperature can change up to 80°C. For a single gram of water, this will require the addition of 80 calories, which is about 335 Joules. This means that a single gram of water could absorb 40 W for about 8.3 seconds before boiling<sup>2</sup> (without cooling).

Assuming that I would transmit at maximum power for no longer than two minutes, each of my resistors would have to absorb 40 W×120 s = 4800 J. This converts to 4800 J/4.186 J/cal = 1147 cal. Again, assuming the temperature goes from

<sup>1</sup>*Ranger Handbook* by Department of Army (Apple Pie Publishers, LLC; ISBN: 0967512344).

<sup>2</sup>This formula is greatly simplified. It ignores cooling effects by the atmosphere and disregards the latent heat of vaporization, which would require an additional 2.3 J/ml to boil.

 $20^{\circ}$ C to  $100^{\circ}$ C, the resistors would require a minimum of 1147 cal/80°C = 14 g (14 ml) of water. Again, this equation disregards cooling effects.

With such a relatively small amount of water being required for my worst-case scenario, it would be practical to exceed this volume by a couple of orders of magnitude.

After a few quick calculations, I headed to the hardware store where I bought 4 feet of 2-inch (OD), schedule 200 PVC pipe, four 2-inch end caps and a tube of silicone sealant. I chose the schedule 200 PVC because it is cheaper than schedule 40 and because it has thinner walls, allowing more rapid cooling of the saltwater. The 200 PVC is more than strong enough for this application.

For each resistor, I used a 2-foot-long piece of PVC. I drilled a  $^{3}/_{32}$ -inch-diameter hole in each of the end caps. I then cut two pieces of #12 AWG bare solid-copper wire and tied a knot about 4 inches from one end. The knot prevents the wire from pulling out of the end cap.

I coiled the short end of one of the wires so that the exposed conductor was as near the end of the cap as possible. Since the entire coil will be exposed to a conductor (saltwater) at roughly the same potential, the coil shouldn't act as an inductor. The length of wire here is not critical, just leave enough so that, as the saltwater corrodes the copper, you'll still have sufficient surface area on the wire to conduct.

I left the other wire straight. This wire goes on top of the resistor (assuming the resistor is placed vertically). The long wire ensures that if some of the water escapes the resistor, enough of the wire will contact the water to conduct.

The long end of each wire was then fed through the end



Figure 1—At A, the formed lower terminal and the drilled end cap. At B, the terminal has been inserted in the drilled cap and secured with silicone sealant.





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

caps from the inside (see Figure 1). A liberal amount of silicone sealant was applied to seal the hole with the coiled wire. Seal both the inside and outside of the hole, but try to seal only the hole. Don't coat the entire wire, or it won't make contact with the saltwater. I allowed this cap to dry over night, added more silicone to the hole, and then secured this end cap on the pipe with silicone to keep it from leaking. This cap is the bottom of the resistor.

Note that I did not silicone the cap with the straight wire. You'll need a small vent when you put this cap on or it may pop right back off, especially if the resistor heats up. I let the pipe assembly dry overnight before mixing the saltwater.

The specific ratio of salt to water you should use is a complicated formula. Instead, I chose a less scientific, albeit effective method: Take a bunch of water and add a bunch of salt.



Figure 2—A pair of finished

I boiled the solution to ensure that as much of the salt as possible would dissolve in the water. After it cooled, I poured the solution into the pipe, put the top cap (the one with the straight wire on it) on the pipe, and measured the resistance between the two wires with a VOM. I then adjusted the resistance as follows:

If the resistance of the solution is too high, pour it back into the pot you boiled it in, add salt, simmer and try it again. I don't recommend just adding salt to the pipe since it might take some time to completely dissolve, thus changing the resistance over time.

If the resistance is too low, pour some of the solution back in the pot, add water to the pipe, shake well, and measure it again. Note that you *can* add water do the pipe, since the salt in the pipe is already dissolved. Adding water simply dilutes the mixture, but you should ensure that the water and saltwater are thoroughly mixed.

After repeating the above steps three or four times, I read a resistance of about 750  $\Omega$ . I pushed the top cap onto the pipe (without silicone, so I could disassemble it later) so that it could support the resistor's weight when hung by the top conductor. The products are shown in Figure 2.

After operating for 12 hours, the resistors' values were still right where they belonged, *and* they were cool to the touch. The terminated V worked amazingly well using these resistors. I created a pair of high-power resistors for about \$7!

I don't recommend using this type of resistor for anything really critical or expensive. However for antennas, where you get goofy impedances whenever elevation changes, it rains, or a particularly large bird flies overhead, this design is more



Figure 4—KØOVQ's center insulator for a dipole antenna made from two Hamstick whips.

than adequate.—*Scott Baker, AC7JC, 210 NW Anthony St #5, Pullman, WA 99163;* srbi24@mail.wsu.edu

#### AN INSULATOR FOR WHIP DIPOLES

◊ Because of limited real-estate size and an unfortunate placement of overhead power lines, my HF antenna space is confined to a spot under the eaves only 20 feet in length and a mere 11 feet off the ground. I put a 10-meter wire dipole in the space, and it worked remarkably well, but as sunspots waned, I looked for a way to get on other bands. I decided to try two 20-meter Hamstick mobile antennas in a dipole configuration—certainly not an original idea.

In my case, the appeal is that Hamsticks are available for all the popular HF bands, and all are roughly the same length (about 7 feet). I could switch bands with a couple of wrenches and a relatively short ladder. My problem was that the commercial mounting brackets available for the purpose didn't suit my needs. I wanted a 1:1 balun at the feedpoint to limit feedline radiation.

My solution was a Van Gorden balun with a top cover fashioned from a PVC cap for 3-inch ID pipe (Figure 4). I drilled a <sup>5</sup>/s-inch hole in the top of the cap to clear the upper eyebolt and used a rotary tool to cut shallow grooves inside the cap that clear the side eyebolts. The antenna mounts are taken from RadioShack #21-961 feedthrough adapters (**www.radioshack** .com). I replaced the SO-239 sockets with short <sup>3</sup>/s×24 bolts and solder lugs. Before soldering the balun to the mounts, I fastened the PVC cap in place with epoxy cement. (Tip: Use slow-drying epoxy so you can align the pieces carefully.)

The assembly hangs from an egg insulator. Rigid insulators and nylon cable ties near the center of each Hamstick prevent rotation in the wind.

My SWR is 1.1:1 in the center of the 20-meter phone band. The 2:1 bandwidth is 200 kHz. My first contact produced a 20-over-9 report from California. Subsequent reports have been entirely satisfactory.—*Roy A. Raney, KØOVQ, 600 Jackson St, Denver, CO 80206-4545;* k0ovg@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.

# PRODUCT REVIEW

# ICOM IC-2720H Dual-Band FM Transceiver

#### *Reviewed by Steve Ford, WB8IMY* QST *Editor*

The IC-2720H is the latest entry in a well-populated field of dual-band FM mobile rigs. To stand out among competing transceivers, a radio has to offer features designed to entice Amateur Radio buyers. The IC-2720H does this by combining an interesting lineup of bells and whistles with ease of operation and enough output power (maximum 50 W on 144 MHz; 35 W on 440 MHz) for just about any application.

The IC-2720H also sports an interesting physical design. Lots of mobile transceivers offer detachable front panels, but in the '2720H the front panel is detached *permanently* (although it can be mounted to the main unit with the MB-85 combination bracket, sold separately). The main unit-the "guts" of the IC-2720H—is a compact  $5 \times 1.5 \times 7.5$ -inch brick outfitted with various connectors. The front panel is about the size of a chocolate bar and is connected to the main unit with an 11-foot separation cable. You can plug the backlit multifunction microphone (a de facto controller unto itself) into the front panel or directly into the main unit if you can live without a frequency readout.

The mobile operating advantage of this arrangement is obvious: The IC-2720H can find a home in any conceivable vehicle. Using the '2720H as a base unit is more of a challenge, but who is to say that you couldn't mount the front panel on a desk with the main unit tucked out of sight?

#### **About that Front Panel**

The '2720's front-panel LCD displays frequencies for two bands. You can display 144 and 440 MHz, or a different combination such as 144/144 MHz (two frequencies within the same amateur band) or 144 and 127 MHz (working 2meter FM while listening to the aviation band simultaneously). There are separate sets of controls for tuning, volume and squelch, as well as separate sets of backlit function keys for each band. And unlike some dual-band transceivers, the volume and squelch knobs are not concentric; they are completely separate controls. If you've ever cursed the ergonomics of multiband mobile rigs, you know what a blessing this is.



The front-panel buttons have individual labels. In my opinion, this beats the heck out of a row of nondescript buttons with ever-changing "labels" in an LCD display nearby.

#### Main Unit

There is one SO-239 antenna jack on the rear panel of the main unit. With the built-in diplexer, only one jack is necessary. If you are using separate VHF and UHF antennas, however, you'll need to add an external diplexer. In addition to a dc power pigtail, there are two external speaker jacks. The jack designated SP-1 outputs the audio from both bands. But if you plug another speaker into the adjacent SP-2 jack, the "left-side" audio (from whichever band is on the left side of the LCD display) will appear in the SP-1 speaker and the "right-side" audio will appear in the SP-2 speaker.

On the front side you'll find RJ45 connectors for the microphone and separation cable. There is also a 6-pin mini-DIN data connector for 1200 or 9600-baud packet. Bit-error-rate tests in the ARRL Laboratory indicated adequate packet performance at 9600 baud. See Table 1.

#### **Dual-Band Versatility**

As I've mentioned previously, you

#### **Bottom Line**

Dual-band operation and widerange receive combine to make the compact IC-2720H an attractive mobile transceiver have the option of configuring the dualband capability of the '2720H to suit your interest *du jour*. This rig offers wide receive coverage: 118-550 MHz on the "left" band, and 118-174, 375-550 and 810-999 MHz (cellular blocked) on the "right" band.

One combo I enjoyed was setting 440 MHz as the main band so that I could monitor my home Echolink simplex station (see my article "VoIP and Amateur Radio" in the February 2003 issue of QST). I then set the sub-band for my favorite 2-meter repeater so that I could flip-flop one or the other as the need arose. One push of a button changes the main/sub-band assignment. You can only transmit from the main band.

This dual-band flexibility also means that you can work the FM repeater satellites such as UoSAT-OSCAR 14 and AMRAD-OSCAR-27. More about this later.

#### **Memories and Scanning**

The IC-2720H offers 212 memory channels. You can program the repeater offsets in each channel as well as 50 subaudible tones (67-254.1 Hz) for repeater systems that require them and DTMF transmit memories for autopatch access and other functions. You can also split the memory channels into 10 banks designated A-J. This is convenient when you want to group memories for repeaters in specific cities, for example.

Programming the IC-2720H is straightforward. If you can program a handheld's memories, you can program the '2720H. The user manual offers clear instructions with a strong emphasis on

Table 1ICOM IC-2720, serial number 01024	
Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 118-550, 810-1000 MHz (cell blocked); transmit, 144-148, 430-450 MHz.	Receive and transmit, as specified.
Power requirement: Receive, 1.58 A (max audio); transmit, 12 A (high power).	Receive, 0.76 A; transmit, 9.1 A. Tested at 13.8 V.
Modes of operation: FM, AM (receive only).	As specified.
Receiver	<b>Receiver Dynamic Testing</b>
AM Sensitivity, 10 dB S/N: 118-160 MHz, 0.45 μV; 220-260 MHz, 0.79 μV; 260-350 MHz, 5.6 μV; 350-375 MHz, 1.0 μV; 375-400 MHz, 0.63 μV.	AM, 10 dB S+N/Ν: 120 MHz, 0.59 μV.
FM sensitivity, 12 dB SINAD: <i>left band</i> , 118-160 MHz, 0.18 $\mu$ V; 160-180, 220-260, 350-375 MHz, 500-550 MHz, 0.32 $\mu$ V; 180-220, MHz, 3.5 $\mu$ V; 260-350 MHz, 3.2 $\mu$ V; 375-430, 450-500 MHz, 0.22 $\mu$ V; 430-450 MHz, 0.18 $\mu$ V; <i>right band</i> , 118-160 MHz, 0.18 $\mu$ V; 160-174 MHz, 0.2 $\mu$ V; 375-430, 450-550 MHz, 0.22 $\mu$ V; 430-450 MHz, 0.18 $\mu$ V; 375-430, 450-550 MHz, 0.22 $\mu$ V; 430-450 MHz, 0.18 $\mu$ V; 810- 880 MHz, 0.45 $\mu$ V; 880-1000 MHz, 1.0 $\mu$ V.	For 12 dB SINAD, 144 MHz, 0.14 μV; 222 MHz, 0.2 μV; 430 MHz, 0.16 μV; 902 MHz, 0.86 μV.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing: 146 MHz, 68 dB; 440 MHz, 62 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 146 MHz, 61 dB; 440 MHz, 62 dB*; 10 MHz channel spacing: 146 MHz, 78 dB; 440 MHz, 73 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	71 dB.
S-meter sensitivity: Not specified.	S9 indication: 146 MHz, 2.0 $\mu\text{V};$ 440 MHz, 2.3 $\mu\text{V}.$
Squelch sensitivity: < 0.13 $\mu$ V.	At threshold: 146 MHz, 440 MHz, 0.09 $\mu\text{V}.$
Receiver audio output: 2.4 W at 10% THD into 8 $\Omega.$	2.9 W at 10% THD into 8 Ω.
Spurious and image rejection: 60 dB.	First IF rejection <sup>1</sup> , 146 MHz, 123 dB; 440 MHz, 132 dB; Image rejection <sup>1</sup> , 146 MHz, 99 dB; 440 MHz, 68 dB.
Transmitter	Transmitter Dynamic Testing
Power output (H/M/L), 144 MHz: 50/15/5 W; 430 MHz, 35/15/5 W.	146 MHz, 53/15.3/4.4 W; 440 MHz, 35/14.6/5.2 W.
Spurious-signal and harmonic suppression: 60 dB.	VHF, 70 dB; UHF, 67 dB. Meets FCC requirements for spectral purity.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 146, 440 MHz, 175 ms.
Receive-transmit turn-around time (tx delay): Not specified.	146, 440 MHz, 60 ms.
Bit-error rate (BER), 9600-baud: Not specified.	<ul> <li>146 MHz: Receiver—BER at 12 dB SINAD, 5.0×10<sup>-4</sup>; BER at 16 dB SINAD, &lt;1.0×10<sup>-5</sup>; BER at -50 dBm, &lt;1.0×10<sup>-5</sup>; transmitter—BER at 12 dB SINAD, 4.4×10<sup>-3</sup>; BER at 12 dB SINAD + 30 dB, 1.0×10<sup>-3</sup>.</li> <li>440 MHz: Receiver—BER at 12 dB SINAD, 1.0×10<sup>-4</sup>; BER at 16 dB SINAD, &lt;1.0×10<sup>-5</sup>; BER at -50 dBm, &lt;1.0×10<sup>-5</sup>; transmitter—BER at 12 dB SINAD, 9.2×10<sup>-4</sup>; BER at 12 dB SINAD + 30 dB, 2.0×10<sup>-4</sup>.</li> </ul>

Size (height, width, depth): main unit, 1.6×5.5×7.4 inches; weight, 2.8 pounds; remote head, 2×5.5×1 inches; weight, 5.3 ounces.

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.

<sup>1</sup>Worst case for left and right bands.

manipulating the multifunction microphone.

There are several types of scanning options available, plus four scan-resume conditions to choose from. With the broad receive coverage, this makes the '2720H a more-than-competent scanner. I should note that the '2720H can also scan for subaudible CTCSS tones. That's handy when you need to figure out which CTCSS frequency a repeater system is using. There is also DTCS decoding and encoding for paging applications with the "pocket beep" function to give you an audible and visual indication of an incoming call.

#### More Bells and Whistles

There are more clever goodies in the IC-2720H that bear mentioning. You can

change the display color from amber to green (I preferred the default amber). Brightness is variable, too. The '2720H defaults to the AM mode when you tune into the aviation band, but you can also select the AM mode manually for the odd AM signal you may encounter elsewhere.

The IC-2720H includes the weatheralert feature found in other recent ICOM models. When you enable this function, the radio will scan through the 162-MHz NOAA Weatheradio broadcasts every five seconds. If a station transmits a weather alert tone, an "alert" message will appear on the display. This feature works well except for the fact that it causes an audio dropout at 5-second intervals on the frequency you are monitoring. That's a small price to pay for the ability to stay on top of weather alerts, especially if you live in an area where they occur frequently.

With the cloning function you can swap memories with another IC-2720H or—and this was the feature I liked—load data into the '2720H's memories from your PC. You'll need the optional CS-2720 software and OPC-478 cable to do this.

#### **Operating Impressions**

If you don't intend to install the main unit nearby, you'll probably have to attach external speakers to adequately hear the IC-2720H. You can rely on the speaker ensconced in the main unit, but you'll enjoy greater fidelity (and intelligibility) with external speakers. In my installation I put the '2720H under the driver's side seat and found that the audio from the main unit couldn't quite overcome the ambient road noise.



Figure 1—Close-up view of the IC-2720H's microphone, a control panel in itself. Users who, for some reason, really don't need a display may plug the microphone directly into the main unit, bypassing the stand-alone control panel.

An external speaker cured the problem in short order.

The main chassis has a flow-through cooling design with a sizeable fan. I noticed that the fan was extremely quiet. The multifunction microphone is a clever feature, but it took me a while to master. It was just as easy to reach out and adjust the front-panel controls. To each his own—depending on the constraints of the installation, of course.

Signal reports received while using the IC-2720H were consistently good. The transmit audio has plenty of punch and the RF output is more than sufficient for both close-in and fringe locations.

The dual-band aspect of the IC-2720H makes it a joy to use for more than just terrestrial conversations. While driving to work one morning in December, I heard the UoSAT-OSCAR 14 satellite downlink on 435.070 MHz. I switched the main band to 2 meters and dialed up 145.975 MHz, the UO-14 uplink frequency. With just 15 W to a dual-band mobile antenna, I easily worked K8WYT in Iowa, along with several other stations. I continued to listen to a full-quieting signal from the satellite for nearly 10 minutes. That's pretty darn good for a mobile radio!

*Manufacturer:* ICOM America, 2380-116th Ave NE, Bellevue, WA 98004; tel 425-454-8155; fax 425-454-1509; **www.icomamerica.com**. Suggested list price: \$479.99. IC-CS-2720 software: \$45. IC-OPC-478 programming cable: \$45.

# Alinco DJ-S40T UHF Handheld Transceiver

#### Reviewed by Mike Tracy, KC1SX ARRL Laboratory Engineer

I've often debated getting a handheld that covers 440 MHz, but I kept putting it off for a long time. Still, being able to talk to other folks on the band when I am traveling has a lot of appeal. So a small 440 MHz transceiver that is easy on the checkbook appeared to be a good choice as a second handheld.

While not the smallest rig ever offered, the Alinco DJ-S40T is still quite compact the body of the rig is about 4 inches tall by 2 inches wide, and a bit over an inch deep, smaller than some current cell phones (Alinco dubs the rig "pager sized"). Given the small size and light weight of the unit (6.6 oz with 3 AA batteries *and* the belt clip; the rig alone weighs a mere 3.4 oz), this is definitely a shirt-pocket portable!

The rig's appearance is very sleek. The front of the unit has four small, round control buttons, a respectably sized LCD display, and two speaker ports (on either side of the display). The tiny pinhole near the bottom is for the built-in microphone. The top of the rig has a single knob to control volume (which also functions as a button to turn the rig on and off), speaker and microphone jacks (with separate gray rubber covers), and the SMA antenna jack (gold-plated, a nice touch). On the right side of the rig, there are the PTT and MONI buttons, with a single rubber cover. The MONI button is also marked KL to indicate its second function as a control lock. The left side features only the external dc jack.

In spite of the simple appearance, Alinco still managed to include the most commonly used features (and a few uncommon ones). Standard features are CTCSS encode and decode (38 of the 39 tones in the EIA standard set are

#### **Bottom Line**

The Alinco DJ-S40T offers a lot of value for the money, lacking perhaps just a few small refinements.

provided; 69.3 Hz is not included) plus tone scan; memories aplenty (99 regular, plus call and "alarm" channels), memory and VFO scanning and an S-meter/power output indicator.

What really sets this rig apart from other small, "budget" handhelds is that it offers a respectable 1 W output, giving the rig a more useful range than the milliwatters. I was able to reach several repeaters that were a few towns away. Of course, the signals weren't always full quieting, but I still received reports of good audio even when I wasn't fully into the machine.

The owner's manual is well organized, making most functions easy to look up. This came in handy sometimes, as the way some functions are enabled was not always completely intuitive. A few of the less-used functions are not fully described in the manual, but it is otherwise complete.

The orange FUNC SET button has three purposes. A brief push turns on the F icon, which allows you to select the second
#### Table 2 Alinco DJ-S40T, serial number M000529

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 410-470 MHz, transmit, 430-450 MHz.	Receive, 400-480 MHz; <sup>1</sup> transmit, as specified.
Power requirements: 4.5-16 V dc; receive, 0.15 A; transmit, 0.6 A (max, high power).	Receive, 0.15 A (max volume, no signal); transmit, 0.5 A, tested at 13.8 V.
Size (height, width, depth): 4x2.2x1.2; weight, 3.4 ounces.	
Receiver	<b>Receiver Dynamic Testing</b>
Sensitivity: 12 dB SINAD, 0.2 µV.	12 dB SINAD, 0.14 μV.
Two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset from 440 MHz, 57 dB,* 10 MHz offset from 440 MHz, 66 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset from 440 MHz, 56 dB.
Spurious response: Not specified.	IF rejection, 110 dB; image rejection, 58 dB.
Squelch sensitivity: Not specified.	At threshold, 0.13 μV.
Audio output: 200 mW at 10% THD into 8 $\Omega$ .	320 mW at 10% THD into 8 $\Omega.$
Transmitter	Transmitter Dynamic Testing
Power output: 1 W high, 0.15 W low.	Batteries: 0.82/0.18 W; external dc, 1.3/0.19 W.
Spurious signal and harmonic suppression: 60 dB.	59 dB.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, 188 ms.
Receive-transmit turnaround time ("tx delay"): Not specified. *Measurement was noise limited at the value indicated. 'Sensitivity is very poor below 420 MHz.	124 ms.

function of the other three buttons. When the button is held for three seconds, the rig enters SET mode (menu system). If pushed twice in succession, the 1 MHz tuning step is enabled (the MHz digit flashes to indicate this). Because SET is an orange label (as with the second functions on the other buttons), I found that I initially got confused a couple of times on this operation and pressed the button twice in succession when I actually intended to enter SET mode. This is just the force of habit from my use of other handhelds.

The UP TSQL and DWN CALL buttons (both gray) change the frequency by one step when in vFo mode and select the next memory when in memory mode. If they are held in briefly (about a second), scanning starts. If held for a slightly longer time, the frequency change/ memory step function repeats (much like the "auto repeat" feature on a computer keyboard). During the "window" of time to start the scanning mode, the decimal point flashes. When it has stopped flashing, then you know you have entered the step repeat operation. I found this also took a bit of practice.



The second function of UP TSQL toggles between CTCSS encode (T icon), decode (T SQ icon) and off. Enabling either encode or decode also displays the selected tone frequency. To change the tone, you press the UP TSQL and DWN CALL buttons. When you have the selection you want, you press either the v/M MW button or PTT to accept it. If you don't know the CTCSS tone of a particular repeater, you can use the tone scan feature to determine it for you (in most cases). As would be expected, the second function of the DWN CALL button selects (or deselects) the call channel. If you press the UP TSQL button while transmitting, the high power output is selected. Pressing DWN CALL while transmitting selects the low power output (150 mW), and a small  $\perp$  icon appears.

The last button on the front panel, v/M MW, toggles between vFO and memory modes. The second function of this button is used to write the current frequency information to a memory location. The source frequency (plus shift and tone selections) is whatever was on the display before the button was pressed (so you can program a memory from the vFO, the call channel or another memory). When you are in the memory write mode, a flashing w appears as a reminder. You then scroll through the numbered memories until you find the one you wish to program; if the selected memory is empty, the memory number also flashes, whereas if the channel is already programmed, the number doesn't flash (you can still overwrite an existing memory if you choose, however). Another press of v/M MW saves the display to the selected memory.

If you want to clear the contents of a memory, you follow the same procedure as programming a memory, except that instead of pressing V/M MW to save the contents, you press F then V/M MW to clear them. Unfortunately, there doesn't seem to be any way to transfer the contents of a memory that you have programmed back into the VFO.

The CALL channel works in a similar fashion to the memories, with a couple of minor exceptions. You can't scan the call channel, you can't scroll to it while in memory mode (although it appears as c on the memory list when in memory write mode), and you can't clear its contents.

### Features, Features and more Features!

The set mode menu (referred to as "Parameter Setting Mode" in the manual) has 19 items for setting both commonly used and infrequently used functions. Each item is given a number and an abbreviation referring to the function and current setting. Many of the abbreviations differ somewhat from the names seen on other handhelds for the same functions, so this is another area of mental adjustment for those with established habits. As an example, the repeater shift is SFD (shift direction) and when you are in simplex mode, this is indicated by OF, so you have to remember that SFD-OF =simplex. For those who have trouble remembering the meanings of the abbreviations, Alinco thoughtfully included a "cut on the dotted lines" Mode Settings Chart in the owner's manual.

The UP TSQL and DWN CALL buttons are used to change the settings of each menu item, so they can't also be used to scroll through the list; instead, the FUNC SET and MONI KL buttons serve for this (I would have found it slightly more intuitive if V/M MW was used instead of MONI KL, but the pressing the former exits set mode altogether).

While having to enter the settings menu to change items like squelch level and shift direction (no automatic settings are available) is somewhat inconvenient, the alternative would have been for



Figure 2—Batteries not included: The DJ-S40T does not come with a rechargeable battery or a charger, although the user may purchase them as optional equipment. Three AA batteries must be provided by the user. Yes, all three go in the same way: negative pole at the top; positive at the bottom. As you can see, the rig is tiny; the battery pack provides a great deal of the radio's volume (as measured in cubic units of length, not dB).

Alinco to either add more buttons to the radio or make each button perform more tasks, both of which have disadvantages. Also, it is worth noting that the items that are typically changed frequently are all grouped together in the settings menu, so it doesn't take a lot of button presses to get to them.

Because the rig offers the choice of several optional rechargeable batteries as an alternative to the supplied pack for alkaline cells, there is a menu setting that enables and disables internal battery charging (default is disabled to prevent accidental damage to non-rechargeable types). There is another menu setting for battery type (choices are 1 or 2), but the manual offers no insight as to the proper setting for this item. The optional rechargeable batteries come in two different voltages, so I would assume this item corresponds to the different charge voltages.

The Call Tone feature enables the transmission of an audio tone when the MONI button is pressed at the same time as the PTT. A menu setting selects one of four tone choices (1000, 1450, 1750, 2100 Hz) to be transmitted. The call tone feature is disabled if CTCSS is enabled.

For folks who tend to be long-winded, a time-out-timer is included. The interval can be set from 30 to 450 seconds, in 30second increments (it can also be turned off altogether). The transceiver gives a 10-second countdown at the end of the time-out interval to give a bit of warning before it cuts you off.

The Reception Bell is not described in any detail in the owner's manual. However, the operation is essentially the same as the altering function found on Alinco's earlier DJ-S11 handheld. When an incoming signal breaks the squelch, the radio emits a telephone-like ringing sound three times in succession. The volume of the tones is set to a fixed level that does not depend on the transceiver's volume control.

As with the Reception Bell, the Stand-by Beep is only mentioned briefly in the manual. This menu item can be set to on or off. When it is enabled, a beep is added to the end of each transmission, which is heard both at the transmitter and receiver.

The scanning functions on the DJ-S40 are fairly typical, with memory and vFo scanning, the latter including a skip feature for memories that are marked with the skip label. The scan pause behavior can be set for a 5 second timed pause, or set to pause as long as there is a signal present ("busy").

Special features of the transceiver include a theft alarm and a mosquito repelling sound. The theft alarm uses a cable plugged into the speaker jack; the radio will emit the alarm sound when the cable is removed while the alarm is active. Since the theft alarm is turned off by removing the battery pack, this feature offers only a modest level of security. A mosquito-repelling feature uses a high pitched audio tone to dissuade the pests from hanging around. I found the tone to be quite audible when this was enabled. but the volume was not too loud. It could definitely be distracting though. As it wasn't mosquito season when this was being written, the opportunity to "field test" this feature did not arise (and I wasn't anxious to try it in any case).

*Manufacturer*: Alinco Inc, Shin Dai Building 8F, 1-2-6 Doujimahama, Kitaku, Osaka 530-0004, Japan. Alinco's US distributor is ATOC Amateur Distributing LLC, 23 S High St, Covington, OH 45318; tel 937-473-2840; fax 937-473-2862; www.alinco.com. \$89.99.

### HAPPENINGS

# Rock Star Invests in Ham Radio's Future with Donation to "The Big Project"

Hoping that his donation will spur others to contribute to "The Big Project," veteran rock star and well-known amateur Joe Walsh, WB6ACU, has given in a major way to ARRL's Education and Technology Fund. ARRL Chief Development Officer Mary Hobart, K1MMH, says the "significant gift" through the Joseph F. Walsh Foundation will fund an additional eight pilot schools in the ARRL Education and Technology Program.

ARRL President Jim Haynie, W5JBP, expressed his gratitude for Walsh's dedication and support to The Big Project's goals and aims. "I am particularly pleased with Joe's donation, as it emphasizes his belief in our school project and more importantly, investing in the future of Amateur Radio," Haynie said. "The additional schools that will be brought into the program as a result of this donation represent a big step in increasing the number of students participating in the ARRL Science and Technology program." Best known as a guitarist, vocalist and songwriter with The Eagles and The James Gang, Walsh has been an active Amateur Radio operator for more than 37 years. He's also an avid collector of Collins Radio gear. The amount of his donation was not made public.

The Big Project—as the program is popularly known—highlights

Amateur Radio as a significant resource for teachers in classrooms as well as for enrichment and after-school programs. The 40 pilot schools now in the program receive a complete Amateur Radio station, technical library and a curriculum that makes technology fun and relevant for the participating students.

in the Education and Technology Program at its inception after he learned about it from Haynie while attending the Dayton Hamvention. Recognizing the importance of introducing youth to Amateur Radio in the classroom, Walsh subsequently called Haynie to inform him that the Walsh Foundation would make a substantial gift.

"This contribution really makes a statement. It's a significant leadership gift that's going to make a real impact," Hobart said of Walsh's donation. His contribution was one of over 3500 made by ARRL members, who—together—have raised more than \$250,000 to fund the Education & Technology Program in 2003.

Hobart says Walsh became interested

### Partnership Pays Off in Hundreds of Ham Radio Emergency Trainees

A \$33,000 grant from Hartford, Connecticut-based United Technologies Corporation (UTC) announced last spring has fueled a more than 20-fold increase in the number of trained Amateur Radio emergency communicators in Connecticut. In just six months, 258 Connecticut hams completed the ARRL Level-I Amateur Radio Emergency Communications course tuition-free, thanks to the grant.

"UTC has helped us lay the groundwork for taking this training nationwide," said ARRL Emergency Communications Course Manager Dan Miller, K3UFG. "The grant from UTC was worth far more than a dollar amount."

Before UTC offered its support last June, just a dozen Connecticut hams had become certified via the Level I emergency communications course. The number certified now stands at 270.

Some of the Nutmeg State's newest trained ham radio communicators found themselves put to the test November 17, when an early ice storm gripped northwestern Connecticut. The ice storm cut off power to more than 130,000 residences and businesses. For Jim Ritterbusch, KD1YV, an ARRL emergency coordinator, the way hams handled themselves in their roles as emergency communicators during the storm was a



(L-R) Connecticut Lt Gov Jodi Rell, ARRL Connecticut Section Manager Betsey Doane, K1EIC, and EC Jim Ritterbusch, KD1YV, were among the dignitaries attending the announcement of the UTC grant in June 2002.

direct result of the ARRL Amateur Radio emergency communications training subsidized by the UTC grant.

"The value of the training was apparent in many of the operators who had taken Level I," he said. "The nets ran more accurately and efficiently than we have seen in the past."

The partnership between UTC and ARRL has served as a model for dramatically expanding Amateur Radio emergency communications courses. Nearly 1700 amateurs nationwide have gone through at least one of the three emergency communications course levels since the program's inception in December 2000.

ARRL Chief Development Officer Mary Hobart, K1MMH, said the League hopes UTC now will approve a three-year grant to help fund further expansion to the national level. "A second grant from UTC for a national scale program will enable ARRL to certify 5000 radio amateurs in Level I, II or III of the emergency communications course, and have an even

### FCC News -

#### FCC LAUNCHES "CONSUMER-FRIENDLY" ELECTRONIC COMMENT FILING SYSTEM

The FCC has launched "ECFS Express," an updated electronic system that the Commission says will make it easier for at least some members of the public to file comments on FCC proceedings. ECFS Express is a simplified version of the popular Electronic Comment Filing System (ECFS), but it is not available for all FCC proceedings.

ECFS Express is accessible from the FCC home page **www.fcc.gov**. Users just click on the "File Comments" logo— which is on the left-hand side of the page about one-third of the way down under the words "Filing Public Comments." Anyone who wants to comment just has to click on a topic, fill in their personal information, write their comments and hit "SEND."

"ECFS Express will highlight the proceedings most likely to generate consumer interest," the FCC said. "The topics will change periodically as new issues emerge."

The downside is that if the particular issue you want to comment upon is not listed among the ECFS Express topics, you'll have to use the "expert version" of ECFS, elsewhere on the FCC Web site. At press time, the EFCS Express list included no Amateur Radiorelated petitions. The FCC says the original version of its Electronic Comment Filing System—which includes *all* docketed FCC proceedings—will continue to be available at **www.fcc.gov/ e-file/ecfs.html**.

#### Amateur Enforcement

♦ **KV4FZ returns to ham radio:** After nearly two years off the air, Herb Schoenbohm, of Kingshill, Virgin Islands, made good on his promise to one day return to the Amateur Radio ranks. The FCC on December 4 issued Schoenbohm a new call sign, NP2MJ, as a General-class licensee, and on December 5 it acted on his subsequently filed Amateur Extra class application. Using the vanity call sign program, Schoenbohm got back his former KV4FZ call sign on December 27.

In 1994, the FCC put Schoenbohm's renewal application for KV4FZ up for hearing following his 1992 felony conviction on federal fraud charges. The Commission finally turned down his re-

newal application in 1998, the US Appeals Court upheld the FCC's decision in 2000, and the US Supreme Court declined to hear the case later that same year. After losing his renewal bid and his operating privileges, Schoenbohm applied for a new license in 2001, first passing the General and then the Extra exams. The FCC subsequently designated Schoenbohm's General application for hearing on the basis of character issues stemming from his 1992 conviction as well as his alleged lack of candor during subsequent FCC hearings on the matter.

Following a hearing last spring, Administrative Law Judge Arthur I. Steinberg in October cleared the way for Schoenbohm's return to ham radio by declaring that Schoenbohm appeared rehabilitated and qualified to again become a Commission licensee.

♦ FCC initiates review of Georgia ARRL VEC exam session: The FCC has initiated a review of a June 2000 ARRL VEC examination session in Pelham, Georgia. At that session, an examinee who had unsuccessfully attempted to pass Element 2 (Technician) seven times at other exam sessions got a perfect score on Element 2 and also passed the Element 3 (General) exam.

The applicant in question, Arthur Lee Clark, of Oxford, Georgia, subsequently was granted a General ticket as KG4IJV. It's not clear when or how Clark obtained credit for the Element 1 (Morse code) examination. The FCC called Clark in for retesting last spring and canceled his license after he failed to appear.

FCC Special Counsel for Enforcement Riley Hollingsworth wrote volunteer examiners William K. Ferguson, W9UNH, Alice Childs, AF4HB, and Walter J. Childs, KQ4SF, on November 12 asking them to provide further information on the examination session. In a separate letter November 12, Hollingsworth requested that the ARRL VEC not accept the services of the three VEs involved in the Pelham session at least until the FCC concludes its investigation. Suspension of volunteer examiners is standard procedure during such inquiries.

♦ FCC completes exam session reviews: The FCC has completed its review of ARRL VEC Amateur Radio examination sessions held in 1999 and 2000 in Cookeville, Tennessee, and in 2001 in Trumbull, Connecticut.

The Cookeville case involved exam

sessions on December 14, 1999, and on March 11, 2000. In a November 18 letter to ARRL VEC Manager Bart Jahnke, W9JJ, FCC Special Counsel Riley Hollingsworth recommended that the ARRL VEC no longer accept the volunteer examiner services of five amateurs involved with the sessions. He named James N. Keaton, W4SOH; Maria C. Droke, KC4FLW; George S. Droke, W5SD; Bobby A. Raymer, N2BR, and Steven G. Hunter, KF4FAV.

Hollingsworth said the FCC's decision was based on the fact that members of the VE team participated in the examination of applicants they knew—or should have known—to be related to certain VEs, contrary to §97.509(d) of the FCC rules. The FCC launched its probe after the ARRL VEC called apparent discrepancies to the FCC's attention.

In a separate letter November 20 to Gary E. Hunter, KG4FRN, the brother of former VE Stephen G. Hunter, KF4FAV, the FCC downgraded Gary Hunter's license from Amateur Extra to Technician—his license class prior to the Cookeville session administered in part by his brother. The wife of Bobby Raymer, Kathy J. Raymer, ex-KG4FWO, also had been credited with having passed exam elements at the session. Kathy Raymer agreed earlier to forfeit her Technician license.

Regarding the Trumbull, Connecticut, review, Hollingsworth wrote Jahnke on November 14 that 9 of the 10 VEs administering the May 10, 2001, session "followed proper testing procedures" and that the FCC has no objection to their being reinstated as VEs. Reinstated were ARRL VEC VEs Kevin W. Cellini, N1GKM; Glenn J. Krieger, N1HAW; Allen H. Silberstein, N1RWE; Andres A. Rosado, KB1FKJ; Robert E. Moreland, KA1ZMF; Peter J. Keyes, N1GOJ; Donald W. Stowe, N1VNM; Arthur L. Cartier, III, N1VGT; and Kenneth A. Frissora, N1JKA.

A 10th VE, Freddy Martin, W1BIQ (ex-KB1FKI), remains suspended from the roster of active ARRL VEC VEs. Hollingsworth said he anticipates no further action in the case. The Trumbull probe had focused on discrepancies in documents submitted on behalf of Elvis Mendez, KB1GPY, who had attempted to upgrade to Extra at the May 10 session. Mendez' Extra exam was invalidated as a result of the discrepancies.

greater impact on homeland security and disaster relief efforts," she said.

More information on the ARRL Certification and Continuing Education Program is available on the ARRL Web site, www.arrl.org/cce/courses.html.

#### ARRL CONCLUDES 5-MHz EXPERIMENTS, AWAITS FCC DECISION ON NEW BAND

Without fanfare, the ARRL allowed its WA2XSY 5-MHz experimental license to lapse January 1 rather than request renewal for another year. Last May, the FCC proposed going along with the ARRL's 2001 request for a new domestic (US-only), secondary HF allocation at 5.25 to 5.4 MHz. Discussions with various governmental agencies-including the Interdepartment Radio Advisory Committee (IRAC) and the National Telecommunications and Information Administration (NTIA)-continue on how to accommodate amateur operation in the band, which is primary for several governmental agencies including the military. The NTIA regulates radio spectrum allocated to the federal government.

"At this point, we have every reason to believe the FCC will act on its proposal early this year," ARRL Chief Executive Officer David Sumner, K1ZZ, said in January. "As to what the outcome will be as far as 5 MHz is concerned, we cannot predict."

In a December 24 letter, Sumner thanked the 15 Amateur Radio clubs and individual amateurs who took part in the 5-MHz experimental operation that began in January 1999 and largely concluded in 2002. "You assisted in providing an important part of the groundwork for our petition for a domestic allocation to the Amateur Radio Service in this frequency range by demonstrating the desirability and feasibility of a shared allocation," he wrote. "We hope it will not be long before amateurs throughout the country are able to enjoy the fruits of your efforts."

Sumner said the ARRL chose not to request another renewal of the WA2XSY license because it already had obtained sufficient information to justify its petition for the band.

Until surprise opposition surfaced last fall from the NTIA, the FCC had the League's request for a new 60-meter band on the proverbial fast track. In a letter filed with the FCC last August—after the comment deadline had passed—the NTIA recommended that the Commission not go forward with the 5-MHz proposal. The NTIA said several government agencies with allocations in the proposed spectrum had expressed reservations about allowing amateurs to use the band, even on a non-interference basis.

The League has been working with the federal agencies involved to resolve the issues the NTIA letter raised.

The ARRL has called the 5 MHz allocation "an urgent priority of the Amateur Service." In its July 2001 petition, the League told the FCC that a new band at 5 MHz would aid emergency communication activities by filling a "propagation gap" between 80 and 40 meters.

Experimental operations on 5 MHz continue on a very limited basis in the United Kingdom and in Canada. In Newfoundland, the Marconi Radio Club's VO1MRC has been operating under experimental authority from Industry Canada and an endorsement from Radio Amateurs of Canada to conduct experiments on 5 MHz. On December 21, VO1MRC completed a cross-band (5 MHz/7 MHz) CW contact with VK7RO in Tasmania.

#### ARISS TEAM TALKS ABOUT FUTURE HAM-RADIO-IN-SPACE PROJECTS

Members of the Amateur Radio on the International Space Station (ARISS) International Team met December 5-8 at the NASA Goddard Space Flight Center in Greenbelt, Maryland. Delegates represented partner countries, International Amateur Radio Union (IARU) membersocieties and AMSAT organizations in Europe, Japan, Canada, Russia and the US.

"I was extremely impressed with the quality of the discussions at our meeting and the camaraderie of the international team," said ARISS International Chairman Frank Bauer, KA3HDO. "The ARISS Team really has come together to



ARISS Vice Chairman Gaston Bertels, ON4WF, holds a copy of the European Space Agency publication *On Space*, which recently included an article on ARISS.



ARISS International Chairman Frank Bauer, KA3HDO, displays the prestigious NASA Outstanding Leadership Medal, which he recently received. Bauer is employed by NASA.

be a cohesive international team since we first met in 1996." Bauer also represented AMSAT-NA during the session, which was moderated by Roy Neal, K6DUE. ARRL Field and Educational Services Manager Rosalie White, K1STO, attended on behalf of the ARRL. AMSAT-NA President Robin Haighton, VE3FRH, was on hand as a delegate for Canada.

The delegates heard progress reports on various ARISS equipment proposals, including timing for certification and future delivery. Previously approved hardware projects were being completed to make the most of the four Amateur Radio antennas now installed on the ISS Zvezda Service Module—the crew's living quarters. Operations on 70 cm could commence this spring, and SSTV (SpaceCam) hardware could be launched later this year. Once it's in place, students will be able to see the astronauts via SSTV while in QSO with them.

Delegates re-elected Bauer as ARISS chairman, White as ARISS secretarytreasurer, and Gaston Bertels, ON4WF, as ARISS vice chairman. All will serve two-year terms. ARISS is an international project, with US participation by ARRL, AMSAT and NASA.

#### NEW JERSEY LAWMAKER INTRODUCES PRB-1 BILL

New Jersey State Assemblyman Matt Ahearn (D-Fair Lawn) has introduced an Amateur Radio antenna bill, Assembly Bill 3065, in the Garden State. Ahearn is KB2PNN and an ARRL member. If approved by New Jersey lawmakers, the measure, put into the legislative hopper December 9, essentially would codify the limited federal preemption known as PRB-1 into New Jersey's statutes. The measure also would preclude regulation via any ordinance or regulation that effectively prohibits an antenna support structure of 70 feet or less above ground level—exclusive of any antenna upon the structure.

"This policy enhances the state's available pool of emergency communications volunteer operators and stations that can provide reliable emergency communications at no cost to the state or municipal governments," said Ahearn. ARRL Hudson Division Director Frank Fallon, N2FF, said he was thrilled that there are now PRB-1 bills in both New Jersey and New York.

Ahearn's bill would prohibit governing bodies from adopting a zoning ordinance or regulation that "prohibits or has the effect of prohibiting" the construction, maintenance or use of an Amateur Radio antenna and support structure. The measure would require municipal ordinances and regulations to "permit sufficient height of those antennas and support structures so as to reasonably accommodate Amateur Radio communications." Restrictions on antennas and support structures "shall constitute the minimum practicable regulation necessary."

#### RADIO ASTRONOMY PIONEER GROTE REBER, EX-W9GFZ, SK

Grote Reber, ex-W9GFZ, one of the earliest pioneers of radio astronomy, died December 20 in Tasmania, where he had been living since 1954. He was 90. Reber was



the first person to build a radio telescope dedicated to astronomy, and his selffinanced experiments laid the foundation for today's advanced radio astronomy facilities.

"All radio astronomers who have followed him owe Grote Reber a deep debt for his pioneering work," said National Radio Astronomy Observatory (NRAO) Director Fred Lo. Reber was the first to systematically study the sky by observing something other than visible light.

As a radio engineer and avid Amateur Radio operator in Wheaton, Illinois, in the 1930s, Reber was inspired by Karl Jansky's 1932 discovery of natural radio emissions from outer space. The concept of viewing space via radio signals presented Reber—who had worked his share of terrestrial DX—with a whole new challenge that he attacked with vigor.

Reber concluded that what he needed was a parabolic dish antenna, and in 1937, using his own funds, he constructed a nine-meter dish antenna in his backyard. Using electronics he designed and built that pushed the technical capabilities of the era, Reber succeeded in detecting "cosmic static" in 1939. In 1941, Reber produced the first radio map of the sky.

In a 1977 paper, "Endless, Boundless, Stable Universe," Reber concluded: "Time is merely a sequence of events. There is no beginning nor ending. The material universe extends beyond the greatest distances we can observe optically or by radio means. It is boundless."

Reber's amateur call sign, W9GFZ, now is held by the NRAO Amateur Radio Club in Socorro, New Mexico. —*NRAO news release by Dave Finley, N1IRZ; Tom Crowley, KT4XN* 

### Media Hits

• *The Knoxville News-Sentinel* in Tennessee ran a lengthy feature on Amateur Radio emergency communications following a tornado that hit the state late in 2002. Tennessee Section Emergency Coordinator Sheila Tallent, KB4G, was interviewed about her efforts during the storm, along with the those of area hams who mobilized to help the police, fire departments, the Red Cross and other agencies. Tallent told how hams get involved during emergencies and the variety of tasks they perform.

• Members of the Wabash Valley Amateur Radio Association in Indiana received high praise for their public service efforts during the 220 mile World Hovercraft Cruise on the Wabash River in September 2002. The event was part of the World Hovercraft Championship. Members of the club were stationed approximately every 20 miles along the river and reported information on the racers during the two-day event. The club's efforts reported in the September/October 2002 issue of *Hovernews*, the magazine of the Hovercraft Club of America.

• Nacogdoches (Texas) Amateur Radio Club President Tom Smith, KD5MBZ, was photographed for a front-page item in the *Daily Sentinel*. The caption described the storm-spotting activities of SKYWARN volunteers who were preparing for a severe thunderstorm. The photograph and caption clearly got across the message that hams are there to help during emergencies.

#### SECTION MANAGER ELECTION NOTICE

To all ARRL members in the Maryland-DC, Nevada, New Hampshire, Northern New Jersey, Rhode Island, San Joaquin Valley, Utah and West Texas 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 7, 2003. Whenever more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before April 1, 2003, to full members of record as of March 7, 2003, which is the closing date for nominations. Returns will be counted May 20, 2003. Section Managers elected as a result of the above procedure will take office July 1, 2003.

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, 2003. If no petitions are received from a section by the specified closing date, such section will be resolicited in the July 2003 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 filled 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 **Q57** 

### PUBLIC SERVICE

# The 2002 Bicycle Assault on Mt Mitchell

#### By Elsie Finkelstein, KA2CLX

The Spartanburg (SC) Amateur Radio Club has been providing communications for the "Assault" for some 20 years. This story tells about our experiences at the 27th Assault on May 18, 2002.

On this gray and drizzly day in May, Church Street was a myriad of colors and bicycles. Some 1600 bicyclists were on the mark, prepared to take off on an adventure, either to Marion, North Carolina or, for most, to the top of Mt Mitchell, at 6684 feet the highest peak east of the Mississippi River. Little did we know how arduous an adventure it would be.

As the clock struck 6:30 in the morning, the horde of cyclists started off, very slowly at first, but within a few minutes, the pack became a stream, and the leaders were on their way. They would all pass the lone cyclist, Van Epps, who had started out at 2:30 in the morning on his hand cycle, and was somewhere ahead on the course. But this was not a race against time. It was a test of endurance, both physical and mental. And this is not a story about cyclists. It is a story about the part Amateur Radio played in this event.

For the first time, a radio operator had been assigned to a bike repair truck. As we were standing at the start, watching the cyclists take off, a bike repair truck was coming toward us. I was standing with Mike Thompson, KE4KMA, who was to ride in the truck. The truck started to speed up and whizzed by us without stopping. Mike and I waved and waved, but to no avail—so much for communications. This turned out to be an omen.

My duty was to ride with the ride organizer, John Bryan, and keep him in contact with those who were responsible for the various aspects of providing safety and comfort to the riders-such as water, food, buses and repair vehicles. I started riding with John for the first time two years ago at the 2000 Assault. One of the complaints of his team had been that they couldn't find him easily when problems arose and decisions were needed. Lester Kennedy, KF4EQC, who had accepted the task of organizing our club's participation, asked for a volunteer to stay with John during the Assault to relay problems and information. I volunteered.

Twenty-five radio operators, excluding the motorcycle hams, more commonly re-



George Hincapie (center) is the first to complete the 2002 Assault on Mt Mitchell. © 2002 Bird's Eye View, Inc. [Photo used with permission.]

ferred to as Motos, were stationed at the 10 water stops as well as at the top of the mountain. Of that number, others were assigned as back-up home-based operators, another was assisting Lester, and I was with John. Marion, North Carolina, was the natural hub of radio operations. and two operators were net controls at this station. Marion represented the first 72 miles of the Assault and some 640 cyclists were scheduled to complete their rides at this stop. Upon arrival in Marion, the cyclists would have completed about 4500 feet of the climb. There would be 640 tired cvclists with 640 bikes, and countless family members and friends. It was also a hub for the buses and trucks that would carry the cyclists, visitors and bicycles down from the mountain and back to Spartanburg, South Carolina. As it turned out, the buses were a dire need in view of what we actually faced from the weather at the top of Mt Mitchell.

John drove us on a route to the top different from that which the riders would be taking. The heavens had opened and rain was pouring. We were snug and warm, but what about the cyclists and the motorcycle radio operators? At 7:45 AM a call came in that a bike needed repair. Through asking the water-stop hams, the repair vehicle was found and sent to the rider. At 8:20 AM, the first rider was at the 45-mile mark. We received a call that there was no drinking water at Stops #1 and #2. We sent out a call for the water truck to stop there and fill them up. At 9:10, it was announced that Van Epps was at mile 63.7. John breathed a sigh of relief. He had mentored Van Epps to ready him for this ride each year. From the Overlook, it was reported that there was no portolet (portable toilet). As we drove along, John and I looked for the portolet and found it a half mile up the road from the Overlook stop. It was barely to be seen through the low hanging clouds and then only from the up side. The cyclists would miss it. We reported the location to Overlook for relay to the cyclists. Apparently those responsible for setting up the stop had not found the portolet and just selected a flat place to arrange their wares.

At 10:02 AM, there was no peanut butter for the cyclists at Water Stop #8. We sent out a call that the next ham to see the supply truck should send it to Stop #8. There were also six buses at Marion. John gave directions to fill them up and go. The first riders were at 81.4 miles. At 10:58, they were at 94 miles, and at 11:04 they were at the entrance to the park. The temperature was now 40 degrees and the wind was blowing some 30 miles per hour up here in the clouds. The windchill was in the 20s. The weather was miserable. The first rider, the famed George Hincapie, crossed the finish line in 4 hours, 59 minutes or at 11:29 AM. [Hincapie is a key rider for Lance Armstrong and the US Postal Service cycling team.] Van Epps crossed the finish line at 6:12 PM. I must admit I didn't see either of them finish.

When Hincapie crossed, I was in John's truck handling the radio as best I could. My teeth were chattering, and I was shaking with the cold. I had been out to get John's orders about dispersing the buses, and the weather got to me each time I ventured out. Each time I thought the wind was going to blow me off the mountain. I had thought I was prepared for any type of weather with my winter jacket and hat, two sweaters and heavy boots. The windchill did me in. At about 1:30 PM, I packed it in and rode down to Marion on a warm bus after devouring three cups of hot tomato soup which was customarily available for those at the top of the mountain. Lester had to take over my job.

At Marion, I sat near the net controls, Craig Hall, KV4EE, and Ken Kirkley, NO4D, who were complaining about the cold weather and wind at their location.

My retort was, "Fellows, this is like Florida compared to the top."

Craig and Ken had a very important task to perform. It was they who relayed the bus information. We had to get the cyclists down from the top as fast as they crossed the finish line. The emergency medical services group at the top of Mt Mitchell told John that if there were any delays with the buses, there would be mass hypothermia among the cyclists. The cyclists and their safety were our major concern. In 2001, we had coped

#### **Freewheeling Van**

Havnesworth Van Epps rode the Assault on Mt Mitchell for the first and last time as a bicyclist in May of 1990. In July, while he and a friend were cycling, Van Epps was hit by a reckless driver and dragged some 656 feet. He sustained multiple injuries and lost the use of his legs. Five years later, he was taken to meet a handcyclist. The Spartanburg Freewheelers purchased a Freedom



Spartanburg Freewheelers purchased a Freedom Ryder handcycle for

him. As a result, he handcycled the Assault on Mt Mitchell for the first time in 1997. Since that time, Van has ridden the Assault every year, starting out at 2:30 in the morning, accompanied by an escort automobile for safety purposes. He usually finishes the ride in about 16 hours. He does, indeed, finish in spite of all odds and the most merciless weather at the top of the mountain. One of the most important of the Amateur Radio communication tasks is reporting his progress along the arduous route. Everyone roots for Van and seeks information about his progress on the ride.

with 6 inches of sleet on our windshields. That was nothing compared to the winds stinging our faces with the cloud moisture and the dropping temperatures. The effective temperature this year was some  $20^{\circ}$ . To me, it felt more like zero.

The net control log at Marion was almost totally devoted to maneuvering buses

#### International Traffic Handled by the National Traffic System

Bill Thompson, W2MTA, Manager of the NTS Second Region Net, Cycles 2 and 3, and the NTS Atlantic Region Net, reports that the ARRL National Traffic System handled more than 60 pieces of traffic for over 20 different countries outside of the United States and Canada during 2002. The list of international destinations for the third-party traffic included Australia, Barbados, Brazil, Colombia, Costa Rica, Cuba, Dominica, El Salvador, Ghana, Guyana, Haiti, Honduras, Israel, Jamaica, Mexico, Philippines, St Lucia, Samoa, Trinidad, Uruguay and Venezuela.

The primary international interface is the International Assistance and Traffic Net (IATN) which meets on 14,303 kHz at 1130 UTC in winter (Standard Time) months and 1100 UTC in summer (Daylight Saving Time) months.

onnieu o	laies		1-1 a	ILY II		greem	ento		
Countries	with v	which	tho I	Inited	States	shares	third-narty	traffic	agreements

United States Third-Darty Traffic Agroements

ooun		na pan	ly traine agreetinente.		
V2	Antigua and Barbuda	C5	Gambia, The	OA	Peru
LU	Argentina	9G	Ghana	DU	Philippines
VK	Australia	J3	Grenada	VP6	Pitcairn Island*
V3	Belize	ΤG	Guatemala	V4	St Christopher and Nevis
CP	Bolivia	8R	Guyana	J6	St Lucia
Т9	Bosnia-Herzegovina	HH	Haiti	J8	St Vincent and the Grenadines
PY	Brazil	HR	Honduras	9L	Sierra Leone
VE	Canada	4X	Israel	ZS	South Africa
CE	Chile	6Y	Jamaica	3DA	Swaziland
ΗK	Colombia	JY	Jordan	9Y	Trinidad and Tobago
D6	Comoros (Federal Islamic Republic of)	EL	Liberia	ТА	Turkev
ΤΪ	Costa Rica	V7	Marshall Islands	GB	United Kinadom**
ĊO	Cuba	XE	Mexico	CX	Uruquav
HI	Dominican Republic	V6	Micronesia. Federated States of	ΥV	Venezuela
.17	Dominica	YN	Nicaragua	4U1ITU	ITU. Geneva
HC	Ecuador	HP	Panama	4U1VIC	VIC. Vienna
YS	El Salvador	ZP	Paraguay		,

\*Since 1970, there has been an informal agreement between the United Kingdom and the US, permitting Pitcairn and US amateurs to exchange messages concerning medical emergencies, urgent need for equipment or supplies, and private or personal matters of island residents.

\*\*Limited to special-event stations with call sign prefix GB (GB3 excluded).

Note: At the end of an exchange of third-party traffic with a station located in a foreign country, an FCC-licensed amateur must transmit the call sign of the foreign station as well as his own call sign.

up to the top of the mountain and down to Marion or Spartanburg. From the time the first rider came in until the last was safely at the top, the hub at Marion was busy. At the time, it may not have seemed like much, but, in truth, it was life saving.

Let us not forget the Motos, who were also out there with the cyclists. [A more complete description of the tasks of the motorcycle radio operators can be found in the March (pp 69-73) and April (pp 48-56) 2002, issues of Wing World in a twopart article written by Howard D. Johnson, W4CCP, "26th Assault on Mt. Mitchell."] Eight radio operators and three non-hams volunteered their time to keep the roads clear with the help of various law enforcement agencies. They followed the cyclists along their path, some to Marion and some to the top. One of their tasks was to make sure that no cyclist entered the State Park



A view of the Mt Mitchell area.

after 4 PM since there would not be time for them to finish before the park closed. Another task that was assumed by the Motos was to check out the route for stragglers and make certain that any who needed help would get it.

Our task was not so glamorous as a DXpedition. We were not going to get contacts from exotic places, nor were we going to get recognition for literally weathering the storm. Why do we do it? The Amateur Service is a public service, and this is one project that needed our help. There was also a camaraderie that we had built around it.

As I rode the bus to Marion with a group of cyclists in bike shorts and tee shirts, I listened to their telling of being cold and how difficult the fog and wind had made their rides.

I asked them, "Are you coming back next year?"

Their responses were a unanimous "Yes!" and I will, too, with a suitcase full of winter clothes. Incidentally, 772 cyclists completed the ride to the top of Mt Mitchell, a distance of 102 miles.

#### **Field Organization Reports**

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll December 2002

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 maxi-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 posi-tion; maximum 30.

4) Participation in scheduled, short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emer-gency tests and related practice events. This includes off-thegring tests and reacting tests with related emergency groups and served agencies.—5 points per hour (or any por-tion 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

3) Faitclatton and inplating entry response when the Amateur Radio operator is on the scene. This also in-cludes 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 sys-

tem that handles AREL 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 quality for PSHR 12 consecu-tive months, or 18 out of a 24 month period, will be awarded

a certificate from Headquarters upon writen notification of qualifying months to the Public Service Branch of Field and Educational Services at ARRL HQ.

706 W7TVA 650 W2MTA 540 N9TVT 511 K6SOJ 450 N2CCN	351 N4TAB 350 K2YS 345 KA2ZNZ 334 K2ZTF 323 N5NAV	235 WI2G NC2F 230 KB2KOJ 218 AB5WF 205 KB2CCD 200 200	180 K9JPS N2IKR 178 KB2ETO N2JBA 175 KB5WY W4AUN 165 W5ZX	KB2VRO 137 W5JYJ 136 W4CC KG9B 135 W5OMG 133 K5ER
420 N2LTC 412 K2CSS 380 N5JCG 365 N9VE 364 KC2DAA	275 NN2H 270 W2LC 267 KA2GJV 262 AB2IZ 245 W9RCW	KB2SNP 199 N2YJZ 191 K1CFI 188 WB2LEZ 187 AL7N	160 K4RLD 158 W6IVY 155 KD5SWI 152 WNØY 145 N8IO	130 N2HQL W3YVQ KE4JHJ KG4CHW AG9G 129 WA1QAA 128 NØSU

The following stations qualified for PSHR points in previous No Foliowing stations qualified for PSHH points in previous months, but were not recognized in this column: (Aug) NSSIG 90 (Sept) W8IM 90 (Oct) N5NAV 1840, W5ZX 725, N5SIG 205, W5JYJ 175, KD5SWI 160, AD5KE 155, KC5OZT 150, AC5XK 150, W5ARS 143, W5OMG 130, WB5NIC 130, KA5KLU 120, N5OUJ 120, KB5TCH 115, W5IM 115, K5UPN 110, W5GKH 110 (Nov) W5ARS 129.

#### Section Traffic Manager Reports December 2002

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CT, EMA, EPA, EWA, GA, ID, IL, IN, KS, KY, LA, MDC, MS, MI, ME, NC, NFL, NH, NLI, NNJ, NNY, NTX, NV, OH, OK, OR, ORG, SB, SC, SD, SDG, SFL, SJV, SNJ, STX, TN, VA, VT, WI, WCF, WMA, WNY, WPA, WV, WWA, WY.

#### Section Emergency Coordinator Reports December 2002

The following ARRL Section Emergency Coordinators re-AK, AR, AZ, EWA, IA, IL, IN, KS, KY, LA, MDC, MN, MO, NC, NLI, NNJ, SFL, SNJ, STX, SV, WMA, WNY, WPA, WV.

#### Brass Pounders League December 2002

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	3366	3308	0	6708
W1PEX	0	38	1978	0	2016
W1GMF	0	588	1204	14	1806
N2LTC	0	870	878	36	1784
NM1K	799	30	802	0	1631
W4ZJY	0	762	834	1	1597
KW1U	0	658	517	9	1184
WX4H	3	473	673	4	1153
K7BDU	149	382	570	37	1138
N1LKJ	35	534	516	31	1116
W4EAT	2	483	461	5	951
KF5A	4	429	494	1	928
K9JPS	0	445	33	444	922
W6IVV	0	429	441	0	870
N1IQI	340	65	367	0	772
K2BCL	0	341	299	67	707
W7TVA	42	311	303	50	706
W9CBE	0	321	303	4	628
NG1A	0	304	302	0	606
W6DOB	0	235	353	3	591
W7QM	28	280	279	0	587
K5UPN	21	314	238	9	582
WØWWR	0	98	471	8	577
W9RCW	0	285	21	267	573
KA5KLU	0	145	351	33	529
WA9VND	21	317	174	14	526
WB2IJH	1	250	264	1	516

BPL for 100 or more originations plus deliveries: K9GU 192, NJ5M 150, N9VE 149, K8CQF 106. The following station qualified for BPL during November, 2002, but was not rec-ognized in this column: KF5A with 761 points.

### **QRP POWER**

### A Year in Retrospect

The atrocities of September 11, 2001 served one purpose: It brought home the concept of exactly how vulnerable we are as a nation. The "invincibility" of America was compromised in an instant. What followed was the dream shattering reality that we had sustained attacks upon American civilians, military personnel and foreign nationals that killed over 3000 people. Thankfully, through the super-heroic efforts of the NYPD, FDNY, the New York Transit Police and EMS personnel, thousands of people were safely evacuated from the World Trade Center Towers before they collapsed. Radio amateurs in and around New York City, Washington, DC, along with their counterparts near Pittsburgh, Pennsylvania, rallied to the cause by providing emergency communications support to disaster response crews working the devastation caused by the cowardly terrorist attacks.

The ham radio community, as depicted in the November 2001 and April 2002 issues of *QST*, immediately did what it does best: furnish communications in times of disaster/emergencies. The idea that we could sustain three separate terrorist attacks in widely separated geographical areas, almost simultaneously, served as a wakeup call to hams all over the US.

#### Nobody does it Better

League stationery says it all: "Amateur Radio, a national resource." Unlike other hobbies, we are in a unique position to provide a valuable service to our communities by establishing and maintaining critical communications links in support of county, state and national emergency response personnel. This month, we'll look at how QRP ties in with emergency communications and how we, as QRPers, can offer our services as emergency communications specialists.

If your idea of emergency communications support begins and ends with a VHF handheld and a couple of spare battery packs, then you need to readjust your thinking. While most handhelds' power output fall within the 5-W definition of QRP, there is much more to accomplish, communicationswise, than your trusty handheld transceiver can hope to provide.

We have a tremendous repository of



This was my operating position at the Conyngham Borough EOC during the Susquehanna Steam Electric Station emergency drill last October. From the left: Mirage BD-35 V/UHF amplifier, RIGrunner power distribution panel (hooked directly to the deep cycle battery in the back of the picture) and the Yaesu FT-817 atop the Z-11 autotuner. My antenna was a  $5/_8$  wave mobile mag mount with only 10 feet of coaxial cable attached to a heat pump cowling just outside the door.

frequencies at our disposal and we also have a wide assortment of operating modes at our fingertips. In a word, we are "versatile." Unlike anything else on the horizon, we Amateur Radio operators can establish and maintain vital communications links using a variety of equipment, modes and frequencies. For instance, using V/UHF FM handhelds, we can "shadow" key disaster response personnel, providing valuable real-time tactical communications support to on-scene commanders. V/UHF FM nets can support various served agencies by moving time sensitive traffic between outlying shelters and a central command post. Using modes like portable ATV and digital communications, we can provide video and error-free digital communications support in the field. Our long-haul HF links can move emergency traffic into and out of affected disaster areas. and we work for free!

### Emergency Communications and QRP

So how does QRP fit into the emergency communications equation? Simply put, we QRPers are capable of sustained extended operation using our low-power gear, without the need for heavy-duty power support from ac mains or generators. This is a big plus during emergencies when ac power may be nonexistent



This is a close-up of the rear of the FT-817 and the Z-11 tuner showing how I configured the dc power plugs using tie wraps that had screw hole mounting tabs. With this arrangement, I can leave the dc plugs continuously attached to both the rig and tuner, even when using the Mt Ops Tac-Pac wrap. The ends of these two power cables are terminated in Anderson Powerpoles, the new standard for EMCOMM equipment.

or extremely limited. Using a rig like the Yaesu FT-817, a couple of deep cycle batteries and a 45-W solar panel, a QRPer can stay on the air indefinitely, providing long-haul HF and tactical VHF voice/ data communications. As a matter of fact, the FT-817 is so uniquely suited to an emergency communications role (it covers HF, VHF and UHF using AM, FM, SSB, CW and data modes) no serious ARES/RACES volunteer should be without one. No other radio currently on the market offers this much flexibility and frequency agility in a single tiny package. The FT-817 greatly simplifies gear selection for the ARES/RACES "Jump Kit."

Second, the ARES guidelines for volunteer personnel deal with short-term use of our communications talents, on the order of one to three days. In reality a minimum self-sufficiency criteria of 14 days should be considered the absolute minimum requirement with 30 days as a much more realistic goal. As ARES/ RACES communicators, we must be able to operate independently, with little or no logistical support from other agencies for extended periods of time. If we can't then we become a burden upon an already overloaded disaster relief mechanism.

#### The "Jump Kit"

My personal "Jump Kit" radio gear consists of a Yaesu FT-817, LDG Z-11 Autotuner, a 35 W linear amplifier for HF, a 35 W dual-band V/UHF FM linear amplifier, 40 meter dipole fed with 300 W ladder line, a Ventenna HFp multi-band HF vertical antenna, collapsible whip antennas for 2 and 6 meters, Arrow Antenna Yagis for 2 meters and 70 cm. three 30 ft lengths of coaxial cable, a RadioShack HTX-420 dual-band handheld for 2 and 70 cm with extra lithium-ion battery packs, a 7 Ah gelled electrolyte battery with charger, various power cords and connectors, a digital clock, coaxial adaptors and a roll of fluorescent twine. A small packet TNC and palmtop computer can be added for digital communications support. A copy of The ARRL Field Resources Manual, ARRL message forms, writing paper, log sheets and pens/pencils are contained in a Posse Box that is included with the "Jump Kit" gear.

Hey, Arland, this is a ORP column. Why are you talking about linear amplifiers for HF and V/UHF? Simple: There will be times that 5 W won't cut the mustard. You'll need the extra RF power to establish and maintain communications. This was proven when I was assigned to the Conyngham Borough EOC during the Susquehanna Steam Electric Station drill in early October 2002. The EOC had been moved from the old Public Works garage (with a 2 meter gain antenna permanently installed) to the new building. You guessed it; the antennas for the amateur station had not been installed at the time of the SSES drill and I was given a <sup>5</sup>/<sub>8</sub>-wavelength magmount mobile antenna with 10 feet of coax attached as "my antenna." Since the new EOC was a single story building with no access to the roof, I was forced to place the 2-meter antenna on a heat pump cowling about 3 feet off the ground.

After finally situating the antenna on different parts of the cowling, I found the "sweet spot" and was able to hear the NCS at the EOC. However, I could not establish contact. Out came the Mirage BD-35 V/UHF FM amp (2 W input for 35 W output) and I was finally able to check into the EOC net. Without the amp I would have been unable to communicate and fulfill my EMCOMM duties. While I do take tremendous pride in my ORP accomplishments, I am not blind to the fact that there will be occasions when I really need to use higher power to get the job done. Bottom line: Don't turn your nose up at the thought of using a linear amp if the situation warrants.

#### Train Hard, Be Ready

Training is another area that is vital and all too often overlooked. Your local Emergency Coordinator (EC) should have some kind of ongoing training schedule, which



Kirk Wetzel, Conyngham Borough Communications Officer, prepares to copy a message from the Luzerne County Emergency Management Agency EOC during the SSES drill. All messages are sent twice, once through the County EMA UHF voice net and simultaneously through our ARES back-up communications net, ensuring that no important information falls through the cracks.

should be integrated into the local emergency/disaster relief plans of your county and/or community. As an ARES member in Luzerne County (Pennsylvania), we support the county Emergency Management Agency at the Emergency Operations Center (EOC) by providing comm support for the Susquehanna Steam Electric Station (Berwick Nuclear Power Plant). We have an annual emergency exercise with additional training classes throughout the year. The Pennsylvania Power and Light folks who run the Berwick Nuclear Power Plant love us! Over the years we've built a solid reputation for emergency communications support and they recognize our collective worth.

#### The ARRL's ARECC

Let's not forget the Certification and Continuing Education Program (C-CEP) training classes offered on-line by the ARRL. Currently there are three courses in Amateur Radio Emergency Communications (AREC). Level I is the basic course that acquaints the student with the concepts of providing emergency communications. There are no prerequisites other than a desire to sharpen your communications skills and become involved with emergency communications at a local level. This course is composed of 20 lessons and takes approximately 25 hours to complete and earns 1.5 CEUs.

Level II is an advanced course in emergency communications (EMCOMMS) and delves deeper into EMCOMMS to enhance the skills and knowledge received in the Level I AREC course. Particular attention is paid to the function and operations of nets, traffic handling, what it takes to be a Net Control Station (NCS), Net Manager and Liaison of an emergency communications network. In order to take the Level II AREC course you must have previously



Pennsylvania EMA evaluator Mike Kenney and Ken Eddy, a FEMA assigned evaluator, are busy rating the job the EOC staff are doing during the SSES drill. Nothing gets by these two guys!

completed the Level I course. This second course, which consists of 20 lessons, should take approximately 25 hours to complete and earns 1.5 CEUs.

Finally, Level III is an in-depth course for those who desire to become fully involved with EMCOMMS by taking on a leadership role. Prerequisites include both the Level I and Level II AREC courses. There are 23 lessons in this course and estimated completion time is 25 hours, earning 1.5 CEUs.

All three of these courses are chockfull of information to prepare ARES/ RACES volunteers for the daunting task of providing EMCOMMS to those served agencies needing our help. A syllabus of each course is available on-line at the ARRLWeb. ARRL members may be reimbursed for the Level I course through a grant from the Corporation for National and Community Service (CNCS). The cost of each course depends upon whether or not you are an ARRL member (\$45 for members and \$75 for non-members). For all the details, check out the ARRLWeb, **www.arrl.org/cce/**.

To recap, we need training to be considered by the professional disaster communicators as an asset to their agencies. We need to offer our services *only* if we are truly capable of doing the job as well as the pros we will be supporting. As QRPers we can offer a host of ways to establish and maintain emergency communications links with no adverse impact on the disaster relief efforts we will be supporting.

I hope this column will stimulate many of you who are not currently involved with EMCOMM to obtain the training, assemble a Jump Kit and volunteer with your local ARES/RACES group. Remember: In today's highly volatile and hostile world, preparedness is *not* an option.

# MICROWAVELENGTHS

### Making Those Microwave QSOs

It seems that every type of amateur operation has evolved its protocols and manners for finding other stations, initiating contacts and exchanging information. Some may seem very technical, such as is the case with EME, and others seem to combine rapid-fire discipline with courtesy, as can be seen during HF pileups for a rare country. Repeater operators, amateur television, satellites, emergency communication, traffic handling and packet are other examples of how Amateur Radio serves different purposes.

Different types of operations can share the same aspects, such as the need to exchange call signs, and others can be very different, such as the need to send messages or TV pictures. Microwave operation itself can cover several types of operating depending on whether you are working on rare DX, a band opening or a contest, or are just chatting. Some microwavers always operate from hilltops, others from home. Rovers typically operate from hilltops, but can stop at any pullover, and some even operate while mobile.

#### The Basics

No matter what the communication mode and purpose, amateurs always identify themselves with call signs. When they wish to acknowledge that a contact has taken place, they will also exchange some other piece of information. Signal reports often fill this need, being useful information as well. Microwave operators will often share their Maidenhead Grid Locator to either four places or six places.1 In order to provide evidence that a QSO has taken place, the ARRL contest rules for VHF and higher contests usually require a grid to be noted in the log. Many contests use the number of grids as multipliers in scoring, so there is extra incentive to get this information. Further evidence of a QSO includes the time and frequency. This information should be kept in the station log anyway, so most microwave operators do keep an accurate station log.

#### What is Hilltopping?

Much of the microwave activity at 10 GHz and above is from portable stations brought to hilltops. Setting up and operating a portable station is a load of fun

<sup>1</sup>Notes appear on page 83.

(see Figure 1). For me it is an adventure. Think of how you might put together a station that will work from battery power, is easy to set up, can be lugged to a good site by one person, hopefully in one trip. It has to withstand extremes of weather, because in most parts of the country there is unpredictable precipitation and high and variable winds at these elevations. To prepare for low temperatures, some amateurs will put their systems into the freezer overnight and after pulling it out the next day, find out just what doesn't work. Knowing that if something can go wrong, it will, lots of preparation is good advice. Having ex-



Figure 1—In this photo, from left to right, Jud, K2CBA; Walt, WA2ALV, and Dennis, WA1HOG, set up on the side of the road at Mount Greylock in western Massachusetts. Note the liaison antenna above all else.

tra cables, a multimeter, and some spare parts can help tremendously.

### Why do Microwavers use Liaison Radios?

The purposes of the liaison circuit are to establish that the stations want to communicate, figure out in what directions to point, determine whether it is worth trying, decide who will transmit first (and how) and to report back regarding signal strength and the next step.

Most parts of the US use 144.260 SSB as a calling frequency to perform liaison. Amateurs who are looking for a QSO on a microwave band during a microwave contest or some other event will call there first, and then move to some other part of 2 meters, such as up or down the band in 10 kHz increments depending on activity levels. Clear signals on the liaison afford the best chance for making a tough microwave contact. It is most convenient to construct a system that provides IF and liaison radios and other interfacing into one unit (see Figure 2).

At the least, 25 W and a 3-element beam on 2 meters make an effective liaison station. Although it may seem strange to the newcomer, less than this will often result in difficulty. I have participated in liaison relays more than once in which the two 10 GHz stations were unable to communicate on 2 meters because of insufficient power or antenna systems. This required that one or even two stations relay the liaison information, only to have the microwave stations, once aligned, make a Q5 QSO on SSB!



Figure 2—Here is one of W1GHZ's microwave setups. The liaison radio, along with a 100 W amplifier, and an IF radio, keys and a PDA all are accommodated in one box.

Tom Williams, WA1MBA 🔶 wa1i

wa1mba@arrl.org

#### How do we Point?

Most horns need to be pointed within 10 or more degrees, and so the uncertainty of pointing is reduced or eliminated. Those who are using the typical 2 foot dish, however, want to start with their antennas pointed to within 1 or 2° of the expected direction. To do this, one must have an indicator on the dish mount. and that indicator must be set correctly. A compass style indicator, called a "rose," is usually attached beneath the dish. It is placed on the top of the tripod in such a way that it can be rotated by hand but will stay in place once set (see Figure 3). You can obtain the initial directional setting (once the tripod is placed and leveled) by either knowing the direction of the sun or the direction of some signal, such as a beacon. Then point at it, and set the rose so that the correct direction is indicated. To assist with sun pointing, hams will fix a thin string on the dish and draw a line on the dish so that the string's shadow will fall on the line when the dish is pointed at the same azimuth as the sun (see Figure 4).

Either pointing method (and pointing toward any station, for that matter) requires knowing the direction. Programs for this purpose are available for PCs and for PDAs so that one can compute these directions easily once in the field.<sup>2</sup> If your own location is not known in advance, bring along a GPS unit that reads out Maidenhead grids.

#### How do I Make a Contact?

Once a station is set up and the equipment is stable, stations look for each other on the liaison calling frequency, and move to some other part of 2 meters. Next the stations will exchange sufficient information to figure out where to point. If there are several stations on a hilltop, they perform much better if they coordinate working the other station (or group of stations). Typically, the best-equipped station of a group will contact the other station(s) first. It is much easier to be heard and to hear if you are operating with more power and have a better receiver. This way, weaker stations can listen to the QSO and line up their antennas and fine-tune their radios prior to working the distant station.

The two stations about to work need to decide on an order of operation, whether alone or in a group. An effective procedure will start by determining who has the most powerful transmitter. That station transmits first. If narrowband operation is available, either a continuous transmission with "key-down" or dashes are often used. Dashes are easy to discriminate from birdies and interference, and in times when rain scatter may be



Figure 3—A compass rose in use on one of W1RIL's tripods.



Figure 4—A string on the front of the dish will cast a shadow onto the line on the dish when pointed at the same azimuth as the sun.

present, dashes are most easily heard. If the stations are using wideband FM, one station begins speaking or sends a tone.

The receiving station will tune across an appropriate frequency range and swing the antenna across a reasonable arc until the other station is heard and peaked. Then the receiving station will report back on the liaison radio, and usually the next step is to have the receiving station transmit so that the originally transmitting station can peak the antenna. Often, the ability to slightly elevate the direction of the antennas can further peak the signals. If sufficient signal levels are present, a QSO can proceed. This might be either with CW or SSB for narrowband systems, or wideband FM for Gunnplexer radios.

All of this may seem complicated and time-consuming. In fact, it all goes quite smoothly and quickly. The most timeconsuming part of the process (as it should be) is the hunt for the other station.

Don't forget to log your contacts and add other information, such as weather, signal qualities, dial frequency, and so forth. There are logging programs available for PCs and PDAs for the various contests. It is always wise to carry along a pad of paper and extra pencils because there are always little things to remember.

#### What is my Frequency?

It is always helpful to know your frequency. Unfortunately, at 10 GHz and above, typical crystal controlled circuits are susceptible to changes in temperature and supply voltage. This, in turn, results in frequency uncertainty, even though you may have tweaked everything just right before leaving home. There are several ways to overcome this problem. The easiest is to go to hilltops where there are other amateurs involved in the same contest. They will have already established the calling frequency. Another is to tune into a beacon, if there is one close enough to be heard well. Failing these two approaches, one can bring along a standard that is both well protected and well regulated. Folks who do this will design and set their standard to 1152 MHz, and listen for harmonics at 2304, 3456, 5760. 10.368 and 24.192 MHz.

Home station operators need not worry much about frequency stability as long as they have standards by which the frequency can be checked occasionally. Some home stations, if well equipped, can act as a standard for hilltoppers in the area. Furthermore, home stations can easily operate more liaison power, and often will assist difficult liaison situations between portable stations.

Of course, home stations have more flexibility in working when the weather is bad and there are no stations on hilltops. Home stations will still follow much the same procedures as outlined above. Typically a pair of stations will start on a VHF band, decide on a liaison frequency, and work higher and higher bands to find out just what DX is available. I find that at least half of my microwave operating time is spent on testing equipment and propagation rather than chasing contest points or DX. Whether a home or portable station is in your future, get together with other hams and have fun on these bands.

#### Notes

- <sup>1</sup>Curtis, "VUCC—20 Years and Counting," QST, Feb 2003.
- <sup>2</sup>The W1GHZ Web site has pointers to many sources for Palm OS software for microwave operation. Set your browser to www. w1ghz.org.

### HOW'S DX?

### SØ7L Mini-expedition and Telecommunications Aid to Western Sahara

#### By Bela Lindenfeld, N8SHZ

Early September while scanning the band on PSK31 I ran into an old friend Luis Chartarifsky, XE1L, and as we typed to each other he asked if I was interested in a mini-expedition to SØ, Western Sahara. Knowing Luis I said ves without hesitation. He explained that it would be a two-fold expedition: 1) Opening up Western Sahara for amateurs, and 2) Installing a VHF repeater in the Western Sahara in order to bring the Democratic Republic of Saharui into the world of telecommunications, sponsored by the URE (Union de Radioaficionados Espanoles), the OLOT, Spain city council and Radio Amateurs Without Frontiers. This installation would be facilitated for us by Mahafud Zein, SØ1MZ, Director of Telecommunications for Western Sahara.

Julio Volpe, EA5XX, was the one responsible for the original invitation and all the arrangements both in Spain and Western Sahara. We were to leave in early November; however, in the middle of September we were asked if we could move the timetable up a month and depart the first week of October. Luis and I agreed that it was possible, so we immediately began our preparations.

While we were busily preparing and testing equipment, the fourth member of the team Xevi Gargallo, EA3BTD, was fully involved in the preparation of the repeater and other radios to be installed in Western Sahara. This proved to be a monstrous job, but in the skilled hands of Xevi all was prepared, boxed and ready on time.

The end of September came and we were settled on a very small group: Luis, XE1L, an experienced DXpeditioner and architect from Mexico City; the author, a retired educator from Benton Harbor, Michigan and first-time DXpeditioner; Julio, EA5XX, a businessman and experienced DXpeditioner from Alicante, Spain, and Xevi, EA3BTD, a police officer and technician from Olot who hadn't yet been on HF. Toni, EA5RM, who works for the police department of Elche, Spain, was our excellent pilot for this expedition.

Tickets were purchased, last minute checks of baggage made, final e-mails sent and on October 6, 2002 I met Luis, who was coming in from Mexico City to Chicago. We then took a flight to Madrid. Two hours after we arrived, we left for Alicante, Spain, arriving the afternoon of October 7 and were met by Julio, Toni and Carlos. With a great deal of effort we got all our bags into the cars. We then went to the apartment of Marta, a friend of Julio.

The next morning at five, after carrying our bags down four floors and incurring the wrath of Marta's neighbors, we were joined by Carlos, EA5PR, President of Radio Amateurs Without Frontiers, and Toni, EA5RM. We went to the airport and prepared to board, passing through security with minimal problems, and waited for the plane to Tindouf, Algeria. Since this charter flew to Tindouf only once every two months the flight time was not specific, leaving us some time to talk to the other passengers. Many were on humanitarian missions.

We boarded the plane in late afternoon and in less than two hours arrived at Tindouf. We were met by Mahafud, SØ1MZ, and went through customs with no problems thanks to excellent preparation by Julio and the aid of Mahafud.

We then loaded our gear into an allterrain Toyota 4X4 and were driven through the desert to the town of Rabuni, where we were assigned rooms in what was an old foreign legion outpost named Protocolo. Xevi immediately began the preparations for the next day's work, sorting equipment and repairing things that were broken in transit. He and Julio would remain in Rabuni the next day to mount the antenna for the repeater on top of a 100 foot high water tower. Luis and I would go on to Merkata-ha, 50 km from the capital Rabuni in the liberated territories . We were summoned shortly after we arrived to a welcome ceremony which we were required to attend under the threat of most severe consequences. It was quite a welcome and after the exchange of gifts. Mahafud presented all of us with "Turbantes" to use while in the desert.

Early on the morning of the 9th Luis and I, accompanied by Hatri, SØ1KH, and a driver, proceeded to Merkata-ha. Upon our arrival we were met by several people at a small compound, which included a military school and facilities for us. We unloaded our gear and were shown our operating position; we were able to get two tables and three chairs to work with. These were hard to come by as it is normal to sit on the floor here. General Ahmed-Jer, head of the military compound, secured the seal and signature on all our papers, permissions and permits to transmit. These same papers were later given to Mahafud Zein for his seal and signature. All papers were returned to us properly signed the next day

We began immediately to set things up. Luis was able to fix the wiring for both their electricity (220 V from generators, on only 8 to 10 hours a day) and the generator lent to us by the URE.

While I worked on the dipoles Luis performed his magic at the operating positions and within a very short time all three radios were set up along with their respective logging computers, plus one for PSK31, RTTY and SSTV. We were on the air in very short order and immediately encountered pileups.

Luis worked the TS-50 on PSK31 and I began the new experience of being at the other end of a pileup (this being my first true DXpedition). We operated at least one radio 24 hours a day and most of the time, except for meals, there were two radios operating. We ran into a problem or two, the most difficult being that we did not have band pass filters and the proximity of the antennas caused quite a bit of interference. We had band pass filters figured into our overall plan as URE had some; however, when the generator was picked up, the band pass filters were somehow left behind (Hello, Mr Murphy!). We adjusted the bands we were operating on, so as to eliminate this problem as much as possible.

The following day Julio arrived and with the help of Hatri, we installed the other antennas. Julio began to do PSK31 while Luis and I worked the pileups on 10 and 20 meters. Twice a day the electricity would be cut off for several hours so we would switch to the Honda 1.9 kW generator. During the times we were operating with the Honda generator, power was reduced for transmission, particularly when all three radios were in operation. This was my first DXpedition and the first



Luis, XE1L, at the S07L operating position.

few hours I had a lot to learn. Thanks to Luis, I learned very quickly, understanding the fantastic wealth of knowledge Luis had from previous DXpeditions. I changed whatever he suggested immediately, with

Saharui.

very gratifying results. Julio, who had made all our arrangements, was a welcome sight and a super addition to our operating position. He helped with the other antennas and provided excellent skills in all aspects of the DXpedition. Between Luis and Julio I could not have found myself in a better learning situation.

All of the equipment worked very well. The FT-920 was well worth the effort of bringing it. It did a terrific job in the pileups and was easy to use split. It had no problems operating 24 hours a day. We also had no problems with the TS-50 and FT-100D.

We had only three and a half days to operate so our mission was to keep at least one radio operating 24 hours a day. We shut down one night for two and a half hours because of propagation, but all the rest of the time we had one or more radios operating. The only exception was at meal time.

While we were operating Xevi was working to complete the task of setting up a number of mobiles and handhelds for the Saharauies and instructing the Saharaui technicians on the maintenance of the equipment. Xevi did a marvelous job, and it was only on our last day that he was able to work the pileups, a new experience for him as well. I cannot say enough about the dedication and skills that Xevi demonstrated in managing the other half of this DXpedition.

We continued operating as much as possible with as many radios as we could man. We seldom averaged more than 2-3 hours of sleep a day, but the adrenaline and good food (camel stew and tuna with rice or spaghetti) kept us going. It was amazing how large the pileups were considering that we were using dipoles and often a bit less than 100 W.

During our stay we were well taken care of by Hatri, SØ1KH and Mohamed "Hamida" a military instructor from Merkata-ha. They cooked for us, ate with us (a wonderful time to talk and understand their country a bit better), attended to all our needs as was possible. They spoke Spanish which made it easy for all of us to communicate. We were able to use a refrigerator run by LP gas, adjacent our shack and it was always kept full of fresh bottled water and soda. Often, they would bring our meal to us (especially for breakfast), so that we could continue to operate. Our relationship with these two fine gentleman was marvelous and the feeling of good will was ever present.

During our second day of operation Mahafud, SØ1MZ, came to visit and through the efforts of Luis the only amateurs in the country were able to converse with several different countries using our equipment. This was the first time on HF for Hatri, SØ1KH (see photo). Mahafud was able to talk to Carlos, EA5PR, from the group Radio Amateurs Without Frontiers to explain how much had been accomplished and how appreciative he was for the equipment and installation. During this same day Jack, WA8IAL, was able to contact me and patch me through to my wife Jean, KC8MIO. This was a thrill for both of us.

During our operations we were in regular contact with our pilot Toni, who sent numerous e-mails and made several phone calls to our families to assure them of our well-being. Toni was an extremely important part of the group supplying us with much needed information.

The final night came quickly, and we packed up our gear except for one radio on 17 meters. All three of us were exhausted, but we continued to work the one radio. At about 12 midnight I took over the FT-920 for the last go on 17 meters. I was able to last until 4:30 AM knowing

that we had to be ready to leave at about six, so I sadly signed off and went to bed.

In the three and a half days we had a total of 7704 QSOs of which 1977 were on RTTY or PSK31 and 21 were on SSTV. We were a happy but tired group as we packed our things, said our good-byes and were off to Tindouf for our flight home. We returned to Elche for a much needed day of rest. The following day Luis and I headed home. "Mr Murphy" got involved in our return with canceled flights, lost bags, etc, but we arrived at our homes safely. Our bags were a different story, the last one arriving October 22.

The DXpedition proved to be very successful, with over 7700 QSOs of which almost 2000 were in the digital modes. This was done by an average of two operators working with dipoles and 100 W or less. During this same period of time a repeater was set up and 11 mobiles and handhelds were programmed for use with the repeater. The Saharauies were also taught to use and maintain the system.

We wish to thank Mahafud Zein, SØ1MZ, and all the others in Western Sahara who made our expedition a wonderful experience. We were treated with utmost respect and all our needs within their power were afforded us. I also wish to thank Luis and Julio for the invitation to participate, the URE for taking care of the QSLs, and the radio amateurs Without Frontiers (EA5PR) for their help, including the assistance of Xevi and the Olot city council for the donation of the repeater. Finally I wish to thank Luis for his exceptional help to me (The Rookie). His positive attitude and excellent instruction made it possible for me to effectively participate in the pileups.

#### WRAP UP

That's all for this month. A special thanks to N8SHZ. Don't forget to send any DX news, photos, newsletters, etc, to your editor. Until next month, see you in the pileups!—*Bernie*, W3UR

### AMATEUR SATELLITES

# Projects Eagle and Echo

There are two new AMSAT satellites on the horizon, figuratively speaking: Project Eagle and Project Echo. They are two very different spacecraft with different missions. The fact that both project names begin with E has led to some confusion. Let's sort it out.

#### **Project Echo**

It helps to remember that word "echo" invokes the idea of *repeating*. Project Echo, or AO-E as it is called, is a low-Earth-orbiting (LEO) satellite. It is also a *microsat*, another of those small, solarcell-encrusted cubes similar to OSCARs 27, 16, etc. The current Echo design offers the following features:

• Analog operation including FM voice. Uplinks will be on 2 meters with downlinks on 70 cm. This is promising news for hams who currently enjoy the OSCAR 14 and 27 FM-repeater satellites.

• Digital operation including highspeed APRS.

• High downlink power (up to 12 W, which is rock-crushing compared to previous amateur LEOs).

• Multiple channels using four receivers and two transmitters.

• Simultaneous voice/data capability. Echo will be more than a loud FM repeater in space (although it will be that, too). Its digital functions will be among the most advanced ever incorporated into an Amateur Radio satellite. Echo will feature a wideband TDMA single-frequency data link for multiple simultaneous users and modes. The uplink for this will be on 1.2 GHz with the downlink on 2.4 GHz.

Unlike older microsat technology, Echo will be designed to be as autonomous and self-healing as possible. When a problem arises, Echo will have many options to follow to a solution, and it can pursue those options independently if necessary.

So when does Echo fly? The answer is "sooner than you think." AMSAT-NA has partnered with an outside contractor, SpaceQuest, who will assist in building the satellite bus. AMSAT volunteers are responsible for the design, development, integration and testing of the various experimental payloads.

Project Echo is moving rapidly toward a possible launch this year or in 2004. Because it is a microsat, Echo benefits from the fact that there are more launch opportunities in a given year for small



Artist's concept drawing of Project Eagle.



A mechanical model of Project Echo

satellites vs large ones. The prospects are good for a timely flight.

#### **Project Eagle**

Project Eagle will be the successor to AMSAT-OSCAR 40. Just as earthbound eagles soar through the sky, Project Eagle will soar far into space (a handy metaphor to remember when you confuse these new satellites). Eagle will travel in an elliptical orbit that will bring it within a few hundred miles at perigee, and as much as 40,000 miles or more at apogee.

The current design calls for transponders with uplink/downlink combinations that include 145 MHz, 435 MHz, 1.2 GHz and 2.4 GHz. Eagle's design is in flux and won't be "frozen" until late this year. Here are some of the key specifications, at least as they exist now. . .

• Mass: 100 kg or less

• Size: 600-mm cube with fixed and deployable solar panels

• Attitude: Spin stabilized

High-gain Antennas: 145 MHz, 435
MHz, 1.2 GHz, 2.4 GHz, 5.6 GHz, 10 GHz
Omni Antennas: 145 MHz, 435
MHz.

Project Eagle is still at an embryonic stage and much remains to be done. As with OSCAR 40, this will be an expensive satellite to build and launch. Current estimates are that Eagle may reach orbit in 2006.

#### Help is Needed

Obviously, these satellites don't assemble themselves. AMSAT needs volunteers with design experience in a number of areas. AMSAT also needs money. It is going to take a steady flow of dollars to see Echo through to launch, and still more funding to realize the goals of Eagle.

The amateur satellite community needs these new spacecraft to reinvigorate itself. We're not moribund, but we're not in the peak of health, either. With the loss of several "easysats" (like RS-12/13) and the reduced capabilities of OSCAR 40, our space fleet is showing its age and slowly losing its appeal. A shot or two in the arm is long overdue.

If you can give your time, money or both, contact the AMSAT-NA offices. Go to the AMSAT President's Club page on the Web at www.amsat.org/amsat/ amsat-na/presidents.html, or call 301-589-6062.

# THE WORLD ABOVE 50 MHZ

## Crossing the Atlantic on VHF/UHF: Tropospheric Ducting Revisited

There has been continuing interest in the Brendan Trophies offered by the Irish Radio Transmitters Society www.irts.ie/ to each of the operators of the two Amateur Radio stations that first establish two-way communication between Europe and North or South America on 2 meters (see www.irts.ie/brendan.htm for more information). Recently I was fortunate to see some correspondence from Bob Cooper, ZL4AAA/K6EDX, concerning the possibilities for such a contact. For those of you who do not know Bob, let me say that aside from being an antenna designer and a serious 6 meter DXer, he is probably the greatest TV DXer of all time. He may know as much as anyone we have about long distance VHF/UHF propagation. He has been providing detailed and entertaining information about this subject for more than four decades (see for instance Cooper, Robert B. "Sporadic-E Skip on 200 Mcs," QST, Nov 1958, p 33ff). Here edited to conserve space are his latest comments on this fascinating topic.

Ev Tupis (W2EV) has done an excellent job of outlining the challenges and prospects for crossing the Atlantic on two meters or above without the aid of artificial "reflectors" (*QST* August 2002, p 36). The subject is inspiring, identifying a challenge still unmet.

Some history might be in order to broaden the discussion. From (August) 1956 through the time of its closing in February 1960, I collected, through the monthly Gernsback publication Radio-Electronics (RE), the TV and FM DX reports and compiled the columns required as well as the annual reports, which Ed Tilton had inaugurated in 1952. As Tilton had written in his years at RE, trends and patterns were quickly evident. So, too, were those that fit no known mode of propagation and for which there were (at the time) no reasonable explanations (short of the obvious one-that it never happened at all!).

In his QST article, Ev Tupis wrote: "The opportunity (Hawaii to mainland USA) usually begins with someone in Southern California happening to catch weak snippets of Paul's (KH6HME) 60-W beacon located atop Hawaii's Mauna Loa volcano-(and) Paul makes the long journey from his home to the beacon location." The point to remember is the considerable elevation at the Hawaii (western) end. Anecdotal reports covering the California end, in particular, report quite the opposite effect. The KH6HME beacon is often inaudible until some elevation is reached. Openings that drop the KH6HME signal right down to the Pacific shoreline are less common. Stations at a few hundred meters MSL or higher appear to do better. On the Hawaiian end, there have been occasions when the tropo duct drops down the slope of Mauna Loa. Shel, NI6E/KH6, has a logbook filled with Mexican and California FM radio stations he has heard over the years from an elevation of approximately 300 m above MSL.

In the western suburbs of Monterey, Mexico, TV DX enthusiast Fernando Garcia has a similar logbook filled with six years of observations of UHF TV stations extending as far as North Carolina at distances approaching 2100 km. Garcia's 550 m (above MSL) location is on the eastern side of the Sierra Madre range which looks "downhill" over 200 km of gradually diminishing land until sea level appears at the Gulf coast.

Interestingly, Garcia sees distinct patterns, which I characterize as "vertical profiles." Some "openings" across the Gulf yield only to high-powered stations using >150-m towers and nothing shorter, while others "start high" (the tall-tower stations) and then go "low" (low-power stations with antennas on 60-m sticks). When reception goes low, it is common for the much more powerful tall-stick stations to fade out, while those with short sticks are being received. One does not need a degree in astrophysics to work out what is happening here, nor on the KH6/W6-7 path as well.

In the myriad of reports to *RE* in the last half of the 1950s, three stand out as extraordinary. They originated from a frus-

This Month		
March 15-16	2003 European	Worldwide
	EME Contest	
March 16	Very good EME	
	conditions*	
*Moon Data fro	m W5LUU	

trated W6 amateur stationed in the Azores Islands at Lajes Field on the island of Terceira. Investigating his wife's report of "funny noises" on the local AFRTS FM station in June 1958, he soon had 15 FM radio stations in his "logbook." Much to his surprise, they were not Europeans but stations from Atlantic City (New Jersey), New York City and Boston—many fullquieting, "as stable as a rock" as he later wrote and "it lasted for two days plus." The distances were 2900 km and greater. It happened again in July and then again late in May and June 1959.

Lajes Field is on the northeast corner of the coast of Terceira at 38.45°N at sea level to a height of a few hundred meters. The center of the island (toward the southwest) rises to nearly 1050 m—a very effective terrain block for tropospheric signals from the west that are farther "south" than 38.45°N.

Indeed, our FM DXer never heard a station south of 39.23°N (Atlantic City) over the two-year period. Moreover, all of the stations logged were within visual line of sight (LOS) of the Atlantic Ocean on the western end. Even working from printed station lists he could find no trace of stations "inland" (for example, no stations in Washington, DC or Philadelphia were heard).

In 1992, my wife (ZL1GG) and I scheduled nearly four weeks on Terceira. With the kind assistance of Jamie Eloy (CU3AK), on arrival we located a rental home west of Lajes Field at Biscoitos to avoid the obstruction in the island's midsection. Having the dates of the reception, I was fortunate to locate the base's weather records, which vividly told the story. The Atlantic High (pressure area) forming above the Sargasso Sea, about which Ev Tupis wrote, had been pushed northward and eastward on the dates of interest. The June 1958 dates had a stagnating high stretching from New England south to the Mid-Atlantic states eastward directly across the Azores. As Ev points out, Bill Hepburn's tropo forecast maps (www. iprimus.ca/~hepburnw/tropo nat.html) for the dates of interest-had they existed in the late 1950s-would have been "red" from New York City to someplace off the coast of Portugal. Most of the other dates

Gene Zimmerman, W3ZZ 🔶 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) 🔶 w3zz@arrl.org

were similar or identical, although we also located maps that looked every bit as good for well down the coast to beyond Miami, to central Cuba to be precise.

Based upon Lajes Field observations and the Monterev and Hawaii reports, the key is for the western end to be (1) somewhat elevated, and most important, (2) direct LOS (line of sight) into the (Atlantic) duct. Daily coastal winds (sweeping onto shore in the daytime, away from shore at night) amplified by irregular updrafts occurring as a result of terrain or heavy human intervention tear ducting to shreds. Lajes Field observations suggest the ducts formed down to within a few hundred feet of the surface on the western end but Monterey and Hawaii suggest much more elevated ducts at the western terminus. Fernando Garcia writes to me that his travels by car when the "band is open" indicate that, typically when his 550-m location is running hot with ducting signals, by the time he reaches 750 m, the signals are gone! Inversely, driving "downhill" brings similar results around 350 m. All of this rings true with W6's observations of the KH6 signals. Keep in mind-this is the western not the eastern end of the duct.

The Lajes Field reception suggests the eastern end can be virtually down on the "deck" (identical to the W6 observations from KH6). Also, remember as Ev's report advises, the all-time distance record on 2 meters was from KH6HME on Mauna Loa to W1LP/MM at 4754 km. You can't get much closer to the water (MSL) than being /MM.

The Irish Radio Transmitting Society (IRTS) "rules" for claiming the Brendan Trophy spell out at their Web site (see above) where you can and cannot be to qualify. Even their point of reference, the (London) *Times Atlas of the World*, provides little real guidance. Are the Azores on the European continental shelf (by this definition) or somewhere else?

What is clear is that the western end could be in a variety of locations ranging from the Caribbean to Florida northward. If we believe (as I do at the moment) the western end should be located as I have previously described, Florida is an unlikely spot. While I might concur with Ev Tupis' "longer but better" path to Florida from the UK or Ireland, I do not like the maximum elevation of 150 feet and that well inland. Inland locations and/or heights too great to couple into the Sargasso Sea "duct" might discourage use of reachable peaks in Puerto Rico (for example, Cerro de Punta at 1338 m) or most similar elevations in Haiti and the Dominican Republic. The mountains of North Carolina and Virginia largely suffer the same fate, being too far inland even if the Atlantic is LOS.

The "rules" of this game are evident: (1) Don't be too high. (2) Don't be too low. Most important of all, (3) Pick your time (month, date) to take maximum advantage of the Bill Hepburn red-area tropo forecasts (see the URL above). We have had 50 years of serious 2-m DXing effort. With limited unverified exceptions, nobody has ever reported concrete evidence that a signal at 100 MHz or above can cross or has crossed the "full Atlantic" (to mainland Europe-setting aside the Lajes experience). I believe that it will not simply "happen" because two guys are both tuned to 144.200 at the same time on opposite sides of the ocean. Yet I hold onto hope, awaiting a dedicated effort at an appropriate time, with a hand-selected western end and a closely coordinated eastern end,

If the FM DX reception reported were common, a reasonably well equipped 2-m station on Terceira could complete schedules with an equally well equipped station "on the coast" (not even a little bit inland!) on several occasions between mid-May and mid-September. The coastal stations could be located anywhere from Cape May (New Jersey) northward to Portsmouth (New Hampshire). Clearly this has not happened, so perhaps 1958 and 1959 were most unusual years with impressive ducting, perhaps not to be repeated annually.

Finally, at the risk of complete lunacy, here is a suggestion for bridging the distance from (almost) mainland North America to (almost) mainland Europe, certainly within the most stringent interpretation of the IRTS rules. (I happen to agree with Ev Tupis that more southerly locations are more likely than, say, New England.) The western end station should be "at elevation" in Cuba, in the mountains above Baracoa (El Yungue) at the eastern end of the island (approaching 600 m high). The Azores would be a good choice for the eastern terminus, if in fact they meet the criteria established by IRTS. Terceira, where I landed in 1992, is probably not the optimum location because islands to its west/southwest with elevations exceeding 2351 m would be disruptive to the ducting layer. One of my alternate paper-preference spots is Hungry Hill (685 m) on the southern side of the Caha Mountains west of Bantry in Ireland. Any serious attempt should remember experience from the Pacific duct. Sometimes the eastern end settles to sea level; a properly equipped effort should be prepared to "follow the duct's elevation down as well as 'up' on short notice." Equally attractive locations appear along the coastline of Spain (example: between Carnota and Ezco, Mte Pindo at 641m).

In closing, I am reminded of early 1950s commercial airline pilots who rose above the Golden Gate Bridge leaving San Francisco. Frequently, between late May and early October, they "found" the Honolulu control tower 126-MHz signal "loud and clear" as they passed through the 600-1200 m altitude region. As the craft climbed higher, the signal disappeared and was not heard again until they were within "normal" range of Honolulu. I recall sitting in the shack of John Chambers, W6NLZ (who was the first on the mainland to "bridge" the Pacific on 2 meters) discussing this at length some years prior to his original 2-meter contacts across the Pacific. Then, as now, it was always a matter of being "at the right place at the right time."

So, there you have it. A tale of VHF/ UHF ducting from one of the most experienced observers. Will the Atlantic be bridged on 2 meters by some form of tropospheric ducting akin to the Pacific duct, by a once-in-a-lifetime sporadic E cloud(s), or by some form of MS using or not using FSK441? Certainly Ev Tupis' BEACONet 31 system is a systematic way to exploit any of these modes except MS—only time will tell.

#### **ON THE BANDS**

December featured decreasing amounts of 6-meter activity and one of the year's bigger meteor showers. My thanks to KG4QWC, K5YC, K7JA, K9MLD, KØKP, W3EKT, WA8MKY, WA9JNM and G4UPS not otherwise acknowledged and the DX Summit and 50/144 Propagation Logger Internet spotting networks.

#### Geminids

In recent years, the Geminids has not been a very productive shower. It contains a fair number of meteors, but these are usually small and support only pings or very short bursts. Perhaps because of the advent of high speed FSK441 (WSJT) this year appears to have been reasonably successful. Unless otherwise noted, all contacts were on FSK441. John, W5UWB (EL17), reports the peak between 0800Z and 1100Z with 12 2-meter contacts in 10 grids and a completion with K7ICW (DM26) on 222 after three years of trying in various showers. In addition to that 222-MHz QSO, Al (K7ICW) reports seven contacts on 2 meters, the longest with KØPW (EN34) at 2067 km and a partial with KB9PJL (EN44) at 2230 km. Doug, WØAH (DM78lx), found activity quite good, working 28 stations in 26 grids and 14 states with KB8U (EN71) his longest OSO at 1657 km. Gary, NW5E (EL98), had 2-m SSB QSOs with two stations in the mid-Atlantic. Likewise Jon. NØJK (EM17), reports a short distance 2-m SSB contact with N4FN (EM78).

#### EME

JT44 continues to expand the EME horizons. Dave, KJ9I, reports a 2-meter contact

#### **EME Annual Standings**

Published Earth-Moon-Earth annual standings include stations with a minimum number of unique initial contacts as of January 1. For a complete list of all reporting stations, check the VHF/UHF/Microwave Standings Boxes at **www.arrl.org/qst/worldabove/ standings.html.** To ensure that the Standings Boxes reflect recent activity, submit reports at least every two years by e-mail to **standings@arrl.org**. For printed reporting forms, send a request with an SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

Call	Initial QSOs	DXCC Entities S	US States	Call	Initial QSOs	DXCC Entities Si	US tates	l Call C	nitial 2SOs	DXCC Entities Sta	US ates	Call	Initial QSOs	DXCC Entities S	US States	Call	Initial QSOs	DXCC Entities S	US tates
6 m	neters (	50 to 54 M	IHz)	W7EME	204	30	46	W1JR	243	41	50	23 cm	(1240	to 1300 M	Hz)	WA6PY	2	7	10
K6QXY	31	13	10	W7MEM	203	39	37	W7HAH	220	41	47	OE9XXI	261	45	37				
W7FN	17	5	5	K8BHZ	195	44	32	W5LUA	201	33	46	W5LUA	204	41	32	9 cm	(3300 1	to 3500 MH	z)
				WA1JOF	179	40	35	HB9Q	174	21	10	HB9BBD	172	36	16	W5LUA	`   5	5	<u>í 1</u>
2 me	eters (1	44 to 148	MHz)	WD5AG0	D 163	33	34	AL7OB	115	20	28	WD5AGC	) 170	36	33				
VE7BQH	1270	132	50	KØFF	162	34	50	WA4MVI	115	36	38	KØYW	119	28	22	5 cm	(5650 1	to 5925 MH	z)
HB9Q	913	64	33	WA2FGK	( 150	35	45	K1CA	108	31	30	HB9Q	109	25	17	OE9PMJ	21	15	<b>4</b>
N5BLZ	790	93	50	WØVD	136	38	50	WD5AGO	101	23	25	KD4LT	99	50	20	OE9YTV	21	15	4
HB9CRC	725	_	50	K6PF	119	27	27	K4EME	81	21	25	WA4OFS	55	13	16	W5LUA	21	14	4
WØHP	648	86	50					SV1BTR	64	25	17	WA1JOF	53	15	18	W7EME	1	1	1
W7FN	459	67	50	1.25 me	eters (2	22 to 225 M	(Hz)	KJ7F	50	15	17	WA6PY	50	13	15				
9A9B	449	27	16	W5LUA	29	4	<b>3</b> 4					W7EME	13	6	5	3 c	m (10 to	0 10.5 GHz	)
K1CA	425	109	50	W1JR	27	3	24	33 cn	n (902 t	to 928 MHz	)	KØRZ	3	2	_	W5LUA	41	17	, 6
K6AAW	371	53	48					W5LUA	9	2	́б	W1JR	1	1		AA5C	33	16	4
WA6PEV	344	52	50	70 c	m (420	to 450 MHz	z)	AF1T	7	1	6					WA6PY	1	1	1
AA7A	342	54	50	DL9KR	774	84	, 50	WØRAP	6	2	5	13 cm	(2300 t	o 2310. 23	90 to				
KL7X	277	36	49	N9AB	378		_	WA8WZG	5	5	5		2450	MHz)					
WØPT	264	42	32	KD4LT	334	50	37	K2DH	4	1	3	OE9XXI	11	´21	56				
SV1BTR	250	54	34	KØRZ	309	47	41	VE4MA	4	1	3	W5LUA	9	21	49				
WA4MVI	217	59	50	W7FN	289	58	50				-		-						

with HL1/ON4MU who was running only 2 17-el F9FT Yagis and 200 W. Meanwhile, he notes for the low-ERP crowd that Gary, KB8RQ, is erecting a 24×2-m Yagi EME array that should be the second biggest in the USA to W5UN's and match that of W5LBT in Louisiana. *The 432 and Above EME Newsletter* notes that Al, W5LUA, completed the first North America-to-JA 3-cm QSO on December 22 with JA7BMB exchanging O/O reports on a cross-band contact (10.450/10.368 GHz).

#### 6 Meters

This year's Northern Hemisphere winter sporadic-E season appears to have been about average but may have felt even better because of the extremely poor summer E<sub>s</sub>. Sporadic-E contacts were reported on almost half of the days in December. While Cycle 23 continues its inexorable decline, there is still some excitement to be had. After a quiet beginning, a spike in the solar flux led to the first good opening from the US to Europe on December 19. Contacts were reported from New England, its environs and Florida to the European continent as far eastward as SP and 9A. At midday, a strong transcontinental opening ensued as reported by NW5E, K6LMN and KE8FD. December 20th brought a more widespread opening from the Eastern seaboard to all parts of Italy. The best opening of the month belongs to Bruce, K2RTH (EL95), who worked 3W2FM via long path at 1325Z on December 21. The rest of that day featured solid propagation from South American and the Caribbean to many parts of the US. The days around Christmas provided F and  $E_s/F$ links from many parts of the west and southwest to VK and ZL. Finally, the East Coast enjoyed another opening into Western Europe on December 29.

#### HERE AND THERE

European Worldwide EME Contest 2003: This contest, sponsored by DUBUS and the REF, brings out many big European EME operators. The first weekend is from 15 March 2003, at 0000Z to 16 March, 2400Z on 432-MHz, and 2.3 GHz to 5.7 GHz. The second weekend is 12 April 2003, 0000Z to 13 April 2003, 2400 UTC on 144 MHz, 1.3 GHz and 10 GHz. There's more information at www.marsport.demon.co.uk/rules% 202003. htm.

**Brazil to South Africa FSK441 Tests:** Shelby, W8WN, shares correspondence with Orlando, PY2ANE (GG66rf), detailing HSMS tests between Chris, ZR1L (JF96hd) and him at the Geminids peak on December 14. Initial reports of partial sequences exchanged over the 6350-km path cannot be confirmed, but they have been urged to continue their tests. While strict MS propagation is highly unlikely over that great distance, some other form of transatlantic propagation could be occurring.

VHF Activity Down Under: Shelby also reports heartening levels of VHF activity in Australia. Correspondence from Rex, VK7MO, reports his giant FSK441 roving expedition to 26 rare grid squares in the Queensland and New South Wales outback during the Geminids, using a small 2.7-mlong Yagi only 3 m above the ground. Activity was high with up to 10 stations calling at a time. This presented no problem because the footprint on the pins was very narrow so stations only a few kilometers apart did not overlap. Rex also passes along the current JT44 UHF/SHF records from Australia. These range from 660 km on 70 cm and 590 km on 23 cm to 144 km on 13, 9 and 5 cm.

Cheap Yagis: A recent discussion on the VHF Contesting Reflector provides a reminder about how good the Yagis designed by Kent, WA5VJB, are for portable, rover and even fixed-station use. Originally published in the 1994 Central States VHF Society Conference *Proceedings*, information can be found at www.clarc.org/Articles/uhf.htm or www. fredspinner.com/W0FMS/CheapYagi/ vjbcy.html.

### **NEW PRODUCTS**

#### SIX-CONTACT FIBER OPTIC CONNECTORS FROM NEMAL ELECTRONICS

♦ Nemal's NEFO-600 series of multi-contact fiber optic connectors includes cableand panel-mount plugs and jacks, plus dust caps. The Nemal design allows for the use of two to six contacts, multimode or single mode, giving users flexibility for future expansion without changing connectors.

NEFO-600 connectors include multikeyed polarization locks, built-in strain re-



lief and a positive-locking design. They're available from stock or as custom assemblies using Nemal's high-quality FO662B

tactical fiber. A complete line of fiber optic tools and test equipment is also available.

For pricing and additional information, contact Nemal Electronics at 12240 NE 14th Ave, North Miami, FL 33161; tel 305-899-0900, fax 305-895-8178, info@nemal.com, www.nemal.com.

### **OLD RADIO**

# "Sparks"

As radios were being placed aboard ships in the early 1900s, it created a job market for radio operators. Many a young ham ran away to the sea, to become known as *Sparks*. *The Old Man* (the Captain) would assign him to duty in the shack (many times it was a quickly constructed room out on the deck of a ship, a ship that was built long before the use of radio). As he *tickles* his *bug* he hears his rotary gap, the *Rock Crusher*, beat out his transmission. Sometimes radiomen would give up the sea, but would continue to work at *land-side* stations.

This month we are treated to such a story about a young man who ran away to the sea, and later became a radioman and known as *Sparks*. It is written by his son.

#### His Handle was Al

By Carl E. Hammond, W7WQA

Al Hammond was raised in Tacoma, Washington and ran away to sea aboard the lumber schooner Lottie Bennett as a cabin boy. That was in December of 1911. Eighty-two days later the ship tied up to the pier at Sydney, Australia. Al became a "man" during that passage. He stuck with the merchant marine service for the next 20 years and ended his sea-going career as a radio officer. According to his "World Wide Wireless, Service Record and Identification Certificate of Radio Operator," part of which still remains intact, he served on the SS Hegira (7/29/26 to 4/26/27) and the SS Lurline (10/21/27 to 11/18/27). There were other ships and owners for whom he worked as a radio operator-including the Federal Department of Revenue during the Prohibition era. However, one of the most interesting stories was about his stint with Libby McNeil & Libby, a pioneer commercial salmon fishing and canning enterprise in Alaska.

The 1924 photograph was taken inside his one room cabin and radio shack at the Libby cannery site in Yakutat, Alaska, during one of his several seasons there. His radio log for the 1925 season is the only record that remains of his experiences at Yakutat. As a boy, I can recall many stories of this period in his career that are not recorded in the "log." Two years earlier on his first trip to Yakutat, he with the aid of some local natives, erected huge antennapoles for the long wire antenna system. As you can see from the photo the radio station equipment was primitive by our standards today. It was a "spark-gap" transmitter, with power supplied by a motorcycle engine driving a generator. According to Al's surviving radio log, he arrived at Yakutat that year on April 8, 1925, aboard the SS *Libby Maine* to put station KKA on the air for the forthcoming fishing season. The snow was deep and the weather was foul. It was blowing and snowing too hard to get



Al Hammond, K7IIJ, using his son's Heathkit AT-1 and Hallicrafters S-38.



The Libby McNeil & Libby Yakutat Alaska Salmon and Cannery Radio Station. Taken in 1924, it shows the combination radio shack and living quarters for Operator Al Hammond. This was pretty good accommodations for 1924 Alaska. If you look closely at the desktop you can see his key, and just to the left his *mill* (typewriter). The spark gap transmitter, behind the mill is the same as found aboard ships of that time. Behind his key is an early tube receiver that may be an early De Forest, but it's hard to tell. At the right, just under the calendar, you can see the butt of the pistol he used to scare off wild animals who showed up from time to time. He kept that handy, just over his bed. I have posted this photo on my Web page (**www.eht.com/oldradio/arrl/ index.html**) so you can look at it more closely. If anyone has other photos of the Yakutat Station, please contact me by e-mail.—*K2TQN* 

needed equipment off the ship and into his shack. As the storm lessened, the parts and pieces were landed from the ship. The generator powered by a motorcycle engine had an apparent attitude problem. It didn't want to operate. Finally after all wires were attached, he was able to power up his transmitter and receiver. It was 10:10 AM on April 15, 1925, and the first contact was NPB in Sitka. NPB I have concluded was the Libby Company's net control station.



The call signs scratched into the bottom of Al's old bug were those stations he operated: WQD—SS Hisko, WDG—SS Otsego, KKA—Libby Cannery Station at Yakutat, KOTD—SS Cross Keys, KDV—SS Libby Maine, WNUO-SS Brookdale, KIDF—SS Hegira, WML—SS Lurline, and WKDM-name unknown.

#### Profile: Carl E. Hammond, W7WQA

Carl Hammond was drafted into the US Army in 1952, in the middle of his sophomore year in college. After completing infantry basic training at Camp Roberts, California, he was given the choice of Officer Candidate School, Language School, Radio School or Cooks School.

"I guess I chose Radio School because of my Dad. He didn't try to influence my choice

though," Hammond said.



"After graduation I was sent to Europe and wound up as a radio instructor in the 4th Infantry Division Radio School, at Division HQ located in the northern suburbs of Frankfurt, Germany," Hammond continued. "We had a ham station, DL4IVY, on the base and I quickly became friends with a band of brothers, all interested in Amateur Radio."

After his hitch was over, he returned home to Bremerton, Washington, and encouraged his Dad to get his ham license.

Hammond finished up by saying, "Although I ultimately moved to Portland after finishing college, my Dad and I continued to have fairly regular schedules until his death. After that, I became very occupied with Law School, working, raising a family etc, and my radio airtime became less and less. In fact, my license expired and the grace period for renewal also expired.

By the time my son was in his early teens, he became interested in Amateur Radio, and proceeded to set up a station of his own. I was still too busy with other things to consider taking out a new license. However, in anticipation of retirement years, I did so in 1999. Later, after retiring, I found that my old call sign was still "on the shelf," so I applied for and got it back. I'm still not too active, but expect to be spending more time on the air in the future. My rig presently is a Kenwood transceiver in my shack and a Yaesu VX-5 in my car. I still have AI's NC-300 and Viking Ranger (see photo). In the past I have loaned his equipment to youngsters interested in the hobby of Amateur Radio." Later that day, Al noted in his log: "cleared KPE on all skds. He (KPE) comes in QSA, but has lots of QRN and my note is bad. Engine will not hold up to a clear note somehow." It was May 25, 1925 before his "Arc" was reported to be "working fine." The log entries are complete until October 3, 1925, when the last entry was made: "Cleared NPB and closed the station at 2:30 PM." He then boarded the *Libby Maine* for the return trip to Seattle.

In 1930, Al "swallowed the anchor" and stopped going to sea, a pre-condition to marrying my mother. I was born a year or so after they were married. In the mid-1950s, Al, now a widower, retired from his shore-side work and, at the urging of my sister and me, applied for and received his General class ham license. He received the call K7IIJ. He again took to the air with the enthusiasm of a youngster. He was still using CW only, but now with a new Johnson Viking Ranger, instead of a spark gap rig. The receiver was a new National NC-300.

I returned home from my military service a licensed ham, and went back to school. On finishing, I moved to Portland, married, and started my own family. Al and I had pretty regular schedules-again, CW only of course, usually on the 80-meter band. It was during one of these mid-week schedules that I noticed a profound change in Al's fist. I got on the phone and called my sister who lived nearby his residence, and asked her to look in on him. He grumped that he was "okay"; however, the following Saturday night he quietly passed away in his sleep. A few days later one of the several northwest 80-meter nets in which he had been active conducted a memorial service for him during a break in the regular schedule. Thereafter, I sadly signed off for Al and closed his station.

Al's grandson John, my son, received his amateur license when he was 14 or 15 years of age. His call was WB7ODP. John, now an Intel engineer, was only a babe-in-arms when Al died, but early this year he applied for and received a new call sign. The new call is K7IIJ. It was indeed a surprise and touching moment when I again heard that call sign, now spoken by my son John.

For whatever added historical value it may have, the following are some of the call signs Al worked from April to October 1925, taken from Al's 1925 radio log: NPB, KICZ, KDID, KPE, WAW, KONV, KOV, KEQ, WDG, CWG, KMT, KFIM, KAK, WWEH and WUJ.

# **DIGITAL DIMENSION**

# Tweaking the "Framistan"

When I was a kid just getting started in Amateur Radio, WA1NQP, a local who I had met on 2-meter AM mobile, asked me if I would be interested in joining the gang using his 450 FM repeater. I thought to myself, "I know about FM, but what's 450 and what's a repeater?" (This was a long time ago.) Although I did not know what I was getting into, I was willing to try something new and the price was right (around \$50), so I answered in the affirmative.

A day or two later, I drove to NQP's house with \$50 of hard-earned cash in my fist and was introduced to my first "boat anchor." My \$50 purchase was an old commercial Motorola mobile radio that was heavy enough that it literally could have secured a small boat in Lake Lillinonah. NQP had made the necessary conversion for the ham bands and provided a power supply.

I trucked my major prize home, powered it up, and tried to hit NQP's repeater, which was about five miles via line-ofsight from my shack. I heard nothing.

I telephoned NQP and he revealed that my boat anchor was very sensitive to bumps in the road and was probably misaligned by now. He suggested tweaking the radio's "framistan." I did and after some judicious adjustments, I was able to hit the repeater and join the gang on 450.

The "gang" consisted of NQP, K1KRY, WA1EXA, WA1EXE and me. Despite the size of the gang, we had a great time using a new ham radio mode. If I'm not mistaken, WA1NQP's repeater was one of the first 450-MHz repeaters in the Northeast and was one of the first FM repeaters on any band in the Tri-State area. (It is still on the air, by the way.)

#### Silk Purses from Sows' Ears

It was exciting to be a pioneer and what added to our enjoyment was that we were making silk purses out of sows' ears, making treasures out of someone's trash. Hams do that a lot; that is, take commercial radio technology and make it our own—and it's happening again.

High-speed digital networking has been something a lot of us have desired since the early days of amateur packet radio. Although high-speed networking did develop in some areas, for a number of reasons, it never grew to the proportions we had hoped it would. Yet that did not stop us from putting high-speed digi-



Figure 1—Check the High-Speed Digital Networks and Multimedia Web page (www.arrl.org/ hsmm/) to see what is happening in the "Wi-Fi" Amateur Radio world.

tal networking at the top of our "most wanted" lists.

The ARRL Technology Task Force recognized our desires and the ARRL Board of Directors voted unanimously that the ARRL should proceed with the development of high-speed digital networks. That vote begat the ARRL High-Speed Multimedia (HSMM) Working Group.

#### Eight Oh Two Eleven Bee

The initial effort of the HSMM Working Group is to develop the ARRL 802.11 Local Area Network (LAN) on 2.4 GHz. To accomplish this, the group will find and modify, as necessary, commercial off-the-shelf wireless network equipment for Amateur Radio use. Sound familiar?

Back in the September 2000 installment of this column, I wrote about the radio in my computer. My Macintosh PowerBook contains a 2.4-GHz Direct Sequence Spread Spectrum (DSSS) transceiver called the AirPort card. It provides wireless Internet access by communicating over the air with another 2.4-GHz transceiver (the AirPort base station), which is copper-wired to the Internet.

AirPort, like the proliferation of wireless ("Wi-Fi") equipment that followed in its flight pattern, uses the IEEE 802.11b standard under Part 15 (unlicensed operation) of the FCC Rules. Coincidentally, 6 of the 11 US channels that Wi-Fi uses for communications fall in the 2.4-GHz Amateur Radio band. So, it made sense to the Working Group to take commercial Wi-Fi equipment and tweak the equipment's framistan so that it can be used under Part 97 of the FCC rules on the 2.4-GHz Amateur Radio band.

According to the Working Group, tweaking the framistan also involves:

• Identifying or building suitable highgain horizontally polarized omni-directional antennas,

• Identifying and/or building 1 to 10 W external bi-directional amplifiers,

• Modifying and/or optimizing, if possible, the firmware in the wireless equipment for operation under Part 97, and

• Providing multi-platform hardware drivers and other software for network configuration, operation and maintenance.

That sounds like a tall order, but the working group is already well on its way. It is now conducting on-the-air experiments in Michigan using 802.11b channel 6, which falls totally within the 2.4 GHz ham band and does not interfere with other Amateur Radio operations. (I recently tuned my AirPort to channel 6 so as not to miss any band openings!)

Once the network is up and running, expect multimedia modes of voice, data including messaging, telemetry, telecommand and geolocation beyond Automatic Position Reporting System (APRS), images (stills and video), interconnection to the Internet, amateur television (ATV) repeaters as well as voice repeaters, maybe even WA1NQP's 450 repeater! To keep tabs on what the HSMM Working Group is doing, be sure to regularly check the High-Speed Digital Networks and Multimedia Web page on the ARRLWeb at www.arrl.org/hsmm/.

Stan Horzepa, WA1LOU 🔶 One Glen Ave, Wolcott CT 06716-1442 🔶 wa1lou@arrl.net, www.tapr.org/~wa1lou

### AMATEUR RADIO WORLD

### Two Associations Elected to IARU

IARU admits Cameroun and Macau: By vote of the present membersocieties of the International Amateur Radio Union (IARU), two new members-Association des Radio Amateurs du Cameroun (ARTJ) and Associãcao dos Radioamadores de Macau (ARM)-have been admitted to the IARU effective December 9. ARTJ was founded in 1998. Its official address is Ecole Nationale Superieuse des Postes et Telecom, BP 6132 Yaounde, Cameroun, There are 14 members of ARTJ, seven of whom are licensed. ARM was formed on June 15. 1992 by seven founding members and now has 85 members. Its official address is Box 6018, Macau SAR; arm@ macau.ctm.net.

While Macau-a former Portuguese colony-is considered a "special administrative region" of the People's Republic of China, its admittance as an IARU member will retain its status as a separate DXCC entity. The Chinese Radio Sports Association (CRSA) expressed its firm support of the application, stating that "according to the basic law of Macau Special Administrative Region of the People's Republic of China, CRSA will respect all the decisions by ARM and will never interfere in its internal affairs." The IARU, founded in 1925, is a worldwide federation of national Amateur Radio societies with members in 153 countries and separate territories. In addition to becoming members of the worldwide IARU, ARTJ and ARM become members of IARU Region 1 and IARU Region 3, respectively. Georgia (4L), Armenia (EK) and Vietnam (3W) have applied for IARU membership.-IARU news release

IARU presents Amateur Radio Administration Course in Kenya: The International Amateur Radio Union (IARU) has announced the successful presentation of the Amateur Radio Administration Course (ARAC) in Nairobi, Kenva. The course, conducted jointly by IARU and the African Advanced Level Telecommunications Institute (AFRALTI), was taught December 9-13, 2002, to a class of 22 telecommunications officials from English-speaking African countries. Support for the course was provided by the International Telecommunication Union Telecommunication Development Bureau (ITU-D), the African Telecommunications Union (ATU) and the Communications Commission of Kenya (CCK).



The IARU's Amateur Radio Administration Course (ARAC), conducted jointly by IARU and the African Advanced Level Telecommunications Institute (AFRALTI), was taught in Nairobi December 9-13, 2002, to a class of 22 telecommunications officials from English-speaking African countries.

Students were from administrations and telecommunications operators from Ghana, Kenya, Sudan and Zambia. Presenters were Paul Rinaldo, W4RI, for IARU: Mohamed K. Noorani of AFRALTI; and Gideon Mwakatobe of ATU. AFRALTI Director Edward Mallango participated in the opening ceremony and ATU Secretary-General Jan Mutai officiated at the closing ceremony. Amateur Radio Society of Kenya (ARSK) Chairman E H M (Ted) Alleyne, 5Z4NU, set up an HF station at the training site. "The presentation of the course in Nairobi was made possible by a strong sense of partnership that exists between ITU, ATU, and IARU," said IARU Secretary David Sumner, K1ZZ. "IARU President Larry Price, W4RA, has assigned a high priority to the development of Amateur Radio in Africa. We are most gratified that ITU-D Director Hamadoun Touré as well as ATU Secretary General Mutai and his colleagues in Nairobi share our conviction that Amateur Radio can contribute to human resource development for the improvement of telecommunications in Africa." The course included instruction in subjects such as the ITU, Radio Regulations, spectrum management, the IARU, domestic and international regulations, Amateur Radio operations and technology, disaster communications and the Amateur-Satellite Service.

In December 2002, the Communications Commission of Kenya (CCK), approved the United States/Kenya Reciprocal Agreement. It has been nearly 10 years since US amateurs have been granted reciprocal licenses in Kenya. More information and application forms can be found at the Amateur Radio Society of Kenya's Web site at **qsl.net/arsk**.

#### BRIEFS

• The Union de Radioaficionados Espanoles (URE) announced its new Board of Directors: Angel Padin, EA1QF, President; Diego Trujillo, EA7MK, Vice President and Treasurer Pere Espunya, EA3CUU, Auditor; and Jose Diaz, EA4BPJ, Secretary. URE's Web site at www.ure.es has more information.

• The Philippine Amateur Radio Association, Inc (PARA) also announced its new officers: Jose Mari Gonzales, DU1JMG, President; Gil Brian Santos, DU1MS, Executive Vice President; Serafin Nepomuceno, DU1SAN, Internal Vice President; Jaime Trinidad, 4F3MJ, External Vice President; and Joseph San Juan Sy, DU1DX, Secretary General. PARA's Web site at www.qsl.net/ dx1par/ has more information.

• The Hong Kong Amateur Radio Transmitting Society (HARTS) named its 2003 committee including Paul Anderson, VR2BBC, President and IARU Liaison; Stephen Tse, VR2ZST, Hon Secretary; and Steven Cheng, VR2YFF, Hon Treasurer & Membership Secretary.

• April 18, 2003 marks the annual Amateur Radio Day. The theme for this year is "Amateur Radio Supporting Technology Education in the Classroom." Amateur Radio Day marks the founding of the International Amateur Radio Union in 1925.



### SILENT KEYS

#### It is with deep regret that we record the passing of these amateurs:

ex-WB1ALV, Elmer M. Farnsworth, Alamogordo, NM

K1AVL, Leo R. Antaya, Bristol, RI KB1CG, David S. Kendle, Clinton, CT KB1DUJ, Betty Guild Tucker, Essex Junction, VT WA1DVS, Harold C. King Sr, Killingworth, CT N1EQK, Marguerite Moran, Winthrop, MA N1GLC, Philip H. Choate, East Falmouth, MA W1SVR, Douglas W. Grimshaw, Farmington, CT W1TAD, Alan Cooper, Pittsfield, MA WA1VMC, Arline P. Bender, W Hartford, CT W2AGW, Howard W. Wolfe, Harrington Park, NJ N2BGU, Robert M. Gowling, Hackettstown, NJ AA2CQ, Gerald E. McCarthy, Penn Yan, NY N2DJY, James W. Maitland, Haddonfield, NJ W2DLC, Howard J. Tatum, Atlanta, GA W2DND, Clarence R. DeBow Jr, Cherry Hill, NJ WB2FNT, Ernest Juhn, Forest Hills, NY ex-WA2GYU, Bernard J. Chiore, Albany, NY K2HFO, Wesley Sparry, Staten Island, NY W2IID, Sidney Berg, Great Neck, NY N2JAW, Ronald Raposo, Holland Patent, NY W2LPE, Frank Policastro, Hillside, NJ K2RAB, Donald C. Becker Jr, Schoharie, NY K2ROR, Alan A. Nickel, Seaford, NY W2VWK, Howard L. Stuart, Stafford, VA \*W2YGU, C. W. Westwood, Vincentown, NJ W3EKF, Frederick W. Breslyn, Rockville, MD W3EPR, Camille S. Marie, Pikesville, MD \*W3GU, Harry J. Yust, Winter Garden, FL WB3JEU, Paul T. Gardner, Bath, NY K3LIP, Ulysses G. Shaffer Jr, Oakdale, PA W4AAY, Benjamin C. Bagley, Statesboro, GA K4AEA, Walter C. Ward, Merritt Island, FL AF4AM, Don L. Boyer, Vine Grove, KY \*W4BKY, Wayne E. Butler, Norfolk, VA KF4CXH, Margaret J. Cave, Tampa, FL K4DCP, Eldridge E. Rowe, Blacksburg, VA K4FOJ, Charles Heisner, Pace, FL W4JRL, Theodore M. Conte, Richmond, VA \*K4NV, Robert W. Stankus, Jacksonville, FL KF4NYI, Alfred B. Brock, Armuchee, GA K4OSR, J. S. Thomas, Hoogeveen, Netherlands WD4PNJ, Clifton L. Adams, Birmingham, AL AA4PT, Charles C. Massengale, Pace, FL ex-WA4PWV, Gabe Bamberger, Memphis, TN KG4QBQ, Richard A. Kitchen Sr, Royal Palm Beach, FL KD4VCL, Leon H. Hall, Statesboro, GA W4WED, John S. Mahoney Sr, Richmond, VA W4ZFD, Elmer L. Littell, Largo, FL

K5BVM, Walter W. Kunde Jr, Garland, TX WA5CJO, Hiram A. Gatewood, Raymond, MS WA5DXU, Betty Shotwell, Humble, TX W5EEX, George O. Leediker, Houston, TX N5HUP, Glen C. McAskill, Cisco, TX KD5IVM, Joseph N. Siciliano, Poughkeepsie, NY NN5K, David J. Hundahl, Dallas, TX WA5NOQ, Willard L. Moheng, Owasso, OK WA5OBF, Shelby T. Alexander, Houston, TX KG5QA, Herbert L. Wilson, Bedford, TX \*W5RR, John Adel, Dallas, TX \*K5RVF, William A. Roussel Jr., Port Arthur, TX W5YIY, Billy J. Carter, Fort Worth, TX W5YYC, Earl Granbery, Dallas, TX WA6AKJ, Edward M. Smith, Oxnard, CA WA6DCR, Robert W. DeBro, Tucson, AZ WA6DHS, Roy W. Warner, Port Hadlock, WA W6FMK, Aldo Bussi, Scotts Valley, CA WA6IDZ, Allen H. Sochel, Santa Barbara, CA WA6IVM, Ray Eichman, San Francisco, CA KE6IY, Thomas N. Hall Sr, Escondido, CA KH6JEO, Anthony Bessara, Kapolei, HI KA6PLL, Louis A. DeLateur, Sunnyvale, CA W6PWV, Vernon M. Freeman, Turlock, CA KE6QCW, Anne M. Bell, Utica, NY WB6QDM, Bert D. Doyle, Fresno, CA W6RJH, Richard B. Shuler, Salem, OR NV6V, C. C. Cutler, Waterford, ME WA6YDF, Herb Brasch, Sunnyvale, CA W7CRV, Fred Filmore Kaser, Wichita, KS W7DEW, Thomas E. Walker, Yakima, WA WA7ELB, Robert F. Jamieson, Seattle, WA W7KCZ, Hilmer T. Taxdahl, Ferndale, WA KC7MLH, Alice L. Ross, Salt Lake City, UT KF7PQ, Martha A. McCormick, Kingman, AZ K7QLZ, Roy Green, Gresham, OR W7ROL, Reginald Hoskin Sr, Four Lakes, WA N7TPF, Nona M. Prout, Tacoma, WA \*W7TWU, Richard A. Keller, Seattle, WA WA7UZF, Clinton McClain, Aberdeen, WA K7YIN, James T. Dwyer, Grand Junction, CO K8AKJ, Lewis O. Williamson, Dayton, OH WB8CFV, Douglas G. Burke, Kalamazoo, MI N8DVQ, Darwin W. Bass, Cincinnati, OH KC8GQF, Shirley Darrell Davis, Newport, OH K8JMP, Jose M. Perez, Medina, OH WA8MVH, John Sheldon, Ludington, MI N8NPV, Eduard H. F. Vander Gronden, Burton, MI WB8PLU, David R. Wood, Port Clinton, OH W8THH, Harold R. Dewey, Rapid City, MI W8UGU, Harvey C. Olson Jr, Westland, MI KB8ZG, Don R. Allen, Hurricane, WV W9KTE, Fredrick Brechlin, Eau Claire, WI W9LFO, C Richmond Thayer, Greenview, IL

KC9ML, Larrie A. Gould, Fort Wayne, IN \*\*W9MM, James L. Dean, Greenwood, IN W9MQ, Michael W. Hench, Wausau, WI WA9NZF, Rodney N. Jackson, Jacksonville, IL K9PPW, Robert B. Stedman, Hoffman Estates, IL N9QGJ, Kenneth Klebenow, Merrill, WI W9ROP, Edward J. Sebahar, Lansing, IL W9TDX, J. N. Meade, Bayonet Point, FL \*WA9TPQ, William M. Erickson, St Charles, IL KB9VLN, Loraine Neumiller, Racine, WI N9XXZ, Wayne A. Wilzbacher, Evansville, IN WB9YIN, Donald DeVilbiss, St Charles, IL NS9Y, Leo D. Staley, Sun City West, AZ KØAFI, John E. Kelly, Blairstown, IA WØAOA, John C. Carroll, Longmont, CO KZØC, James W. Bohnsack, Waterloo, IA ex-WBØCUF, Roy R. Ridge, Rockwell City, IA KAØDTY, Myron C. Dake, Lamont, IA WØDVR, Ernest P. Buresh, Fairfax, IA WØHCZ, Elmer L. Christenson, Centennial, CO NØISL, John R. Douglas, Elk River, MN WØJB, James N. Blair, Westwood, KS KBØNTN, Michael Contreras, Greeley, CO WØPRQ, J. D. Brown, St Charles, MO WBØPVO, William E. Green, Winona, MN WØZIQ, Donald T. Meisel, Sioux Falls, SD WAØZOE, Dean E. Light, Glidden, IA I8KDB, Giampaolo Nucciotti, Caserta-Ce, Italy \*VE4RM, Andre Sheyka, Winnipeg, MB, Canada

\*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. 057~

Kathy Capodicasa, N1GZO 🔶 Silent Key Administrator 🔶

#### n1gzo@arrl.org

### **STRAYS**

#### **VK AWARDS PROGRAM**

♦ The Wireless Institute of Australia offers several attractive awards that are available to all radio amateurs. Awards include the WIA DX award, available to all radio amateurs who submit evidence of having worked 100 approved entities, and can be endorsed for various bands (1.8-29, 52-144 MHz) and modes; WAVKCA HF (Worked all VK Call Areas HF); HAVKCA (Heard all VK Call Areas) for DX SWL, and the WIA Grid Square Award.

You can contact Federal Awards Manager Malcolm Johnson, VK6LC, at PO Box 196, Cannington, Western Australia 6987, Australia; e-mail **awards@wia.org.au**. Up-to-date information on all WIA-sponsored awards is available at **www.wia.org.au/awards**/.

#### CODE PROFICIENCY AWARDS

♦ Evaluate your Morse code ability through the ARRL Code Proficiency program. Copy one of W1AW's qualifying runs (see W1AW schedule on page 95 of this issue), and submit one minute of solid copy (legible) along with a fee of \$10 for the initial certificate or \$7.50 for an endorsement to ARRL HQ. Your submission will be checked directly against the official W1AW text, and if you pass, you'll get your initial Code Proficiency certificate. From then on, endorsement stickers are issued for speeds up to 40 wpm. Non-hams and hams alike are eligible for the Code Proficiency program.

The American Radio Relay League, Inc. Headquarters, Newington, CT USA
Certificate of Code Proficiency
By this certificate and any appended endorsements to show additional qualifications, the American Radio Relay League expresses recognition of merit and progress in code proficiency on the part of
who has on this data demonstrated skill in the basic att of reception by car of the international Moreo or Continental Code. One commission of corps submitted indicates absolute accuracy at a speed of works per minute for a period of at least one minute of plain-language computer generated text averaging five characters to the word, which we hereby certify. Date of the ARXII. Instansions for MV NAV.
Ji bly W5JBP

# 75, 50 AND 25 YEARS AGO

#### March 1928

• The cover photo shows a state-of-the-art receiver. The editorial describes a recent Federal Radio Commission hearing in Washington, using words such as "So many people who knew nothing about radio never before assembled in the same room to talk about it."

Wilfred Taylor pre-

8 PM

9 P M

10PM

11 PM

sents the cover article, "Double-Detection Receivers with Band-Pass Filters and Screen-Grid Amplifiers," showing a receiver that features individual stages each in their separate shielded compartment-a very futuristic looking radio. J. K. Clapp and Howard Chinn describe "Directional Properties of Transmitting and Receiving Antennae." A simple receiver for beginners is presented by Harold Westman, in "Another Code-Learning' Set." The excellent station of "nu4OC" in Durham, N. C. is described and shown in photographs. Bert Smith discusses "The Design of Variable Condensers for High Voltage Operation." Herman Radlofi, 9AIR, tells about his experiments with portable stations for touring Minnesota's 10,000 lakes, in "Experimenters' Section Report." Herman came up with the idea of switching a common circuit between receiving and transmitting, coining the word "transceiver," a novel word for a novel concept. In the column, "The Communications Department," by Ed Handy, 1BDI, communication with two expeditions via Amateur Radio is discussed.



#### March 1953

Al Broadon, W1AB

CODE BULLETIN

◆ The cover photo shows W4AO and W3GKP working on "Project Moonbeam"—wherein they bounced 2-meter ham signals off the moon! The editorial discusses problems in the FCC's accounting system for determining how many amateurs there are. "Lunar DX on 144



Mc.!" provides details on the moonbounce work by Ross Bateman, W4AO, and Bill Smith, W3GKP, the first hams to accomplish the feat. George Rose, K2AH, in "The Transistor—Or 25 Miles on a Hunk of Germanium," provides details of his history-making transistor transmitter that was shown on last month's cover. The subtitle of his article predicts, "Some background on the tiny devices that may revolutionize the electronic art." George Grammer, W1DF, tells about "Combining the Antenna Coupler and Low-Pass Filter" in a unit built as a companion piece for the 75-watt transmitter described in the December 1952 QST. By Goodman, W1DX, describes "An All-Purpose Super-Selective I.F. Amplifier" that uses parallel amplifiers of different bandwidths. J. G. Rountree, W5CLP, tells about "A One-Tube 75-Meter Mobile Converter" that uses one tube and crystal control. "The Poor Man's DX-Getter," a simple but effective 20-meter ground-plane antenna, is putting lots of DX contacts into the log of Ed Spight, W6OXR. Lew McCoy, W1ICP, helps new Novices (and other hams) understand receivers with his article, "Let's

Listen." In the column "On the Air with Single Sideband," the comment is made that "An s.s.b. DXCC is a long way off..." because so few countries are yet represented on sideband.

#### March 1978

♦ The colorful cover shows an LED readout, with the question, "What's behind those alluring numbers?" The editorial discusses a recent demonstration of the newly developed narrow-band voice modulation system. Patrick Dreher,

WB1AJN, discusses "How Visual Displays Work."



Jay Rusgrove, W1VD, describes "An FET Volt-ohmmeter with Linear Ohms Readout," while Bob Shriner, WAØUZO, discusses "New Tasks for the Digital Voltmeter." Warren Gregoire, W6TME, tells how to build "A Permeability-Tuned Variable-Frequency Oscillator." Fred Schnell runs an idea up the flagpole to see who salutes the four-band vertical he calls "The Flagpole Deluxe." Jim Kearman, W1XZ, tells of his mountain-topping adventures in "Microwaves, Mozzarella Burgers and Mountains." Mark Starin, WA1TZK, presents Part 2 of "The Lure of 2 Meters." Ellen White, W1YL, tells about the various ham awards offered by Soviet organizations in "From Russia with Love." In "PR Coup-NYC Marathon," Steve Mendelsohn, WA2DHF, and Peter O'Dell, WB8NAS, tell how hams helped with communications for the Marathon and simultaneously got a lot of good publicity for Amateur DST-Radio

	W	<b>1</b> A	W	Sc	he	du	le	
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	\ 12 PI	/ISITING M-1 PM	GOPERA CLOSEI	ATOR T D FOR L	IME UNCH)
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		COD	E BULL	ETIN	
3 PM	4 PM	5 PM	6 PM	TE	ELEPRIN	ITER BL	JLLETIN	1
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		COI	DE BULI	ETIN	
6 PM	7 PM	8 PM	9 PM	٦	TELEPR	INTER E	BULLET	IN
645 PM	7 <sup>45</sup> PM	8 <sup>45</sup> PM	9 <sup>45</sup> PM		VOI	CE BULI	LETIN	
7 PM	8 PM	9 P M	10 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE

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:

Contributing Editor

Frequencies are 1.818, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5,  $7^{1/2}$ , 10, 13 and 15 wpm.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 wpm.

Code practice text is from the pages of *QST*. The source is given at the beginning of each practice session and alternate speeds within each session. For example, "Text is from July 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.

### **COMING CONVENTIONS**

#### ROANOKE DIVISION CONVENTION

#### March 8-9, Charlotte, NC

The Roanoke Division Convention (Charlotte Hamfest and ComputerFair), sponsored by the Mecklenburg ARS, will be held at the Charlotte Merchandise Mart, Independence and Freedom Halls, 2500 E Independance Blvd (US 74); I-77 to Exit 11, Brookshire Freeway E to Independance Blvd at Exit 2B. Doors are open Saturday 8:30 AM to 5 PM, Sunday 8:30 AM to 2 PM. Features include giant indoor flea market with over 425 tables (**fleamarket@w4bfb.org**); dealers (dealers@w4bfb.org); over 100 commercial exhibitor booths with major equipment manufacturers; new and used radio and computer equipment; fantastic forums; VE sessions (Ŝaturday, Mar 8; registration 12:30 PM, testing at 1 PM; walk-ins accepted; \$10 fee); Bob Heil, K9EID, from Heil Sound; Riley Hollingsworth from FCC; Wayne Mills, N7NG (ARRL Membership Services Manager); keynote speaker NASA Astronaut Lee Morin, MD, PhD (Captain, USN; www.jsc.nasa.gov/Bios/ htmlbios/morin.html); DXpedition programs (Dave Anderson, K4SV); pre-paid parking \$3 (good for both days); refreshments. Talk-in on 145.29. Admission is \$6 in advance, \$8 at the door (under 13 free). Tables are \$22 (good for both days). Con-tact Tom Hunt, KA3VVJ, 16007 Wynfield Creek Pkwy, Huntersville, NC 28078; 704-948-7373 (hamfest info line); hamfest@w4bfb.org; www.w4bfb.org/hamfest.

#### **OKLAHOMA SECTION CONVENTION**

#### March 14-15, Claremore

The Oklahoma Section Convention, sponsored by the Green Country Hamfest Assn, will be held at the Claremore Expo Center, 400 Veterans Pkwy; just 30 minutes NE of Tulsa off historic Rte 66 at Hwy 20. Doors are open Friday 5-9 PM, Saturday 8 AM to 5 PM. Features include Radio, Electronics and Computer Show; flea market; commercial vendors; forums (ARRL, ATV, MARS, ARES, AMSAT, OK DX, Weather); VE sessions; free test table; on site RV parking; free parking. Talk-in on 147.09, 444.35. Admission is \$8 in advance, \$10 at the door (under 13 free). Tables are \$8 in advance, \$10 at the door (electricity \$15, cords not provided). Contact Steve Miller, AA5V, Box 470132, Tulsa, OK 74147-0132; 918-245-0354; info@GreenCountryHamfest.org; www. GreenCountryHamfest.org.

#### **TEXAS STATE CONVENTION**

#### March 15-16, Midland

The Texas State Convention (48th Annual St Patrick's Day Hamfest), sponsored by the Midland ARC, will be held at the Midland County Exhibit Building, North Service Rd; <sup>1</sup>/<sub>2</sub> mile E of the intersection of Fairgrounds Rd and old Hwy 80 (also called Front St or Business 20); westbound on I-20, Exit 144; eastbound on I-20, Exit 143. Doors are open Saturday 8 AM to 5 PM, Sunday 8 AM to 1 PM. Features include huge indoor flea market, many dealers, large tailgate area (\$10

February 22 Vermont State, Milton\* March 8 Western Washington Section, Puyallup\* April 25-26 Southeastern VHF Conference, Huntsville, ΔI April 25-27 SETI League Technical Symposium, Trenton, NJ May 2-3 Midwest Division, Lebanon, MO May 3 South Carolina State, Greenville May 3-4 Alabama State, Birmingham West Texas Section, Abilene June 20-22 **ARRL** National Convention, Arlington, TX \*See February QST for details.

per space, includes 1 table), ARRL forum (Friday, Mar 14, with ARRL West Gulf Division Director Coy Day, N5OK, and West Texas Section Manager John Dyer, AE5B), Hospitality Room (Saturday, 7 PM, at MARC Clubhouse), VE sessions (Saturday, 1 PM, Extension Service Bldg; \$12 fee), QLF Contest (Sunday), Sunday Lunch (11:30 AM; Johnny's BBQ, \$6), RV parking, refreshments. Talk-in on 146.76, 147.3. Admission is \$8 in advance, \$9 at the door. Tables are \$14 each (for the first 4), \$20 (for each additional table over 4). Contact Joe Coldewey, KK5ZG, c/o Midland ARC, Box 4401, Midland, TX 79704; 915-697-7846; kk5zg@caprok.net; www.w5qgg.org.

#### NEBRASKA STATE CONVENTION

#### March 21-22, Norfolk

The Nebraska State Convention, sponsored by the Elkhorn Valley ARC, will be held at the Northeast Community College Lifelong Learning Center, 801 E Benjamin Ave; from the intersection of US Hwys 81 and 275 go N on Hwy 81 (13th St) to Benjamin Ave, turn right (E), proceed E for approximately 1.7 miles to entrance of NECC (on N side). Doors are open Friday 5-9 PM, Saturday 8 AM to 5 PM. Features include flea market, dealers, seminars, ARRL forum, VE sessions (both days), banquet (Saturday, 7 PM; \$12 each or \$22 per couple), refreshments. Talk-in on 146.73 (131.8 Hz), 444.25. Admission is \$6 in advance, \$7 at the door. Tables are \$15. Contact Dave Thege, NØXBN, 207 S 9th St, Norfolk, NE 68701; 402-371-3550; **n0xbn@arrl.net; www.qsl.net/** evarc/.

#### MAINE STATE CONVENTION

March 28-29, Lewiston

The Maine State Convention (24th Annual "Andy"

Hamfest and Computer Fair), sponsored by the Androscoggin ARC, will be held at the Ramada Conference Center, 490 Pleasant St; take Exit 13 off I-495 (Maine Tpk) to traffic light, take first left after light. Doors are open Friday 7-9 PM, Saturday 8 AM to noon. Features include exhibitors, vendors, new and used radio and electronics gear, computers, forums, VE sessions (Saturday, registration 10 AM, exams start at noon). Talk-in on 146.61. Admission is free Friday evening, Saturday \$5, under 16 free. Tables are \$8 (additional \$6 each). Contact Rick James, N1WFO, 7 Judkin Ave, Lewiston, ME 04240; 207-784-1266; **n1wfo@artl.net; www.dlois.com/mainearrl/ convent.htm.** 

### MARYLAND STATE CONVENTION

#### March 29-30, Timonium

The Maryland State Convention (32nd Annual Greater Baltimore Hamboree and Computerfest), sponsored by the Baltimore ARC, will be held at the Maryland State Fairgrounds, York Rd; I-83 to Exit 17 (Padonia Rd to the E), turn right at York Rd. Doors are open Saturday 8 AM to 5 PM, Sunday 8 AM to 3 PM. Features include giant indoor electronics flea market, vendors, major manufacturers, commercial exhibitors and displays, outdoor paved tailgating (opens at 6 AM both days), forums, VE sessions (Sunday, 9 AM, Vista Room; preregistration requested, John Creel, 301-572-5124; wb3gxw@arrl.net), QSL card checking (Saturday 9 AM to 1 PM, Sunday 9 AM to noon), banquet, refreshments. Talk-in on 146.67, 224.24, 449.625. Admission is \$10 in advance for a weekend pass, \$6 per day at the door. Contact Doug Wittich, N3VEJ, Box 95, Timonium, MD 21094; 410-426-3378 or 410-526-4263; hamfest@ gbhc.org; www.gbhc.org.

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262. **Note:** Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance.

HAMFEST CALENDAR

Attention: The deadline for receipt of items for this column is the **1st of the second month pre**ceding publication date. For example, your information must arrive at HQ by March 1 to be listed in the May 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 (Scottsdale)—Mar 15**, 6 AM to 3 PM. Sprs: Scottsdale ARC and AR Council of Arizona. Scottsdale Community College, 9000 E Chaparral Rd (E side of Scottsdale); Exit 64 on Rte 101. VE sessions. TI: 147.18 (162.2 Hz). Adm: \$2 (parking). Tables: \$10. Ed Nickerson, WU7S, 902 N 73rd Pl, Scottsdale, AZ 85257-4302; 480-949-

**Convention Program Manager** 

<sup>†</sup>ARRL Hamfest

5162 or 480-947-9343; enickerson427@aol.com. †Arkansas (Fort Smith)—Apr 5; set up Friday 5-9 PM, Saturday 6-8 AM; public 8 AM to 2 PM. Spr: Fort Smith Area ARC. K of C Hall, 10203 Columbus Ln; I-40 to I-540 to Exit 12, S on US 71, 3 lights, take right onto Broken Hill, go 300 ft to Columbus Ln on left. Indoor flea market, tailgating (free), dealers, vendors, displays, new and used equipment, computers, ARKIE con QRP forum, demos, speakers, VE sessions (AM), ARRL session, refreshments. *TI*: 146.94, 146.64, 444.5.

Gail Iannone

giannone@arrl.org

Adm: \$5. Tables: \$10 (electricity \$10 in advance). Mark Clayton, WB50NE, 2008 Jacobs Ave, Fort Smith, AR 72908; 479-648-9343; hamsat1@ swbell.net; or Art Sellers, W5UOS, 479-474-7633; w5uos@arrl.net; www.fsaarc.org.

†**Connecticut (Pomfret)—Mar 15**, 8 AM to noon. *Spr:* Eastern Connecticut ARA. Pomfret Public School, corner of Rtes 169 and 101; 4 miles W of Rte 395. Flea market, VE sessions. *TI:* 147.225 (156.7 Hz), 146.52. *Adm:* \$2. Tables: \$10. Paul Rollinson, KE1LI, 182 Wrights Crossing Rd, Pomfret Center, CT 06259; 860-928-2456; **KE1LI@arrl.net; www.qsl.net/k1muj**.

**†Connecticut** (Southington)—Apr 6; set up 6:30 AM; public 9 AM to 1 PM (Early Bird Special: doors open at 8:30 AM and admission is \$10 until 9 AM). Spr: Southington ARA. Southington High School, 720 Pleasant St; I-84, Exit 32, go S on Rte 10 for 1 mile, take left onto Flanders St, go 1/2 mile to Pleasant St on right. Flea market, ham radio equipment, electronics, computers, vendors, meetings (annual spring ARES, CT Spectrum Management Assn), VE sessions (all classes; must preregister, no walk-ins), refreshments. TI: 145.49, 147.345, 224.8, 444.25 (77 Hz). Adm: \$5, under 12 free. Tables: 6-ft, advance \$12, door \$15 (1/2 off if you bring your own table). Make checks payable to SARA and send with SASE to Chet Bacon, KA1ILH, c/o SARA, Box 873, Southington, CT 06489: 860-628-9346: kalilh@chetbacon.com: www.chetbacon.com/sara.htm.

Connecticut (Westbrook)—Mar 20. Dan Kinsman, KB1IUW, 860-399-5647.

†Florida (Ft Walton Beach)-Mar 15; set up Friday noon to 5 PM, Saturday 7:30-8 AM; public 8 AM to 3 PM. Spr: Playground ARC. Okaloosa Fairgrounds, 1958 Lewis Turner Blvd (State Rte 189); from I-10 exit S onto SR 85 at Crestview, go about 11 miles and exit S onto SR 123, bypass brings you back to SR 85 (after 4 miles), turn right onto SR 189 (intersection with light). Amateur Radio and Computer Show/Swapfest, vendors, RV sites (850-862-0211). TI: 146.79. Adm: \$5 (accompanied ladies and under 15 free). Tables: \$10 (includes 1 admission). Louis Carter, KF4HRM, c/o PARC, Box 873, Ft Walton Beach, FL 32549: 850-243-4315; parcfest@w4zbb.org; www.w4zbb.org. †Florida (New Port Richey)-Mar 22; set up Friday after 5 PM; public Saturday 8 AM. Spr: Gulf Coast ARC. Ridgewood High School, 7650 Orchid Lake Rd, next to Marchman Technical Education Center; take Ridge Rd off US 19, go S on Lemon Rd; or take Little Rd W to Lemon Rd and turn S (left). Amateur Radio and Computer Show, tailgating (\$6 admission ticket only), vendors (overnight camping available), ARRL forum, VE sessions (9 AM). TI: 146.67. Adm: \$6. Tables: \$3 (plus admission). Rick Brown, AG4JN, Box 595. New Port Richey, FL 34656-0595; **ag4jn@arrl. net**; or Don Patee, AA4EK, 727-372-3811; aa4ek@arrl.net; www.gulfcoastarc.org/.

Florida (Plantation)—Mar 22. Robin Terrill, N4HHP, 954-583-3625.

†Florida (Port Charlotte)—Mar 15; set up Friday noon to 8 PM; public Saturday 7 AM to 2 PM. Sprs: Englewood ARS and Peace River Repeater Assn. Charlotte County Fairgrounds, 2333 El Jobean Rd; opposite Stadium, SR 776, 2.5 miles W of US 41 and approximately 5 miles W of 1-75. Swap tables, tailgating (\$10 per space, includes 1 admission), demonstrations (APRS, Echolink, and more), DXCC card checking, VE sessions (all classes), overnight self-contained RV parking (\$10, no hookups), free parking, refreshments. *TI*: 147.255. Adm: \$5. Tables: \$20 (includes 1 admission; additional tables \$15 each). Bill Norris, KC7TSG, 6468 Pan American Blvd, North Port, FL 34287; 941-426-0214; hamscanner@aol.com; www.fcrosby.com/hamfest/flyer.html.

†**Florida (Stuart)**—**Mar 15**; set up 6 AM; public 8 AM to 2 PM. *Spr:* Martin County ARA. Martin County Fairgrounds (North Lot), 2626 SE Dixie Hwy, S of Monterey Rd; from I-95 take Exit 63 (Kanner Hwy), go E to SE Dixie Hwy, then S to Fairgrounds. Swapfest, vendors, tailgating (free), club table, free parking, refreshments. *TI:* 147.06. *Adm:* Free. Tables: bring your own. Peter Lynch, W1MNY, Box 1901, Stuart, FL 34997; 772-288-

#### 1048; w1mny@arrl.net; www.qsl.net/kg4via.

†**Florida (Trenton)—Mar 8**, 8 AM. *Spr:* Dixie ARC. Field of Dreams Sports Complex, SR 129 N to Complex; from US 19 or I-75 take US 26 to Trenton, then go N on SR 129 for approximately 2 miles to Complex. *TI:* 147.39. *Adm:* \$2. Tables: \$5. John Mc Cleese, K8HL, HC 5, Box 163, Old Town, FL 32680; 352-542-3235; **k8hl@arrl.net**.

†Georgia (Marietta)-Mar 15; set up Friday 1 PM; public Saturday 8 AM to 4 PM. Spr: Kennehoochee ARC. Jim Miller Park, Callaway Rd (formerly Cobb County Center Park); from I-75N to Delk Rd, go W to Austell Rd, turn right, go approximately 3 miles and take right onto Callaway Rd, go 1 mile to event site. Hamfest/ Emergency Communications Expo, flea market, tailgating (first-come basis), boneyard, vendors, exhibits, static displays and demonstrations, VE sessions (9 AM on site; you must provide your own copies of license, no copier on premises; \$10 fee), one day No Code Tech License Training and Testing (8:30 AM to 5 PM, \$35 fee, instructional materials and test included). RV hookups (\$10 per night; advance registration required, Mike Fisher, KG4DPF, 770-971-3610 before 9 PM; kg4dpf@ **arrl.net**), free parking. *TI*: 146.88 (100 Hz). *Adm*: \$5, under 12 free with adult. Tables: \$20 (inside flea market), boneyard 10-ft space \$10 (open), \$15 (covered). Bob Butler, W4RBB, 770-579-9420: fax 770-973-1423; w4rbb@arrl.net; or Elliott Kanter, W4PGI, 770-815-1570; w4pgi@arrl.net; qsl.asti.com/hootch/KARC-HamF.html.

<sup>†</sup>**Illinois (Grayslake)**—Mar 23; set up 6 AM; public 8 AM to 2 PM. *Spr:* North Shore RC. Lake County Fairgrounds, Rtes 120 and 45; 4.4 miles W of Hwy 94, on Rte 120. Radio, electronics, and computer swapfest; VE sessions (9 AM to noon); free parking; refreshments. *TI:* 147.345 (107.2 Hz), 146.52. *Adm:* advance \$5, door \$7 (under 12 free). Tables: wall \$25, non-wall \$20. Jacob Fishman, NEØNS, 834 Bach St, Northbrook, IL 60062; 847-291-4160; jaf@lwt.net; www.ns9rc.org.

**†Illinois (Sterling)—Mar 16;** set up Saturday 6-9 PM, Sunday 6 AM; public 7:30 AM. Spr: Sterling-Rock Falls ARS. Challand Middle School Gymnasium, 1700 6<sup>th</sup> Ave; LeFevre Rd E to 6th Ave. Large indoor flea market, vendors, radio and electronics items, VE sessions (walk-ins; CW testing at 8 AM and 8:30 AM; written exams 9-11 AM), self-contained mobile homes, free parking, refreshments. *Tl:* 146.85 (114.8 Hz). Adm: advance \$4, door \$5. Tables: \$7 (bring your own drop cords and carts). Lloyd Sherman, KB9APW, c/o SRFARS, Box 521, Sterling, IL 61081-0521; 815-336-2434; lsherman@ essex1.com; www.sterling.hamfest.com

†Indiana (Michigan City)—Mar 22; set up 5 AM; public 8 AM to Noon. Spr: Michigan City ARC. Michigan City High School, 8466 Pahs Rd; from 1-94 take Exit 34, go N on Hwy 421; or from 1-80 take Exit 39, go N on Hwy 421 to Kieffer Rd, go E to Woodland Ave, go N to Pahs Rd (4-way stop), go E from there for ¼ mile, School is on S side of Pahs Rd. Vendors, free parking, refreshments. *TI*: 146.97 (131.8 Hz). *Adm:* \$5. Tables: \$1 per ft (limited electricity \$2). Ron Stahoviak, N9TPC, 5802 N 400 W, Michigan City, IN 46360; 219-325-9089; rstahoviak@adsnet.com; home.attbi.com/~w9ly.

†**Iowa (Council Bluffs)—Mar 2**, 9 AM to 2 PM. Spr: South West Iowa ARC. Travelodge Motel, 24th and N Streets; from I-80 go N on I-29 for 3½ miles to Exit 55 (25th St), go 1 block E to Travelodge. *TI*: 146.82. Adm: \$3. Tables: \$5 (includes 1 admission). Rich Swig, WAØZQG, 2306 Rolling Hills, Council Bluffs, IA 51503; 712-256-7775; wa0zqg@yahoo.com; www.k0swi.org.

**Iowa (Sioux City)—Mar 29**. Jerry Huldeen, WBØT, 712-274-1371.

†**Kentucky (Elizabethtown)—Apr 5**, set up Friday 6-9 PM, Saturday 6 AM; public 8 AM. *Spr:* Lincoln Trail ARC. Pritchard Community Center, 404 S Mulberry St; take Exit 94 off I-65, S on US 62 (US 62 same as Mulberry St); will be on right after you cross Hwy 31W and before you get to 31W Bypass. Vendors, forums, VE sessions (registration 9:30-10 AM, testing 10 AM to Noon, \$12 fee; Archie, AF4EB, **amack1@btel.com**), refreshments, free coffee. *TI*: 146.98. *Adm:* advance \$4, door \$5. Tables: 6-ft \$7 (with chair). Leon Priest, N4TFK, Box 342, Vinegrove, KY 40175; 270-351-4721; n4tfk@arrl.net; www.qsl.net/ltarc/.

Maine (Lewiston)—Mar 28-29, Maine State Convention. See "Coming Conventions."

Maryland (Timonium)—Mar 29-30, Maryland State Convention. See "Coming Conventions."

†Massachusetts (Amherst)—Mar 9; set up 7 AM; public 9 AM. Spr: Mount Tom Amateur Repeater Assn. Amherst Regional Middle School, 170 Chestnut St; from Mass Pike Exit 4 take Rte 91 N to Exit 19 (Rte 9), take Rte 9 to Amherst Center, at light in Amherst Center take left and proceed through several lights, take right onto Chestnut St (just past Bank), School on left. Vendors, tailgating (\$5), VE sessions (10 AM, preregistration strongly recommended; Dave Cote, WA1DC, wa1dc@arrl.net), commercial license testing (Steve, N1SR, 413-593-6554), handicapped parking, refreshments. TI: 146.94, 145.13 (123.0 Hz). Adm: \$5, under 12 free. Tables: 8-ft \$15. Bob Meneguzzo, K1YO, 3 Dairy Ln, Southwick, MA 01077; 413-569-0320; k1yo@ arrl.net; www.mtara.org.

†Michigan (Highland/Milford)—Apr 5, 8 AM to 1 PM. Spr: Milford ARC. Milford High School, 2380 Milford Rd; from I-96 take Exit 155, go N through the village of Milford, go 7.2 miles, turn left into High School N parking lot. Swap-n-Shop, Amateur Radio gear, computers, electronics, refreshments. *TI*: 146.55. Adm: \$5, under 12 free. Tables: \$1 per ft. Rose Mary Moore, KC8NQJ, 1383 Sylvan Dr, Hartland, MI 48353; 810-632-5174; www.qsl.net/w8ydk.

†Michigan (Marshall)—Mar 15; set up 6 AM; public 8 AM to 3 PM. Sprs: Southern Michigan ARS and Marshall High School Industrial Arts Club. Marshall High School, 701 N Marshall; I-94 to Exit 110, go S on old US-27 to North Dr, go E on North Dr, 2 blocks to school. 42nd Annual Michigan Crossroads Hamfest, vendors, free parking, refreshments. *TI*: 146.66, 146.52. *Adm*: advance \$4, door \$5. Tables: \$1 per foot (plus admission; minimum 4 ft, reserved until 8 AM). John Malinowski, N8BGM, 20577 Division Dr, Marshall, MI 49068; 269-781-4540; **n8bgm** @aol.com.

†Minnesota (St Paul)-Mar 29, 7:30 AM to 1 PM. Spr: Robbinsdale ARC. Concordia University Gangelhoff Center, 235 Hamline Ave; I-94 to Snelling Ave, S to Concordia Ave, E to Hamline Ave. Indoor Swapmeet, new and used equipment, commercial exhibitors, vendors, electronics, computers, hardware, software, components, VE sessions (registration required; Denny Ackerman, KBØOQQ, 651-769-0358; kb0oqq@arrl.net), handicapped accessible, free parking. TI: 146.7 (127.3 Hz). Adm: advance \$6, door \$8 (under 15 free). Tables: advance \$25 (by Mar 15), \$35 (after Mar 15, subject to availability); electricity \$30 extra. Terry Johnson, KCØJMG, Box 22613, Robbinsdale, MN 55422; 763-537-1722; k0ltc@visi.com; www.k0ltc.org.

†Missouri (Joplin)—Apr 4-5; set up Friday Noon to 9 PM, Saturday 6-8 ÅM; public Friday 6-9 PM, Saturday 8 AM to 3 PM. Spr: Joplin ARC. John Q. Hammons Convention Center, 3615 Range Line Rd; from I-44, Exit 8-B (Business US 71), right at first traffic light (36th St), go ¼ mile E, next door to Holiday Inn. Flea market, commercial vendors, dealers, VE sessions (register at 1 PM, testing at 1:30 PM sharp; \$12 fee), Breakfast (7 AM, with ARRL Midwest Division Director Wade Walstrom, WØEJ), forums, Keynote Luncheon (Noon, with ARRL International Affairs VP Rod Stafford, W6ROD), DXCC card checking. TI: 147.21. Adm: advance \$5, door \$6, under 12 free when accompanied by adult. Tables: private \$10, commercial \$20. Make checks payable to Joplin ARC and send with SASE by Mar 15 to J. C. Alexander, K5DMI, c/o JARC, Box 2983, Joplin, MO 64803-2983; 417-206-2339; westham62@hotmail.com; www. joplin-arc.org/.

Nebraska (Norfolk)—Mar 21-22, Nebraska State Convention. See "Coming Conventions."

**†New Hampshire (Henniker)—Mar 9**; set up 7 AM; public 8 AM to 1 PM. *Spr:* Contoocook Valley RC. Henniker Community School, 15 West-

ern Ave (near Concord); I-89 N to Exit 5 (left exit), follow Rtes 202 and 9 to Henniker, take Rte 114 Exit (New England College), turn left at end of ramp, go down hill, turn right at flashing light, School is 5th building on left. VHF presentations (Chip Taylor, W1AIM), current ARRL and FCC news (ARRL New England Division Director Tom Frenaye, K1KI), VE sessions (registration 9 AM, testing 9:30 AM; Dexter Howe, KY1M, 603-938-2955; \$12 fee), ARES EmComm Level 1 Course, refreshments. *TI*: 146.895 (100 Hz). *Adm*: \$3 (2 for \$5). Tables: \$10 (additional tables \$8 each; do not bring tables). Shawn Upton, KB1CKT, HCR 64, Box 688, Wilmot, NH 03287; 603-927-6012; **kb1ckt@arrl.net; www.qsl.net/k1bke**.

†New Jersey (Clinton)—Mar 15; set up 6 AM; public 8 AM to 2 PM. Spr: Cherryville Repeater Assn. North Hunterdon Regional High School, on Rte 31 (1 mile S of I-78); Exit 15 (eastbound) or Exit 17 (westbound) off I-78, take Rte 31 S to High School on right. Indoor flea market, vendors, new and used radio equipment, computers, parts and accessories, DXCC QSL Field Checking, VE sessions (preregistration requested; Marty Grozinski, W2CG, 908-788-2644 before 10 PM), SKYWARN Session, club table, handicapped accessible, free parking, refreshments. *TI:* 147.375. Adm: \$6. Tables: \$15 (electricity \$5 extra). Barry Campbell, W2CGX, 91 Old Croton Rd, Flemington, NJ 08822; 908-788-9153 or 908-788-4080; w2cra@qsl.net; www.qsl.net/w2cra.

**†New York (New Windsor)—Apr 5**; set up 6 AM; public 8 AM to 1 PM. *Spr:* Orange County ARC. Temple Hill School, 525 Union Ave; I-84 to Exit 7-S (Rte 300 S), take 300 S to 8th traffic light, turn left onto Union Ave, School is ½ mile on right. Tailgating (\$9, 8-ft space), VE sessions (8-11 AM), ARRL table, free parking, refreshments. *TI:* 146.76 (100 Hz). *Adm:* \$5 (nonham spouses and under 12 free). Tables: 7½-ft \$14 (advance only, by Apr 3); you supply table \$9. Ed Moskowitz, N2XJI, 123 Harold Ave, Cornwall, NY 12518; 845-534-3492; **n2xji@arrl.net; www.bestweb.net/~ocarc/**.

North Carolina (Charlotte)—Mar 8-9, Roanoke Division Convention. See "Coming Conventions."

†North Carolina (Kinston)—Mar 23; set up Saturday 4-9 PM (overnight security provided), Sunday 6 AM; public 8 AM to 3 PM. Spr: Down East Hamfest Association. Lenoir County Fairgrounds, Fairgrounds Rd; Hwy 11 S, follow signs from US 70 E. Indoor flea market, tailgating, VE sessions (11 AM; walk-ins only), meetings (ENC Traffic Net, SKYWARN), free parking, refreshments. *TI*: 146.685, 145.21. Adm: advance by Mar 15 \$4 (3 for \$10), door \$5 (3 for \$12). Tables: 8-ft \$10 (electricity \$5). Doug Burt, W4OFO, Box 1778, Kinston, NC 28503; 252-524-5724 (after 6 PM); **jeanhd@icomnet.com**.

<sup>7</sup> **Ohio** (Madison)—Mar 23, 8 AM to 2 PM. Spr: Lake County ARA. Madison High School, 3100 Burns Rd; I-90 to Rte 528 (Exit 212), go N to Middle Ridge Rd, turn left to Burns Rd, follow signs to High School. 25th Annual Hamfest/ Computerfest; flea market; vendors; new and used Amateur Radio, computer, and assorted electronics equipment; VE sessions; paved parking, refreshments. TI: 147.21. Adm: \$5. Tables: 6-ft \$8 (2 6-ft tables for \$15), 8-ft \$10. Roxanne, 440-209-8953 (leave message); roxanne@lcara.org; hamnet.org/lcara.

†Ohio (Maumee/Toledo)—Mar 16, 8 AM to 2 PM. Spr: Toledo Mobile Radio Assn. Lucas County Recreation Center, 2901 Key St; S of Heatherdowns and N of Anthony Wayne (SR 25); Exit 6 off I-475/US 23, turn right onto Dussel Dr, go E to Key St. Hamfest/Computer Expo, all indoors (2 large heated halls), ham radio equipment, computers, software, shareware, electronic parts, free parking, refreshments. *TI*: 147.27. *Adm*: \$6, (under 12 free with adult). Tables: \$20-\$25 (depending on location within building). Brian Harrington, WD8MXR, 4463 Holly Hill Dr, Toledo, OH 43614; 419-385-5624; wd8mxr@ arrl.net; www.tmrahamradio.org.

Oklahoma (Claremore)—Mar 14-15, Oklahoma Section Convention. See "Coming Conventions." Ontario (Brampton)—Mar 22. Victoria Svatina,VA3VJS, 905-455-4625. †Pennsylvania (Butler)—Mar 15, 8 AM to 3 PM. Spr: Butler County ARA. Butler Twp Park, 468 S Duffy Rd; Rte 8, go W on Hansen Ave, left on Whitestown Rd, left on S Duffy, go about 1 mile, Park on right. "Science Fair" for Hams, table-top exhibits, lectures, on-air stations. *T1*: 147.36. *Adm:* Free. Kevin Berry, KF4RMA, 380 Three Degree Rd, Renfrew, PA 16053; 724-586-1182; kf4rma@ arrl.net; www.qsl.net/w3udx.

†Pennsylvania (Greensburg)—Mar 2, 8 AM to 2 PM. Spr: Foothills ARC. Fire Department Hall (Hose Co No 1), 10 McLaughlin Dr; Rte 66 N of Greensburg, turn right onto Old Salem Rd, turn right onto McLaughlin Dr. Refreshments. TI: 147.18 (131.8 Hz). Adm: Free. Tables: \$10 (8-ft table space). Larry Gaebel, WA3TLT, 42 Mohawk Rd, Greensburg, PA 15601; 724-834-7137; or Al Compton, N3LQX, 724-523-3727; N3LQX1@ msn.com; www.geocities.com/foothills007/.

†Pennsylvania (Monroeville)—Mar 23, 8:30 AM to 3 PM. Spr: Two Rivers ARC. Al Monzo's Palace Inn, intersection of Rtes 22 and 48, at Turnpike; from E or W take PA Turnpike (I-76) to Exit 6 (Monroeville), take Business 22 ramp, turn left at traffic light, go 200 feet, Palace Inn on left; from N or S take PA Turnpike Rte 48 to Monroeville, Palace Inn is at intersection of Rtes 22 and 48. Hamfest/Computer Show, forums, VE sessions. *TI*: 146.73, 147.12. *Adm*: \$5. Tables: \$20. Bill Hetrick, N3LQC, 696 King St, McKeesport, PA 15132; 412-751-1937; n3lqc@ attbi.com; www.qsl.net/w3oc/hamfest.htm.

Tennessee (Knoxville)—Mar 1. Paul Baird, K3PB, 865-986-9562.

†**Tennessee (Tullahoma)—Mar 29**; set up Friday 4 PM, Saturday 6:30 AM; public 8 AM. *Spr:* Middle Tennessee ARS. Tullahoma Business Incubator, 412 Wilson Ave; I-24 to Exit 111, take Hwy 55 S for 12 miles to Hwy 41A N, at 4th traffic light take left onto Wilson Ave, go ½ mile to building on right. Vendors, tailgating, forums (ARES, MARS, APRS, ARRL TN Section), VE sessions, refreshments. *T1*: 146.7 (114.8 Hz), 146.82. *Adm:* \$5. Tables: \$10. Jimmy Floyd, NQ4U, c/o MTARS, Box 932, Tullahoma, TN 37388; 931-393-0095; **nq4u@bellsouth.net**; or Larry Marshall, WB4NCW, 931-968-0650; **www.qsl.net/mtars/events/hamfest.htm**.

†**Texas (Brenham)—Mar 15**, 8 AM to Noon. Spr: Brenham ARC. Washington County Fairgrounds (Food Service Building), 1305 E Horton Loop (also known as FM 577); just N of Hwy 290 and 105 Horton Loop. Flea market, commercial vendors, dealers, onsite camping. *TI*: 147.26. Adm: Free. Tables: \$10. Dan Lakenmacher, N5UNU, 10312 Hwy 36 N, Brenham, TX 77833; 979-836-8739; **Ilakenmacher@yahoo.com**; www. alpha1.net/~barc.

†**Texas (El Paso)—Feb 22,** 8 AM to 4 PM. *Spr:* El Paso ARC. Club House, 2100 San Diego; from E exit I-10 at Cotton, go to traffic light, turn right on Cotton, go to top of hill, Club House on right; from W exit I-10 at Dallas, turn left at stop sign, turn right at Wyoming, turn left on Cotton, go to top of hill, Club House on right. Indoor tables, outdoor tailgating (\$10), electronics, antennas and accessories, refreshments. *TI:* 146.7, 162.2, 444.2 (100 Hz). *Adm:* Free. Tom Stripling, WB5QLR, 6805 Toluca Dr, El Paso, TX 79912; 915-833-3901; wb5qlr@excite.com; www.qsl.net/w5es.

†**Texas (Irving)—Mar 8**, 8 AM to 2 PM. Spr: Irving ARC. Betcha Bingo Hall, 2420 W Irving Blvd No 125; State Hwy 183 E/W at Story Rd Exit, go S to Irving Blvd, cross intersection southbound, behind Eckerd's Drugstore. All indoors, VE sessions. *TI*: 146.72 (110.9 Hz). Adm: advance \$3, door \$4. Tables: advance \$8, door \$10. Coleta Taylor, KD5QFH, c/o Irving ARC, Box 153333, Irving, TX 75015-3333; 972-579-9089; kd5qfh@ arrl.net: www.irvingarc.org.

Texas (Midland)—Mar 15-16, Texas State Convention. See "Coming Conventions."

†**Texas (Weatherford)—Mar 22.** ARC of Parker County. Texas National Guard Armory, 716 Charles St; I-20 to Weatherford (N or S), Exit at 406 on Bowie, go N to 4-way stop sign, turn right on Charles. New and used equipment, VE sessions, refreshments. *TI*: 146.64. *Adm*: advance \$4, door \$5. Tables: \$10. James Adams, AD5KG, 4500 Old Springtown Rd, Weatherford, TX 76085; 817-341-1979; ad5kg@arrl.net.

†West Virginia (Charleston)—Mar 15, 9 AM to 3 PM. Spr: Charleston Area Hamfest and Computer Show. West Virginia National Guard Armory, 1707 Coonskin Dr; take Greenbrier Exit off 1-64/77 towards airport, veer right past airport exit, at traffic light turn left onto Coonskin Dr, Armory is ¾ mile on left. VE sessions. TI: 145.35, 146.52. Adm: \$5. Tables: \$5. William H. (Jack) Kibler, Jr., K8WMX, Box 916, St Albans, WV 25177-0916; 304-722-3150; k8wmx@juno.com.

†Wisconsin (Jefferson)—Mar 16; set up 7 AM; public 8 AM to 1 PM. Spr: Tri-County ARC. Jefferson County Fairgrounds Activity Center, Hwy 18 W. Vendors, VE sessions (9 AM, on site), refreshments. Tl: 145.49. Adm: \$4. Tables: 8-ft space \$6. John Satterlee, WA9SAB, 213 Frederick St, Ft Atkinson, WI 53538; 920-563-6381 (eves); fax 920-563-9551; jsatt@ticon.net; or tricountyarc@ globaldialog.com; www.cmdline.com/tcarc/.

<sup>†</sup>Wisconsin (Milwaukee)—Apr 4-5; Friday 2-7 PM, Saturday 8:30 AM to 3 PM. Spr: Amateur Electronic Supply. AES Headquarters, 5710 W Good Hope Rd. "AES Superfest," all indoors, 35 major manufacturers, forums, 15-20 area clubs represented, VE sessions, special guest Gordon West. Adm: Free. Ray Grenier, K9KHW, 5710 W Good Hope Rd, Milwaukee, WI 53223; 414-358-4088; **rayk9khw@aol.com**; www.aesham.com.

#### Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as donated ARRL publications, handouts, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111. Or send e-mail to giannone@arrl.org.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to advertise your event in *QST* at special rates. Make your hamfest a success by taking advantage of this great opportunity. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

### STRAYS



These two new ham stamps are from the Republic of San Marino. They were issued on the occasion of the November meeting of the International Amateur Radio Union Region 1.

#### QST Congratulates . . .

♦ John Pinckney, WD4EBY, who has been elected state chair of MADD Virginia (Mothers Against Drunk Driving). John has been involved with the organization since he was injured in a DWI crash in 1994. In addition, John has also been appointed by Governor Mark Warner to his Task Force to Combat Driving Under the Influence of Drugs and Alcohol.—Laurie Fraley, MADD Virginia

♦ Olin Boyer, W5LNK, of Tulsa, Oklahoma, who at age 70 sat for—and passed—all four Amateur Radio exam elements at a single test session recently.—*Gerald Carlburg, K50KE* 

### **CONTEST CORRAL**

#### Feedback

In the photo in the 2002 June VHF QSO Party results, the call sign of **N5QYC** was inaccurately reported as N5QYX.

In the 2002 IARU HF World Championships, **KI7WX** should be shown as the 9th place finisher among W/VE stations in the Top 10 boxes with a score of 528,504. **HG6N** was reclassified to Multioperator and placed 4th in that category with a score of 2,794,930. This moves **UA9AM** into 1st place in the World Single Operator Mixed mode category and moves **N2NU** into 10th place in same category. Because the **OE1XHQ** Headquarters station was required to use separate call signs, there was an error in counting their multiplier total. Their final score should read \$698,722, with 7955 QSOs and 366 multipliers, moving them to 13th place among HQ stations.

W1AW Qualifying Runs are 10 PM EST Thursday, March 6, and 7 PM EST Thursday, March 20. The K6YR West Coast Qualifying Run will be at 9 PM PST Wednesday, March 12. Check the W1AW Schedule for details.

#### Mar 1-2

ARRL International DX Contest—Phone— 0000Z Mar 1-2400Z Mar 2 (see Dec *QST*, p 95 or www.arrl.org/contests/rules/2003/intldx.html). DARC 10-Meter Digital "Corona"—RTTY/ AMTOR/PACTOR/PSK31/Clover, sponsored by Deutscher Amateur Radio Club from 1100Z-1700Z Mar 2 (see Nov *QST*, p 102, or www.darc.de/ referate/dx/).

#### Mar4

Spartan Sprint—CW—sponsored by the Adventure Radio Society from 0200Z-0400Z Mar 4 (Monday evening in the US). Held on the first Monday of every month. Frequencies (MHz): 3.560, 7.040, 14.060, 21.060, 28.060 (QRP calling frequencies). Categories: SO. Exchange: RST, SPC, and power output. Score: "Skinny" division—total QSOs / total station weight, "Tubby" divisions—total QSOs. For more information—www.natworld. com/ars/pages/spartan\_sprints/ss\_rules.html. Logs due Wednesday after the contest via the ARS Web site or to hjohnc@core.com.

#### Mar 8-9

**RSGB** Commonwealth Contest—CW—sponsored by the RSGB from 1000Z Mar 8-1000Z Mar 9. Open to British Commonwealth stations only, work stations once per band outside your own call area. HQ stations may be worked by everyone and count as a separate call area. Frequencies: lower 30 kHz of 80-10 meters. Categories: SO—open (fulltime), —restricted (12 hrs max), Headquarters— MO and SO, no spotting assistance. Scoring: 5 pts/ QSO, 1st 3 QSOs with a call area count 25 pts. For more information—www.rsgbhfcc.org/. Logs due April 7 to commonwealth.contest.logs@ **rsgbhfcc.org** or G3UFY, 77 Bensham Manor Rd, Thornton Heath, Surrey CR7 7AF, England.

**UBA Spring Contest**—CW—from 0700Z-1100Z Mar 9 (see Jan *QST*, p 97 or **www.uba.be**).

Wisconsin QSO Party—Phone/CW—sponsored by the West Allis RAC from 1800Z Mar 9-0100Z Mar 10. Frequencies (MHz): CW—3.550, 3.705, 7.050, 14.050 and 15-2 meters, Phone—3.890, 7.230, 14.290, 21.350, 28.400 and 6/2 meters, no repeater QSOs. Categories: SO, MS, MM, and Mobile. Mobile operators may not sit on a county line to operate. Exchange: SPC or WI county. QSO Points: Phone—1 pt, CW—2 pts. Score: Pwr mult × QSO pts × WI counties (max 72), WI stations— QSO pts × WI counties + SPC. WI mobiles/portables add 500 bonus points for each county with 12 or more QSOs. Power multiplier: ×2 (<5 W), ×1.5 (<150 W), ×1 (>150 W). For more information—www.warac.org. Logs due April 10 to Wisconsin QSO Party, West Allis Radio Amateur Club, PO Box 1072, Milwaukee, WI 53201.

North American RTTY Sprint, sponsored by NCJ from 0000Z-0400Z Mar 9. Frequencies 80-20 meters. North American stations work everyone; others work NA stations only. Exchange both call signs, serial number, name, and SPC. The same station can be worked multiple times provided 3 contacts separate the contact in both logs, regardless of band. QSY rule: Stations calling CQ, QRZ, etc, may only work one station in response to that call; they must then move at least 1 kHz before working another station or 5 kHz before soliciting another call. Once you are required to QSY, you may not make a new QSO on the previous frequency until you have made a contact at least 1 or 5 kHz (as required) away. For more informationwww.ncjweb.com. Logs due 30 days after the contest to rttysprint@ncjweb.com. Check Web site for expected changes to contest manager and log submission addresses.

#### Mar 15-17

BARTG Spring RTTY Contest-sponsored by the British Amateur Radio Teledata Group from 0200Z Mar 15-0200Z Mar 17. Frequencies: 80-10 meters. Categories: SO-Expert, SOSB, SOAB (one band change per 5 min), MS, MM, and SWL. SO operate 30 hours total with off periods of 3 hours min. Operators with a Top 10 log during the past three years must enter as an Expert. Exchange: three-digit serial number and four-digit time. Multipliers: DXCC entities + W/VE/JA/VK call areas, counted once per band. Score: QSOs × multiplier x continents (count only once). For more information—www.bartg.demon.co.uk/. Logs in Cabrillo format due May 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 John Barber GW4SKA, PO Box 611, Cardiff, CF24 4UN, Wales (only logs with <50 QSOs may be submitted as printed logs).

**Russian DX Contest**—CW/SSB—from 1200Z Mar 15-1200Z Mar 16. Frequencies: 160-10 meters. Categories: SOAB –HP and –LP (<100 W), SOSB (Mixed HP only), MS (Mixed HP only, 10 minute rule), SWL, SO may enter Mixed Mode, CW, or SSB, MO and SWL are Mixed only, Club/Team competition. Exchange: RS(T) + serial number, RU stations—RS(T) + Oblast designator. QSO points: own entity—2 pts, different entity, same continent—3 pts, diff. cont.—5 pts, with Russians—10 pts. Multiplier: DXCC entity + Oblasts, count once per band. Score: QSO points × multiplier. For more information—www.rdxc. org. Logs due 45 days after the contest to rusdxc@contesting.com or to Russian DX Contest, PO Box 88, 123459 Moscow, Russia.

Virginia QSO Party—Phone/CW—sponsored by the Sterling Park ARC 1800Z Mar 15-0200Z Mar 17. Frequencies (MHz): CW—1.805 and 50 kHz up, Phone—1.845, 3.860, 7.260 14.270, 21.370 28.370, Novice/Tech—28.370, VHF/UHF— 50.125, 144.200, 146.58, 223.50, 446.00. No repeater or cross-mode QSOs. Categories: SO, MS, MM fixed station and Mobile. Exchange: serial number and SPC or VA county/city. QSO Points: Phone—1pt, CW—2 pts, VA Mobile—3 pts. Score: QSO Points × VA city/counties + SPC (counted only once). VA mobiles add 100 pts per VA city/county activated. Add 500 pts for QSO with K4NVA. For more information—www.qsl. net/sterling. Logs due April 15 to ks4ii@arrl.net or Virginia QSO Party, Call Box 599, Sterling, VA 20167.

Montana QSO Party—Phone/CW/Digital sponsored by the Flathead Valley Amateur Radio Club from 2300Z Mar 15-2300Z Mar 16. Frequencies: 160-10 meters, no categories or time limit. Exchange: RST and SPC or MT county. If a station changes counties, it can be worked again. Score: QSOs × SPC + MT counties (counted only once). Logs due April 15 to **k7lyy@arrl.net** or **rosscons@digisys.net** or FVARC, 117 Rainbow Dr, Kalispell, MT 59901.

YL International Single Sideband System QSO Party—Phone (see Feb *QST*, p 103, or www.qsl. net/yl-issb/).

#### Mar 22-23

Oklahoma QSO Party—Phone/CW/Digital sponsored by the Oklahoma DX Association (OKDXA) from 13002 Mar 22-1300Z Mar 23. Frequencies: 160-10 and 6 meters and higher, no repeater contacts, operate 18 hours max. Categories: SOHF-HP (>100 W), -LP, -QRP (<5 W), SO-VHF, MS, MM, Rover (OK only). Exchange: serial number and SPC or OK county. QSO points: Phone—2 pts, CW/Digital—3 pts. Score: QSO points × OK counties (OK stations use States + Provinces), counted only once. For more information—www.okdxa.org. Logs due April 30 to k5yaa@okdxa.org (ADIF or CABRILLO format preferred) or OKDXA, PO Box 2591, Claremore, OK 74018-2591 (<100 QSOs only).

CLARA and Family HF Contest-Phone/CWsponsored by the Canadian Ladies ARA, from 1700Z Mar 22-1700Z Mar 23. Frequencies (MHz): CW-14.033, 21.033, 7.033, 3.688, Phone-28.300, 21.225, 14.120 14.285, 7.033, 7.200, 3.750, 3.900, work CLARA and YL stations once per band/ mode. Cross-mode contacts count as phone for both stations. Categories: SO only, no time limit. Exchange: RS(T), name, QTH, and whether CLARA member, Family member, non-member YL, or OM. QSO Points: 5 pts for CLARA members, 2 pts for CLARA family members, 3 pts for non-CLARA YLs, 1 pt for OMs. Multipliers are VE provinces and DXCC entities (only if QSO with YL) counted only once. Score: QSO points × multipliers. For more information—CLARA\_YL.tripod.com. Logs due April 23 to ve7vpe@rac.ca or Paulette Schouten, VE7VPE, c/o VECTOR, 3301 East Pender St, Vancouver, BC V5K 5J3, Canada.

#### Mar 24

Spring QRP Homebrewer Sprint-CW/ PSK31—sponsored by New Jersey QRP Club from 0000Z-0400Z Mar 24 (Monday in the U.S.). Frequencies: QRP CW and PSK31 frequencies on 80-10 meters, CW and PSK31 are considered separate bands. Exchange: RST + SPC + Output Power. QSO Points: 2 pts for QSOs made with Commercial Equipment, 3pts for Homebrew Xmtr or Rcvr, 4 pts for Homebrew Xmtr+Rcvr or Xcvr, 5 pts for Homebrew PSK31 station, kits are okay for homebrew. Score: QSO Points × SPC (counted once per band) × power multiplier. Power Multiplier: 0-250 mW =  $\times 15$ , 250 mW-1 W =  $\times 10$ , 1-5 W =  $\times 7$ , >5 W =  $\times 1$ . For more information www.njqrp.org/data/qrphomebrewersprint. html. Logs due 30 days after the contest to n2cq @arrl.net (text only) or Ken Newman, N2CQ, 81 Holly Dr, Woodbury, NJ 08096.

#### Mar 29-30

CQ WW SSB WPX Contest—SSB—sponsored by CQ Magazine, from 0000Z Mar 29-2400Z Mar 30 (CW is May 24-25). Frequencies: 160-10 meters. Categories: SOAB, SOSB, SO-Assisted, -HP, LP, and -QRP, MS (10-min rule), MM, SO-Rookie, SO-Tribander-and-Single-Wire, SO-Band-Restricted. SO operate 36 hours max with off times at least 60 min. Exchange: RS(T) + serial number. QSO Points: different continents—3 pts (14-28 MHz) and 6 pts (1.8-7 MHz), with North America— 2 pts (14-28 MHz) and 4 pts (1.8-7 MHz), with own country—1 pt. Score: QSO points × prefixes worked (ie, N8, KA1, HG73, JD1) counted only once. For more information—home.woh.rr.com/wpx/. Logs due May 1 (CW, July 1) to wpxsb@kkn.net (wpxcw@kkn.net).

H. Ward Silver, N0AX

22916 107th Ave SW, Vashon, WA 98070 🔶 n0ax@arrl.org

## **SPECIAL EVENTS**

Marion, OH: Marion Amateur Radio Club, W8GVB. 1500Z-2300Z Mar 1. Ohio Bicentennial 1803-2003. 28.360 14.260 7.260. Certificate. Richard Carey, KB80TZ, 5211 Berry Rd, Marion, OH 43302.

Tallahassee, FL: Tallahassee Amateur Radio Society, K4TLH. 1500Z-2200Z Mar 1. Challenger Learning Center opening with ham astronauts. 28.450 14.250 7.240. QSL. K4TLH, Tallahassee Amateur Radio Society Inc, 911 San Luis Rd, Tallahassee, FL 32304.

Arlington Heights, IL: Peace Corps ARC, KA9NLX. 1800Z Mar 1-2200Z Mar 3. To honor American Peace Corps Volunteers around the world. 28.450 21.375 14.325 7.283. Certificate. John Paskevicz, 1423 N Ridge Ave, Arlington Hts, IL 60004.

Wasilla, AK: Matanuska Amateur Radio Association, KL7JFU. 1800Z Mar 1-one day after the end of the race, about Mar 21. 31st running of the Iditarod Sled Dog Race. 160-6 m voice, CW and PSK-31 28.460 21.315 14.250 7.290. QSLs and certificates. MARA, PO Box 873131, Wasilla, AK 99654. lelbak@yahoo.com.

Brainerd, MN: Brainerd Area Amateur Radio Club, WØUJ. 1500Z-2300Z Mar 8. Annual Antique Snowmobile Rendezvous. 28.450 21.350 14.250 7.250. Certificate. BAARC, PO Box 801, Brainerd, MN 56401.

St Clairsville, OH: Eastern Ohio Amateur Wireless Association, K8O. 1500Z Mar 15-2359Z Mar 16. Celebrating Ohio's 200th Birthday. 14.250 7.050 3.550 145.210. QSL and certificate. Russ Landers, WB4ZKO, 67474 Willow Grove Rd, St Clairsville, OH 43950.

Arleta, CA: Canterbury Elementary School ARC,

WØR. 1600Z Mar 17-2300Z Mar 21. Establishment of a Wonder of Reading Library at Canterbury. 28.400 28.200. Certificate. NN6RK/WØR, 13670 Montague St, Arleta, CA 91331.

Norfolk, VA: Swift Boat Sailors Association, N4S. 1700Z Mar 20-2359Z Mar 23. Reunion of US and Vietnamese Sailors serving on Swift Boats. 28.550 21.300 14.250 10.110. QSL. Bob Shirley, KF5DX, 7 Darr Rd, Heath, TX 75032. pcf45.com/n4s.htm.

New Port Richey, FL: Gulf Coast Amateur Radio Club, K4C. 0000Z Mar 20-2400Z Mar 30. 81st Annual Chasco Fiesta in West Pasco County, Florida. 28.450 21.350 14.250 7.250. Certificate. Gulf Coast Amateur Radio Club, Chasco Fiesta, PO Box 595, New Port Richey, FL 34656-0595. East Hampton, NY: Peconic ARC, W2AMC. 1400Z-2100Z Mar 22. Suffolk County Lighthouse Day. 14.270 7.270. Certificate. Peconic ARC, W2AMC, PO Box 113, Peconic, NY 11958. Macon, GA: Macon Amateur Radio Club, W4BKM. 1500Z-2200Z Mar 22. 21st Annual Cherry Blossom Festival. 14.240 21.335 7.055 14.055. Certificate. Macon ARC, PO Box 4862, Macon, GA 31208.

Virginia Beach, VA, and Moss, Norway: Virginia Beach Amateur Radio Club, Inc and Mossegruppen av NRRL, W4UG and LA5M. 1300Z Mar 22-2200Z Mar 23. 112th Anniversary of the Norwegian Lady statue. 14.278 14.040 7.280 7.040. Certificate. VBARC, PO Box 62003, Virginia Beach, VA 23462.

**Baton Rouge, LA:** USS *Kidd* ARC/Baton Rouge ARC, W5KID. 1500Z-2300Z **Mar 29**. 25th anniversary of the release of the movie "Run Silent, Run Deep." General class bands, 14.250 to 14.320; CW QRP subbands. QSL. W5KID, c/o USS *Kidd*Museum, 305 S River Rd, Baton Rouge, LA 70802.
Del Mar, CA: Desert Pacific Council of Boy
Scouts of America, WB6BSA. 1700Z-2359Z Mar
29. Helping Boy Scouts earn radio merit badges
at scout fair. 28.390 21.360 14.290 7.270. QSL.
Scout Ham Radio, Desert Pacific Council, BSA, 1207 Upas St, San Diego, CA 92103.

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a  $9 \times 12$  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 May QST would have to be received by Mar 1. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (events@ arrl.org) to ARRL HQ. 057~

#### Maty Weinberg, KB1EIB 🔶 events@arrl.org

### **NEW BOOKS**

#### THE FRIENDLY IONOSPHERE: SIGNALS, NOISE AND PROPAGATION

By Crawford MacKeand, WA3ZKZ/ VP8CMY

Published by Tyndar Press, PO Box 236, Montchanin, DE 19710, tel 302-994-9588. First edition, 2001, softcover, 6×9 inches. ISBN 0-9659066-5-5. \$14.95 + s/h.

#### Reviewed by John Stanley, K4ERO

♦ A professional engineer and long time amateur operator and experimenter, Crawford MacKeand has obviously spent a great deal of time learning about the workings of the ionosphere. The reference section of this book, which alone could justify the price for some readers, contains most everything there is to know about ionospheric propagation as it affects HF ham operations. Crawford extracts from this huge body of information enough concepts, data and formulas to allow him to write a quite useful freeware program, SNAPmax, which one can use to estimate real time conditions on any HF band, based on realistic details of the equipment on both ends of the circuit and prevailing ionospheric conditions.

Most of the book is dedicated to setting forth the underlying equations used in *SNAPmax* and explaining in very brief form what they mean. Make no mistake, this is not a book for the novice. Before even considering working through this text, one should master the HF

propagation sections of *The ARRL Handbook* and *The ARRL Antenna Book* or read some other book intended for the beginner. For those who are far enough along to successfully use software for propagation predictions, and especially for those who want to understand the limitations of such a program as well as its underlying math, MacKeand's book may be what you need.

Having outlined the method, the author then uses it for some detective work. Most interesting to me was a look at how Marconi spanned the Atlantic just over 100 years ago—if indeed he did do so. An analysis of radio logs from Amelia Earhart's final flight is also mined for clues, and several typical ham paths are tested for usefulness of the HF bands. These examples, like the book, are not for the faint-hearted. The



Earhart example is especially technical.

One cannot evaluate the book without also looking at the SNAPmax itself which, while available as standalone freeware, can also be purchased (on a 3.5 inch floppy) with the book. This program of medium size and sophistication, quite intuitive in its use, and available at little or no cost, is probably a good choice for many hams. It will not do all that VOACAP, for example, will do, but is much easier to learn. I tested the program on three paths with which I am very familiar. The prediction seemed overly optimistic for a short davtime path on 75 meters. The SNAPmax MUF algorithm missed the best time for 6 meter openings from Quito to W4. VOACAP did well with both of those paths. Neither SNAPmax nor VOACAP predicted the well known early morning stateside-to-VU long path opening. In spite of the above failures, SNAPmax will give the less-experienced ham a good starting point to look for band openings. For a free program that only half fills a floppy, that is not bad. As with all propagation programs, one must compare on-air experience with the results of the mathematical model to learn where its limits and biases are. SNAPmax is worth a look, even if you are not yet ready to buy the book. Thanks to WA3ZKZ for all the hard work involved in Q57~ making it available.

### AT THE FOUNDATION

### New Scholarship to Fund Full Undergraduate College Education

The ARRL Foundation, Inc, is happy to announce the Goldfarb Memorial Scholarship, a major scholarship award that will provide full funding for the undergraduate college education for one fortunate student-ham beginning in 2003. One student among all applicants who have submitted their applications by our *Goldfarb Scholarship deadline of March* 15, 2003 will be selected to receive this prestigious award.

#### The Goldfarb Memorial Scholarship

The award, endowed through the generosity of William R. Goldfarb, ex-N2ITP, in memory of his parents Albert and Dorothy Goldfarb, is intended exclusively for educational use, to provide assistance with costs of tuition, room, board, books and/or fees essential to the advanced education of the recipient.

Applicant requirements:

1) Applicant must have applied to an accredited baccalaureate degree granting institution beyond the high school level and hold an FCC Amateur Radio operator license.

2) Students must plan to major in an undergraduate program in a businessrelated area, computers, medical or nursing, engineering or the sciences.

3) The scholarship grant will cover the college education for the selected applicant's undergraduate college career to the extent of the funds available.

4) Application forms, as provided by the ARRL Foundation, must be submitted prior to February 1 for the academic year beginning in September of that year. (For 2003, the initial year, the Goldfarb deadline will be March 15.)

5) The applicant should financially need a scholarship to acquire a college education. A copy of their Free Application for Federal Student Aid (FAFSA) Student Air Report (SAR—www.fafsa. ed.gov/) must be included with the scholarship application (www.arrl.org/arrlf/ Goldappl.html) and transcripts.

6) Academic merit, financial need and a demonstrated interest in promoting the Amateur Radio Service will be considered highly important in selecting a recipient. Current academic transcripts should be attached to the application.

The ARRL Foundation Scholarship Committee shall consider all applicants. The decision of the Committee, upon acceptance by the Foundation Board of Directors, is final.

#### Award

The William R. Goldfarb Scholarship as administered by the ARRL Foundation

The Jesse Bieberman Meritorious Membership Fund

Joseph G. Muench, W7NKA Steel City ARC, Inc (Pennsylvania) in fond memory of Lavern Peters, KA3EXO

#### **Contributor's Corner**

France L. Muench, in loving memory of

Richard A. Maloney, Richard C. and

Eleanor M. Johnson, in fond memory of Edward C. Kimpton, K1AAO George A. Huff, in loving memory of

Greg Lapin, N9GL, in fond memory of Anne Diamond, N9QFP

George O. Huff, W9UPC Rowan ARS (North Carolina) in fond memory of Henry "Grady" Withers, Jr, K4BEC Howard Huntington, K9KM

The General Fund

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

Peter H. Putman, KT2B, in fond memory of Michael DiJulio, WB2BWJ Wade Walstrom, WØEJ

ceremony and presentation.

The Martin J. Green, Sr, K2TEO Memorial Scholarship Fund Martin J. Green, Jr, K2PLF, and Patty Green, N6WHB

may be a perpetual scholarship, with

grant amounts to come from annual in-

come earned by the fund. The scholar-

ship may include funds for transportation

and lodging for the scholarship winner

to attend an ARRL convention awards

The Bill Orr Technical Writing Award Fund Stephen Cornell, K4AHA

The Paul and Helen L. Grauer Scholarship Fund C. W. Chong

The Barry Goldwater Scholarship Fund C. W. Chong

As received and acknowledged during the months of November and December.

Q57~

### **NEW PRODUCTS**

#### MOBILE LOGGING SOFTWARE FOR YOUR POCKET PC

♦ Designed for hams on the move, *MobileLog* v1.0 has been released for the PocketPC. The software is a full-featured ham radio logging package designed for devices running *Windows CE* 



3.x, including PDAs such as the Compaq iPAQ, Casio Cassiopeia, HP Jordana and the Toshiba Genio-e.

Designed by Patrick Rundall, NØHR, *MobileLog* offers ADIF import and export (sync your PDA log with your desktop logging package); call sign searching; DXCC reports by band or mode; beam heading and distance; customizable colors; county tracking; online help and more.

Price: \$29.99. For more information, point your Web browser to **n0hr.tripod. com** or **www.n0hr.com**.

### STRAYS



Jake Fishman, NEØNS, of the North Shore Radio Club (www.ns9rc.org) assists 8-year-old Max Geifman, of Northbrook, Illinois, with his first QSO during the Kid's Day event in early January at Chicago's Adler Planetarium. Max's parents are N9RSR and N9NSA, and his grandfathers are KBØKRO and K9APE.

# 2002 September VHF QSO Party Results

all the ARRL VHF contests, the September VHF QSO Party always holds the most surprises. In June the only real question is how much E skip we will get and which regions of the country will be smiled upon by the propagation gods and which will not. The January VHF SS is still the premier club competition event and produces the highest amount of activity but invariably yields the worst propagation conditions. The major question is how severely ice and snow will curtail rover activity and detune antennas. Conditions in the September contest can vary from great to terrible. All kinds of propagation are possible but not necessarily guaranteed by any means. The equinoxes are a prime time for aurora; the fall season is the best for tropospheric ducting of all kinds; and even E<sub>s</sub> on 6 meters occurs every few years.

Let's see how this contest has fared in the past several years. Last year in 2001 the East Coast was blessed with a superb tropo opening extending from the Canadian Maritimes to the Carolinas and northern Georgia. Multiplier and QSO records were set in most classes and microwave contacts were made over distances hundreds of kilometers longer than normal. And the West Coast-Hawaii duct to KH6HME on Mauna Loa was open. While conditions were flat in the year 2000, in 1999 we had short selective tropo openings from Florida and in the Midwest. 1998 brought an excellent tropo opening in the Midwest extending into the Appalachians, which would have been truly

spectacular had the contest been two days earlier; 6 meter  $E_s$  in several areas of the country; good tropo conditions in the Pacific Northwest; and transequatorial propagation from the southern tier of states into South America on 6 meters. 10 band VUCCs were possible. 1997 featured strong north/south openings in the Midwest and 1996 had its share of 6 meter  $E_s$ from the southern states to both coasts.

So what about 2002? Was it a treat or a treatment?

#### 2002 Summary

Given the interesting propagation at least somewhere during the past several years, perhaps we were due for a flat year. The propagation gods were looking the other way in 2002. Every single region reported absolutely unenhanced conditions. The only advantage to this is that the contest gives you the chance to see what you can do without any help from conditions. This kind of data is not easy to get and provides the contester with a baseline against which to judge all his

#### Expanded Results, Line-Score Printout 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 selfaddressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington, CT 06111. Please be sure to include the contest name and year. other efforts. Let's see what happened.

This year 534 logs were submitted compared to the 553 logs submitted last year. This continues the slow decline in September contest logs, which began in 1997 when a record 752 entries were made. Most notable is a reduction of 16 single operator low power entries and 9 Single Operator portables (19 vs 28 last year-32% of the total). On the other hand rover entries increased to 63 from 52 last year (+21%). The reasons for the overall drop in submitted logs are not clear but appear to have little to do with band conditions. Entries in 1998 and 2001, both years with excellent propagation, were fewer in number than the immediately previous years, which featured much inferior conditions.

#### The National Scene

One might have expected the top scores in the single and multioperator categories would be found along and within reach of the East Coast in a contest with no enhanced propagation, but that was not necessarily the case. After trying for 17 years, Dave, K1RZ, is the top single operator high power winner over perennial SOHP winner Jeff, K1TEO. Later in this article, look to see how Dave does it with equipment and antennas that are far from the superstation category. Central Region stalwart, Bob, K2DRH, takes the single operator low power category by 20 k points over WSJT author Joe, K1JT. No question that Bob's multiple stacked antennas do put him in the superstation category. Since the inception of the Single Operator Portable category last year, the winner has

Top Ten											
Single Ope	rator.	Single Ope	erator,	Single Ope	rator Portable	Limited M	Limited Multioperator		rator	Rover	
Low Power		High Powe	r	K6MI	31.155	<b>K3YTL</b>	366,886	W2SZ	1,690,106	ND3F/R	260,820
K2DRH	145.924	K1RZ	303,226	KA6AMD	12,737	NC1I	306,775	K8GP	1,415,598	W3IY/R	177,656
K1JT	125,481	K1TEO	273.033	KG4LEV	8.883	W4IY	286,000	N3EMF	884,070	N2JMH/R	109,250
WB1GQR	79.764	K3DNE	205,920	N8XA	8,085	AA4ZZ	196,270	W2FU	702,402	AB5SS/R	96,472
(W1SJ. or	) )	KMØT	183,222	KD7TS	4,292	W3SO	176,176	K1WHS	589,656	KC3WD/R	94,200
AF1T	62.662	WB9Z	159,782	WN8ATM	4,040	K2BAR	144,720	N2PA	333,830	N7CFO/R	88,200
K5MA	55,447	W4RX	156,999	WB2AMU	2,604	N2NK	142,830	W9ICE	158,465	NØDQS/R	87,840
K4TO	53,250	K2SMN	141,197	W7ZOI	1,512	W4NH	121,935	W2EA	127,762	W7DHC/R	63,640
W3KJ	51,183	K1GX	116,748	(KA7EXM	(qo .	K8CC	84,528	N8KOL	110,357	KD4DSX/R	51,005
WB2SIH	45,733	K8TQK	103,224	NŻIR	1,420	N8ZM	76,692	W6TOI	81,536	N6DN/R	50,052
AI3Z	44,160	WA2FGK	101,470	KT4GG	1,406						
KB8U	43 848		, -		,						

Regional	Results

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime	Southeast Region (Delta, Roanoke and Southeastern Divisions)	Central Region (Central and Great Lakes Divisions; Ontario Section)	Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba	West Coast Region (Pacific, Northwestern and Southwestern Divisions;
And Quebec Sections)           K1JT         125,481         A           WBIGOR         79,764         A           (W1SJ, op)         AF1T         62,662         A           AF1T         62,662         A         K1RZ         303,226         B           K1TEO         273,033         B         K3DNE         205,920         B           WB2AMU         2,604         Q         K3YTL         366,886         L           NC11         306,775         L         W3SO         176,176         L           W2SZ         1,690,106         M         N3EMF         884,070         M           W2FU         702,402         M         K1WHS         589,656         M           ND3F         260,820         R         N2JMH         109,250         R	K8WW         30,030         A           W40ZK         18,760         A           W40ZK         18,760         A           KU4R         18,750         A           W4RX         156,999         B           K4QI         81,312         B           K2UOP         52,658         B           KE8FD         46,529         B           KG4LEV         8,883         Q           W4IY         286,000         L           AA4ZZ         196,270         L           W4NH         121,935         L           K8GP         1,408,875         M           W3IY/R         177,656         R           KC3WD         94,200         R           KF4VZQ         24,225         R           N40FA/R         23,580         R	K2DRH         145,924         A           K4TO         53,250         A           KB8U         43,848         A           WB9Z         159,782         B           K8TQK         103,224         B           K8MD         81,840         B           K9EA         62,609         B           N8XA         8,085         Q           WN8ATM         4,040         Q           K8CC         84,528         L           N8ZM         76,692         L           W9ICE         158,465         M           N8KOL         110,357         M           K9RN         73,042         M           VE30IL/R         43,616         R           K0PG/R         34,164         R           KB9TLV         32,504         R	and Saskatchewan Sections)           WW2R         32,830         A           K05HF         27,202         A           K40PQW         20,828         A           W3XO         19,680         A           KM0T         183,222         B           N0URW         41,540         B           W0GHZ         30,072         B           N7QF         230         Q           KC0P         105         Q           NØRPM         5,070         L           KAØMR         7,021         M           WØKVA         3,380         M           AB5SS/R         96,472         R           NØDQS/R         87,840         R	Alberta, British Columbia and NWT/Yukon Sections)           K7MI         26,424           KC6ZWT         23,826           W6OMF         15,004           KTKISK         32,452           W6KBX         23,324           W6KBX         23,324           K76KI         31,155           Q         KA6AMD           K77S         4,292           KF6KDA         19,769           K7UI         19,530           W6TOI         81,536           VA7ISL         45,522           MOFOI         81,536           WATISL         45,522           MOFOI         88,200           WTOHC/R         63,640
- ,				

been John, K6MI, operating this year from a new location in DM06 on the eastern slopes of the High Sierras. His 31 k point score not only wins the category over another West Coast station, Eric, KA6AMD, but is larger than any other Western Coast Region score except one, regardless of power, a stellar achievement. Also see the "How Do They Do It?" section to get a look at his station.

K3YTL, the Murgas ARC in the rare FN11 grid, takes the Limited Multioperator class again. In a close battle for second place, the crew at Frank's station, NC1I, edged out Woodbridge Wireless operating as W4IY from Flagpole Knob in VA. The MGEF (W2SZ) on Mt Greylock, MA wins the perennial Multioperator class battle again over the Grid Pirates (K8GP) on Spruce Knob, WV, this time by about 270 k points out of nearly 1.7 million. Both of these big stations were more than 1100 OSOs down in 2002; K8GP was 120 multipliers less and W2SZ 143 multipliers less. If you are interested in how these behemoths produce the scores they do, visit the Web report at www.arrl.org/membersonly/contests/results/2002/Sept-VHF/.

The Rover class was a bright spot. Rover log submissions were up and rovers often provided a source of activity in many areas that kept the contest interesting. The battle for the top two spots continued between Brian, ND3F, and Bill, W3IY, with Brian again the winner. The next four places were closely bunched starting with N2JMH followed by AB5SS in Texas, East Coast newcomer KC3WD, and N7CFO in the Pacific Northwest. You can get a more detailed look at the AB5SS rover station later in this article.

#### **Regional Highlights**

Regional scores are summarized in the

Affiliated Club Competition				
	Score	Entries		
Medium Category				
Potomac Valley Radio Club	2,983,936	28		
North East Weak Signal Group	1,623,831	21		
Rochester VHF Group	1,210,631	10		
Society of Midwest Contesters	469,901	9		
Northern Lights Radio Society	386,739	19		
Mt Airy VHF Radio Club	263,474	10		
South Jersey Radio Assn	253,607	3		
Pacific Northwest VHF Society	232,894	14		
Badger Contesters	188,675	13		
Yankee Clipper Contest Club	124,399	9		
Mad River Radio Club	116,282	3		
Downey ARC	100,256	3		
Western States Weak Signal	52,607	5		
Lawton Fort Sill ARC	13,841	6		
West Park Radiops	7,454	3		
Frankford Radio Club	7,212	3		
Local Category				
Delaware Valley VHF Society	67,079	4		
ARA of Southwest Florida	9,741	4		

table above. A more complete version and a detailed breakdown by Divisions are available in the Web report.

**Northeast.** In addition to the scores already mentioned, several highly competitive scores emerged from the Northeast including SOHP K3DNE (FM19); LM W3SO (FN00); and KD4DSX/R. There were a number of several hundred thousand point multioperator scores as well: N3EMF (FM19) from the former K3MQH site; W2FU (FN13); and K1WHS (FN43).

**Southeast.** Top SOHP scorer in this region was W4RX (FM19) who finished #6 nationally. Other notable efforts included K4QI (FM06); K2UOP (FM09); and KE8FD (EM84), a recent transplant from central Ohio. In addition to W4IY, LMs AA4ZZ (EM96) and W4NH (EM85) turned in excellent scores from NC as did KC3WD/R in the greater Washington, DC/Baltimore area and west.

**Central.** In the SOHP class WB9Z (EN60) bested K8TQK (EM89), respec-

tively #5 and #9 nationally. K8CC (EN82) edged N8ZM (EM79) in the LM category and W9ICE (EN60) bested N8KOL (EN80) although both finished in the top 10 nationally. VE3OIL/R was the top dog over K9ILT/R, KØPG/R and KB8TLV/R in a close race.

**Midwest.** KMØT easily won the top SOHP spot with his #4 national showing, an outstanding performance from EN13. WW2R edged out KØSHF, KAØPQW and W3XO in a close SOLP race. Less than 10 k points separated the Texas team of AB5SS/R and N5DF and inveterate plains rover NØDQS/R.

West Coast. Close single operator contests in both power classes saw SOLP K7MI (CN83) edging KC6ZWT and W6OMF; and K6TSK (DM03) overcoming W6KBX and KE7SW. LM KF6KDA (DM06) squeaked past K7UI by only 239 points! Meanwhile W6TOI (DM04) took the multioperator category over VA7ISL and AD6IJ. Substantial rover scores were produced by N7CFO/R over W7DHC/R and N6DN/R.

#### Affiliated Club Competition

The number of participating clubs increased from 13 in 2001 to 20 this September. The Potomac Valley Radio Club (almost 3 meg points), perhaps energized by the close race last year, extended its margin over the Northeast Weak Signal Group (1.6 meg) and the Rochester VHF Group (1.2 meg) in the race for the Medium Category gavel. The PVRC did it with big scores: 3 stations in the SOHP top 10, three of the top 10 rovers and two top 10 multiops. The Local Category gavel went to the Pacific Northwest VHF Society with 232 k points, posting an easy victory over the Delaware Valley VHF Society.



The antenna system of SOHP winner K1RZ is arrayed on a single 60 foot tower.

At right, AB5SS (left) and W5DF (right) in back of the AB5SS rover. Some of the extensive antenna system can be seen in the truck bed including multiple Yagis and the microwave dish.



#### How Do They Do It?

K1RZ. Dave is living proof that you can actually win the single op portion of the VHF contest with a station that the HF contesters would call a little pistol. Located at 740 feet elevation on a ridge just north of Damascus, MD in FM19jg, Dave has assembled a versatile and highly competitive high power VHF+ station without falling at all into the superstation category. Dave is equipped through 10 GHz except for 3.4 GHz with near legal limit power on the bottom 4 bands and anywhere from 200 mW to 250 W on the microwaves. Transceivers and IF strips include an FT920, FT726, FT736 and FT100D. The impressive thing is the modest antenna system: single modest linear or loop Yagis except for the 4 looper system on 2.3 GHz and a 2 foot dish on 5.7 and 10 GHz (see photo). Dave's success is no secret: his exceptional operating skill and a good location toward the high population centers to his northeast.

**K6MI**. Previously a member of various portable VHF multiops, John has recently taken to entering the Single Operator Portable category from a variety of locations in the Pacific Division. This September he was located at Bear Mountain, a 3000 foot peak 35 miles east of Fresno, CA in DM06ir. Operating from a van with batteries, solar panels and a small generator for power, John has



The K6MI Single Operator Portable station.

equipment and antennas for all bands through 10 GHz except for 5.7 GHz. Antennas are small beams mounted on an Armstrong rotated 20 foot push-up pole that fits through the roof of the van. John must be doing something right because he makes a score equal to or greater than anyone else on the West Coast, regardless of power.

AB5SS. The rover class has produced

substantial scores in almost every part of the country. With almost 100 k points, John, AB5SS, is the highest scoring non-East Coast rover this September. John and his second operator Dan, W5DF, covered 11 grids in Texas and Oklahoma from EM20 to EM04. Operating a route in the flatlands, John and Dan concentrated on tracking fixed stations like W5LUA, WW2R and W3XO in TX, OK and LA with multiband capabilities, especially on the microwaves. The emphasis is on reliability and rapid installation/removal. This rover is equipped to be operated both while stopped and in motion by using a combination of small linear and loop Yagis, a dish and a pair of KB6KQ loops. John comments that increased activity fostered by both the North Texas Microwave Society and the Roadrunners Microwave Group has really improved life for Texas-based rovers.

#### **Next Year**

The next September VHF contest will be held on September 13 and 14. What will happen? Tropo openings? Aurora? A little E skip? Who will win this time? Can K1RZ defend his SOHP title against K1TEO and what about WA8WZG? Will ND3F defend his rover title? Can K8GP dethrone W2SZ? Will K6MI capture another SO Portable title from still another grid square? Join in the fun and find out.

# The 2002 ARRL 10 GHz and Up Contest Branch Manager

hy in the world would some hams rack their brains and spend their time, money or energy to operate on 10 GHz and higher frequencies?

The challenges of being successful on the microwave amateur bands pretty much speak for themselves. There are no high hourly QSO rates. The thrills come from being able to complete a QSO in a world where tenths of a dB make a real difference. Personal satisfaction comes from being able to squeeze an additional kilometer of distance out of your equipment.

Though small in number there was record participation during the 2002 ARRL 10 GHz and Up Contest. Held during the weekends of August 17-18 and September 21-22, a record 134 entries were received. In fact participation in this event has grown an outstanding 76% over the past five years.

#### A First Time Experience

Mark, KI7N, was a first-time participant and really exhibits the sense of adventure seen among the microwave crowd. Mark stressed that participation didn't begin at the start of the event. Rather, "For me, the start of the 10 GHz and Up Contest is marked by my attendance at a North Texas Microwave Society meeting in the spring of 2002, several months before the contest began. I had always been interested in operating at 10 GHz and above, but I

Top 10 Scores					
Call Sign	Score	Call Area	Call Sign Score Call Area		
10 GHz c	only		10 GHz and Up		
XE2/ W6YLZ KK6MK NØIVN AA6IW AD6IW KR7O AD6A N9JIM N6XQ	112,975 66,515 66,331 59,701 59,134 49,929 47,610 43,623 41,573	DX 6 0 6 6 6 6 6 6	KØRZ         105,666         0           AD6FP         100,654         6           W6QI         74,018         0           WD4MUO 66,810         0         0           NØUGY         62,049         0           W60VJ         32,471         6           N1JEZ         25,564         1           WA6NIA         22,438         6           KA10J         22,098         1           W1FKF         20,554         1		
KE6HPZ	41,506	6			

#### **Entries by Call Area**

Call Area	Entries	Call Area	Entries
Ø	18	6	41
1	25	7	5
2	3	8	8
3	3	9	1
4	7	VE	10
5	9	DX	4



Dennis, WA6NIA, working 24 GHz in the Santa Ynez Valley, CM94wo, while Doug, K6JEY, looks on.

#### Expanded Results, Line-Score Printout 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 selfaddressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington, CT 06111. Please be sure to include the contest name and year.

#### Best DX by Bands

10 GHz Only	Category		
WA]\6CGR	1100	AD6A	891
XE2/W6YLZ	1100	N6LL	891
KE6HPZ	941	AA6IW	891
KK6MK	915	N6XQ	817
W6QIW	896	N6CA	792
10 GHz and U	p Category		
10 GHz	,	W6HCC	244
WA6JBD	986	WA1MBA	205
WA6NIA	960	N1JEZ	205
W6OYJ	916	W1FKF	205
WA6QYR	900	W1RIL	205
AD6FP	819	W6QI	204
W6QI	609	AD6FP	204
N1JEZ	522	W4SW	100
K4EFD	442		
AB5SS	419	47 GHz	
W5LUA	418	K4EFD	102
		W4SW	90
24 GHz			
KØRZ	246	300+ GHz	-
NØUGY	246	NGIZW	8
WD4MUO	246	WB6IGP	8

never quite got there."

With some fine Elmering, he was able to make his first foray into a new aspect of our hobby. Mark's comments also sound a universal tone in assessing his adventure. "Getting on the air for this contest proved to me that one can get on 10 GHz with simple equipment, and a great deal can be learned along the way," he said. "Much was learned about microwave circuit topology, assembly techniques, and 10 GHz propagation." Sounds like a challenge accepted and well met.

Visit the ARRL On-line Soapbox for the contest at **www.arrl.org/contests/ soapbox** where you will find interesting comments from other neophyte and seasoned competitors.

#### Results

Leading the pack in the 10 GHz-only category was Michael, W6YLZ, operating portable in XE2 and surviving some equipment problems, was able to break the 100 k point barrier and take top honors with a score of 112,975. He worked 44 different stations and completed the best distance QSO on 10 GHz with Dave, WA6CGR, at 1100 km. A photo finish for second place involved Rex, KK6MK, who edged out Ron, NØIVN, by a mere 184 points. Rex parlayed his West Coast advantage to work 33 different call signs and had a best distance QSO of 915 km while Ron used his Colorado OTH altitude to work 17 different stations with a best distance of 277.

In the 10 GHz and Up category, another tight race developed between a Colorado and California station combo, this time with the altitude topping the population density. Bill, KØRZ, and Gary, AD6FP, both topped the 100 k point level. Gary worked the highest total of different call signs between these two competitors, but Bill was able to take first place on the basis of about 8 k more distance points. This was helped by Bill's top 24 GHz distance QSOs with John, WD4MUO, and Don, NØUGY.

The 2003 ARRL 10 GHz and Up Contest will be held the weekends of August 16-17 and September 20-21. Perhaps you will find yourself like Dennis, WA6NIA, another first-time participant. Dennis summed up his experience this way: "What an introduction to microwave contesting! This was my first 10 GHz and Up contest and I spent both weekends on 10 GHz NB and managed to make several QSOs on 24 GHz SSB as well. What a thrill!"

#### ANAHEIM, CA (Near Disneyland) 933 N. Euclid St., 92801 (714) 533-7373 800) 854-6046 Janet, KL7MF, Mgr. anaheim@hamradio.com

BURBANK, CA 2416 W. Victory Bl., 91506 (818) 842-1786 800) 854-6046 Eric, KA6IHT, Mgr. Victory Blvd. at Buena Vista 1 mi. west I-5 burbank@hamradio.com

OAKLAND, CA 2210 Livingston St., 94606 (510) 534-5757 Mach, K6KAP, Mgr. I-880 at 23rd Ave. ramp oakland@hamradio.com

SAN DIEGO, CA 5375 Kearny Villa Rd., 92123 (858) 560-4900 800 854-6046 Tom, KM6K, Mar. Hwy. 163 & Claremont Mesa sandlego@hamradio.com

SUNNYVALE. CA 510 Lawrence Exp. #102 94085 (408) 736-9496

(800) 854-6046 Mark, WI7YN, Mgr. So. from Hwy. 101 sunnyvale@hamradio.com

**NEW CASTLE. DE** (Near Philadelphia) 1509 N. Dupont Hwy., 19720 (302) 322-7092 644-4476 Rick, K3TL, Mgr. RT.13 1/4 mi., So. I-295 newcastle@hamradio.com

PORTLAND, OR 11705 S.W. Pacific Hwy. 97223 (503) 598-0555 800) 854-6046 Leon, N7IXX, Mgr.

Tigard-99W exit from Hwy. 5 & 217 portland@hamradio.com

DENVER, CO 8400 E. Iliff Ave. #9, 80231 (303) 745-7373 444-9476 Joe, KDØGA, Mgr. John, N5EHP, Mgr. denver@hamradio.com

PHOENIX, AZ 1939 W. Duniap Ave., 85021 (602) 242-3515 444-9476 Gary, N7GJ, Mgr. 1 mi. east of I-17 phoenix@hamradlo.com

ATLANTA, GA 6071 Buford Hwy., 30340 (770) 263-0700 Mark, KJ4VO, Mgr. Doraville, 1 mi. no. of I-285 atlanta@hamradio.com

WOODBRIDGE, VA (Near Washington D.C.) 14803 Build America Dr. 22191 (703) 643-1063 Steve, N4SR, Mgr. Exit 161, I-95, So. to US 1 woodbridge@hamradio.com

SALEM, NH (Near Boston) 224 N. Broadway, 03079 (603) 898-3750 (800) 444-0047 Chuck, N1UC, Mgr.

Exit 1, I-93: 28 ml. No. of Boston salem@hamradio.com



R

FT-817 HF/VHF/UHF TCVR

Compact 5.3" x 1.5" x 6.5", 2.6 lbs

9.6v Nicad or 8 AA battery capable

**Call Now For Low Pricing!** 

FT-2800M 2M Mobile

65w • Ruggedly Built
 Alpha Numeric Memory System

Direct Keypad Frequency Entry

VX-7R/VX-7R Black

· Wideband RX - 900 Memories

5W TX (300mw 220Mhz)

. Fully Submersible to 3 ft.

· Internet WIRES compatible

Now available in Black!

**Great Price, Call Today!** 

Built-in CTCSS/DCS

50/2M/220/440 HT

. Li-Ion Battery

Bullet-proof Front End

VX-5R/VX-5RS

Wideband RX • 6M-2M-440TX

· 220 mems, opt. barometer unit

FT-50RD

2M/440mHz Compact HT

Alpha numeric display

Wide Band receive

. DVR, Decode, Paging Built-in

Battery Saver • 112 Mems

Mil-Spec
 HiSpeed scanning

**Call For Your Low Price!** 

**COAST TO COAST** 

UPS - Most Items Over \$100

**Rapid Deliveries From** 

**The Store Nearest To You!** 

5W output
 Li-Ion Battery

 Alpha Numeric Display · CTCSS/DCS built-in

**Call For Low Price!** 

50/2M/440HT

5W @13.8V ext DC • USB, LSB, CW, AM, FM

built in CTCSS/DCS • TX 160-10M, 6M, 2M, 440

Packet (1200/9600 Baud FM) • 200 mems





#### FT-897 VHF/UHF/HF Transceiver HF/6M/2M/70CM • DSP Built-in

· HF 100W (20W battery) · Optional P.S. + Tuner



**Call Now For Low Intro Pricing!** 3/31/03

### FT-1000MP MKV HF Transceiver

• Enhanced Digital Signal Processing FT1000MP MKV Dual BX field unit 100w Collins SSB filter built-in w/built-in power 200W, External power supply supply in stock **Call For Low Price!** 



### FT-100D HF/6M/2M/70CM Transceiver

 Compact Transceiver w/detachable front panel Rx 100kHz to 970mHz (cell blocked)

- Tx 100W 160-6M, 50w 2M, 20W 70CM
- · Built-in DSP, Vox, CW keyer 300 Memories

### **Call Now For Low Pricing!**





FT-857

Ultra compact HF, VHF, UHF

WORLDWIDE DISTRIBUTION

- . 100w HF/6M, 50w 2M, 20w UHF
- DSP 32 color display · 200 mems · Detachable front panel (YSK-857 required)
- **Call for Low Intro Price!**



### FT-90R

2M/440 Mini Dualbander Transcelver

- 50w 2m, 40w 440mHz
- Wide Rx 
   Detachable Front Panel
   Packet Ready 1200/9600 Baud
- Built-in CTCSS/DCS Encoder/Decoder
- . Less than 4" wide!

#### **Call for Your Low Price!**


### 12 Store Buying Power!



CALL TOLL FREE Phone Hours: 9:30 AM – 5:30 PM 5:30 PM Closed Sun. Tolf free, incl. Navsal, Alasha Canada, call roleted to orarrest toting in HRD 800 House can assid you. If the first line year call is busy, you may call sentities

 West
 800-854-6046

 Mountain
 800-444-9476

 Southeast
 800-444-7927

 Mid-Atlantic
 800-444-4799

 Northeast
 800-644-4476

 New England
 800-444-0047

Look for the HRO Home Page on the World Wide Web http://www.hamradio.co

or the ne Page the ide Web amradio com AZ, CA, DO, GA VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

### ANAHEIM, CA

(Near Disneyland) 933 N. Euclid St., 92801 (714) 533-7373 (800) 854-6046 Janet, KL7MF, Mgr. anaheim@hamradio.com

BURBANK, CA 2416 W. Victory Bl., 91506 (818) 842-1786 (800) 854-6046 Eric, KA6IHT, Mgr. Victory Blvd. at Buena Vista 1 mi. west I-5 burbank@hamradio.com

OAKLAND, CA 2210 Livingston St., 94606 (510) 534-5757 (800) 854-6046 Mach, K6KAP, Mgr. I-880 at 23rd Ave. ramp oakland@hamradio.com

SAN DIEGO, CA 5375 Kearny Villa Rd., 92123 (858) 560-4900 (800) 854-6046 Tom, KM6K, Mgr. Hwy. 163 & Claremont Mesa sandieo@hamradio.com

SUNNYVALE, CA 510 Lawrence Exp. #102 94085 (408) 736-9496 (800) 854-6046 Mark, WI7YN, Mgr. So. from Hwy. 101 sunnyvale@hamradio.com

NEW CASTLE, DE (Near Philadelphia) 1509 N. Dupont Hwy., 19720 (302) 322-7092 (800) 644-4476 Rick, K3TL, Mgr. RT.13 1/4 mi., So. 1-295 delaware@hamradio.com

PORTLAND, OR 11705 S.W. Pacific Hwy. 97223 (503) 598-0555 (800) 854-6046 Leon, N7IXX, Mgr. Tigard-99W exit from Hwy. 5 & 217 portland@hamradio.com

DENVER, CO 8400 E. Iliff Ave. #9, 80231 (303) 745-7373 (800) 444-9476 Joe, KDØGA, Mgr. John N5EHP, Mgr. denver@hamradio.com

PHOENIX, AZ 1939 W. Dunlap Ave., 85021 (602) 242-3515 (800) 444-9476 Gary, N7GJ, Mgr. 1 mi. east of I-17 phoenix@hamradio.com

ATLANTA, GA 6071 Buford Hwy., 30340 (770) 263-0700 (800) 444-7927 Mark, KJ4VO, Mgr. Doraville, 1 mi. no. of I-285 atlanta@hamradio.com

WOODBRIDGE, VA (Near Washington D.C.) 14803 Build America Dr. 22191 (703) 643-1063 (800) 444-4799 Steve, N4SR, Mgr. Exit 161, I-95, So. to US 1 virginia@hamradio.com

SALEM, NH (Near Boston) 224 N. Broadway, 03079 (603) 898-3750 (800) 444-0047 Chuck, N1UC, Mgr. Exit 1, I-93; 28 mi. No. of Boston salem@hamradlo.com

#### ANAHEIM, CA (Near Disneyland) 933 N. Euclid St., 92801 (714) 533-7373

### Janet, KL7MF, Mgr. anaheim@hamradio.com

**BURBANK, CA** 2416 W. Victory Bl., 91506 (818) 842-1786 Eric, KA6IHT, Mgr Victory Blvd. at Buena Vista 1 mi, west I-5 rbank@hamradio.com

OAKLAND, CA 2210 Livingston St., 94606 (510) 534-5757 Mach, K6KAP, Mgr. I-880 at 23rd Ave. ramp oakland@hamradio.com

SAN DIEGO, CA 5375 Kearny Villa Rd., 92123 (858) 560-4900 Tom, KM6K, Mgr. Hwy. 163 & Claremont Mesa sandiego@hamradio.com

SUNNYVALE, CA 510 Lawrence Exp. #102 94085 (408) 736-9496 Mark, WI7YN, Mgr. So. from Hwy. 101 nyvale@hamradio.com

**NEW CASTLE, DE** (Near Philadelphia) 1509 N. Dupont Hwy., 19720 (302) 322-7092 Rick, K3TL, Mgr. RT.13 1/4 mi., So. I-295 newcastle@hamradio.com

PORTLAND, OR 11705 S.W. Pacific Hwy. 97223 (503) 598-0555 Leon, N7IXX, Mgr. Tigard-99W exit from Hwy. 5 & 217 portland@hamradio.com

DENVER, CO 8400 E. Iliff Ave. #9, 80231 (303) 745-7373 444-9476 Joe, KDØGA, Mor John, N5EHP, Mgr. denver@hamradio.com

PHOENIX, AZ 1939 W. Dunlap Ave., 85021 (602) 242-3515 444-9476 Gary, N7GJ, Mgr. 1 mi, east of I-17 phoenix@hamradio.com

ATLANTA, GA 6071 Buford Hwy., 30340 (770) 263-0700 Mark, KJ4VO, Mgr. Doraville, 1 mi. no. of I-285 atlanta@hamradio.com

WOODBRIDGE, VA (Near Washington D.C.) 14803 Build America Dr. 22191 (703) 643-1063 Steve, N4SR, Mgr. Exit 161, I-95, So. to US 1 woodbridge@hamradio.com

SALEM, NH (Near Boston) 224 N. Broadway, 03079 (603) 898-3750 Chuck, N1UC, Mgr.

Exit 1, I-93; 28 mi. No. of Boston salem@hamradio.com



WORLDWIDE DISTRIBUTION





### TH-D7A(G) 2M/440

· 2M/440 Dual Band

- · Built-in 1200/9600 Baud TNC APRS Compatible
- DX Packet Cluster Monitor
- · 200 Mems., CTCSS VC-H1 Messaging Control
- **Call Now For Low Pricing!**



TH-F6A 2M/220/440 Dual Chanel Receive . .1 - 1300 mHz Rx, FM, AM, SSB • 5w 2M/220/440 TX, FM • 435 Memories • Li-Ion Battery •





.

### TH-G71A 2m/440

- · 2m/440 Dual Band HT · 200 Mems
- PC Programmable
- . 6w 2m, 5.5w UHF @13.8 VDC
- Alphanumeric Display · CTCSS Built It
- · Backlit Keypad
- **Call For Low Price!**







### TM-V7A 2M/440Mhz

R

- 50W/35W 280 Mems Visual Scan
- Alpha Numeric Enc/Dec & Duplexer Built-in Computer Programmable 9600 Baud Ready Cool-blue Reversible LCD Backlit Mic

#### **Call Now For Low Price!**



### 100W HF, 6M, 2M 50W 70CM

- 10W 1.2 GHz w/optional UT-20 module
   IF Stage DSP Built-in TNC, DX packet cluster
- Backlit Front Key Panel



.... 0000 0 Great Low

Price

### TM-261A 2M Mobile

- 50W + Mid and Low Mil-Spec
- 61 Mem. Chanels
   Alpha Numeric Function
   Dual Menu, DTMF Memory
- Backlit mic & built-in encode
- **Call Now For Special Low Price!**

#### \$200 URBY expires Ē 5/31/02

#### -570DG/TS-570SG DSP Enhanced TS

- 100w HF, (100w on 6M TS-570SG only)
   QSK, CW Auto Tune Autotuner incl 6M
- DSP Large LCD Display Elect. Keyer
   RCP2 Radio Control Program Compatible
- **Call New For Your Low Price!**

Look for the **HRO Home Page** on the World Wide Web http://www.hamradio.com



#### TM-D700A 2M//440 Dualband

 50w VHF 35w UHF
 Opt. Voice Synthesizer · Receives 118-1300 mHz (cell blocked) · Remote Head Inst. only (kit included) · 200 Memories · Built In 1200/9600 baud TNC Advanced APRS Features Dx Packet Cluster

Tone Scan • GPS/VC-H1/PC Ports



### TS-50S HF Transceiver

- . TS-50S World's smallest HF trans. SSB, CW, AM, FM, • 12V Gen. Cov. RX,
   6.4 lbs., 7.16 x 2.4 x 9.32" • 100W out
- 105 db dynamic range, 100 Mems. · Opt. ext. ant. tuners available

#### **Call For Special Low Price!**



#### TM742AD 2M/440Mhz

- Optional 3rd band available 
   Back-lit mic
  - Up to 303 memories 101 per band
- PL Encode Built in Detachable front panel

COAST TO COAST

UPS - Most Items Over \$100

**Rapid Deliveries From** 

The Store Nearest To You!

**Call Now For Your Low Price!** 



#### T R U Y N P Ξ 0 -G 0 2 5





#### **KAM '98**

- · Single port VHF or HF
- RTTY, CW, Packet, GTOR, AMTOR, WEFAX
- GPS, NMEA-0183 compatible
- 6-16 VDC, DB-9 connector port
- **Call Now For Your Low Price!**



### KAM XL

- DSP modem offers great performance on Packet 300/1200,G-tor,Pactor, Amtor,PSK-31
- RTTY, Navtex, ASCII, Wefax, CW. GPS NMEA-0183 and more!

**Call Now For Special Pricing!** 



KPC-3 Plus/KPC-9612 Plus

High-performance, low power TNC. Great for packet, and APRS compatible. **Call For Special Low Price!** 



Detailed illuminated map shows time, time zone, sun position and day of the week at a glance for any place in the world.Continuously moving areas of day and night change as you watch Mounts easily on wall. Size: 34 1/2" x 22 1/2". Reg \$1295. SALE \$999.95

CALL TOLL FREE Phone Hours: 9:30 AM - 5:30 PM 5:30 PM Closed Sun Toll free, find, Hausdi, Alazha, Canada, can Idade You, if the tirret line, you call is busy, you may call another.	West.         800-854-604           Mountain         800-444-947           Southeast         800-444-792           Mid-Atlantic         800-444-792           Northeast         800-644-479           Northeast         800-644-479           Northeast         800-644-479           New England         800-444-004
---	---



Look for the **HRO Home Page** on the World Wide Web

MA-40 40' Tubular Tower REG. \$1007 SALE \$849.95 MA-550 55' Tubular Tower Handles 10 sq.ft. at 50mph Pleases neighbors with tubular streamlined look Reg.\$1704 SALE \$1399.95	NNNNNN
TX-4555 55 Freestanding Crank-Up Handles 18 sq. ft. ® 50 mph No guying required Extra-strength const. Can add raising and motor drive acces. Towers Rated to EIA Specifications Other Models at Great Prices! Ball \$1599.95	NNNHMM ANNNNNNHMM MAAA

ANAHEIM, CA (Near Disneyland) 933 N. Euclid St., 92801 714) 533-7373 800) 854-6046 Janet, KL7MF, Mgr anaheim@hamradio.com

BURBANK, CA 2416 W. Victory Bl., 91506 (818) 842-1786 800) 854-6046 Eric, KA6IHT, Mar. Victory Blvd. at Buena Vista 1 mi, west I-5 burbank@hamradio.com

OAKLAND, CA 2210 Livingston St., 94606 (510) 534-5757 (800) 854-6046 Mach, K6KAP, Mgr. I-880 at 23rd Ave, ramp oakland@hamradio.com

SAN DIEGO, CA 5375 Kearny Villa Rd., 92123 (858) 560-4900 (800) 854-6046 Tom, KM6K, Mgr. Hwy. 163 & Claremont Mesa sandiego@hamradio.com

SUNNYVALE, CA 510 Lawrence Exp. #102 94085 (408) 736-9496 (800) 854-6046 Mark, WI7YN, Mgr. So. from Hwy. 101 sunnyvale@hamradio.com

**NEW CASTLE, DE** (Near Philadelphia) 1509 N. Dupont Hwy., 19720 (302) 322-7092 (800) 644-4476 Rick, K3TL, Mgr. RT.13 1/4 mi., So. I-295 newcastle@hamradio.com

PORTLAND, OR 11705 S.W. Pacific Hwy. 97223 (503) 598-0555 (800) 854-6046

Leon, N7IXX, Mor. Tigard-99W exit from Hwy. 5 & 217 portland@hamradio.com

DENVER, CO 8400 E. Iliff Ave. #9, 80231 (303) 745-7373 (800) 444-9476 Joe, KDØGA, Mar. John, N5EHP, Mgr denver@hamradio.com

PHOENIX, AZ 1939 W. Dunlap Ave., 85021 (602) 242-3515 (800) 444-9476 Gary, N7GJ, Mgr. 1 mi, east of I-17 phoenix@hamradio.com

ATLANTA, GA 6071 Buford Hwy., 30340 (770) 263-0700 (800) 444-7927 Mark, KJ4VO, Mgr. Doraville, 1 mi. no. of I-285 atlanta@hamradio.com

WOODBRIDGE, VA (Near Washington D.C.) 14803 Build America Dr. 22191 (703) 643-1063 800) 444-4799 Steve, N4SR, Mgr. Exit 161, I-95, So. to US 1 woodbridge@hamradio.com

#### SALEM, NH (Near Boston) 224 N. Broadway, 03079 (603) 898-3750 (800) 444-0047 Chuck, N1UC, Mgr. Exit 1, 1-93: 28 mi. No. of Boston salem@hamradio.com

sales tax. Prices. specifications.

subject to change







PALSTAR INC. PIQUA,OH

Tel:1-937-773-6255 Email: palstar@erinet.com WEB Page : palstarinc.com : palstar.com

other products see PALSTARINC.COM

### Check out RADIOS-ON-LINE http://www.arrl.org/ads/RadiosOnline/ Buy, Sell or Trade gear FAST...VERY FAST

### & D Enterprises





VA10CS \$399 VA10 interfaced to a Yaesu VX-2000U commercial UHF xcvr. "Plug and Play'

> 1P \$69 A full-featured repeater controller. Small! 2" × 3.5"



BX1 \$129 A speaker level mixer. 6 inputs AVAILABLE IN MARCH-BX2 A mobile version of the BX1.

RCS16 \$129 DTMF remote controller for the Yaesu VXR-7000 repeater.

For more information on these products www.bdenterprises.com VISA Toll free (888) 280-8287

### **HP® GPS RECEIVER** DISCIPLINE CLOCK

\$249 (Org. list \$4,800)

ups

FedEx

Model: Z3801A® Refurbished. Supply is limited.)

- · Disseminating precise time and frequency (time acc.  $<1 \mu$ S)
- NIST traceable freq reference, 10 MHz
- · Manual and software included
- · 48V dc/600 mA power supply and GPS antenna available

### www.buylegacy.com info@buylegacy.com San Marcos, CA 760-891-0810 • 800-276-1010 Fax 760-891-0815

HP# and Z3801A# are registered trademarks of Hewlett Packard.



DL2K

### **ARRL** Publication VA10 \$179 A multi-function voice announcer/controller.

**Digital Sig** Processi Techno



"The amateur interested in advances in DSP and communication processing can learn from the excellent presentation of this needed material."

Dennis Silage, PhD, K3DS, Professor of Electrical & Computer Engineering, Temple University, Philadelphia, PA.

Introduction to DSP **Digital Sampling Computer Representations of Data Digital Filtering** Analytic Signals and Modulation **Digital Coding Systems for Speech**  **Direct Digital Synthesis Interference Reduction Digital Transceiver Architectures** Hardware for Embedded DSP Systems **DSP System Software** Advanced Topics in DSP, and more...

Digital Signal Processing Technology ARRL Order No. 8195 \$44.95\*

Contents:



**Digital Signal** Processing Technolog

**Order Toll Free** 1-888-277-5289 Mon.-Fri. 8 AM-8 PM

www.arrl.org/shop Or, contact us to locate a dealer near you.

\*shipping: \$8 US (UPS) **\$10 International** 

QST 3/2003

225 Main Street • Newington, CT 06111-1494 • USA tel: 860-594-0355 fax: 860-594-0303 e-mail: pubsales@arrl.org





There IS a Better Way!

### Plasti-Dip & Liquid Electrical Tape

Fair better than tape! Waterproofs and completely seals virtually anything Bectrically insulating U.V. resistant: Permanent and extremely durable Easily removed from non-porous surfaces Comes in several colors PlastiDp in Can or Spray for almost any application Liquid Tape in Can with self-applicator brush Thousands of other uses around the house Limited Time Offer Save 10% [Use Pricing Code "0ST203" when ordering]

Now offering RF Connectors, Adapters and Other Items!

### The K1CRA Radio WebStore www.k1cra.com

Phone: 716-662-7840/Fax: 240-282-7255

### The Hallicrafters Technical CD-ROM

#### **Over 120 Different Models**

Need info to repair or restore an old Hallicrafters. This CD has it all, transmitters, receivers and accessories for over 120 different models. Owners manuals & service data, historical info and more. Only \$ 89 postpaid USA

Over 50 other technical CD's - Sams, RCA, Collins Radio, Radiophile & Antique Radio Repair series and more. Ask for our catalog!

SCHEMATIC & MANUAL SERVICE BUREAU Over 300,000 schematics in stock - Call us!

2043 Empire Central - Dallas, Texas 75235 214-358-5195 - Fax 214-357-4693 We take all major credit cards Visit us @ http://www.radioera.com



Rapidan Data Sys., PO Box 418 Locust Grove, VA 22508 540-785-2669 or FAX 540-786-0658 Demo disk \$5 or free at website http://www.dx4win.com e-mail: NJ4F@erols.com

# CAN YOU HEAR ME?

Do **YOU** want to be heard? *OF COURSE*! Then use the SGC Smartuner<sup>TM</sup> - the *Essential* link between your **HF transceiver** and **antenna**. Matching at the transceiver is good, but matching at the antenna is better. SGC Smartuners are designed to do just that. They operate completely independently to provide the best match between the feed line and the antenna, eliminating SWR problems completely.



SG-231 Coupler Catalog Number 54-17



SGC Smartuners are designed to work with *any* transceiver and *any* antenna. They are fully automated, intelligent enough to select the best match between feed line and antenna in seconds and remember it so it can recall that match in milliseconds. The Smartuner sets the standard. It is the original and still the best.

Visit www.sgcworld.com for more information on the entire line of Smartuner antenna couplers.

Once you've learned how the Smartuner works, you won't want anything else!

### Smart Choice! Smartuner!



SGC Inc. 13737 SE 26th St. Bellevue, WA 98005 USA Tel: 425-746-6310 Fax: 425-746-6384 sgc@sgcworld.com www.sgcworld.com

### \$199.00

### **Return to** Yesteryear

Nixie Tube clock for only US \$ 199.00 at www.nixieclock.net

### WWW.NIXIECLOCK.NET

### **DK9SQ** Products

**33' collapsible Fiberglass Mast** 10 - 40 loop, 80/40 dipole, 2m/440 Yaqi NEW - All Band Folded Vertical

Kanga US 3521 Spring Lake Dr. • Findlay OH 45840 419-423-4604 www.bright.net/~kanga/kanga/

### Ham University

Learn Morse code, pass your 5 words-per-minute code exam, and increase your copying speed! This software introduces the code one letter at a time. Exercises and games make learning the code effortless (you set the speed). BONUS! Ham University contains the guestions for all three FCC written exams. Learn the code, and pass your exams! CD-ROM requires Win95-XP. - ARRL Order No. 8735 - \$39.95\* shipping \$5 US (UPS)/\$7.00 International

The national association for AMATEUR RADIO

Order toll-free 1-888-277-5289 (US) www.arrl.org/shop

tel: 860-594-0355 fax: 860-594-0303 e-mail: pubsales@arrl.org

You are cordially invited to join the 446 members of

The ARRL Diamond Club

The ARRL's new program to support **ARRL** operations

For a full brochure and information, contact

Mary Hobart K1MMH **Chief Development Officer** ARRL 225 Main Street Newington CT 06111 Tel: 860-594-0397 Email: mhobart@arrl.org or

visit us on the web at www.arrl.org/diamondclub

- Benefits begin at \$75 a year (\$50 a year for Life Members)
- Benefits and include subscription to OST, Diamond Club pins, certificates, car decals and more.
- Join at any time during your current membership cycle. Contributions are tax deductible.

### Where The PROs Are! Save \$200!

AND receive a FREE PS-125!\* This is a limited time offer. Call for details!



AM STATION

### **IC-756PROII** Features:

HF/6M • 100W • All Mode • Enhanced Rx • Dual Watch • 32 Bit IF-DSP • Independently Selectable IF Filter Shapes For SSB & CW • Variable Level Noise Blanker • Auto & Manual Notch Filter • Twin Passband Tuning • Improved 5" TFT Color Display • CW Memory Keyer • VOX • Auto Antenna Tuner • SSB/CW Synchronous Tuning • External Control For Voice Memory & Memory Keyer • Adjustable RIT Clear • 1/4 Tuning Steps In Digital Mode



### FREE! ps-125\* PURCHASE AN IC-756PROII OR A 746PRO AND RECEIVE A FREE PS-125. THAT'S A TOTAL VALUE OF \$600!

(\$200 SAVINGS ON THE IC-756PROII AND 746PRO, \$400 VALUE ON THE PS-125)



### IC-746PRO Features:

HF/6M/2M • 100W • All Mode • Enhanced Rx • 9600 Baud Ready • 32 Bit IF-DSP & 24 Bit AD/DA Converter • Independently Selectable IF Filter Shapes For SSB & CW • SSB/CW Synchronous Tuning • Built-in RTTY • Variable Level Noise Blanker

- Auto & Manual Notch Filter Digital Twin Passband Tuning Mic Equalizer
- CW Memory Keyer VOX Auto Antenna Tuner

### See us for great deals at these Hamfests...

Feb 22 Dalton, GA Mar 1 Cave City, Ky MAR 8,9 Charlotte, NC Sat,Sun APR 5 Elizabeth Town, KY APR 27 Arthur, IL Sun. MAY 16,17,18 Dayton, OH "Schedule subject to change

1......



### 800-729-4373 www.hamstation.com email: sales@hamstation.com

812-422-0231 fax: 812-422-4253 220 N. Fulton Avenue • Evansville, IN 47710 Store hours: Mon-Fri: 8am-4pm Sat: 9am-1pm Central Time MASTERCARD • VISA • DISCOVER • AMERICAN EXPRESS

### The Ultimate in Station Control When Seconds Count You Need to be In Control !

Accessories for the EOC

> ARES RACES NWS

> > EMA

Quality Reliability Satisfaction

### Is Your Station Up to the Task ? Let NCS Put You in Control

#### Multi-Switcher, NCS-3240 \$279.95

No more plugging and unplugging ! Switch up to 4 audio sources between 4 separate radios. Switch between your favorite microphones or headset and connect them to any of the 4 radios (including HF, and VHF/UHF radios). Switch seamlessly between SSB, CW, RTTY, Packet, or other modes without resetting audio levels or plugging and unplugging cables. A two-stage amplifier with adjustable gain insures plenty of audio regardless of mic or radio. The proper receive audio is automatically switched to external speakers or headphones when the radio is selected. Use the NCS-3230 with the Multi-Switcher for full control of your receive audio. All at the Push of a Button !

Multi-RX Switcher, NCS-3230 \$279.95 Put your receive audio where you want it | Select the left, right, or "phantom" center audio channel for each radio. Unselect individual radio channels to mute or select the "Mute All" button to silence all audio. A built-in 2.5 watt stereo amplifier delivers more than ample audio to speakers or headphones. Record any or all audio channels using Manual or VOX operation. For recording a line level audio output is provided Busy Lights are provided for each radio for quick ID of active audio channels. Selectable "Mute on Transmit" provides muting of all channels except the transmit radio to allow audio or sidetone monitoring. Great for the ham with multiple xcvrs or receivers. Dxing, contesting, emergency operations or casual operating make this a must have accessory! All at the Push of a Button !

### Multi-Patch, NCS-3400 \$129.95

An organized way of Interfacing your radio audio with external speakers, computer sound cards, TNCs, phone patches, tape recorders, telephone devices and video devices. The Multi-Patch makes it quick and easy to add equipment or modify your existing audio configurations. A really useful accessory for the shack !

#### Microphone Cable, NCS-3570 \$.95/ft

This cable was specially designed and fabricated to NCS specifications for use with our audio products. The cable has a shielded twisted pair plus 5 other conductors (total of 7 plus shield). This is an excellent flexible microphone cable with a nominal diameter of 0.190 inches. Works with standard mic connectors as well as modular connectors such as RJ-12 and RJ-45.



#### New Communications Solutions, LLC 5364 Valley Mist Trace, Suite 101, Norcross, GA 30092

Toll Free Tel: (888) 883-5788 Email: ncs@ncsradio.com Owned and Operated by Hams for Hams www.ncsradio.com



#### Reflections II -Transmission Lines and Antennas

- by M. Walter Maxwell, W2DU An in-depth treatment of transmission lines, standing



waves, antenna matching, reflected power and antenna tuners. Included is a wealth of information on matching networks, antennas, and use of the Smith Chart. It is filled with many charts, figures and photographs. ARRL Order No. REF2 - \$19,95\*

shipping \$5 US (UPS) / \$7.00 International

The national association for ARRL AMATEUR RADIO Order toll-free 1-888-277-5289 (US) www.arrl.org/shop tel: 860-594-0355 fax: 860-594-0303 e-mail: pubsales@arrl.org



Overloaded with weekend projects, and ways you can improve your gear, antennas, operating, and more.

#### Separate chapters cover:

- Equipment Modifications
- Batteries and Generators
- Mobile and Portable Stations
- Equipment Construction and
- Maintenance
- Test Gear

### Resourceful

Fun!

- Antenna Systems Creative
- Operating
- Suppliers

Plus, you'll find easy to follow suggestions for solving all types of interference problems!

### **Hints & Kinks**

for the Radio Amateur ARRL Order No. 7903 Only \$12\* \*shipping: \$4 US \$5.50 International

ARRL

225 Main Street, Newington, CT 06111 http://www.arrl.org/

Toll-Free 1-888-277-5289 Phone 860-594-0355 fax 860-594-0303 email: pubsales@arrl.org

QT3/2001



### 6 & 2 meters & 440 MHz On your freq, plug & play

On your freq, plug & play \$399.95 & \$499.95

Repeater Controllers RC-1000V w/voice ID, CW ID, autopatch, remote base and more....\$259.95 RC-1000 w/o voice ID... \$199.95 RC-100...\$129.95

Micro Computer Concepts 8849 Gum Tree Ave New Port Richey, FL 34653 727-376-6575 10 AM-10 PM

e-mail mccrpt@earthlink.net http://home.earthlink.net/~mccrpt



\$99.95 + \$9.05 (US) s&h **E-Z Hang,** Code Q 8645 Tower Dr, Laurel, MD 20723 Phone: 540-286-0176 www.ezhang.com

### **RIGrunner** Intelligent DC power panel

Conveniently power your station with Anderson PowerPole<sup>®</sup> connectors.
 40 Amps total, outlets to run all of your transceivers and accessories.

- Each and every outlet individually ATC fused with LED open fuse indicators.
- Precision LED and audio alert of safe, over or undervoltage, 4012 & 4008.
- No messy binding posts, frayed wires, black tape or short circuits.
- Safe, secure, hot connect, polarized, color keyed, unisex, connector system.
- Conforms to the ARES, RACES, RSGB recommended standard.
   Perfect for home, mobile, rover, portable, emergency and contest stations.

3 Models from \$49.95!

### **RIGblaster** Have more fun with your radio

The only no compromise sound card interfaces.

The easiest to set up, high quality, complete solution.

The best support too! Read our user comments!

Internet remote base linking with EchoLink!

See our NEW RIGblaster pro on page 133

http://www.westmountainradio.com West Mountain Radio de N1ZZ and K1UHF 18 Sheehan Avenue, Norwalk, CT 06854 (203) 853 8080

#### W7FG True Ladder Line Vintage Nominal Impedance – 600 OHMs • Spreaders – Light Weight, Low Manuăls Wind-Loading & Long Life • Wire - 16-Gauge, 26-Strand, 100% Copper One conductor from equipment to far-end antenna insulator (supplied) No Splices • 100 ft. of Ladder Line with each Doublet Antenna **Over 350** 160-10 Meter Doublet Antenna .....\$74 Manufacturers 80-10 Meter Doublet Antenna .....\$60 and over 40-10 Meter Doublet Antenna ......\$52 6,000 Manuals G5RV 80-10meter Doublet Radio, Test Equip., Audio with 31 feet of Ladder Line .....\$35 FREE CATALOG 100 ft. of Ladder Line Only ..... \$40 50 ft. of Ladder Line Only ..... \$23 VISA (800) 807-6146 800) 807-6146 33 E www.w7fg.com www.w7fg.com



### Surplus Sales of Nebraska

Visit our exquisite website @ www.surplussales.com

<b>Collins Parts &amp; Tube K</b>	lits
KWM-2/KWM-2A Manual covers all versions	\$ 3
312B-4 / 312B-5 Manual	S 1
5" x 7" 4Ω Replacement Speaker	S 2
Collins Spray Paint, All Colors	\$ 1
#557 Ceramic Trimmers, 3-12, 5-25, 8-50 pF	\$
Tube Kit - KWM-2/A With 6146W Finals	\$13
Tube Kit - KWM-2/A WITH OUT 6146W Finals	\$11
Tube Kit - 51S-1	\$13
Tube Kit - 75S-1	S 9
Tube Kit - 75S-3 / A / B / C	S 9
Tube Kit - 32S-1 or 32S-3 / A please specify	\$10
4D32 fits 32V-1, 32V-2 or 32V-3 \$20 5	+ \$1





### Free Global Calling over Broadband!

No cost to join. Our QuickStart Guide answers your questions and gets you setup.

Visit: http://pulver.com/fwd for more info

	Quantum	Calas	secondus acquires
	Surplus	Sales	recently acquired
1	500,000	vacuum	tubes including new
	USmade	e Sweep T	ubes. Limited quan-
	tities at i	introducto	bry sale prices!
1	6106	\$20 00	\$65/ matched pr
1	0100	527 eu.	SOD/ multiled pr.
	6JE6	539 ea.	S85/ matched pr.
	6KD6	\$39 ea.	\$85/ matched pr.
	6JS6C	\$39 ea.	\$85/ matched pr.
	6LB6	\$24 ea.	\$55/ matched pr.
	6LQ6	\$39 ea.	\$85/ matched pr.
	6MJ6	\$59 ea.	\$125/ matched pr.

HI-MANUALS Surplus Sales recently purchased HI-Manuals of Council Bluffs, Iowa. Priority Mail included in our manual price + we will ship most manuals within 24 hours. Give us a shot the next time vou need a quality book quickly.

811A CETRON, US MADE. Matched sets of 4 now only \$105 6146W Replaces 6146, 6146A, 6146B. By GE. \$19 6+ \$18 6146W Matched Pairs (GE) \$39 3+pairs \$35 (GE Brand) 12BY7A-JAN .. \$10 6CL6-JAN ... \$5 (Phillips Brand) 6AZ8JAN ... \$8 6BA6-5749 .. \$6

#### 1502 Jones Street, Omaha, NE 68102 · Fax: 402-346-2939 · e-mail: grinnell@surplussales.com Visa, MasterCard, American Express or Discover . Call or e-mail for shipping and total charges



### Since 1979, Quality, Service and Value! **FREE** Samples Wayne Carroll, W4MPY

P. O. Box 73 Monetta, SC 29105-0073 Phone or FAX (803) 685-7117 URL: http://www.gslman.com Email:w4mpy@gslman.com





#### The World's most popular Desktop Autotuner! · Rated 5 to 150 watts, will tune antennas with a 10 to 1 SWR or less

· RF sensing, operates all frequencies between 1.8MHz and 30 MHz · Interface available for Icom, Alinco, and Yaesu FT-100D



RT-11 Autotuner \$209

Z-11 Autotuner \$179

LDG Electronics, Inc.

1445 Parran Rd.

PO Box 48

### Remote mountable, great for mobile or marine

· 0.1 to 125 watts on all HF frequencies, tunes 10:1 SWR antennas · Water resistant ABS plastic case, tower mountable Interfaces for Icom and Alinco (\$20). Perfect for the IC-706



Balun (RBA-1) 4:1 Balun \$30

200 Watts Ladder line Long wires

Sales: 877-890-3003 Support: 410-586-2177 Fax: 410-586-8475 ldg@ldgelectronics.com



Designed just for the QRP'er

Interface available for the Yaesu FT-817

· Latching relays hold tuned position forever

· 0.1 to 60 Watts on all HF frequencies



### **Become a member** of ARRL's Legacy Circle ...

Once you have provided for the people you love, we hope you'll consider a bequest to the American Radio Relay League, Inc. (ARRL) to support its work on behalf of Amateur Radio.

When you write or review your will, ask your attorney to include such words as: "To The American Radio Relay League, Inc., a non-profit corporation headquartered in Newington Connecticut (Federal ID # 06-6000004) I give .... "

You may designate your bequest to one of several ARRL program funds...

- The Defense of Frequencies Fund
- The Education & Technology Fund
- The W1AW Endowment Fund
- The Historic Preservation Fund
- The ARRL Laboratory Fund
- The ARRL Legal Research and Resource Fund
- The ARRL Operating Fund

For more information on gift planning and The Legacy Circle, contact:



### KENWOOD

TH-G71A Sharp Distinction: The brighter side of handy communications. (right) This FM dualbander (144/440MHz) boasts an illuminated keypad and LCD, high-performance antenna, and a stylish yet ergonomic design. The 5W G71A also offers convenience with its memory name function, menu mode, PC compatibility and 200 memories. 2.31"w x 4.44"h x 1.44"d, 11.6 oz......\$259.95





TM-261A Fully equiped, supremely user-friendly 2M mobile. The 261A puts out an impressive 50 Watts with mid- and low-power settings. For quick access, essential data can be stored in 62 "memory name function" memory channels. Other features include DTSS selective calling, multi-scan capability, and a case built to MIL-STD. 5.5"w x 6.56"h x 1.56"d, 2.2 lbs ..... \$149.99 TM-G707A The essence of ease. From the extra-large panel to Kenwood's Easy Operation mode, the G707A is extraordinarily userfriendly. In addition to its regular profile, it can store four others for instant recall. This 50W/35W, FM dualband (144/440MHz) offers 180 multi-function memories with name function to identify each. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs.....\$299.95 TM-V7A Cool Blue: The look of mobile communication. The V7A 144/440MHz FM transceiver marks a departure in ergonomic design with its easy-to-operate control panel and reversible LCD. The "5-in-1" programmable memory, 50/35W, DTSS and pager functions, and dual receive on one band make it a pace-setter. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs.....\$419.95 TM-D700A Harnessing APRS®, GPS and SSTV. This FM 144/440MHz mobile features a built-in TNC offering options including simple packet. However, the brightest spot of the 50/35W D700A is its ability to enable APRS® without a computer. It also has 200 memories, dual receive, built-in CTCSS/DCS, and DX cluster monitoring. 5.5"w x 1.58"h x 

TS-505 Compact milestone. One of the most compact HF (160-10M) transceivers, the 50S can be mounted in a vehicle, taken on DXpedition, or installed as a base station. Despite its compact dimensions it packs a hefty 100W punch. Features include DDS with "fuzzy" control, AIP, and dual VFOs. 7.06"w x 2.38"h x 9.19"d, 6.4 lbs ...... \$689.95 TS-570D(G)\* Affordable DSP without compromise. High-end technology doesn't mean a high-end budget. With 16-

TS-2000 Distinctive by design, packed for performance. The all-mode, HF, 2M, 6M, 70cm 2000 is serious about DSP. Its advanced digital technology converts analog waveforms into digital data, enabling such digital processing as IF filtering, slope tune, auto notch and AGC. 10.63"w x 3.75"h x 12.5"d...... \$1999.95





5710 W. Good Hope Rd. Milwaukee, WI 53223 414-358-0333 1-800-558-0411 Fax 414-358-3337 Service 414-358-4087 milwaukee@aesham.com

621 Commonwealth Ave. Orlando, FL 32803 407-894-3238 1-800-327-1917 Fax 407-894-7553 orlando@aesham.com

28940 Euclid Ave. Cleveland, OH 44092 440-585-7388 1-800-321-3594 Fax 440-585-1024 cleveland@aesham.com

4640 South Polaris Ave. Las Vegas, NV 89103 702-647-3114 1-800-634-6227 Fax 702-647-3412 lasvegas@aesham.com

Store Hours Mon—Fri • 9am to 5:30pm Saturday • 9am to 3pm

### 1-800-558-0411 www.aesham.com

\*Prices BEFORE rebate from Kenwood. Prices subject to change without notice.





\*APRS-READY\* Weather Stations



www.goatsystem.com

972-241-9139

patent pending (antenna not included

### NEN El Dorado The Antenna for Restricted Locations

HE CAYPAL

708-423-0605-1691 fax

Dame Wills

Motor driven antenna tunes from 80 to 10 meters. Rated at 1KW SSB. Bottom section is just 3 feet tall. A 6 foot whip is included. Overall length 9 to 10.5 feet. Weighs less than 9 pounds. Black, white or gray powder coating. High Q coil and no fingerstock.

Package includes powder coated antenna, stainless steel whip, powder coated stainless steel mounting bracket, manual control box. 50 feet of coax with motor wires and 8 wire radials that are just 10 feet long.

### High Sierra AntennAs www.cq73.com 530-273-3415



Back issues of ARRL's popular technical magazine, QEX, are now available in convenient, space-saving CD-ROM format! Each page-all the articles, ads, columns and covers-has been scanned to provide a black-and-white image that can be read on your computer screen or printed.

- search for articles by title and author
- · select specific year and issue
- browse individual articles and columns

### This set includes all QEX issues from its inception in 1981 through 1998!

Requires a Pentium or equivalent IBM-compatible PC, and Microsoft Windows™ 95, 98 or NT 4.0.



\*Shipping US \$5 (UPS)/International \$7.00

The national association for AMATEUR RADIO SHOP DIRECT or call for a dealer near you. ONLINE WWW.ARRL.ORG/SHOP ORDER TOLL-FREE 888/277-5289 (US)

OST 3/2003

### o ICOM



IC-Q7ABC 2M/440 tx; wide band rx. (right) The ultra-compact, 350/300mW Q7ABC offers features of a wide band scanner in a dualband HT. A large built-in speaker provides loud, clear audio while protected by a drip-resistant body. Tone squelch is standard on the 200-memory Q7ABC which employs an easy band switching system. 2.28"w x 3.38"h x 1.06"d, 6 oz ...© \$109.95

IC-T7H Powerful output, ample receive audio. (left) A 6W amp circuit provides superior transmit on both VHF and UHF when 13.5 V DC is supplied. The speaker puts out a full 500mW of AF – easy to copy in noisy places. Separate CTCSS tone encoder

and enc/decoder standard. This 2M/440MHz meets MIL SPEC. 2.25"w x 4.34"h x 1.06"d, 10 oz...... S **179.95** IC-T81A Amazingly compact 4-bander. The T81A multiband transceiver is built tough, offers a variety of functions, and is "single-band" simple. Covering 50, 144, 430MHz and 1.2GHz, this water resistant unit provides 5W (1W/1.2GHz). The T81A features a multi-function "joy-stick" switch, wide FM and AM receive modes, tone squelch, 124 memories, PC programmability, and auto repeater function. 2.28"w x 4.19"h x 1.13"d, 10 oz.....Closeout S **249.99** 

IC-2100H-25N Durable 2M rig with superior RX IMD, performance. The 2100H25N offers 50W on transmit, extending its range. It also features CTCSS tone enc/decode, tone scan and 100 alphanumeric memories. It can be remote controlled using the new backlit mic. 5.5"w x 1.56"h x 7.09"d, 2 lbs, 10 oz@ \$149.95

**1C-2720H Twice the versatility, twice the fun!** The 2M/440MHz, 50/35W 2720H offers simultaneous receive capability, independent controls for each band, and Dynamic Memeory Scan with 212 memories. It also features CTCSS and DTCS, wideband receive, weather alert, auto repeater, remote control microphone, and compact remote control head. Mount controller to main unit with the optional MB-85. 5.5"w x 1.56"h x 7.38"d, 3 lbs (main) ....... © \$379.99

IC-718 Origin of the HF transceiver. With performance found in the HF all-band 718, such as wide dynamic range, high S/N ratio, and full duty operation, making distant contacts is easy. Experience its combo of the latest RF and digital technology. 9.44"w x 3.75"h x 9.41"d, 8 lbs, 6 oz ...... NOW! FREE UT106 included © \$549.95

IC-706MKIIG Base station features, mobile size. The 160-10M + 6M, 2M, 70cm Mark II G is constructed for stable, quality output with low IMD and spurious emissions. It features tone squelch, DSP, auto repeater, and 107 alphanumeric memories. 6.56"w x 2.28"h x 7.88"d, 5 lbs, 6 oz.... NOW! FREE RMK706 included © \$779.95



IC-756PROII A leap forward for the digital revolution. An all-mode, HF, 50MHz transceiver designed to include customersuggestions. The PROII not only offers a 32-bit Floating DSP, but also has



5710 W. Good Hope Rd. Milwaukee, WI 53223 414-358-0333 1-800-558-0411 Fax 414-358-3337 Service 414-358-4087 milwaukee@aesham.com

621 Commonwealth Ave. Orlando, FL 32803 407-894-3238 1-800-327-1917 Fax 407-894-7553 orlando@aesham.com

28940 Euclid Ave. Cleveland, OH 44092 440-585-7388 1-800-321-3594 Fax 440-585-1024 cleveland@aesham.com

4640 South Polaris Ave. Las Vegas, NV 89103 702-647-3114 1-800-634-6227 Fax 702-647-3412 lasvegas@aesham.com

Store Hours Mon—Fri • 9am to 5:30pm Saturday • 9am to 3pm

### 1-800-558-0411 www.aesham.com

Prices subject to change without notice. © w/Instant Coupon, coupons expire 2/28/03

built-in 24-bit AD/DA converter, enhanced backlighting, selectable IF shape, adjustable noise blanker, and improved audio fidelity. 13.38"w x 4.38"h x 11.19"d, 21 lbs, 1 oz...... NOW! FREE PS-125 included © \$2769.95





Plug in and play ATV with this 4 channel Tx 420-450 MHz band/ch3 Rx 20 Watt ATV Transceiver...\$549 Join the ATV fun! Plug in your camcorder or video camera, TV set, 70cm antenna, mic and 13.8Vdc @5A. Send and receive live action color video just like broadcast TV with other hams.



Check out the ATV action with this 420-450 MHz to Ch 3 Downconverter and your TV set.

#### TVC-4G ATV downconverter...\$99

Hams, call or email for our 10 page ATV catalogue or down load from our web site. We have it all for the 420 MHz to 10.4 gHz ham bands: ATV transmitters - AM and FM, downconverters starting at \$59, receivers, modules, antennas, etc., for base, repeaters, portable, R/C, rockets, balloons and more. Email: tom@hamtv.com

CALL (626) 447-4565 M-Th 8AM - 5:30 PM PST. P. C. ELECTRONICS VISA Since 1965 2522-WR Paxson Lane Arcadia CA 91007 Tom (W6ORG) & Mary Ann (WB6YSS)



Build a Hard Hat Cam or Fly R/C ATV Videolynx 434 MHz Video Transmitter...\$99 50-100 mW, .6x.8x2.3", 1.5 oz., 9V@40ma Videolynx Z70A w/sound & 4 ch Tx.....\$149 TXA5-RC 1.5 Watt ATV Xmtr board ..... \$129



Video ID Overlay boards from Intuitive Circuits Insert into the video line. Plua in GPS data line. OSD-GPS...\$119

**ADVERTISE** 

Z

10

TODAY

#### R/C Aircraft ATV with GPS & Call ID overlay

24hr FAX: (626) 447-0489

Web: www.hamtv.com

### ARRL Book on CD-ROM



### Are we alone in the Universe?

YOU can play a vital role in finding the solution to the greatest mystery of all time with...

### Tune in the Universe!

A Radio Amateur's Guide to the Search for Extraterrestrial Intelligence

by Dr. H. Paul Shuch, N6TX, **Executive Director** of The SETI League

Tune in the Universe! is an easy-to-use guide for hams, amateur astronomers, and other hobbyists participating in a scientifically credible search for extraterrestrial intelligence. Covers current SETI theories, techniques and results. Even build a SETI monitoring station! Its six sections are part history,

tutorial, and memoir (includes 16 "Dr. SETI" songs). Richly illustrated with color images and drawings.

"I congratulate Dr. Shuch on his lucid, comprehensive, and often very amusing account of the radio search for ETs. Perhaps, as some wit remarked, the best proof that there is Intelligent Life in Outer Space is the fact it hasn't come here. Well, it can't hide foreverone day we will overhear it." —Sir Árthur C. Clarke

CD-ROM is Windows, Macintosh and Linux compatible. Requires an Internet-ready computer and an installed Web browser, sound card, CD-ROM drive and mouse



shipping: \$5 US (UPS) \$7.00 International







VX-150 Designed to perform under the most difficult conditions. (middle) This 2M 5W HT provides exceptional receiver performance with clean, clear transmit. Built to withstand outdoor use, the 16-key 150 is constructed to MIL-STD standards, with high-output, commercial-grade speaker and Omni-Glow<sup>™</sup> keypad. 4.3"h x 2.3"w x 1"d, 11.5 oz .......© \$109.95 FT-50RD/41B Commercial-grade, military

**SORD** covers 144 and 430MHz while also offering the "widest" band receive allowable. Perfect for outdoor activities. Built

VX-7R/VX-7RB The first submersible amateur handhelds. (left) Protected against water by gaskets and weatherproofing techniques, the 50/144/430MHz, 5W 7R/7RB are rated for a 3-foot, 30-minutes submersion. Tough magnesium bodies make them ideal for the outdoors. They include dual/wide-band receive, status strobe, and "internet" key for access to the new WIRES<sup>™</sup> system. 7RB sports a black case. 2.4"w x 3.5"h x 1.1"d, 9.2 oz .....© \$299.95

FT-1500M A masterpiece of RF engineering. This 144MHz FM mobile is the quietest and most efficient radio transceiver ever built. 50-tone CTCSS encode/decode, direct keypad frequency entry, alphanumeric memory, 50 Watts of output power, and 6-pin mini-DIN data port are just the start. 5"w x 1.4"h x 4.9"d, 2.2 lbs© \$139.99

FT-8900R Leading the way in FM mobile design. Quite simply, the 29/50/144/440MHz 8900R has no peer among mobile transceivers. This quad bander offers leading edge features like VHF/UHF full duplex, cross band repeat, independent operation on two bands, and six "Hyper Memory" keys to store configuration settings. The



FT-840 Performance forward. Blending high performance digital frequency techniques with operating convenience, the 840 is a base station that beginners and seasoned operators will appreciate. In additon to 100W on 160-10M, the 840 adds a choice of two optional remote auto antenna tuners and a wealth of functions. 9.4"w x 3.7"h x 9.6"d, 12 lbs ...... © \$499.95 FT-817 Self-contained, battery-powered, multi-mode portable. The 5W 817 is designed for operation on HF, plus 6M, 2M, and 70cm. Whether you perfer SSB, CW, AM, FM, Packet, or SSB-based digital modes, it is ready to join you on your next hiking, camping, or search-and-rescue adventure. 5.3"w x 1.5"h x 6.5"d, 2.6 lbs......© \$599.95 FT-100D The smallest full-featured HF/VHF/ UHF transceiver. With coverage from HF to UHF, built-in DSP, and 100W HF/50MHz output (50W on 2M, 20W on 430), the 100D keeps you in touch with the world, at home or away. It also features a 500Hz crystal filter, high-stability oscillator, CTCSS decoder, and high-quality speaker. 6.3"w x 2.1"h x 8"d, 6.6 lbs. C \$739.95 FT-1000MP MK V Improving the 1000 series Elite-Class. Building on the success of the 1000 series, the Mark V offers five new developments. This HF all-mode adds 200W



5710 W. Good Hope Rd. Milwaukee, WI 53223 414-358-0333 1-800-558-0411 Fax 414-358-3337 Service 414-358-4087 milwaukee@aesham.com

621 Commonwealth Ave. Orlando, FL 32803 407-894-3238 1-800-327-1917 Fax 407-894-7553 orlando@aesham.com

28940 Euclid Ave. Cleveland, OH 44092 440-585-7388 1-800-321-3594 Fax 440-585-1024 cleveland@aesham.com

4640 South Polaris Ave. Las Vegas, NV 89103 702-647-3114 1-800-634-6227 Fax 702-647-3412 lasvegas@aesham.com

Store Hours Mon—Fri • 9am to 5:30pm Saturday • 9am to 3pm

### 1-800-558-0411 www.aesham.com

© w/Instant Coupon, coupons expire 3/31/03

# ARRL membership? What's in it for Me?

AS HAM RADIO OPERATORS, most of us love a bargain – whether it's on a new radio that nobody else has yet or a "swap meet treasure". But, the best bargain in ham radio is actually ARRL membership!

### Here's what's in it for you:

Home delivery of QST magazine every month so you can read all the news, product reviews, features and columns you won't find anywhere else. If you purchased QST one issue at a time, it would cost you \$59.88 per year. So... your ARRL membership saves you over \$20 a year just on QST, the most widely read ham publication in the country.





ARRL protects your access to the airwaves! Just as other organizations send lobbyists to Washington D.C., ARRL spends hundreds of thousands of dollars every year to represent your interests in our nation's capitol and at international radio conferences. When changes in frequency allocations are discussed, who is looking out for you and over 600,000 fellow hams? The ARRL.

Legislative Representation.







Access to ARRL "Members Only" Web features including product review archives, QST on-line index for a quick search of past QST articles by title or author, up-to-theminute news and ADVANCE notice on product reviews, contest results, call sign lookups, plus many other useful resources!

ARRL Email Forwarding Service. Sign up for this FREE service and email sent to "your call sign @ arrl.net" will be forwarded to whatever email account you specify. If you change email providers, all you have to do is change your forwarding address with ARRL.net to continue to receive all your email.

Answers to your ham radio questions. Experts at ARRL help members with technical questions, rules and regulations, and with assistance for licensing and



examining. Members can reach the "ARRL Lab" and other departments by phone, email, and mail. It's that easy! Extensive ARRL Services made possible by member support include the awards program, educational outreach, QSL bureau, W1AW and internet bulletin services, support for Volunteer Examiners, ARRL Amateur Radio Emergency Service® (ARES) and more!

### Join or renew today!

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

### So Sign up today!

### Just call TOLL-FREE 1-888-277-5289

between 8AM and 8PM Eastern time, Monday - Friday and put your membership on a credit card or visit our Web site at WWW.arrl.org/join.html

### your SIGNAL is only as good as your WIRE...

For years, hams have been forced to use audio cable built for other purposes, tape recorders, guitars, MIDI - certainly not connecting A.C. audio and D.C. PTT voltages. With the recent focus on higher quality audio and increased RF power, the need for a higher quality audio cable has grown. But the proper audio cable just simply has not existed - until now...

### HEIL has answered this problem with HeilWire

**HeilWire** is specifically for use in interfacing microphones and audio outputs. Two 18 ga. (not usual 24 ga.) leads reside in a 100% silver shield that protects those sensitive audio signals from the outside RF world. Outside of this braid is another pair of 18 ga. control wires for PTT that keeps the D.C. components away from the sensetive A.C. audio signals. Very flexible outer jacket.





**HeilWire** brings new dimensions to direction to audio cable systems for amateur radio as well as commercial broadcast industries.

20 Years Of Defining Amateur Radio Communications

Available at your favorite dealer or at www.heilsound.com • 618-257-3000





Explore the possibilities of using Amateur Radio to see and talk with other hams! With home computers, widely available software, and gear many hams already own, it's easier than ever to enjoy the imaging modes: Narrow-Band Television (NBTV), Amateur Television (ATV), Slow-Scan Television (SSTV), and Weather Satellite Imaging (WEFAX).





### The ARRL Image Communications Handbook

by Dr. Ralph E. Taggart, WB8DQT Book includes CD-ROM with software utilities.

ARRL Order No. 8616-\$25.95\*

\*shipping: \$6 US (UPS) \$8.00 International (surface)

Sales tax is required for orders shipped to CA, CT, VA, and Canada.

Available from ARRL Dealers EVERYWHERE.



225 Main Street, Newington, CT 06111-1494 tel: 860-594-0355 fax: 860-594-0303 In the US call our toll-free number **1-888-277-5289** 8 AM-8 PM Eastern time Mon-Fri.

QST 11/2002





### DON'T MISS THIS ONE !

### 2003 GREATER BALTIMORE HAMBOREE & COMPLITERFEST



SATURDAY, MARCH 29 & SUNDAY, MARCH 30, 2003 MD STATE FAIRGROUNDS - TIMONIUM, MD HOST TO THE ARRL MARYLAND STATE CONVENTION



Show Hours: Saturday, 8 AM til 5 PM - Sunday, 8 AM til 3 PM Indoor & Outdoor Tailgate areas open at 6:00 AM each day Admission is just \$6 per day Sponsored By: The Baltimore Amateur Radio Club, Inc.

### FEATURING

ARRL Convention and Banquet Over One Half Million Square Feet of Sales Area 3 Buildings with over 1,100 Indoor Spaces Amateur Radio Manufacturers, Dealers, and Fleamarket 5 Acre Outdoor Hard Surface Tailgate Area FCC Amateur Radio License Exams Ham Radio Demonstration <u>Many Show Special Bargains</u> SHOW WILL BE HELD IN ANY WEATHER

Phone: (410) HAM-FEST or (800) HAM-FEST Internet Address: <u>www.gbhc.org</u> E-Mail: <u>gbhc@gbhc.org</u> Address: GBH&C, P.O. Box 95, Timonium, MD 21094-0095 Talk-In: 146.67-, 224.24-, 449.625- (PL 107.2)



Hangin' Judge Parker Hamfest ARKIE Con 2003 April 5, 2003 Fort Smith, Arkansas W3TZ@ARRL.NET WWW.FSAARC.ORG Rely on our many Years of Graphic Experience and receive great OSL Cards WWW.QSLSHOP.com 1000 High Glossy QSL Cards for only \$120 incl. S&H Other Quantities Available · Online Orders Possible Order Form Downloadable · Service in Native English Use your own Photos, Slides, Digital Images or

Use your own Photos, Slides, Digital Images or our Huge Premium Digital Stock at No Extra Cost Read Customer Comments on www.eham.net QSLSHOP • P. O. BOX 73 • 10122 BERLIN • GERMANY



### You've Got Questions We've Got Answers!

Now you can enjoy the wealth of knowledge included in this collection of popular questions <u>with answers</u>, handled by the ARRL Lab's Technical Information Service (TIS) and *QST*'s column "The Doctor."

Ham Radio FAQ The ARRL Lab and "The Doctor" answer your Frequently Asked Questions

"Here in one place you'll find answers to the questions hams ask most often! What is the best antenna? What radio should I buy? And even, where did the name HAM come from?" — AI Alvareztorres, AA1DO— ARRL TIS Coordinator

Inside:

- Antennas, Transmission Lines and Propagation
- Station Setup and Operation
- Mobile, Portable, and Repeater
   Operating
- Batteries
- · Grounding and Lightning

And, a References chapter filled with all kinds of useful material: addresses, telephone numbers, web sites, and more!



ORDER TODAY!

Ham Radio FAQ ARRL Order No. 8268 -\$14.95\* \*shipping: \$5 US (UPS) \$7.00 International

### ARRL



QBT 9/2001

### **DON'T MESS WITH TEXAS TOWERS**

### $\star$ Your PRO Headquarters $\star$



0 0

ICOM IC-756PROII

### 

### **IC-756PROII** Features:

HF/6M • 100W • All Mode • Enhanced Rx • Dual Watch • 32 Bit IF-DSP • Independently Selectable IF Filter Shapes For SSB & CW • Variable Level Noise Blanker • Auto & Manual Notch Filter • Twin Passband Tuning • Improved 5" TFT Color Display • CW Memory Keyer • VOX • Auto Antenna Tuner • SSB/CW Synchronous Tuning • External Control For Voice Memory & Memory Keyer • Adjustable RIT Clear • 1/4 Tuning Steps In Digital Mode

• 32 BIT FLOATING POINT DSP & 24 BIT AD/DA CONVERTER. At the heart of the '756PROII, the DSP is an incredible tool for handling the QRM found on the bands.

 SELECTABLE DIGITAL IF FILTER SHAPES FOR SSB & CW. Tailor the filter shape & bandwidth to your personal operating preferences or band conditions. Sharp for selectivity & signal fidelity, soft for readability, or somewhere inbetween - it's your choice! Change on the fly & compare the difference!

 IMPROVED 3RD ORDER INTERCEPT POINT. The newly designed 4 element system delivers a measurable improvement in the 3rd Order Intercept Point, resulting in less distortion from strong signals.

 REAL-TIME BANDSCOPE. The adjustable 5" TFT color display shows band activity with relative signal strengths around a center frequency. A peak hold feature gives a snapshot of band activity while using the Dual Watch & sub-band marker to search for new stations or open frequencies on a crowded band.

### FREE! PS-125\*

PURCHASE AN IC-756PROII OR A 746PRO AND RECEIVE A FREE PS-125.

THAT'S A TOTAL VALUE OF \$600!

(\$200 SAVINGS ON THE IC-756PROII, \$400 VALUE ON THE PS-125)



### **IC-746PRO Features:**

HF/6M/2M • 100W • All Mode • Enhanced Rx • 9600 Baud Ready • 32 Bit IF-DSP & 24 Bit AD/DA Converter • Independently Selectable IF Filter Shapes For SSB & CW • SSB/CW Synchronous Tuning • Built-in RTTY • Variable Level Noise Blanker • Auto & Manual Notch Filter • Digital Twin Passband Tuning

COM IC-746PRO

999 99

14.195.00

- Mic Equalizer 
   CW Memory Keyer 
   VOX 
   Auto Antenna Tuner
- 32 BIT FLOATING POINT DSP & 24 BIT AD/DA CONVERTER. At the heart of the '746PRO, the DSP is an incredible tool for handling the QRM found on the bands.

 SELECTABLE DIGITAL IF FILTER SHAPES FOR SSB & CW. Tailor the filter shape & bandwidth to your personal operating preferences or band conditions. Sharp for selectivity and signal fidelity or soft for readability.

- AGC LOOP MANAGEMENT. Multiple AGC loops, controlled by the 32 bit DSP, filter out unwanted interfering signals, eliminating pumping of the AGC.
- AUTOMATIC NOTCH FILTER. Perfect for SSB operation to eliminate annoying heterodynes and "tune up", without effecting the receive audio.
- MANUAL NOTCH FILTER. Perfect for CW or digital operations, the 70db manual notch filter eliminates unwanted signal without effecting the actual passband of your filters.

### TEXAS TOWERS A Division of Texas RF Distributors, Inc. 1108 Summit Avenue, Suite #4 • Plano, TX 75074

(800) 272-346 WEEKDAY HOURS: LOCAL CALLS:

9AM-5PM CST SATURDAY HOURS:

9AM-NOON CST

CREDIT CARDS: M/C, VISA, DISCOVER LOCAL CALLS: (972) 422-7306

EMAIL ADDRESS: sales@texastowers.com

INTERNET ADDRESS: www.texastowers.com





Enjoy 5% discount with on-line orders of \$100 in material or greater.

**Ready-Made Coax Assemblies** 

with USA made Silver/Teflon® Gold Pin PL259 connectors.

CXP1318FX FLEXIBLE strd BC cntr foil +95% braid 2.7dB 400MHz NC/DB/UV JKT. 200' \$166.95 175' \$143.95 150' \$121.95 125' \$110.95 100' \$84.95 75' \$67.95 50' \$48.95 25' \$29.95 15' \$26.95 10' \$22.95 6' \$15.95 3' \$14.95 1' \$13.95

CABLE X-PERTS, IN

ConnectingYoutothe World

with USA made Silver/Teflon®/Gold Pin male "N" connectors. CXP1318FX FLEXIBLE strd BC cntr foil+95% braid 2.7dB 400MHz NC/DB/UV JKT.

150' \$143.95 125' \$116.95 100' \$98.95 75' \$81.95 50' \$66.95 35' \$54.95 25' \$48.95 15' \$39.95 10' \$31.95 6' \$20.95 3' \$19.95 1' \$18.95

LMR-600 Low Loss cable (less expensive alternative to hard-line) w/"N" Male on both ends.

200' \$284.95 150' \$227.95 100' \$169.95 75' \$143.95 50' \$114.95 w/PL259 (UHF Male) on both ends.

200' \$305.95 150' \$248.95 100' \$191.95 75' \$164.95 50' \$134.95 Tellort\* is a registered trademark of DuPon

Check your local dealers AES, HRO, Juns, Ten-Tec

RG213/U strd BC Mil-Spec NC/BD/UV JKT.

with USA made Silver/Teflon® Gold Pin PL259 connectors.

Oul

1.2dB 2500 watts @ 30MHz. 200' \$115.95 150' \$89.95 125' \$77.95 100' \$61.95 75' \$49.95 60' \$42.95 50' \$37.95 25' \$25.95 15' \$22.95 10' \$20.95 6' \$14.95 3' \$12.95 1' \$11.95

with USA made Silver/Teflon® Gold Pin PL259 connectors. RG8 MINI(X) strd BC foam 95% braid UV resistant JKT. 2.0dB/875watts@ 30 MHz.

100' \$49.95 75' \$39.95 50' \$29.95 25' \$24.95 Clear PVC Jacket on these lengths: 18' \$16.95 12' \$14.95 9' \$13.95 6' \$12.95 3' \$11.95 1' \$10.95

Rotor Cables (all w/U.V. Resistant Black Jacket) 100 ft/up: 1806 (18ga 6/c) \$.25 ft • 5971 (2/18, 6/22) \$.27/ft • 1618 (2/16, 6/18) \$.37/ft • 1216 (2/12, 6/16) \$.80/ft



FAX: 847-520-3444 / TECH INFO: 847-520-3003



225 Larkin Drive, Ste 6 • Wheeling, IL 60090 • Hours: M-F 9AM-5PM CST

CABLEXPE

394 BLOOMFIELD AVE., CALDWELL, NJ 07006 • 973-364-1930 • HOURS M-F 1-5, 7-10 PM, SAT-SUN 1 -5 PM, CLOSED WED. • www.kjielectronics.com

SERVING AMATEUR RADIO SINCE 1978

**Electronics** 

((((ພ))))

### "KING OF THE HILL" HF PACKAGE \$7,899 DELIVERED TO YOUR DOOR\*!



### **OTHER GREAT ICOM HF RIGS**



YOUR ICOM HEADQUARTERS IN NEW JERSEY SINCE 1978 MASTERCARD ACCEPTED

AM-5926





Tell time by the U.S. Atomic Clock -The official U.S. time that governs ship movements, radio stations, space flights, and warplanes. With small radio receivers hidden inside our timepieces, they automatically syncronize to the U.S. Atomic Clock (which measures each second of time as 9,192.631,770 vibrations of a cesium 133 atom in a vacuum) and give time which is accurate to approx. I second every million years. Our timepieces even account automatically for daylight saving time, leap years, and leap seconds. \$7.95 Shipping & Handling via UPS. (Rush available at additional cost) Call M-F 9-5 CST for our free catalog.

EDUCATIO

### Transmission Line Transformers

4th edition! — by Jerry Sevick, W2FMI

Classic techniques of Guanella and Ruthroff as well as hundreds of real transformers constructed and measured to establish the practical levels of band-width and loss performance that can be obtained with transmission



transformer techniques. Three new chapters in this edition cover:

- Transmission Line Transformer Efficiency
- Notes on Power Combiners and Mixer Transformers
- Equal-Delay Transformers

Fourth Edition by Noble Publishing Corporation

ARRL Order No. TLT4 — \$39.00\* \*shipping \$7 US (UPS) / \$9.00 International

#### **ARRL** The national association for AMATEUR RADIO

Order toll-free 1-888-277-5289 (US) www.arrl.org/shop

tel: 860-594-0355 fax: 860-594-0303 e-mail: pubsales@arrl.org

...to open the world of Amateur Radio to a new generation!

Support the 2003 campaign for the Education & Technology Program and...

- Introduce Amateur Radio to more schoolchildren nationwide,
- Add new dimensions to education in science, social studies, math and geography,
- · Inspire a skilled technological workforce for the future, and
- · Build a bright future for Amateur Radio!

### Last year hams contributed more than \$250,000 to the ARRL Education & Technology Program. *Thank you!*

Now 40 pilot schools have Amateur Radio Equipment, 1,300 students are on the air, 176 students are licensed hams, and schools are testing a professional curriculum designed for Amateur Radio.

### You're Invited...

Mail, call or email your 2003 contribution to: The ARRL Education & Technology Program 225 Main Street Newington CT 06111-1494 mhobart@arrl.org or,

FECHNOLOGY

Donate on the Web at: www.arrl.org/education



# SAVE BIG on the PROs! and GET FREE STUFF!



Buy an IC-756PROII or IC-746PRO before April 1st, 2003 and Save \$200 off the price of the radio! You will also receive a FREE! PS-125 Power Supply (a \$400 value), Plus a Heil Goldline Mic (GM-5), TB-1 Stand, and CC-11 Cable!

We Take Trade-ins! Sales Order Line 1-800-927-4261

Technical & Info 605-886-7314 Fax 605-886-3444 Website www.burghardt-amateur.com E-mail hamsales@burghardt-amateur.com

**Serving Amateur Radio Operators Since 1937** 

#### DISCOUNT CENTER The finest parts, and not a DOG in the pack.

PL-259ST	Silver-Teflon®, USA		SALE	\$1.0
PL-259GT	Gold-Teflon®, USA	\$1.49 or	\$30 pk	of /2!
N/9913	For 9913, 9086, 9086,	Flexi, etc.	10	\$3.2
N-200ST	"N" Silver-Tef, instal	Is like PL-259		\$3.2
	Coax and Cable Pi	rices	<100	"/100'+
RG-8X+	95%, Type IIA, non-cont	aminating	2	6¢/22
RG-213+	Top quality, 97% shie	eld, IIA jacket	4	5¢/38
Internation	al 9096 flexible 9913-typ	e Highest qu	ality 6	5¢/59
Internation	nal 9086, the best s	solid 9913-ty	ype t	6¢/51

#### RG-8X Premium, 95%, black 14¢ RG-213 95%, Mil-Type Excellent 35¢

R1 Rotator	8 cond. (2 x #18, 6 x #22)	SALE	26¢/20¢
<b>R2 Rotator</b>	8 cond. (2 x #16, 6 x #18)	SALE	47¢/35¢
#14 Hare	d-drawn, 7x22, all copper, bare		8¢
#14 FlexWe	ave <sup>th</sup> 168-strand, bare copper		14¢
#12 FlexWei	ave <sup>th</sup> 259-strand, bare copper		19¢
HD Ladder L Super Ladd	ine 450 ohms, stranded #16 co er Line, stranded #14 cond.	Sale	22¢/17¢ 30¢/26¢
1/2" Tinned	Copper Braid ground strap, ar	y length	650
LadderLock	Center insulator for ladder	r-line	\$11.95
Copper Gro	und Strap, 6" all copper		\$1.49
Custom	Coay lumpers - made to	order	

Pulleys - for antenna support rope. Highest quality, sailboat-type. Small & lightweight. #224 for 3/16" rope @ \$11.95 and #082 for 5/16" rope @ \$14.95

> RFI Quick I Built-in ground strap Breaks up ground loop

Ends RF feedback problems For really tough RFI problems, the T-4G is the ultimate fix by shunting stray RF on your coax directly to ground. Stray RF and feed line radiation doesn't have a chance. It solved all my RF feedback problems in my second floor shack. (W4THU) Don't be misled by \$100 imitations. Our Line isolators are still unequaled.

Antenna Support Line Mil Spec, Dacron® Antenna Support Line, single braid, sun resistant, 3/16° 700# test 100' hank \$8 Kevlar - Dacron® Jacket for sun protection, 500# test, for guying verticals, booms, etc., 075° dia. 200° spool \$15.95



For 16 years, The RADIO WORKS has brought you the best made, best performing wire antennas. No warmed over handbook designs - just performance engineered antenna systems. \$110 SuperLoop 80, 122' long, 80 -10 m. If you want the best, this is it! \$135 CAROLINA WINDOM 160, 265', 160 - 10 m. Big Sig on 160, Killer Sig on 80 \$95 CAROLINA WINDOM 80, 132' long, 80 - 10 m If you hear one, you'll want one! CAROLINA WINDOM 40, 66' long, 40 - 10 m. It helped set two 40 meter records. \$90 CAROLINA WINDOM 40 Plus 18' vertical radiator increase 40-15 performance \$105 CAROLINA WINDOM 160 Special, 160 - 10m, 132' long. All bands 160 - 10 \$125 G5RV Plus, 80 - 10 m, 102' High Power Current Balun, heavy-duty Ladder-line \$59.95

Jim's New Book - "Frequently Asked Questions about Antenna Systems and Baluns." This revealing 124 page book answers questions and dispels myths. The material is presented in a style that's easy to read and Jim. W4THU, is not beyond poking fun at jealously held concepts. However, at the book's heart are questions that hams ask over and over. Available now - \$12.95 + \$3 postage.

### **CURRENT BALUNS**

	-				
IV	lode	els for	every application	ation	
B1-2K	1:1	2 KW	Current-type	80 -10 m	\$24.95
B1-5K	1:1	5 KW	Current-type	160 - 10 m	\$35.95
B1-1KV	1:1	1 KW	Current-type VHF-	15 - 2 m	\$29.95
Y1-5K	1:1	5 KW	Current YagiBalun	160 -10	\$37.95
B4-1KXV	4:1	1 KW	Current-type VHF	10 - 2 m	\$33.95
B4-1.5K	4:1	1.5 KW	Voltage-type	80 -10 m	\$32.95
B4-2K	4:1	2 KW	Voltage-type	80 -10 m	\$39.95
B4-2KX	4:1	2 KW+	Current-type	160 -10 m	\$49.95
NEW! B	1-5K+	5 KW	Current-type	160 - 6 m	\$35.95
H	ere's	the ne	w Super Line Iso	lator Line	up
T-4	U	tra Line	solator, 160 - 10m		\$34.95
T-4 PLUS	S NE	WI T-4	with 160 - 6 meters c	overage	\$38.95
T-4G	Gr	ounded	version of T-4 = highe	er isolation	\$37.95
T-6	15	-2m Lin	e Isolator, SO-239 in a	nd out	\$31.95

5 15 - 2 m Line Isolator, SO-239 in and out \$31. Other Line Isolator types available. See our catalog or Web Site.



Check out our HUGE Web Site

RadioWorks.com

http://www.radioworks.com

e-mail W4THU@radioworks.com

 35.95
 Order Hotline (800) 280-8327

 FAX (757) 483-1873
 FAX (757) 483-1873

 Orders & Technical (757) 484-0140
 Box 6159 Portsmouth, VA 23703

 VISA and MC welcome. Give card #, exp. date, signature
 Add shipping (figure 10%, 57 min.) Mention this ad for sale

 Prices
 Prices velocity
 St will be change.









### DONATE YOUR RADIO

Turn your excess Ham **Radios and related items** into a tax break for you and learning tool for kids.

Donate your radio or related gear to an IRS approved 501 (c)(3) charity. Get the tax credit and help a worthy cause.

Equipment picked up anywhere or shipping arranged. Radios you can write off - kids you can't.

Call (516) 674-4072 FAX (516) 674-9600 crew@wb2jkj.org http://www.wb2jkj.org



THE RADIO CLUB OF JUNIOR HIGH SCHOOL 22 P.O. Box 1052 New York, NY 10002

Bringing Communication to Education Since 1980



The ultimate interface for phone and digital operating.



### For only \$299.95 using a computer, your rig and appropriate software, the pro replaces:

A mic. equalizer/processor	up to \$250	
A rig control interface	up to \$130	Look at it as saving over
A multimode TNC	up to \$550	\$1500, while enjoying
A contest Digital Voice Keyer	up to \$180	higher performance,
A DSP receive filter	up to \$400	simplified operation and
A receive enhancer	up to \$170	a neater more efficient
A DX beacon clock with receive	up to \$100	a heater, more emclent
A sound card interface (of course	) up to \$140	station.

**DYO** 

### THE **PRO**'s NEW FEATURES, just to mention a few.

- Sound card operation easier to set up and operate than ever before.
- Built in computer rig control interface for Yaesu CAT, Icom CI-V, Ten Tec, Kenwood.
- Single serial port operation for both rig control, CW and sound card PTT.
- Transmit speech processing: tailor your audio for DX, rag chewing or even Hi-Fi. Software off the web with an advanced ham radio application coming soon.
- LEDs show PTT, CW, FSK, audio source, processing and computer audio level.
- Record Voice-Keyer messages on the fly or record a QSO; SO2R contest operation.
- Two separate keying outputs, one for FSK and one for CW.
- Two mics: plug in automatic switchover between the main station mic. and a headset mic.
- Dual headphone output jacks may be used for DSP receive with or without comp. spkrs.
- Front panel sound card transmit level control, eliminates mouse sliders.
- PTT in and out jacks for a foot switch, external control or a sequencer.
- Radio speaker loop lets you easily re-connect an external radio speaker.
- Fixed-level receive audio direct from mic. connection for those radios that support it.
- RIGblaster standard automatic bybass, plus a power on/off switch for complete disable.

### http://www.westmountainradio.com West Mountain Radio de N1ZZ and K1UHF

18 Sheehan Avenue, Norwalk, CT 06854 (203) 853 8080

### Why Advertise in DST?

Nearly 160,000 copies printed each month, shipped to over 30 countries worldwide! **IST** is the most widely read Amateur Radio Magazine in the World.

To Reach this Market: Call, E-Mail, or Write us Todav — 860-594-0209 Fax: 860-594-4285 • 1-800-243-7768 www.arrl.org/ads • ads@arrl.org 225 Main Street, Newington, CT 06111





Teri Software www.antennamodel.com sales@antennamodel.com

**Coil Wizard - Graphs** No Segment Limit Only \$85US

SHOP DIRECT or call for a dealer near you.

QST 3/2003

ORDER TOLL-FREE 888/277-5289 (US)

ONLINE WWW.ARRL.ORG/SHOP

# VECTRONICS® kits High-performance electronic kits .... fun to build and use!



### Full featured CW Keyer Kit, \$2495!

VEC-201K, the best electronic keyer bargain in ham radio! Send beautiful sounding Morse Code. Self-completing dot-dashes and dotdash memory forgive timing errors -- makes sending CW easy and accurate. Front panel volume/speed (3-65 wpm) controls. Weight adjusts 25-75%. Sidetone (300 -1000Hz) has LM386 audio amp for external speaker/phones. Select Iambic A or B, fully automatic or semi-auto "bug" mode. Tune mode for tuning rig. RF proof. Sleep Mode battery saver. Use 9V battery. 13/4x4x31/2 in. Simple skill level. VEC-201K shown in optional case (vinyl cover top not shown), VEC-201KC, 314

Aircraft Receiver Kit tunes entire voice aircraft band 118-136 MHz. Picks up air traffic 100 miles away. Track progress of incoming/outgoing traffic in your area,

gain advanced weather information, and discover how the National Air Traffic System really works. Great way to learn about aviation. Use 9V battery. Drives external speaker/phones. 13/4x4x31/2 in. Intermediate skill level. Order VEC-131K, \$29.95.

20/30/40/80 Meter Receiver Kits give high performance! Covers entire band or tailor to cover desired portion. Copy CW/SSB/AM. NE602/ 612 mixer-oscillator, LM386 high gain audio amplifier. 13/4x43/4x 51/4 in. Moderate skill level. Order VEC-1120K (20 Meters), VEC-1130K(30 Meters), VEC-1140K (40 Meters), VEC-1180K (80 Meters), \$29.95 ea.

20/30/40/80 Meter ORP CW transmitter Kits have variable crystal oscillator tuning, front panel switch selects 1 of 2 crystals. 1 crystal included. Transmit and

Receive switch. Connect receiver. 13/4 x4x31/2 in. Intermediate skill level. Order VEC-1220K (20 Meters), VEC-1230K (30 Meters), VEC-1240K (40 Meters), VEC-1280K (80 Meters), \$29.95 ea.



**Tunable SSB/CW Audio Filter Kit has** sharp four pole peak and notch filters.

Zero in with frequency control & adjust 1.1.1 bandwidth for best response. Tune frequency from 300-3000 Hz. Notch is an outstanding 50 dB. 1 Watt amplifier. Speaker/Phone jacks. 12 VDC at 300 mA. 1<sup>3</sup>/<sub>4</sub>x4<sup>3</sup>/<sub>4</sub>x5<sup>1</sup>/<sub>4</sub> in. *Intermediate* skill level. Order VEC-841K, \$34.95.

Vectronics Comprehensive Soldering Course and Kit is the best home study soldering course available! Includes theory, quizzes, PC board, tools, safety, techniques and materials. 1910 Get professional soldering skills and a fun blinking LED project. Gets you ready for "throughhole" PC board assembly and repair. Simple skill level. Order VEC-1500K, \$29.95.



Super CW filter/amplifier Kit has powerful 1 watt audio amplifier to drive speaker. 8 poles active IC filtering uses cascaded low-Q stages. 3 bandwidths: 80,110, 180 Hz. Center frequency: 750 Hz. Up to

15 dB. Use 9-18VDC, 300 mA max. 13/4x4 x31/2 in. Simple skill level. Order VEC-821K, \$29.95.



Super SSB Audio Filter Kit improves readability with 8 poles, optimizes audio bandwidth, reduces SSB splatter, low, hipitched interference, hiss, static crashes, background noise. Use 9V battery. 13/4x4x 31/2 in. Simple skill level. Order VEC-830K, \$19.95.

144/220/440 MHz Low-Noise Preamp . Kits soup up your antenna system. Helps pull in weak signals. Works wonders for scanner or ham-band receiver. Gives great low-noise performance and immunity from damaging electrostatic discharge. 1x1<sup>1</sup>/<sub>2</sub> in. Simple skill level. Order VEC-1402K (144 MHz), VEC-1422K (220 MHz), VEC-1444K (440 MHz), \$17.95.

Vectronics kits feature a professional quality epoxy glass PC board with solder mask and component legend, simple step-by-step instructions and highest quality components.

tenen.hou

CW Memory Keyer Kit stores 512 characters in four 128 character nonvolatile EEPROM message memories. Carry on entire QSOs by just

pressing memory message buttons. True sinewave sidetone with soft rise and fall time eliminates harsh keyclicks. Has all features of VEC-201K CW Keyer Kit. 1<sup>3</sup>/<sub>4</sub>x 6<sup>3</sup>/<sub>4</sub>x5<sup>1</sup>/<sub>4</sub> in. Simple skill level. Order VEC-221K, \$69.95.

### **High-performance 2 Meter**

Preamp Kit pulls weak signals out of noise. Solves three reception problems -- boosts signals using a 1-dB noise figure microwave transistor, provides razor-sharp bandpass filtering, eliminates unwanted electrical noises with built-in balun. Uses 9-14 volts DC. Tiny 1<sup>1</sup>/<sub>2</sub>x3x1 in. fits in any size box. *Intermediate* skill level. Order VEC-1402DK, \$59.95.

2/6/10 Meter FM Receiver Kits let you tune into the world of ham radio. Catch all the action! Each covers the entire FM ---sub-band and runs off your 9 volt battery. Plug in speaker or headphones for loud clear reception. 13/4x4x31/2 in. Intermediate skill level. Order VEC-1002K (2 Meters), VEC-1006K (6 Meters), VEC-1010K (10 Meters), \$34.95 each.

2 Meter Monitor Kit receives 144-148 MHz. Low noise, high gain RF preamp gives you excellent 0.1 uV sensitivity. Air variable tuning capacitor has 8:1 reduction. Dual conversion superhet provides selectivity and stability. Automatically eliminates squelch tails. Built-in speaker, squelch, tone, volume controls. 191/4 in. telescopic whip. 9V battery. 2x41/4 x4 in. Intermediate skill level. Order VEC-104K, \$79.95.

#### 5 Watt 2 Meter FM transmitter Kit lets

you transmit voice and data -- AFSK data (up to 1200 baud) and FSK data (up to 9600 baud). Jumper select reactance or ....

direct FM modulators. Reliable Motorola NBFM transmitter IC and PA transistor. Crystal controlled (x8 frequency multiplication). -60 dBc spurs and harmonics. Use 12-14 VDC, 1.5 amps. 5-pin DIN microphone jack. 13/4x43/4x51/4 in. Difficult skill level. Order VEC-1202K, \$99.95.

#### Ni-Cad/Ni-MH Battery Charger Kit

safely quick charges expensive batteries - no overcharging -- many in less than an top computers. Handles 1 to 12 cells. Charging status LEDs. Discharge before charge function reconditions batteries. Also removes memory effect. Runs on 12-15 VDC. 1<sup>3</sup>/<sub>4</sub>x4<sup>3</sup>/<sub>4</sub>x5<sup>1</sup>/<sub>4</sub> inches. Moderate skill level. Order VEC-412K, \$49.95.

Shortwave Converter Kit converts AM or AM/FM radios to shortwave receivers at a push of a button. Choose two 1 MHz bands between 3 and 22 MHz. Popular 13

16, 19, 25, 31, 41, 49 and 60 Meters inter-national broadcast bands. On/off bypass, NE-602/612 mixer-oscillator IC and tuned input circuit. Use 9 V battery. 13/4x4x31/2 in. Intermediate skill level. Order VÉC-101K, \$27.95.

All metal cases for most kits, \$14.95. Add "C" for case to model #. Example: "VEC-201KC". Has knobs, hardware, rubber feet and brushed aluminum-looking front panel decal.



Crystal radio set Kit lets you relive the experience of early radio pioneers. This baby really works! Wind your own inductor, wire up the earliest radio circuit without soldering a thing and listen to the

magic of radio that needs no power. Put up an antenna, connect a ground. Stations come in amazingly loud and clear. Includes antenna wire, sensitive earphone. 13/4x5x61/2 in. Simple skill level. Order VEC-121K, \$19.95.



20, 25, 22, 19, 17, 16, 15 and 13 Meter bands. Explore AM, SSB, CW, WWV, RTTY and Packet signals. Vernier reduction drive, smooth regeneration control, RF stage. Includes all metal cabinet. 2 earphone jacks. Use 9V battery. 21/2x7x6 in. Intermediate skill level. VEC-102K, \$59.95.

### ORP Transceiver Kits for 80/40/30/20 Meters

Great introduction to QRP, the hottest and fastest growing activities in ham radio.



With this tiny transceiver, you'll discover what thousands of QRP enthusiasts already know -- you don't need a \$1000 radio to get on the air and communicate worldwide. All it takes is some

1 11 9 simple circuitry using less energy than a pen-light bulb! You get VXO frequency control, broadbanded transmitter circuitry, solid one Watt plus output, shaped keying, .3 uV sensitivity, direct conversion receiver. Includes crystal for popular QRP calling frequency, 1<sup>3</sup>/<sub>4</sub>x4<sup>3</sup>/<sub>4</sub>x5<sup>1</sup>/<sub>4</sub> in. *Intermediate* skill level. Order **VEC-1380K** (80 Meters), **VEC-**1340K (40 Meters), VEC-1330K (30 Meters), VEC-1320K (20 Meters) \$59.95 each.

Super CW Audio Filter Kit gives you

three bandwidths: 80, 110, 180 Hz. Eight poles gives super steep skirts with no ringing. Pull CW QSOs out of terrible QRM! Plugs into phone jack to drive phones. QRM down 60 dB one octave from center frequency

(750 Hz) for 80 Hz bandwidth. Improves S/N ratio 15 dB. Use 9V battery. 13/4x4x 31/2 in. Simple skill level. Order VEC-820K, \$19.95.

AM Radio Transmitter Kit lets you set up your

own AM station and broadcast crystal clear programming from your studio with you as the disc jockey or talk show host. Play music from CD player, tape deck or other source. Choose clear frequency from 530-1750 KHz. Standard line level or microphone input. Easy CD, tape deck or mike mixers connect. Audio level adjustment. 1<sup>3</sup>/<sub>4</sub>x4x3<sup>1</sup>/<sub>2</sub> inches. Simple skill level. Order VEC-1290K, \$29.95.

### The GIANT Book of **Electronic Projects, Volume I.**



Volume I

Project book includes 19 exciting kits on this page. Has building tips, complete parts lists, parts placement and PC board layouts, test and alignment, operating instructions, in case of difficulty, theory and specs, schematics, cabinet layout and much, much more. Great school project book or

gift for your favorite ham. Order VEC-1901, \$19.95.

Inspect and download our manuals from: http://www.vectronics.com

Order Toll-Free 800-363-2922 Fax: (662) 323-6551 • Tech: (662) 323-5800 VECTRONICS, 300 Industrial Park Road, Starkville, MS 39759 USA • Add \$6 s/h



2350 W Mission Lane #7, Phoenix, AZ 85021



175 FRIENDS | ANE

WESTBURY NY 11590 516-334-7024

### International Microwave Handbook

 Published by RSGB and ARRL



### Edited by Andy Barter, G8ATD

Reference information and designs for the microwave experimenter: operating techniques; system analysis and propagation; microwave antennas; transmission lines and components; microwave semiconductors and valves; construction techniques; common equipment; test equipment; bands 1.3 GHz, 2.3 GHz, 3.4 GHz, 5.6 GHz, 10 GHz, 24 GHz, and above.

The precursor to this significant work was the three volume **Microwave Handbook** published by the RSGB in the late eighties and early nineties. This new book includes contributions from radio amateurs, organizations, publications and companies from around the world.



Order toll-free 1-888-277-5289 (US) www.arrl.org/shop

ARRL Order No. 8739 — \$39.95\* \*shipping \$7 US (UPS)/\$9.00 International

tel: 860-594-0355 fax: 860-594-0303 e-mail: pubsales@arrl.org

### MFJ-989C Legal Limit Antenna Tuner MFJ uses super heavy duty components to make the world's finest legal limit tuner

ANTENNA

MFJ uses super heavy duty components -- roller inductor, variable capacitors, antenna switch and balun -- to build the world's most popular high power antenna tuner.

The rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

MFJ's AirCore<sup>™</sup> roller inductor, new gear-driven turns counter and weighted spinner knob gives you exact inductance control for absolute minimum SWR.

You can match dipoles, verticals, inverted vees, random wires, beams, mobile whips,

shortwave -- nearly any antenna. Use coax, random wire or balanced lines.

You get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-

MFJ VERSA TUNER V

MFJ-989C 95 Needle SWR/Wattmeter, massive transmitting variable capacitors, ceramic antenna switch, built-in dummy load, TrueCurrent™ Balun, scratch-proof Lexan front panel -- all in a sleek compact

cabinet (103/4Wx41/2Hx15D in).



MFJ AirCore<sup>™</sup> Roller Inductor gives high-Q, low loss, high efficiency and high power handling.

MFJ's exclusive Self-Resonance Killer™ keeps damaging self-resonances away from your operating frequency.

Large, self-cleaning wiping contact gives good low-resistance connection. Solid 1/4 inch brass shaft, self-align bearings give smooth non-binding rotation.

MFJ No Matter What<sup>IM</sup> Warranty MFJ will repair or replace

your MFJ-989C (at our option) no matter what for one year.

### More hams use MF.I tuners than all other tuners in the world. MFJ-16010 random wire Tuner

MFJ-986 Two knob Differential-T™



Two knob tuning (differential \$329°5 capacitor and AirCore™ roller

inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10<sup>3</sup>/<sub>4</sub>Wx4<sup>1</sup>/<sub>2</sub>Hx15 in. MFJ-962D compact Tuner for Amps



MFJ-962D \$26995 A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! AirCore™ roller inductor, geardriven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. 103/4x41/2x107/8 in. MFJ-969 300W Roller Inductor Tuner



MFJ-969 Superb AirCore™ Roller \$199<sup>95</sup> Inductor tuning. Covers 6 Meters thru 160 Meters! 300 Watts PEP SSB. Active true peak reading lighted Cross-Needle SWR Wattmeter, QRM-Free PreTune™, antenna switch, dummy load, 4:1 balun, Lexan front panel. 31/2Hx101/2Wx91/2D inches.

More hams use MFJ-949s than any other antenna tuner in



13

the world! Handles

300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch,

1000 Volt tuning capacitors, full size peak/average lighted Cross-Needle SWR/ Wattmeter, 8 position antenna switch, dummy load, ORM-Free PreTune™, scratch proof Lexan front panel. 31/2Hx105/8Wx7D inches. MFJ-948, \$129.95. Economy version of MFJ-949E, less dummy load, Lexan front panel.

#### **MFJ-941E** super value Tuner The most for your money! Handles 300 Watts PEP, covers 1.8-30

MFJ-941E MHz, lighted Cross-Needle SWR/ #11995 Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek 10<sup>1</sup>/<sub>2</sub>Wx2<sup>1</sup>/<sub>2</sub>Hx7D in.

### MFJ-945E HF+6 Meter mobile Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. MFJ-20, \$4.95, mobile mount.

MFJ-971 portable/QRP Tuner Tunes coax, balanced lines, random wire 1.8-30 MFJ-97

MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x61/2x21/2 inches.



.

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.



# Monoband Performance • On Every Frequency

## www.steppir.com

The antenna is always at the correct length - each element is adjusted from the ham shack with a micro-processor based controller

### Excellent gain, low SWR and unequaled front to back!

Dipole \$489 2 EL YAGI \$815 3 EL YAGI \$1099 20m - 6m continuous BiggIR 40m - 6m vertical \$489 SmallIR 20m - 6m vertical \$449 (radial system required)

Current lead times are at 4 weeks, so if you are thinking about purchasing a SteppIR antenna, we suggest you place your order soon to avoid longer lead times as Spring approaches - Thanks!

SteppIR Antennas • 14135 233rd Place SE • Issaquah WA 98027 Tel: 425-456-0200 • Fax: 425-391-6031 • Email: sales@steppir.com

### GAIN the EDGE with NARTE Certification

NARTE gives you the competitive edge with individual certification in Electromagnetic Compatibility, Electromagnetic Discharge Control and Telecommunications.

1-800-89-NARTE www.narte.org



Industry-recognized certification required or desired by more than 400 corporations nationwide. FRIEND OF BILL W.?? - Join HAAM net Saturdays at 12:30 Eastern on 14.290; Sundays at 09:30 Pacific on 14.340/2. K6LX

Join the LAMBDA AMATEUR RADIO CLUB (LARC) since 1975 the only open and visible public service oriented ham club for gay and lesbian hams. Newsletter, skeds, hamfest meetings, listserv, and full service web site http://www.lambdaarc.com Write LARC, POB 21669, Cleveland, OH 44121-0669 or email larc@lambdaarc.com

RAINBOW AMATEUR RADIO ASSOCIATION - Serving the gay/lesbian community. ARRL affiliated. Privacy respected. Active weekly HF nets, monthly newsletter, e-mail server, chat room, V.E. teams, DXpeditions. Web page: www.rara.org. Information: Info@rara.org or Box 144, 819 Peacock Plaza, Key West, FL 33040.

THE ARRL LETTER — The League's news digest for active amateurs, professionally produced and edited and available in a weekly electronic edition via the World Wide Web at http://www.arrl.org/arrlletter

THE Veteran Wireless Operators Association, a 74-year old, non-profit organization of communications professionals invites your inquiries and application for membership. Write VWOA, Edward Pleuler, Jr., Secretary, 46 Murdock Street, Fords, NJ 08863. Visit our web site for activities, history, membership: http://www.vwoa.org

WORK GEORGIA'S 159 COUNTIES: New award, with progress certificates for 50 and 100 counties. Atlanta Radio Club, http:// www.w4doc.org

### PROPERTY/ VACATION/RENTALS

A BERMUDA HAM QTH awaits you. Email edkelly@ibl.bm or phone VP9GE 1-441-293-2525.

A CARIBBEAN ANTIGUA West Indies Ham QTH with general coverage transceiver and 7 towers with antennas. Constant electricity. Contact Roy 954-801-6061 or 954-962-4723, or Sam WT3Q 717-355-2925 for details.

AFRICAN DX SAFARIS Led by ZS6WPX. Check out www.dxsafari.s5.com

BLUE RIDGE MT. VA. - Beautiful mountain top location - Floyd, VA. www.vamountainland.com KK4WW 1-540-763-2321

BORNEO/9M6AAC - http://www.qsl.net/ 9m6aac

COLORADO CHALET with ham gear, www.lostcreekcabin.com. WØLSD Buena Vista, CO.

CARIBBEAN FAMILY HAM VACATION: Curacao PJ2T station and house; two bedrooms, 100 foot oceanfront, SCUBA,

beach, snorkeling nearby; three kW stations, 11 Yagis, three towers. ghoward@kent.edu, WØCG http://asgard.kent.edu/ccc

DXshack FG, J6, 3W, XU, XW TRX+kWAMP+Beam ANT & Bed. URL: // qth.com/dxshack email: xu2a@fsinet.or.jp

EXCELLENT HAM LOCATION FOR SALE. Country living. Top of a gentle ridge, WONDERFUL DX conditions. I easily work the world with a 360 foot longwire and 100 watts. A beam+kilowatt would rule the ether! 3 acres with buildings or all 30. 1200 square foot house, double-wide mobile home with added full length porch, large "party house", storage building, gazebo and rock garden with large covered barbecue area and much, much more. Lots of room for antenna experimenting, tower. Paved road all the way home. (707) 644-1123 mike@ILikeTheInternet.com

# **10 Bands -- 1 MFJ Antenna!** Full size performance ... No ground or radials Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna Separate full size radiators ... End loading ... Elevated top feed ... Low Radiation Angle ... Very wide bandwidth ... Highest performance no ground vertical ever ...

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get full size performance with no ground or radials!

Full size performance gives high efficiency for more power radiated. Results? Stronger signals and more Q-5 QSOs.

Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique Elevated Top Feed<sup>™</sup> elevates the feedpoint all the way to the top of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

#### Separate Full Size Radiators

Separate full size quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything

### MFJ's Super High-Q Loop<sup>™</sup> Antennas

MFJ's tiny 36 inch diameter loop antenna lets you operate 10 through 30 MHz continuously -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor

**379**<sup>95</sup> homes, attics, or mobile homes. Enjoy both DX and local Ship Code F contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has Auto Band Selection™. It auto-tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- not a lossy thin flat-strip gives you highest possible efficiency.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent MFJ-1778, Ship Code A dipole. Use as inverted high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning.

Heavy duty thick ABS plastic housing

has ultraviolet inhibitor protection. **NEW!** MFJ-1788, \$429.95. Same as

MFJ-1798

89

Ship Code F

MFJ-1786 but covers 40 Meters-15 Meters continuous. Includes super remote control. MFJ-1782, \$339.95. Like MFJ-1786

but control has only fast/slow tune buttons. MFJ-1780, \$249.95. Box Fan Portable Loop is about the same size (2x2 foot) as a box fan, complete with handle. Covers 14-

### 30 MHz. Control has fast/slow tunes. MFJ Portable Antenna

MFJ-1621 **\*89**<sup>95</sup> Ship MFJ-1621 lets y Code operate in most any MFJ-1621 lets you



A electrically free area -apartment, campsite, hotel, the beach, etc.

DXCC, WAZ, WAC, WAS have been won with MFJ-1621! Work 40, 30, 20, 17, 15, 12 and 10 Meters with a telescopic whip that extends to 54 inches. Mounted on a sturdy 6x3x6 inch cabinet. Built-in antenna tuner, field strength meter, and 50 feet of RG-58 coax cable. Handles 200 Watts. MFJ's G5RV Antenna



Covers all bands, 160-10 Meters with anten-\$3995 na tuner. 102 feet long, shorter than 80 Meter

vee or sloper to be more compact. Use on 160 Meters as Marconi with tuner and ground. Handles full legal limit power. Add coax feedline and some rope or other nonconductor and you're on the air!

beyond it. In phase antenna current flows in all parallel radiators.

This forms a very large equivalent radiator and gives you incredible bandwidths.

Radiator stubs provide automatic bandswitching -absolutely no loss due to loading coils or traps.

End Loading

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique Frequency Adaptive L-Network™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the bottom of the antenna.

#### No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you excellent ground isolation.

You can mount it from ground level to roof top and get awesome performance.

#### No Feedline Radiation to Waste Power

The feedline is decoupled and isolated from the 95 antenna with MFJ's exclusive AirCore™ high power current balun. It's wound with Teflon<sup>R</sup> coax and can't saturate, no matter how high your power.

#### **Built to Last**

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure. Efficient high-Q coils are wound on tough low loss fiberglass

forms using highly weather resistant Teflon<sup>R</sup> covered wire.

### MF.I halfwave vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

Only 12 feet MFJ-1796 high and has a tiny \$20995 24 inch footprint! Ship Code F Mount anywhere -ground level to tower top -apartments, small lots, trailers. Perfect for vacations, field day, DXpedition, camping.

Efficient end-loading, no lossy traps. Entire length is always radiating. Full size halfwave on 2/6 Meters. High power air-wound choke balun eliminates feedline radiation. Adjusting 1 band has minimum effect on others.

MFJ-1792, \$169.95. Full size 1/4 wave radiator for 40 Meters. 33 feet, handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, \$189.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.



http://www.mfjenterprises.com 1 Year No Matter What<sup>TM</sup> warranty 30 day money back guarantee (less s/h) on orders from MFJ



MF.J... the world leader in ham radio accessories!



### Excellent gain, low SWR and unequaled front to back!

Dipole \$48 2 EL YAGI \$81 3 EL YAGI \$109 20m - 6m continuous

\$ 489 \$ 815 \$1099 BiggIR 40m - 6m vertical \$489 SmallIR 20m - 6m vertical \$449 (radial system required)

Current lead times are at 4 weeks, so if you are thinking about purchasing a SteppIR antenna, we suggest you place your order soon to avoid longer lead times as Spring approaches - Thanks!

SteppIR Antennas • 14135 233rd Place SE • Issaquah WA 98027 Tel: 425-456-0200 • Fax: 425-391-6031 • Email: sales@steppir.com

### GAIN the EDGE with NARTE Certification

NARTE gives you the competitive edge with individual certification in Electromagnetic Compatibility, Electromagnetic Discharge Control and Telecommunications.

1-800-89-NARTE www.narte.org



Industry-recognized certification required or desired by more than 400 corporations nationwide. FRIEND OF BILL W.?? - Join HAAM net Saturdays at 12:30 Eastern on 14.290; Sundays at 09:30 Pacific on 14.340/2. K6LX Join the LAMBDA AMATEUR RADIO CLUB

Join the LAMBDA AMATEUR RADIO CLUB (LARC) since 1975 the only open and visible public service oriented ham club for gay and lesbian hams. Newsletter, skeds, hamfest meetings, listserv, and full service web site http://www.lambdaarc.com Write LARC, POB 21669, Cleveland, OH 44121-0669 or email larc@lambdaarc.com

RAINBOW AMATEUR RADIO ASSOCIATION - Serving the gay/lesbian community. ARRL affiliated. Privacy respected. Active weekly HF nets, monthly newsletter, e-mail server, chat room, V.E. teams, DXpeditions. Web page: www.rara.org. Information: Info@rara.org or Box 144, 819 Peacock Plaza, Key West, FL 33040.

THE ARRL LETTER — The League's news digest for active amateurs, professionally produced and edited and available in a weekly electronic edition via the World Wide Web at http://www.arrl.org/arrlletter

THE Veteran Wireless Operators Association, a 74-year old, non-profit organization of communications professionals invites your inquiries and application for membership. Write VWOA, Edward Pleuler, Jr., Secretary, 46 Murdock Street, Fords, NJ 08863. Visit our web site for activities, history, membership: http://www.vwoa.org

WORK GEORGIA'S 159 COUNTIES: New award, with progress certificates for 50 and 100 counties. Atlanta Radio Club, http:// www.w4doc.org

### PROPERTY/ VACATION/RENTALS

A BERMUDA HAM QTH awaits you. Email edkelly@ibl.bm or phone VP9GE 1-441-293-2525.

A CARIBBEAN **ANTIGUA** West Indies Ham QTH with general coverage transceiver and 7 towers with antennas. Constant electricity. Contact Roy 954-801-6061 or 954-962-4723, or Sam WT3Q 717-355-2925 for details.

AFRICAN DX SAFARIS Led by ZS6WPX. Check out www.dxsafari.s5.com

BLUE RIDGE MT. VA. - Beautiful mountain top location - Floyd, VA. www.vamountainland.com KK4WW 1-540-763-2321

BORNEO/9M6AAC - http://www.qsl.net/ 9m6aac

COLORADO CHALET with ham gear, www.lostcreekcabin.com. WØLSD Buena Vista, CO.

CARIBBEAN FAMILY HAM VACATION: Curacao PJ2T station and house; two bedrooms, 100 foot oceanfront, SCUBA, beach, snorkeling nearby; three kW stations, 11 Yagis, three towers. ghoward@kent.edu, WØCG http://asgard.kent.edu/ccc

DXshack FG, J6, 3W, XU, XW TRX+kWAMP+Beam ANT & Bed. URL: // qth.com/dxshack email: xu2a@fsinet.or.jp **EXCELLENT HAM LOCATION FOR SALE.** Country living. Top of a gentle ridge, WONDERFUL DX conditions. I easily work the world with a 360 foot longwire and 100 watts. A beam+kilowatt would rule the ether! 3 acres with buildings or all 30. 1200 square foot house, double-wide mobile home with added full length porch, large "party house" storage building, gazebo and rock garden with large covered barbecue area and much, much more. Lots of room for antenna experimenting, tower. Paved road all the way home. (707) 644-1123 mike@lLikeTheInternet.com

### **MFJ** Sound Card-to-Rig Interface Use sound card and rig for all digital modes!

Plug and Play -- includes software, all cables, AC power supply . . . RFIproof . . . Isolation transformers -- no hum, noise, distortion . . . Operate PSK-31, packet, APRS, AMTOR, RTTY, SSTV, CW, Meteor Scatter, others . . . Use as Voice Keyer, CW Contest Memory Keyer ... Monitor On/Off Switch ...

Plug this new MFJ-1275/M/T sound card interface between your transceiver and computer and enjoy operating all digital modes.

Everything you need is included -- software, audio cables, RS-232 serial cable and AC power supply. Provides fully automatic operation with audio and push-to-talk control. It matches sound card audio, eliminates ground loops and provides microphone override. Models available for all transceivers with 8-pin round, 8-pin modular (RJ-45) or 4-pin round microphone plugs. Operate PSK-31, packet, APRS, AMTOR, RTTY, SSTV, CW, high speed CW Meteor Scatter and many others. Also use as Contest Voice Keyer and CW Contest Memory Keyer.

Digital Modes or Normal Operation

Select the ON digital mode -- all connections are made between your rig and computer for instant digital operation. Select BYPASS normal mode -- your transceiver and computer connections are restored for their normal operation.

Audio Isolation Transformers

Audio isolation transformers and relay eliminate ground loops, audio hum, noise and distortion.

#### **RFI-Proof**

Extensive RF suppression and line isolation eliminates RF feedback problems. Automatic Microphone Överride

Transmit mic audio at any time by pressing PTT to override digital modes -great for SSTV and Contest Voice Keyer. More Impressive Features

Serial port -- lets computer control radio to override/interrupt digital transmissions.

VOX Control -- lets you use VOX control when not using computer serial port control.

Level Controls -- for transmitter drive and for receiver-to-sound card drive level. No need to adjust microphone gain or sound card level when you change modes.

Stereo or Mono Audio Input -- A front panel switch selects left, right, or both

### Super Sound Card Interface



MFJ-1279/M/T This super 2095 sound card interface has all of the features of the MFJ-1275 plus . . . Auxiliary Input Jack: Lets you switch

your sound card from MFJ-1279 so you can use your sound card for something else. No more plugging/unplugging! • Direct CW/FSK Keying Jack: Allows direct CW or FSK keying operation. Headphone Jack: Use your stereo headphones so you won't disturb your XYL (also turns off external speaker).



sound card audio output channels to accommodate various programs.

Off-the-air recording -- for replaying or for use with spectrum analyzer programs.

Monitor on/off switch lets you have a normal QSO and receive SSTV pictures at the same time in the "monitor on" position. This is great for modes like SSTV and Voice Keyer operation that may require listening to receive audio during operation.

Rugged Construction -- All aluminum cabinet and surface-mount construction gives you years of trouble-free service. Use any Transceiver

Internal jumpers program microphone wiring for any brand or model radio -- no soldering required. Order MFJ-1275 for 8pin round mic plug. Order MFJ-1275M for 8-pin modular mic (RJ45) plug.

 Footswitch: Use footswitch or other for PTT (push-to-talk) when not using VOX. Plug and Play! Includes software CD, RS-232 and audio cables, AC power supply. Order MFJ-1279 for 8-pin round mic,

MFJ-1279M for 8-pin modular (RJ-45) mic, MFJ-1279T for 4-pin round mic. Add "X" suffix for 220VAC.

### **Basic Digital Interface**



Plug and Play! Has sound card, radio, speaker, RS-232 jacks. Includes: software CD and RS-232, audio, mic

MFJ-1273B cables. No external power **095** needed. Has no mic jack or mic switch. Order MFJ-

MF.I... the world leader in ham radio accessories!

1273B for 8 pin round mic, MFJ-1273BM for 8-pin modular (RJ-45) mic, MFJ-1273BT for 4-pin round mic.

NEW! Order MFJ-1275T, for 4-pin round mic plug, for Ten-Tec and others. Plug and Play!

Everything you need is included -- audio and RS-232 cables, AC power supply and a CD with a collection of the most popular amateur radio software to operate PSK-31, RTTY, SSTV, PACKET, AMTOR, CW, HSCW Meteor Scatter, Contest Voice Keying and other modes. Use 12 VDC or 110 VAC. No Matter What<sup>™</sup> Warranty

Protected by MFJ's famous No Matter What<sup>™</sup> one year limited warranty. MFJ will repair or replace (at our option) your MFJ-1275/M/T no matter what for one full year. Try it for 30 Days

Order from MFJ and try it -- no obligation. If not delighted, return it within 30 days for refund less shipping.

### **DSP** Sound Card **Programs**

MFJ-1296, \$129.95. RadioCom4 integrates PSK31, SSTV, FAX/Sat FAX, RTTY, SITOR, DSP audio filters and radio control.

MFJ-1298, \$199.95. RadioCom5 -- all features of RadioCom4 plus DSP Audio Filter analyzer, Spectrum Analyzer, Dual Scope Display, Sound Recorder, Time and Frequency Management, Frequency Analyzer, 3D Scanner, Satellite tracking, Rig Control for over 80 radios, more! Free demo at: www.mfjenterprises.com/freedemo.php



http://www.mfjenterprises.com • 1 Year No Matter What<sup>™</sup> warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC. 300 Industrial Pk Rd, Starkville, MS 39759 PH: (662) 323-5869 Tech Help: (662) 323-0549

FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. Add shipping. Prices and specifications subject to change. (c) 2001 MFJ Enterprises. Inc.



### Martin Tower Packages

Ma



Convenient / Affordable to needed to get started! Packages in ing assembly, hinge base for easy i grounding kit, and guying kit. Access Strength Strengt yet lightweight	ower packages, including everything nclude 10' aluminum sections, foot- installation, Hazer, rotator mount, essories are also available.		
<b>Strength</b> Strong yet lightweight al Rated at 87 MPH. Most manufacturers Ever wonder why? For more informati	l-bolted, diagonal construction. only rate their towers at 50 MPH. on, visit www.glenmartin.com.		
Safe, Easy Installation Include	s hinged base for easy walk-up		

erection. No gin poles or special equipment are necessary!

Lifetime Investment Quality materials! Anodized finish resists corrosion & rust! Maintains a 'like-new' appearance!

Model#	Description	Width	80 mph	87 mph	Price
M-1330A	30' Hazer Tower Package	13*	16.8	14	\$1614.99
M-1340A	40' Hazer Tower Package	13"	15.6	13	1831.99
M-1350A	50' Hazer Tower Package	13"	14.4	12	\$2069.99
M-1840A	40' Hazer Tower Package	18"	20.4	17	\$2149.99
M-1850A	50' Hazer Tower Package	18"	19.2	16	\$2409.99
M-1860A	60' Voyager Tower Package	18"	19.2	16	\$3355.99
M-1870A	70' Voyager Tower Package	18*	18	15	\$3659.99

13620 Old Highway 40, Boonville, MO 65233 www.glenmartin.com

### Work All The Digital Modes!

The SignaLink<sup>TM</sup> defines a new standard in multimode sound card interfaces that makes the others obsolete! A level of quality, performance, and features not available anywhere else. Whether you are interested in PSK-31, MT63, RTTY, SSTV, APRS or any of the dozens of other digital modes, this is the interface that you have been looking for! The SignaLink<sup>TM</sup> comes fully assembled, tested, and ready to go. Visit our web site and get all the exciting details on this amazing and revolutionary new product.

### www.tigertronics.com

Tigertronics 400 Daily Lane P.O. Box 5210 Grants Pass, Oregon 97527

FOR SALE SOUTH FLORIDA Custom 4BDR / 2 1/2 bath on lake, pool, US Tower 433/HD KLM KT34A. \$224,000. Call ON4TZ (954)749-7746. Details see www.voyagemagazine.com/guy/selling.html

GEORGIA: 4 acres, pine forest, 7 mi. from ocean, 250 ft. HD tower, building included. Bring your camper, quiet, relaxed getaway. \$49,900. Call Jim at 419-782-8591

MAUI HAWAII - Vacation with a Ham. Since 1990. www.seagmaui.com 1-808-572-7914 or kh6sq@arrl.net

NORTHERN AZ QTH Ham operator's paradise on 40 acres, tree covered and fenced. Four bedroom, two bath 2254 sq. ft. home, three car garage, Heritage™ Steel building 44 x 22. Three tower bases ready for self supporting towers, also two telephone poles 1000 foot apart. \$215,000.00 928-607-2611 w7src@winlink.org bootsie@starband.net

QTH of KW5V on 1+ acre of rural Texas hill country subdivision just outside Austin. 70 guyed tower with 204BA plus vertical and wire antennas. All underground feeds to 3/2/ 2 1640 sq. ft. house with huge shaded patio and hot tub. Separate ham shack/hobby room with 220v. \$160,000. Pictures at TexasDiscountRealty.com or email to sbosbach@austin.rr.com

Sun City West AZ: Spacious 1983 2 br home with family room and hamshack, 2020 sq. ft. All appliances, double garage, screened patio, big corner lot, Butternut vertical. Great value at \$134,900. Taxes \$758. Info VE3PFC@azqth.com. Don Steele, Ken Meade Realty, 1-800-877-1776, 623-521-5254.

TURKS AND CAICOS: 3br/2 bath; pristine beach; XYL approved deluxe accommodations; rigs; amps; antennas. www.qth.com/ vp5 270-259-4530; k4isv@k105.com For rent or sale

TURKS AND CAICOS "HAM-LET" VACA-TION: House with station located Providenciales hillside above ocean. Jody Millspaugh, 649-946-4436 or Box 694800, Miami, Florida 33269 USA. E-mail: jody@tciway.tc

WESTERN, WA 3BR, 2B, 1680 sq ft home on 5 acres, 70 ft Rohn 45, KT34XA & 2el 40M beam. Ham BR has 220v, attached 2 car garage, 40 X 30 ft RV storage bldg. \$250,000. W6QON, 360-864-6697

### ANTIQUE/VINTAGE/CLASSIC

ANTIQUE RADIO CLASSIFIED. Free sample copy! Antique radio's largest-circulation monthly magazine. Old radios, TVs, ham equip., 40s & 50s radios, telegraph, books & more. Ads & articles. Free 20-word ad monthly. Subscribe today. Six-month trial: \$19.95. Yearly rates: \$39.49 (\$57.95 by 1st Class). Foreign: write. ARC, PO Box 802-B22A, Carlisle, MA 01741. Phone: 978-371-0512, Fax: 978-371-7129, Web: www.antigueradio.com

ANTIQUE WIRELESS ASSOCIATION. The organization for all enthusiasts of antique and historical radio! Publishes OLD TIMER'S BULLETIN, covering vintage ham gear, keys, telegraphy, contests, broadcast receivers, vacuum tubes, historical, technical articles, restoration, and much more. AWA produces the famous annual Rochester, NY meet. Maintains world-famous historical radioelectronics communications museum. Membership only \$20/year USA, \$25 elsewhere. Antique Wireless Association, Box E, Dept. 1, Breesport, NY 14816. Check our Website: http://www.antiquewireless.org

FREE CDROM Now Included!


# MFJ Pocket size Morse Code Reader™

Hold near your receiver -- it instantly displays CW in English! Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . .

MFJ-461 Is your CW rusty? Relax and place this 095 tiny pocket size MFJ Morse Code Reader

near your receiver's speaker . . Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

Automatic Speed Tracking MFJ AutoTrak<sup>™</sup> automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW.

#### Four Display Modes

1. Bottom line scrolls and fills with text, then that entire line is displayed on top line until bottom line refills -makes reading text extra easy!

Automatically displays speed in WPM. 2. Same as 1, without speed display

-- gives you maximum text display. 3. Top line scrolls, bottom line dis-

plays speed in Words-Per-Minute.

#### MFJ Pocket Morse Tutor

Learn Morse code Main Spinsteron anywhere with this **MFJ-418** tiny MFJ Pocket-\$7995 sized Morse Code

Tutor<sup>™</sup>! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed CW Pro! LCD, built-in speaker.



Both top and bottom lines scroll. Two-line LCD display has 32 large 1/4 inch high-contrast characters.

#### **MFJ** Instant Replay

The last 140 characters can be instantly replayed. This lets you re-read or check your copy if you're copying along side the MFJ-461.

#### High Performance Modem

Consistently get solid copy from MFJ's high performance PLL (phaselock loop) modem. Digs out weak signals. Even tracks slightly drifting signals.

Of course, nothing can clean up and copy a sloppy fist, especially weak sig-nals with lots of QRM/QRN.

#### **Computer Interface**

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your com-puter serial port and terminal program.

More Features When it's too noisy for its micro-

### MFJ Code Oscillator

#### MFJ Pocket CW Keyer MFJ-403P

**MFJ-557** 

Practice

MFJ-557 Socillator has a Morse key and

oscillator unit mounted

together on a heavy steel

base -- stays put on your

1312, \$14.95. Earphone

trols, speaker. Adjustable

table! Portable. 9-Volt bat-

tery or 110 VAC with MFJ-

jack, tone and volume con-

key. Sturdy. 81/2x21/4x33/4 in.

Deluxe Code



**Built-in** Iambic Paddle. Thumbwheel speed control. Adjustable weight. Adjustable sidetone with speaker. Iambic modes A

or B. Fully automatic or semi-auto "bug" mode. Reversable paddle. Tune mode. RF-proof. Battery Saver. Tiny 21/4x31/4x1 in.

phone pickup, you can connect the MFJ-461 to your receiver with a cable. Battery saving feature puts MFJ-461 to sleep during periods of inactivity. It

wakes up and decodes when it hears CW. Uses 9 Volt battery (not included).

#### **True Pocket Size**

Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 21/4x31/4x1 in. 51/2 ounces.

#### No Instruction Manual needed!

Super easy-to-use! Just turn it on -it starts copying instantly!

#### Accessories

MFJ-26B, \$4.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, \$14.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, \$5.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ miniature Travel lambic Paddle MFJ-561, \$19.95. 13/4Wx13/4Dx3/4H in. Formed phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.



# http://www.mfjenterprises.com 1 Year No Matter What<sup>™</sup> warranty • 30 day money

back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC. 300 Industrial Pk Rd, Starkville, MS 39759 PH: (662) 323-5869 Tech Help: (662) 323-0549 FAX:(662)323-6551 8-4:30 CST. Mon.-Fri. Add shipping. Prices and specifications subject to change. (c) 2001 MFJ Enterprises, Inc.

#### MF.I... the world leader in ham radio accessories!

OR	PORAT	MAS	SERIES CR	ANK-UP TUI	r.com BULAR TOW at 50 MPH winds	ERS	
	MODEL NO. MA-40 MA-550 MA-550MDP* MA-770 MA-770MDP* MA-850MDP* Stonder bross	40 55 55 71 71 85	HEIGHT MIN. 21.6 22.1 22.1 22.10 22.10 23.6 0 23.6	NUMBER SECTIONS 2 3 3 4 4 5	WEIGHT POUNDS 242 435 620 645 830 1128	SEC. OD Top. Bot. 3'sq. 4 1/2' 3'sq. 6' 3'sq. 8' 3'sq. 8' 3'sq. 8' 3'sq. 8' 3'sq. 10'	Call US Towe Dealers for Best Pricing
	•MDP models co	omplete with	heavy-duty mo	tor drive with posit	ive pull down, MCL	-100 required.	1 1
	MODEL NO. TX-438 TX-455 TX-472 TX-472MDP* TX-489 TX-489MDPL* TX-489MDPL* TX-489MDPL cc	HEIGHT MAX. 38' 55' 72' 72' 89' 89' ncludes heavy omes with her	III handle 18 HEIGHT MIN. 21 6 22 22 8 23 4 23 4 23 4 23 4 23 4 23 4 23 4 23 4	sq. ft. antennas a NUMBER SECTIONS 2 3 4 4 5 5 5 1/2 Ive with positive pu drive with dual leve	41 50 MPH winds WEIGHT POUNDS 355 670 1040 1210 1590 1800 III down, MCL-100 n el wind and positive	SEC. OD Top. Bot. 12 1/2' 15' 12 1/2' 18' 12 1/2' 21 5/8' 12 1/2' 21 5/8' 12 1/2' 25 5/8' 12 1/2' 25 5/8' 12 1/2' 25 5/8' required. pull down.	
	MDPL models i	FREE ST	ANDING H	switch packages.	CRANK-UP T	OWERS	
CONCEANING AN AN AN AN AN AN	MODEL. NO. HDX-538 HDX-555 HDX-572 HDX-572MDPL* HDX-689MDPL* HDX-689MDPL* HDX-5106MDPL * Includes beav-duty *HDX-689MDPL reter	W HEIGHT MAX. 38' 55' 72' 72' 89' 89' 89' 89' * 106' motor drives wit at 60 sq. h. of at	Image: Weight and the second	sq. ft. antennas NUMBER SECTIONS 2 3 4 4 5 5 6 d positive puldown. MDI nds. * HDX-5109MDPL of	at 50 MPH winds WEIGHT POUNDS 600 870 1420 1600 2440 3450 3700 PL models include fully op atted at 35 sq. ft. of anten	5, <b>SEC. OD</b> <b>Top. Bat.</b> <b>15"</b> 21 5/8" <b>15"</b> 25 5/8" <b>15"</b> 25 5/8" <b>15"</b> 30 5/8" <b>18"</b> 37 1/8" <b>15"</b> 30 5/8" <b>18"</b> 37 1/8" <b>15"</b> 37 1/8" <b>15</b> 37 1/8" <b>17</b> 37 1/8" <b>17</b> 37 1/8" <b>17</b> 37 1/8" <b>17</b> 37 1/8"	
A A A A A	FREE S Will har MODEL NO. TMM-433SS* TMM-433HD* TMM-541SS* * Rotators must	TANDINC adle 18 sq. HEIGHT MAX. 33 33 41 be top mour	G "LOW PF ft. antennas a HEIGHT MIN. 11 4' 11 4' 12 ited	ROFILE" CON tt 50 MPH winds NUMBER SECTIONS 4 4 5	<b>IPACT CRAN</b> 5. ( <i>TMM-433HD</i> ) <b>WEIGHT</b> <b>POUNDS</b> 315 400 430	K-UP TOWERS handles 24 sq. ft.) SEC. OD Top. Bot. 10" 18" 12 1/2" 20 7/8" 10" 20 7/8"	

Prices are FOB, factory: Visalia, CA. Prices and specifications are subject to change without notice.



#### The W2IHY 8 Band Audio Equalizer And Noise Gate brings professional audio processing technology to your shack ... affordably!

The W2IHY 8 Band Audio Equalizer And Noise Gate provides three powerful audiomanagement tools for your microphones and radios. Fine-tune your microphone with 8 Bands of Equalization. Customize your audio for that rich, full broadcast sound or penetrating, pileup busting contest and dx audio. Change from one audio "personality" to another instantly with smooth-action slide pots. The highly effective Noise Gate eliminates background noises picked up by your microphone. Increases signal clarity and presence.

Universal Microphone and Radio matching capabilities let you interface practically any microphone with any radio! Comprehensive impedance matching and signal level controls for input and output, 8-pin, XLR and RCA microphone jacks. Headphone monitor. Extensive RFI protection.

W2IHY 8 Band Audio Equalizer And Noise Gate \$229.99 (Kit \$189.99) Microphone Cable (specify radio make & model) \$15.00 W2IHY Dual Band Audio Equalizer And Noise Gate \$129.99 (Kit \$99.99) \$&H \$8.00 Three year parts & labor warranty.



#### BROADCAST MICROPHONES and accesso-

ries (call letter plates, stands) wanted: early carbon, condenser, ribbon, dynamic models. Cash or trade. James Steele, Box 610, Kingsland, GA 31548. 912-729-6106. jsteele@k-bay106.com; http://www.kbay106.com/mics.htm

CLASSIC RADIOS — www.radiofinder.com finder@radiofinder.com

CODE PRACTICE OSCILLATOR MUSEUM: http://www.n4mw.com

COLLINS REPAIR - Specializing in S-Line and KWM2. Precision Collins Services, N6HK 661-822-6850. n6hk@csurfers.net

DRAKE RV-6 WANTED: Also interested in other harder to find Drake items from the tube era. Please email with price and condition. Brian nx0x@arrl.net

HI-MANUALS WAS RECENTLY ACQUIRED BY SURPLUS SALES OF NEBRASKA. Our combined library of 7000 manual originals, 50+ years service to the Amateur Radio Community and superior quality make us the best choice for your hard-to-find manuals. FREE PRIORITY MAIL IN THE U.S. Visit our website www.surplussales.com or call orders in at 800-286-5701, inquiries at 402-346-1315.

TELEGRAPH KEYS wanted by collector. Bugs and unusual or unique straight keys or sounders, and tube electronic keyers. Also pre-1950 callbooks. Vince Thompson, K5VT, 3410 N. 4th Ave., Phoenix, AZ 85013. 602-840-2653.

TELEGRAPH MUSEUM / COLLECTOR'S INFORMATION: http://w1tp.com

W4QCF MANUALS and Museum www.w4qcfmanuals.com

WANTED: pre-1925 battery radios, crystal sets, and vacuum tubes. Also early telegraph keys and pre-1900 electrical apparatus. Jim Kreuzer, N2GHD, 1541 Bronson Road, Grand Island, NY 14072. 716-773-4999. wireless@pce.net

#### **QSL CARDS/CALL SIGN NOVELTIES**

100 QSL CARDS \$9.50 postpaid. We also print Color QSL cards, Eyeball cards ETC. Send stamp for Sample. Vaso Nagl, KD4WVK, 832 Woodcraft Drive, Nashville, TN 37214.

AFFORDABLE QSL CARDS, available in small quantities with lots of options. Parma Graphics, K2BKA, 5 Rondout Harbor, Port Ewen, NY 12466. 845-339-1996.

CALL SIGN NAME BADGES. Club logos our specialty. Certified ARRL engraver. Capital Engraving, 3109 Marigold St, Longview, Washington 98632-3415. AI, WA7UQE. capengrave@kalama.com. http:// www.kalama.com/~capengrave/

ENGRAVING: Callsign/name badges by WØLQV. Send for price list. Box 4133, Overland Park, KS 66204-0133. E-mail: LQ225147@juno.com

FREE SAMPLES. The QSLMAN®, Box 73, Monetta, SC 29105. Phone/FAX (803) 685-7117 anytime. Email: w4mpy@qslman.com. Always 100% satisfaction guarantee on anything we do. Check the web site at: http:// www.qslman.com

NAME TAGS BY GENE: In full color, our artwork or yours. See our web page for samples and prices. www.hampubs.com Harlan Technologies 815-398-2683

# **MFJ** Speech Intelligibility **Enhancer** ... makes barely understandable speech highly understandable!



"What did you say?" Can you hear but . . . just can't always understand everything people are saying?

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why .

**Research** shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability

to understand speech, you must: First, drastically increase the speech

energy above 500 Hz, where 83% of the speech intelligibility is concentrated. Second. drasti-

cally reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 21/2 Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more. Here's what QST for April, 2001 said

... "I expected a subtle effect at best, but I was astonished ... The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . .

Immuned to RFI. Has phone jack,

on/off speaker switch, 2 inputs, bypass switch, 10Wx2<sup>1</sup>/<sub>2</sub>Hx6D". Needs 12 VDC. MFJ-1316, \$19.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, \$58.80. All-in-one MFJ-616 Accessory Pack. Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. Save \$7! Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

# MFJ Contest Voice Kever

Transformer-coupled -- No RFI, hum or feedback ... 75 seconds total, 5-messages . . . Records received audio . . .



Let this new microprocessor controlled MFJ Contest Voice Keyer<sup>™</sup> call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and play back five natural sounding messages in a total of 75 seconds. Uses eeprom -- no battery backup needed.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is so easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "Please repeat".

A playing message can be

MFJ-434 halted by the 179<sup>95</sup> Stop Button, wour micro-phone's PTT/VOX, remote con-

trol or computer. Has jack for remote or com-

puter control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434 is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

It's easy to use -- just plug in your 8 pin mic and plug the MFJ-434 cable into your transceiver. Internal jumpers let you set it to your rig. Use your mic or its built-in mic for recording.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, \$14.95. 61/2Wx21/2Hx61/2D in.

MFJ-73, \$29.95. MFJ-434 Remote Control with cable.

### 60 dB Null wipes out noise and interference



Wipe out noise and interference before it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes .

It's more effective than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on all modes -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null

out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an adjustable phasing network. You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive **Constant Amplitude Phase** Control<sup>™</sup> makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, \$14.95. 61/2x11/2x61/4 in.

MFJ-1025, \$159.95. Like MFJ-1026 less built-in

active antenna, use external noise antenna.

#### MFJ tunable Supe tilter MFJ-784B

05

Only MFJ gives you tunable and programmable 'brick wall" DSP filters.

You can continuously tune low pass, high pass, notch and bandpass filters and continuously vary bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you



can customize. Automatic notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.



. 1 Year No Matter What™ warranty . 30 day money back guarantee (less s/h) on orders direct from MFJ



http://www.mfjenterprises.com for instruction manuals, catalog, info

## **UPGRADE TO GENERAL OR EXTRA** WITH STUDY AIDS FROM **GORDON WEST & W5YI**



**General Upgrade Software** Value pack – Study Manual, Practice Exam Software, and Morse Code program. GUS \$34.95



CW Course by Gordo Teaches you the code on 6 long-play cassettes for your Element 1 CW test. GW05 \$29.95

**General Class book** Complete explanations to

every Element 3 Q&A that can be on your exam. **GWGM \$12.95** 



Book & Software ECS \$39.95

6

The W5YI Group POB 565101 - Dallas TX 75356

Audio Theory Course **GWEW \$29.95** 

Order TODAY! www.w5yi.org or 800-669-9594 Mention this ad and receive a free gift with your order! S&H \$5 via Priority Mail

### LOW NOISE PREAMPS

#### LNY-() PREAMP **ONLY \$29**

- Miniature MOSFET Preamp.
- Low noise figure.
- Available for various bands from 28 to 450 MHz.

LNK-()

**ONLY \$59** 

PREAMP



 Low noise LNY-type preamp in alum case with **BNC** jacks

#### LNP-( ) PRESELECTOR ONLY \$49

- Eliminate intermod! 
   Sharp 3-section filter
- Low noise preamp
   Avail. 137 to 230 MHz.

# Weather Fax Rcvr

Join the fun. Get striking images directly from the weather satellites!

Our R139 is a very sensitive wideband fm receiver optimized for NOAA APT &

Russian Meteor weather fax on 137MHz band.

We make a complete line of vhf & uhf fm xmtr & rcvr modules, repeaters & accessories; touchtone and ctcss controllers; converters; weather alert, wwv, and aircraft band rcvrs.

65 Moul Rd; Hilton NY 14468-9535; Ph: 585-392-9430 Email: sales@hamtronics.com

See SPECIAL OFFERS and view complete catalog on our website -



HamCall™ world wide CD-ROM Over 1,700,000 listings Over 1.700,000 listings HamCall™ CD-ROM with FREE updates via the Internet for 6 months. Clearly, the most current and complete mar fadio CD-ROM. Updated monthly! The HamCall™ CD-ROM allows you to look up over 1.7 million calisigns from all over the world, from over 300 DX call areas HamCall™ allows the look up of hams world wide by calisign, name, street address, oit, state, postal code, county, county and more. Custom label printing options prints a variety of labels. HamCall™ is 50, plus 55 oh (58 international). Works with noot logging programs. FREE 6 month Internet password included.

3UCKMASTER 6196 Jefferson Highway • Mineral, VA 23117 USA e-mail: info@buck.com 540:894-5777 • 800:282-5628 • 540:894-9141 (fax)



NEW 2002 CATALOG READY! Call. write. email, or FAX for yours! SKYWARN, RACES, ARES supplies plus more. CAPS Unlimited/ SKYWARN Supply.com 972-496-6036; k5hgl@attbi.com, POB 460118 - Garland TX 75046-0118.

QSL CARDS Many styles. Top quality. Order Risk Free, Plastic cardholders, T-shirts, Personalized caps, mugs, shirts. Other ham shack accessories. Free Call. Free samples. Rusprint, 800-962-5783/913-491-6689, fax 913-491-3732. http://www.rusprint.com

QSLKIT at home micro-perf printing on your ink jet printer. CardBox filing systems, index cards and more. www.HamStuff.com by W7NN. QUALITY QSLs by Star Printing. See our display ad on this page.

#### GENERAL

#1 AMATEUR CALLSIGN CD-ROM. "HamCall" contains world wide callsigns with lat/long, grid square, e-mail addresses and much more. Six months FREE Internet updates. Check/Visa/MC. \$50, \$5 ship/ handling. Buckmaster, 6196 Jefferson Hwy., Mineral, VA 23117, 800-282-5628, http://www.buck.com/haminfo.html

2003 CALLBOOK CD-ROM: \$38.95. ARRL items DISCOUNTED, AA6EE@amsat.org; www.radiodan.com/aa6ee/

3300+ DIFFERENT AWARDS online. Annual subscription \$6. http://www.dxawards.com/ offer.html

6.500+ locations WORLD CLOCK software. Review AreaCodeWiz.com, particularly the home and locations pages. Fill in order form. Put QST in Sales Source. That will alert us to charge your CC only \$20 rather than \$30 plus prepaid shipping. 30 day money back guarantee! Limited time offer. For further info e-mail mcgrady@areacodewiz.com

ADVANCED PCB DESIGN offers schematic capture and PCB layout services. Analog, Digital and RF circuits. Commercial and Military applications. Over 20 years experience. Reasonable rates. Call W2FGV at 1-888-618-7267 or visit www.angelfire.com/wizard/pcb

AL-82 AMPLIFIER, QSK, \$1300; MFJ-989C Tuner, \$200; Kenwood TM-V7A, \$225; Ranger 5054DX 6 mtrs, encoder, \$220; Radio Shack HTX-212, \$50; Autek WM-1 wattmeter, \$60; Rigblaster Plus, \$60. W3SML 570-524-7797. ALUMINUM CHASSIS AND CABINET KITS. UHF-VHF Antenna Parts, Catalog E-mail:

k3iwk@flash.net or http://www.flash.net/~k3iwk AMATEUR RADIO PAINTS

www.nctotalelectronics.com 336-229-5671 or ke4lgx@yahoo.com

Amateur Radio Service/Alignment, most brands including amplifiers, tuners, rotors, power supplies, etc. Authorized Kenwood Service Center <N1IMO Bernie-W1ZC Dick> Beltronics Inc., Hollis, NH 603-889-7905 or see WWW.Beltronics.net or Beltronics@juno.com

ANTENNA COMPARISON REPORT: HF TRIBANDERS Find out the real lowdown on HF antenna performance. K7LXC & NØAX test the KT34XA, TH7, TH11, C-3 Skyhawk and more. Over 60 pages. \$17 + \$4 s/h. CHAMPION RADIO PRODUCTS

www.championradio.com, 206-890-4188.

ANTENNA COMPARISON REPORT: HF VERTICALS K7LXC and NØAX test Cushcraft, Butternut, MFJ, Force 12, Diamond, Hustler and Gap verticals. It's 64 pages of protocol, data sets and summaries. Presented at the 2000 Dayton Hamvention. \$17 + \$4 s/h. 206-890-4188 www.championradio.com

# **MFJ** Switching **Power Supplies**

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these new 25 or 45 Amp MFJ MightyLite<sup>™</sup> Switching Power Supplies! No RF hash ... Super lightweight ... Super small ... Volt/Amp Meters ...

MFJ's new adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's MightyLites<sup>™</sup> are so light and small you can carry them in the palm of your hand! Take them with you anywhere.

No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

MFJ's 25 Amp MightyLite™ weighs just 3.7 lbs. -- that's 5 times lighter than an equivalent conventional power supply. MFJ's 45 Amp is even more dramatic -- 8 times lighter and weighs just 5.5 pounds! No RF hash!

These babies are clean . . . Your buddies won't hear any RF hash on your signal! None in your receiver either!

Some competing switching power supplies generate objectionable RF hash in your transmitted and received signal. These super clean MFJ MightyLites™

meet all FCC Class B regulations.

Low Ripple ... Highly Regulated Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load. **Fully Protected** 

You won't burn up our power supplies!

No RF Hash!



They are fully protected with Over Voltage and Over Current protection circuits.

Worldwide Versatility MFJ MightyLites<sup>™</sup> can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

#### MightyLites<sup>™</sup>... Mighty Features

Front-panel control lets you vary output from 9 to 15 Volts DC.

Front-panel has easy access five-way binding posts for heavy duty use and cigarette lighter socket for mobile accessories. MFJ-4245MV has two sets of quick-connects on the rear for accessories.

Brightly illuminated 3 inch meters let you monitor load voltage and current. A whisper quiet internal fan efficiently



cools your power supply for long life. Two models to choose from . . . MFJ-4225MV, \$149.95. 25 Amps maximum or 22 Amps continuous. Weighs 3.7 pounds. Measures 53/4Wx41/2Hx6D in. MFJ-4245MV, \$199.95. 45 Amps maximum or 40 Amps continuous. Weighs 5.5 pounds. Measures 71/2Wx43/4Hx9D in.



MFJ 35/30 Amp Adjustable Regulated DC Power Supply Massive 19.2 pound transformer . . . No RF hash . . . Adjustable 1 to 14 VDC . . .





MFJ's heavy duty 4.095 conventional power supply is excellent for powering HF or 2 Meter/440 MHz transceiver/accessories.

A massive 19.2 pound transformer makes this power supply super heavy duty! It delivers 35 amps maximum and 30 amps continuous without even flexing its muscles. Plugs into any 110 VAC wall outlet.

It's highly regulated with load regulation better than 1%. Ripple voltage is less than 30 mV. No RF hash -- it's super clean!

Fully protected -- has over voltage protection, fold back short circuit protection and over-temperature protection.

You get front panel adjustable voltage from 1 to 14 VDC with a convenient detent set at 13.8 VDC. A pair of front-panel meters let you monitor voltage and current.

Three sets of output terminals include a pair of heavy duty five-way binding posts for HF/VHF radios, two pairs of quick-connects for accessories and a covered cigarette lighter socket for mobile accessories.

A front-panel fuse holder makes fuse replacement easy. Whisper quiet fan speed increases as load current increases -- keeps components cool. 91/2Wx6Hx93/4D inches.

#### plus s&h MFJ High Current Multiple DC Power Outlets Power two HF/VHF transceivers and six or more accessories from your 12 VDC power supply



MFJ-1118, \$74.95. This is MFJ's most versatile and highest current Deluxe Multiple DC Power Outlet. Lets you power two HF and/or VHF transceivers MFJ-1118 \_ and six or more accessories **7495** from your transceiver's main 12 VDC supply.

4995 duty 30 amp 5-way binding posts connect your term Two pairs of super heavy posts connect your transceivers. Each pair is fused and RF bypassed. Handles 35 Amps total.Six pairs of heavy duty, RF 95 bypassed 5-way binding posts let you power your accessories. They handle 15 Amps total, are

protected by a master fuse and have an ON/OFF switch with "ON" LED indicator.

Built-in 0-25 VDC voltmeter. Six feet super heavy duty eight gauge color-

coded cable with ring tongue terminals. Binding posts are spaced for standard dual banana plugs. Heavy duty aluminum construction. 12<sup>1</sup>/<sub>2</sub>x2<sup>1</sup>/<sub>4</sub>x2<sup>1</sup>/<sub>2</sub> in. **MFJ-1116, \$49.95.** Similar to MFJ- 1118. No 30 amp posts. Has "ON" LED

and 0-25 VDC voltmeter. 15 amps total. MFJ-1112, \$34.95. Similar to MFJ-

1116. No on/off switch, LED, meter, fuse. NEW! MFJ-1117, \$54.95. For powering four HF /VHF radios (two at 35 Amps each and two at 35 Amps combined) simultaneously. Tiny 8x2x3 inches.



http://www.mfjenterprises.com • 1 Year No Matter What<sup>IM</sup> warranty • 30 day money

back guarantee (less s/h) on orders direct from MFJ



All are protected by MFJ's famous No Matter What<sup>™</sup> one year limited warranty.



# ADVANCED ANTENNA ANALYSTs<sup>TM</sup>



The VA1 does more than others! • Series L & C • Phase (deg) VA1 RX Analyst 0.5 to 32 MHz \$199.95 + S/H



- Series & Parallel R & X Sign of X

• Much more. Check out our Web page! Don't be misled by others which claim to measure X but don't read sign of X, and can't even tell a capacitor from a coil! The VA1 instantly shows sign, and is not limited to 50 ohm line.



**RFI RF Analyst** 1.2 to 35 MHz Frequency, SWR. True Impedance, L&C. Advanced, but low priced \$139.95 + S/H



**RF5 VHF Analyst** 35 to 75 MHz & 138 to 500 MHz. Similar to RF1 but no direct L/C. Finds lowest SWR automatically. \$229.95 + S/H

Autek Research

P. O. Box 7556

Wesley Chapel, FL 33544

813-994-2199

Order only direct with check, mo, MC, VISA

Add \$8 S/H in 48 states. Add tax in FL. Add \$11

to AK, HI. \$19 Canada. \$28 to most worldwide

locations. Speedy insured shipment

For much more info and combo

discounts, check in at:

http://www.

Each Analyst has a low power "transmitter" to go anywhere in its range-even outside ham bands. Use any to measure SWR curves, feedline loss, impedance, baluns, electrical length (e.g. 1/4 wave lines.) Take one right to the antenna or measure at the transmitter end of the line. Accurately adjust Yagis, quads, slopers, dipoles, phased arrays, matching networks, radials, and so much more. Adjust tuner without transmitting. The RF1 measures "lumped" L and C directly, while the VA1's phase detector can separate out R and X (L/C) separately; you're not "half blind" by knowing only SWR or unsigned X. Each is microprocessor-based & palm sized, only about 8 oz.about the size of the battery pack in others!. Each uses a single 9V standard battery.

### DELUXE SWR & WATTMETER



MODEL WM1 **COMPUTING SWR REMOTE RF HEAD TRUE PEP & AVERAGE NEW - Illuminated Meters** Compare at \$200+ \$149.95 + S/H

Our WM1 gives you exactly what you want-SWR ON ONE METER AND POWER ON THE OTHER Automatically computes SWR. SWR doesn't change with power. No more squinting at crossed needles. NO ADJUSTMENTS. It even reads SWR in PEP on SSB. 4 ft. cable to head avoids "meter pulloff." 5% FS 1-30 MHz, usable on 6M. 2KW, 200, and 20 W scales with 5W center for QRP. 8-18 VDC or 115 VAC. 6-3/8x3-3/ 4x3"d. See excellent review Nov. 1989 QST.) Why use an inferior meter? Get yours today

#### **Tower Grounding Copper Strip**

You KNOW that you need to ground your tower to dissipate a lightning strike's energy! You KNOW that pure copper strip works best! Check out our pricing for .011"x2" pure copper strip versus the competition, AND ours has a machine rounded edge for safer handling. Prices: 50'-\$62.50; 100'-\$98.95; 250'-\$194.95; 500"-\$340.00. Prices include shipping to all contiguous US locations.

The 2003 Model W3BMW Magnet Mount The special feature of the W3BMW is the fact that the magnets "float". The "floating" feature allows each of the magnets to self-adjust for better contact than fixed magnet mounts. The 8-magnet mount has over 1000# holding strength. Prices: The 4-magnet version-\$102.95 and the 8-magnet version-\$128 35. S&H is \$13.50 in the contiguous US. Mounts available with 3/8-24, or SO-239 connector. We also offer a COMMERCIAL/MILITARY MODEL W3BMW mount with a .125"×13"×18" 6061-T6 aluminum plate.



**Copper Foil for Ground Planes** .003"×3" pure copper foil is great for ground planes. It is light and tough! Prices: 25'-\$36.50; 50'-\$60.90. Price includes shipping to all contiguous US locations. Engineering Grade 6061-T6 Aluminum Tubing

Masts and .058" wall telescoping tubing. See our web site or call for prices.





www.rayfield.net/isotron

ANTIQUE QSL's, Free Ham Classifieds: http:/ /hamgallery.com

BEAM HEADINGS \$6.00 PROPAGATION SOFTWARE \$20.00 Engineering Systems Inc., P.O. Box 1934, Middleburg, Virginia 20118-1934 w4het@aol.com

BEST OFFERS. Much ham radio, etc. List: S.A.S.E. Joseph Bedlovies, POB 139, Stratford, CT 06460

BIGGEST on-line ham classifieds: http:// swap.QTH.com

BUY AND SELL AT:

www.RecRadioSwap.com

**CASH FOR COLLINS & HALLICRAFTERS** SX-88; 62S-1; 55G-1; 399C-1; KWM-1; 51S-1 "buy any Collins equipment" Leo KJ6HI ph/fax (310) 670-6969, radioleo@earthlink.net

CHECK OUT OUR SPECIALS AT: www.rossdist.com Call or visit our Web page for complete list and more Specials http://www.rossdist.com , Phone (208) 852-0830 All prices Cash FOB Preston. Ross Distributing Company, 78 South State, Preston, Idaho 83263

COLLINS RADIO 30S1 for sale, round emblem, Peter Dahl power transformer, screen mod, new blower, excellent condition, spare 4CX1000A, \$2600.00, weighs 185 lbs. You pick up. W7UO 520-850-9245.

COLLINS S- LINE ACCESSORIES+

SPARES. Newly manufactured 312B-3 Speakers, 516F-2 Cabinets, Pointer knobs, Emblems etc. All products endorsed by the Collins Radio Association. Please visit our website at, http://www.advanced-optics.com/ collins.htm. For all US and Canadian sales please contact David Knepper, W3ST, Post Office Box 34, Sidman, PA 15955, Phone: (814) 487-4403 Eves, or email him at cra@floodcity.net

CONTESTER laminated keyboard overlays, QSL return envelopes, DX Edge and more. www.HamStuff.com by W7NN.

Cushcraft A3 (2KW), HD73 rotator, \$150.00 u-ship. Ugly, strong 40ft tower, \$50.00 pickup only NW FL. tinsleyj@bellsouth.net

**DIGITAL FIELD strength meters: IC** Engineering, http://www.digifield.com

DUBUS, the guarterly magazine for VHF/UHF and Microwaves. Info / free sample: info@DUBUS.de Please try again - due to email problems in December! DUBUS, Grutzmuhlenweg 23, D-22339 Hamburg, Germany. www.DUBUS.org

**DWM COMMUNICATIONS** - Neat Stuff! SASE brings catalog! POB 87-L, Hanover, MI, 49241.

**DXPEDITIONS on DVD!** Contest and DXpedition Videos by 9V1YC. 7 different titles now available on both DVD and VHS! VKØIR Heard, ZL9CI Campbell, FOØAAA Clipperton, A52A Bhutan, VP8THU South Sandwich, VP8GEO South Georgia, and WRTC 2002 Finland. \$25 each, shipping included. VISA/MC, paypal, or check. Contact: Charlie Hansen, NØTT, 8655 Hwy D, Napoleon, MO 64u74 Tel: 816-690-7535 Email: n0tt@juno.com

ELECTRIC RADIO Magazine in our fourteenth year. Articles on vintage ham and military gear, repair/restoration, history, and AM operation. Large classified section. \$3 for a sample copy, Electric Radio, PO Box 582, Pine, CO 80470. er@officeonweb.net

**ELECTRONIC COMPONENTS**, kits, test equipment, antenna supplies, books, and tools. Many hard to find items like variable capacitors, vernier dials and drives, coil forms, magnet wire, toroids, more. Visit Ocean State Electronics at www.oselectronics.com



2 Meter On-Glass Antenna **ATA144** 

144-148 MHz, Typical VSWR 1.5:1 thru the band, Maximum Power 50 watts, Field Tuneable, 14' of RG58 Cable with PL259, 27 1/2" Copper Plated Whip with Black Finish.



Special price good through 3/15/03 or until stock is depleted, Limit 2



# 2m/70cm Dual Band **On-Glass Antenna ATA270**

144-148 and 440-450 MHz, Typical VSWR less than 2.0:1 thru the bands, Maximum Power 50 watts, Field Tuneable, 14' of RG58 Cable with PL259, 26" Copper Plated Whip with Black Finish.



Special price good through 3/15/03 or until stock is depleted, Limit 2

Some newer automobiles are equipped with "passavated glass" which does not permit on-glass antennas to work properly. Please check your owners manual or you automobile dealer.



FT897..... CALL

CD24 4-Hr Charge Adapter for FNB78....115.95 FNB78 4.5Ah Ni-MH Internal Battery ......115.95 FP30 Internal 100-240V Power Supply.....209.95 



#### FT100D ..... CALL

ATAS120 Active tuning antenna system.	309.95
FC20 Ext Auto tuner	269.95
T9021925 Extra DC Power Cable	32.95
XF117A 6kHz AM Filter	95.95
XF117CN 300Hz CW Filter	69.95
YSK100 Separation Kit	71.95



ATA270 is pictured. ATA144 is slightly different

FT1500M ..... CALL

ADMS2F Software and cable ...... 35.95

FT8900R ..... CALL

MEK2 Mic Extension Kit ...... 38.95

MLS100 High Power External Speaker ..... 49.95 MMB60 Quick Release Mobile Mount...... 27.95

YSK8900 Separation Kit ...... 62.95

# A VX7R/B..... CALL

Choice of the World's top DX'ers SM

#### AT7820 BNC to SMA Adapter ...... 3.50 CD15A Desktop Rapid Charger ...... 17.95 CMP460A Waterproof Speaker/Mic .......... 44.95 CSC88 Soft Case...... 14.95 CT91 Microphone Adapter ...... 9.95 EDC5B DC Cable w/Cigarette Plug ...... 23.95 EDC6 DC Cable ...... 6.95 FBA23 AA Cell Battery Case ...... 22.95

FNB80LI Lithium Ion Battery ...... 58.95 MH57A4B Speaker Mic ...... 27.95 VC27 Earpiece Microphone ...... 27.95

#### Yaesu Closeout Items

CT30 Mic "Y" Connector for 10/40/50 ....... 7.95 FBA17 AA Holder 23/411/470......17.95 FNB31 4.8v 600mah battery for 11/41/51 ...27.95 FNB38 9.6v 600mah battery for 11/41/51 .. 29.95 MH36A6J Replacement Mic FT3000M......39.95 XF117CN 300hz CW filter for FT100........69.95

> Prices are subject to change without notice. Not responsible for typographical errors.







www.vibroplex.com

# **NEW! Updated K2 Transceiver Kit**

 K2 and K2/100 now updated new features, performance improvements

 New KAT100 150-watt ATU with 2 antenna jacks, instant band change



### Elecraft K2 and K2/100 Transceivers

Our 160-10 m, SSB/CW transceiver kit is now available in a 100-watt model! The K2/100 is based on the K2 — same features, same chart-topping receiver performance. Includes rugged 100-watt output stage, RS-232 control port, and silent, diode-switched T/R. All the test equipment you need is built-in, and recent updates make assembly easier than ever. Many options are available, from a rechargeable internal battery to our matching KAT100 autotuner (shown above). K2 base pricing starts at \$599.



K1 Multi-band QRP CW Transceiver: Ideal for first-time builders. 2- or 4-band module; internal battery and internal automatic antenna tuner options. 5 watts+ output. Low current (55 mA on receive) is perfect for camping and back-packing trips. Starts at \$289.



**G** ELECRAFT www.elecraft.com

T P.O. Box 69 m Aptos, CA 95001-0069 Phone: (831) 662-8345 sales@elecraft.com

# Hey—Check out all the latest neat stuff on the Alpha Delta Web Site!

✓ Like the new **PathFINDER HF/6** meter digital auto tuner, the new **PathMINDER HF/6** meter digital auto grounding coax switch, the latest mobile and portable antennas from **OUTbacker** Australia and the UL listed broadband 0-3 GHz **ATT3G50** commercial rated coax surge protector series with field replaceable ARC-PLUG module.

Also, great performing DX series multi-band dipole and sloper HF wire antennas for limited space applications, morse code keys and paddles from KENT Engineers England, DELTA series HF thru UHF manual coax switches and antenna tripods and antenna accessories.

✓ Even more neat stuff on our web site—Articles on how to "Properly install quarter wave slopers", "Which is better, the quarter wave sloper or the half wave dipole?" and "Problem solvers for wire antennas"— a must read before installing any wire antenna.

Complete instruction manuals for the **PathFINDER**, **PathMINDER** and antennas are also on the web site.

It's all here at <www.alphadeltacom.com>





#### K8CX Ham Gallery http://hamgallery.com

KENWOOD Factory Authorized Service. Also repair ICOM, YAESU and others. GROTON ELECTRONICS (978) 630-9996. http:// www.grotonelectronics.com

LEARN CODE by Hypnosis, www.successis-easy.com 800-425-2552.

MACINTOSH ham logging program on CD-ROM. http://www.peachtree-solutions.com

MORSE 0-20 WPM 90 days guaranteed! Codemaster V for IBM compatible PC \$29.95. Morse Express, 800-238-8205. http:// www.MorseX.com

NEW ROHN TOWERS - Cheap. Check us out. www.cox-antenna.com

ONE-MAN TOWERS™. Free-standing. Selferecting. Raise/lower antennas without climbing. 33-82 feet. 120 mph, 19 square feet. Visit us at Hamvention. (888) 558-4300; www.onemantowers.com

PORTALOG general purpose logging software for handheld computers. Ideal for mobile, portable, and field operations. By N9WW. Free demo version. www.hamheld.com

**QFile™ QSL FILING SYSTEM:** Preprinted mylar-reinforced 5x8 index dividers for all current **DXCC** entities. Organize your QSLs! P.O. Box 77001, Charlotte, NC 28271-7000 www.radio-warehouse.com

"RADIO AND ELECTRONICS for beginning Hams age nine to nineteen in the Home, School or Club." 81 pages, 26 easy projects, complete instructions and parts list. Good introduction to electronics and amateur radio. \$11.95 plus \$3.00 postage. To order, Cliff N7ZTY, 3020 W. Old Hwy. Rd., Morgan, Utah 84050 Ph # 801-876-3395.

RADIO REPAIR, Done right! 44,000+ hours experience! Specializing in Kenwood, Yaesu, Icom. All work warranteed. INTERNATIONAL RADIO, 1118 Raymond Ave., Fort Pierce, FL 34950. intlradio@juno.com 1-772-489-6302 http://www.qth.com/irsd

REPEATERS - VHF & UHF "Hi Pro", Two Year Warranty. Free Catalog. Maggiore Electronic Lab., 600 Westtown Rd., W. Chester, PA 19382. 610-436-6051. www.hiprorepeaters.com

**RF TRANSISTORS & TUBES** 2SC2879, 2SC2290, MRF454, 2SC2312, 2SC1969, SD1446, MRF247, 2SC2904, MRF317, SAV7, 3-500ZG, 3CX2500F3, 3CX3000A7, 4CX250B, 4CX1000A, 4CX1500B, 572B, 811A and more. Same day service. Catalogue available. Westgate 800-213-4563

SATELLITE EQUIPMENT - C/Ku Band Big Dish Equipment, http:// www.daveswebshop.com

SMC ELECTRONICS - Surplus and refurbished electronic equipment including repair/ replacement/experimenter parts and accessories. Over 3600 items in stock. KA1BIN www.smcelectronics.com

SURPLUS MICROWAVE PARTS AND TEST EQUIPMENT. Visa, MasterCard and Discover. DudleyLab.com Toms River, NJ, USA. 732-240-6895

TELEGRAPH KEYS wanted by collector. Bugs and unusual or unique straight keys or sounders, and tube electronic keyers. Also pre-1950 callbooks. Vince Thompson, K5VT, 3410 N. 4th Ave., Phoenix, AZ 85013. 602-840-2653.

The SPYDERCONE ANTENNA. Any Band limited space antenna. Call Now Free 877-890-CONE (2663) www.coneantenna.com



# Sweetheart Deal! Save Big on Icom Gear! on IC-746PRO & IC-756PROII on IC-R8500 on IC-718. C-910H. & IC-R75 on IC-2100H & IC-207H on IC-706MKIIG C-V8000, IC-2720H, & IC-PCR1000 purchase of IC-746PRO or IC-756PROII 1:1-706 on Handheld including IC-IC-R3 **C.R**11 Amateur & Receiver products only. This offer cannot be combined with any other special event coupon. Limited time offer. See participating authorized ICOM dealer for details. with purchase of IC-718 or IC-R75 Limit of 10 radios per person.

Who loves ya, baby?

©2003 ICOM America, Inc. 2380 116th Are HE, Bellevue, WA 98004, 425-454-8155. The ICOM logo is a registered trademark of ICOM, Inc. All specifications are subject to change without notice or obligation. AM- 5928 SWEET0ST103

### The **PathFINDER** AutoTuner by Alpha Delta

All-in-One Features for a Clean Desktop - Digital AutoTuner, Complete Digital Readout, Front Panel Switched Outputs for Wire and Coax Fed Antennas! Eliminate Separate Boxes.

The Alpha Delta Model PathFINDER Digital AutoTuner is the ONLY autotuner on the market that has front panel switching outputs and builtin circuitry for Hi-Z (wire type antennas) and Low-Z (coax fed antennas) and full Digital Readout! It is a true multi-function, all-in-one instrument designed for operating convenience.

The PathFINDER provides continuous coverage tuning from 1.8 thru 30 MHz + 6 meters. As a result, it is ideal for Amateur Radio as well as MARS, CAP and Commercial & Government uses. It runs totally under microprocessor control with an average tuning time of 3-4 seconds.



Inside View

VISA

The Digital Readout is a precision Multi-function Bar Graph and Numerical Display that simultaneously reads Power (5 - 200 Watts), peak and average, VSWR and all tuner functions. The Digital Meter provides 5% accuracy plus 1 digit of ANY reading, not just full scale.

Huge, 10:1 SWR tuning range on HF and 3:1 on 6 meters. Much wider than typical built-in transceiver tuners. The PathFINDER will match coax outputs from 6 thru 800 ohms and long wire and balanced outputs from 24 thru 3200 ohms (HF). This wide range allows use of a wide variety of antennas.

Full 200 Watt Power Rating on HF, and 100 Watts on 6-meters with a 50% duty cycle.

In addition to the Digital Readout, there are Audio Beep responses for VSWR and various functions are provided for the visually impaired. DATA cables for popular transceivers will be available, but not required for automatic operation.

Requires 12V DC at only 1 AMP - ideal for Base as well as Portable operation.

Alpha Delta PathFINDER Automatic Antenna Tuner ... \$399.95



Available thru Alpha Delta Dealers or Direct (Add \$8 S/H in U.S. - exports quoted) **Toll Free Order Line: (888) 302-8777** 

ALPHA DELTA COMMUNICATIONS, INC. AA

P.O. Box 620, Manchester, KY 40962 • (606) 598-2029 • fax (606)-598-4413 www.alphadeltacom.com



TUBES: 6JS6C \$35, GE 6JB6A \$17. Other amateur tubes available. www.hamtubes.com n9tew@hamtubes.com 219-924-0945

TUBES: New old stock tubes: Eimac 3-1000Zs @ \$450, plus 804, 805, 812A, 815, 826, 832, 836, 837, other 8xx, 1629, 4D32, sweeps such as 6JB6A, etc. at great prices. Radio Daze, LLC; Phone: 585-624-9755; Fax: 800-456-6494; web: www.radiodaze.com; email: info@radiodaze.com

WANTED: DSP-100/TS850, NX8B, 513-353-9949

WANTED: INFO WAYNE GREEN W2 Never Say Die code teaching. Gave away old 73 magazines. Knox, 5407-117th Street, East Apt J103, Puyallup, WA 98373.

WANTED: KIM's; SYM's; AIM's; SOL's; OMNIBOT's; UNIMAT's & related HW/SW. John Rawley, 1923 Susquehanna Rd, Abington, PA 19001; 215-884-9220; johnR750@aol.com

WANTED: Phillips 777 shortwave automotive radio, Hallicrafters SR-400, and SX-117, KBØW, (916) 635-4994;

frankdellechaie@sprintmail.com

WANTED TO BUY: USAF surplus radars: APQ -109-120-122-126-139-172-153-157-159. Also APG - 60 thru 70. Major system units, sub-assemblies and component parts. As well as US Navy surplus air and shipboard radar systems and assemblies. Plus radar Magnetrons and Klystrons of all types. Call

RRIC 1-800-422-5840 or email radiores@prodigy.net We do rebuild and repair and could use for parts. ALSO WANTED: FAA AND US WEATHER BUREAU RADARS.

WANTED: Tubes. Nobody pays more or faster than us! Mike Forman, 1472 MacArthur Blvd, Oakland, CA 94602, 510-530-8840, mftubes@webtv.net

WANTED: VACUUM TUBES - commercial, industrial, amateur. Radio Daze, LLC, 7 Assembly Drive, Mendon, New York 14506, Phone: (585) 624-9755 Fax: (800) 456-6494 email: info@radiodaze.com web: www.radiodaze.com

WE BUY RADIOS! www.recycledradio.com (603) 942-8709

#### www.seaqmaui.com

Yaesu FT 767GX Transceiver, SP767 Speaker/Filter, manuals, Shure 526T mike, MFJ Keyer. \$500 firm. Art , K1VKO, 203-853-0587

#### JOBS

VISA

National Personal Emergency Response Company (www.link-to-life.com) looking for part time installers in California (Kern & Sacramento, counties), Georgia, Oklahoma (Jefferson, Comanche, Cotton, Ellis & Roger Mills counties), New York, New Mexico (Taos county), West Virginia (Cabell county) & Washington (Lincoln, Adams, Asotin, Douglas, Kittitas, Grant & Pend Oreille counties). Installs take approximately 1 hour. Reimbursed monthly at \$50.00 / install, \$25.00 / service call and \$10.00/disconnect. Please email jh@link-to-life.com.

WANTED FOR SUMMER OF 2003: Instructors in electronics, ham radio, computers and all other sciences. Small boys' science camp in Pennsylvania. Apply: Donald Wacker, P.O. Box 356, Paupack, Pennsylvania 18451. 570-857-1401.

### ONV SAFETY BELT P.O. Box 404 • Ramsey, NJ 07446 800-345-5634 Phone & Fax 201-327-2462



#### www.WEB-TRONICS.com Powerful on-line source for your quality electronic equipment & supplies. Everything from resistors, capacitors, semiconductor devices & inductors to computer boards, data acquisition test equipment, small CCD cameras & much, much more! Circuit Specialists, Inc. 800-528-1417/480-464-2882 Since 1971 FAX 480-464-5824

#### Command Technologies, Inc.

Visit Ham Radio's Big Signal Store HF thru VHF Power Amplifiers 1KW and Up **WWW.COMMAND 1.COM** Toll Free 800-736-0443 Local 419-459-4689

15719 CR 2.50 - P.O. Box 326 Edon, OH 43518

# TECH TALK (

Filters: To buy or not to buy?

If there is one particular aspect or trait most radio amateurs have in common, it is seeking out the best possible performance-versus-cost ratio in an HF transceiver. The quest holds good merit, but remember to factor options responsible for that high performance (like IF filters and DSP) into the equation before making a buying decision. Adding optional IF filters (up to seven for competitive model transceivers) noticeably increases overall cost, yet excluding such optional filters shortchanges one's full radio enjoyment. What to do? Go first class right from the start with Icom's world famous IC-756PROII, naturally!

FILTERS, SKIRTS AND DSP. Two of the IC-756PROII's leading assets are its extensive digital IF filters and its 32 bit floating point DSP. Combined, they produce over

50 different built-in filter widths and response curves to mate with operating needs and band conditions of the day. There are no optional filters needed! These DSP-based filters, incidentally, utilize computer-type concepts to clock signals in



IC-756PROII

and out of the processor. Further, Icom's 32 bit DSP can process data with less noise than a 16 bit DSP system. That's why its filter curves can be wide for full-bodied audio yet ultra steep-skirted (only 200 Hz difference between its -6 and -60dB points in CW) for incredible selectivity. Crystal filters are good and mechanical filters are better, but neither type compare to Icom's DSP filters. It's that simple!

**ADDITIONAL CONSIDERATIONS.** Using IF filters plays a major role in every transceiver's performance, but they must be supported by additional "high end" circuitry to produce a top-line rig—and this is where Icom's IC-756PROII blows away the competition. Its multiple AGC loops support increased receiver sensitivity with a lower noise floor and permit copying weak signals without desensing or "pumping" from strong adjacent-frequency signals. It is a difference you can hear—and appreciate!

Digital Twin PassBand Tuning further separates the IC-756PROII for the competition. By rotating its concentric controls together, you can move IF response up or down. By rotating them separately (one up, one down), you can narrow a filter's width, and by moving only one control, you can tailor only one side of a response curve. As a result, copying weak stations and rare DX is a cinch with Icom's IC-756PROII. Looking for maximum value in an HF transceiver? Put an IC-756PROII in your shack and start hearing what others are missing!

Visit your authorized Icom dealer today to see our full product lineup!

> Why not? You deserve it! www.icomamerica.com



©2002 ICOM America, Inc. 2380 11 6th. Ave NE, Bellevue, WA 98004, 425-454-8155. The ICOM logo is a registered trademark of ICOM, Inc. All specifications are subject to change without notice or obligation. TIPROII/FILTERS1102







IC-756PROII HF/6M Transceiver IC-746PRO HF/6M/2M Transceiver



IC-V8 2M 5W IC-T7H 2M/70CM IC-T81A 2M/6M/70CM & 1W on 1.2 GHz IC-32A 2M/70CM V/U, V/V, U/U

UN'S ELECTRONICS

KENWOOD



TS-2000 HF/VHF/UHF Transceiver TS-B2000 computer/remote head (optl.) version TS-2000X HF/VHF/UHF & 1.2 GHz Transceiver



MARK-V FT-1000MP/Field HF Transceivers

TH-D7AG 2M/70CM W/TNC TH-F6A 2M/1.25M/70CM TH-G71A 2M/70CM



VX-150 2M/5W VX-1R 2M/70CM VX-5R 2M/6M/70CM VX-7R 2M/6M/70CM w/330 mW on 222 MHz

HAMCITY.COM SAVE **MORE HERE** www.hamcity.com hamcity.com



Jun's Electronics

5563 Sepulveda Blvd Culver City, CA 90230 tel 310-390-8003 · fax 310-390-4393 800-882-1343 www.juns.com · radioinfo@juns.com

Mon-Fri 10 AM - 6 PM • Sat 10 AM - 4 PM

ULTRA LOW NOISE	DDEAMD	IFIERS	FROM SS	B ELECTR	ONIC
	Model	MHz .N	F GAIN	PTT/VOX	Ś
and the laws	SP-6	50 <.	8 20 Adj.	750/200W	250.00
ANERS - COMPANY - C	SP-2200	222 <.	9 20 Adj.	650/200W	250.00
	SP-7000	70cm<.	9 20 Adj.	500/100W	250.00
	SP-13	2304 1.	2 18	50/10W	380.00
10 11	LNA	144 <.	4 18	NA	220.00
20.00	SLN	1296 <.	4 30	NA	290.00
	SLN	2304 <.	4 30	NA	290.00
GaAsFET Preamplifier	rs with He	alical Filt	a Low No ters for th	nse mast me ne ultimate	in weak
signal performance.	SSB E	lectroni	c's SP S	eries prear	nplifers
adjustable gain, Helica	jures, nig al or Band	n dynam pass filte	ers, voltag	dual stage te feed via t	design, he coax
or a separate line plus	s the high	est RF-S	ensed (V	OX) and PT	T power
ratings available of	any pre	Maunt	ers on t	ne market	coday.
MKU13-OTX .5 W 1	268 MHz.	TX-UP	ONVERT	ER	C
UTM-1200-DLX 15 W	MAST-MO	UNT 126	8 TX-UPO	CONVERTER	A F
GaAsPA20 20 Wa	tt 2304 /24	100 MHz	Amplifier		Ē
UEK-3000S 2400M	Hz. MastM	ount Mod	ie "S" Cor	overter 0.8db	460.00
AS-3000 2 port Ant	enna Swite	svener N sh High F	ower DC	- 3.0 GHz	180.00
AS-304 4 Port Ant	enna Swit	ch High F	Power DC	- 600 MHz.	180.00
DRENT 1269MH	ATCH-	MICD	OWAVE	EOUIDM	ENT
MKU13G2 1296 MHz.	Transvert	er NF <0	8dB 1.5W	/ out	405.00
MKU23G2 2304 MHz.	Transvert	er NF <0	8dB 1 W	output	499.00
MKU34G2 3456 MHz. MKU57G2 5760 MHz	Transvert	er NF <1 er NF <1	.0dB 200r	nW output	580.00
MKU10G2 10.368 GH	z Transver	ter NF 1	2typ 200r	nW output	580.00
DB6NT TRANS	SVERTER	KITS S	e QST R	eview May 9	01
MKU13G2KIT 285.00	MKU23G	2KIT 3	05.00 MK	U34G2KIT	380.00
MKU57G2KIT 380.00	Anten	2KIT 3	Botore		
6M5X/6M7/6M7JHV219	9/320/271	2M12/2	A5WL/2M	18XXX 175/2	220/254
2MCP14 / 2MCP22	175/255	436CP3	0 / 436CP	42UG 2	255/300
HF Antennas: Call for	Super Pr	ices on t	he new K	T-36XA Tri-l	bander
OR2800PDC ROTOR	1230.00	WEARE		WDOTOOD	0
Alizant Dive	JE 499.00	WH155	499.00	WH370UE	Call
AIRCOM PILIS IS IN		PS/( 11 11		50 obm Er	magan
coaxial cable that every	one	(OD)		50 ohm Ei	uropean
coaxial cable that everyo is talking about. Due to	one its its	inal	-	50 ohm Ei	uropean
Arrcom Plus is the coaxial cable that every is talking about. Due to outstanding electrical an specifications and its ult	its its ra low los	ical is charac	teristics	50 ohm Ei	uropean
AIRCOM PLUS is the coaxial cable that every is talking about. Due to outstanding electrical an specifications and its ult AIRCOM PLUS is extre	its ind mechan ra low los mely suite	ical is charac id for Vi	teristics IF, UHF 8	50 ohm Ei	ations.
Aircom Pitus is the coaxial cable that every is talking about. Due to outstanding electrical an specifications and its ult AIRCOM PLUS is extre AIRCOM PLUS outperfit	its ad mechan ra low los mely suite oms any c IRCOM P	ical is charac is charac is charac is charac is charac is charac is charac	teristics IF, UHF 8 s price cla 3 Loss pe	50 ohm Ei SHF applic ISS. r 100 feet	ations.
Arrcom Plus is th coaxial cable that everyd is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extra AIRCOM PLUS outpert A Freq. MHz. 10 Loop per 100ft 27	its ad mechan ra low los mely suite orms any c IRCOM P 145	ical is charac ed for Vi able in II LUS DE 432 1.	teristics IF, UHF 8 s price cla 3 Loss pe 296 230	SHF applic ss. r 100 feet 04 3000	ations.
Arrcom Plus is th coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outperfor A Freq. MHz. 10 Loss per 100ft .27 25 Mtrs%21, \$71.00	its ad mechan ra low los mely suite orms any o JIRCOM P 145 4 1.37 2 50Mtrs/16-	ical is charac is charac i	teristics IF, UHF 8 s price cla <b>3 Loss pe</b> 296 230 .63 6.1	50 ohm Ei SHF applic 185. r 100 feet 04 3000 55 7.62 Wtrs/328ft \$:	ations. 5000 10,39 252,00
Arrcom Plus is th coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS outperfor A Freq. MHz. 10 Loss per 100ft .27 25 Mtrs/82tt.\$71.00 AIRCOM Connectors:	tis ad mechan ra low los mely suite orms any c IRCOM P 145 4 1.37 2 50Mtrs/164	ical is charac is charac i	teristics IF, UHF 8 s price cla 3 Loss pe 296 230 .63 6. 00 100 259 / N-F	50 ohm Ei SHF applic 185. r 100 feet 04 3000 55 7.62 Mtrs/328ft \$: emale / BNC	ations. 5000 10.39 252.00 10.00
AIRCOM PLUS is the coaxial cable that every is talking about. Due to outstanding electrical an appeditications and its uit AIRCOM PLUS is extre AIRCOM PLUS outperfor A Freq. MHz. 100 Loss per 100ft .27 25 Mirs/82ft. \$71.00 AIRCOM Connectors: BEKO Uttra LINEA DEVO AUTOR LINEA	its ad mechan ra low los mely suite orms any c IRCOM P 145 4 1.37 2 50Mtrs/16 Type-N S R Solid	ical ical ical for VF able in II LUS DE 132 1: .50 4 4ft.\$134. .00 PL State P	teristics IF, UHF 8 s price cla b Loss pe 296 230 .63 6. 00 1001 259 / N-F OWER	50 ohm Ei SHF applic ass. r 100 feet 04 3000 55 7.62 Mirs/328ft St emale / BNC AMPLIFIE	ations. 5000 10.39 252.00 10.00 <b>RS</b>
AIRCOM PIUS is the coaxial cable that every is talking about. Due to outstanding electrical an aspecifications and its ult AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM Connectors: BEKO UItra LINEA BEKO Amplifiers feature VSWR Protection, Switc	is and mechanical and mechanical and mechanical and mechanical and some service and some se	ical is charac is charac i	teristics IF, UHF 8 s price cla B Loss pe 296 230 .63 6.1 00 1001 259 / N-F OWER ation, Ove for SSB &	50 ohm Ei SHF applic ISS. r 100 feet 04 3000 55 7.62 Mtrs/328ft \$ emale / BNC AMPLIFIE CW/FM, built	ations. 5000 10.39 252.00 10.00 RS Sinks, ilt-in TR
AIRCOM PLUS is the coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM CON PLUS outperté AIRCOM Connectors: BEKO UItra LINEA BEKO Amplifiers feature VSWR Protection. Switt relays, Vox or PTT Con	te hew the one its di mechan ra low los orms any c IRCOM P 145 4 1.37 2 50Mtrs/16- Type-N <u>S</u> <b>R Solid</b> a: Ultra Lin chable Del trol, plus e S 2000	ical is charac is charac id for VH able in II LUS DE 432 1: .50 4 ift.\$134,1 0.00 PL State P hear oper ay Time external c	teristics IF, UHF & s price cla 8 Loss pe 296 233 .63 6.4 00 100/ 259 / N-F OWER atton, Ove for SSB & ontrol of n	50 ohm Ei SHF applic ISS. r 100 feet 04 3000 55 7.62 Mtrs/328ft St emale / BNC AMPLIFIE SCW/FM, bui nast-mounter	ations. 5000 10.39 252.00 10.60 <b>RS</b> Sinks, ilt-in TR d
AIRCOM PIUS is th coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outperfer Freq. MHz. 10 Loss per 100ft .27 25 Mirs/82ft. \$71.00 AIRCOM Connectors: BEKO Utira LINEA BEKO Amplifiers featurn VSWR Protection. Switc relays, Vox or PTT Con preamplifiers such as or series includes power si	ne new reaction one its di mechani ra low los ormely suite orms any or IRCOM P 145 4 1.37 2 50Mtrs/16 7 ype-N 2 <b>R Solid</b> a: Ultra Lin chable Del trol, plus e ur SP-2000 upply. Bul	ical is charac id for Vi- cable in It LUS DB 432 1: .50 4 41.\$134. .00 PL State P lear oper ay Time external co 0 & SP-7. It for non	teristics 4F, UHF & 5 price de 296 230 .63 6.3 00 1001 259 / N-F OWER ation, Ove tor SSB & ontrol of m 000's. The -stop cont	50 ohm El Statutorial statuto	ations. 5000 10.39 252.00 10.00 RS Sinks, ilt-in TR d mosfet nt
AIRCOM PIUS is th coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outperf AIRCOM PLUS outperf AIRCOM Connectors: BEKO Utita LINEA BEKO Amplifiers featur VSWR Protection. Swite relays, Vox or PTT Com preamplifiers such as of series includes power as HLV-160/10 144MHz	the hew that are not a first one one its and mechan railow loss merely suite orms any current of the same same constraints of the same same constraints of the same same same same same same same sam	ical is charac id for VF able in II LUS DE 432 1: .50 4 ftt.\$134. .00 PL State P iear oper ay Time external c o & SP-7 It for non 80 W Out	teristics 4F, UHF 8 s price dis 296 230 ,63 6.3 00 1001 259 / N-F OWER ation, Ove for SSB & ontrol of m oo's. The -stop cont Linear Ar	50 ohm Ei s SHF applic Iss. r 100 feet 14 3000 55 7.62 Mtrs/3281 s: emale / BMC AMPLIFIE rsize Heat S CW/FM, bui high power test operation millifer	ations. 5000 10.39 252.00 10.60 <b>RS</b> Sinks, iit-in TR d mosfet n! 569.00
AIRCOM PIUS is th coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outpert A Freq. MHz. 10 Loss per 100ft .27 25 Mirs/82ft. \$71.00 AIRCOM Connectors: BEKO Uttra LINEA BEKO Amplifiers feature VSWB Protection, Switt relays, Vox or PTT Com preamplifiers such as or series includes power sis HLV-160/10 144MHz HLV-160/25 144MHz	the flow and one one one one one one one one one of the one one one one one one one one one on	ical ical ical is charac id for VF able in II LUS DE 132 1: .50 4 41t.\$134. .50 4 41t.\$134. .50 4 41t.\$134. .50 4 9 LSTATE P iear oper ay Time ixternal c 3 & SP-77 It for non s0 W Out s0 W Out s0 W Out	teristics IF, UHF & s price cla S price cla S price cla 2002 2002 2002 Comparison 259 / N-F OWER ation, Over tor SSB & ontrol of m Owo's. The stop cont Linear Ar Linear Ar Linear Ar	50 ohm Ei s SHF applic Iss. r 100 feet 14 3000 55 7.62 Mtrs/3281 \$3 emale / BMC AMPLIFIE rsize Heat S CW/FM, bui high power test operation nplifier nplifier	ations. 5000 10.39 252.00 10.00 RS Sinks, ill-in TR d mosfet n! 569.00 649.00
Arrcom Prus is th coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outperfer AIRCOM PLUS outperfer AIRCOM Connectors: BEKO Utra LINEA BEKO Amplifiers feature VSWR Protection, Switt relays, Vox or PTT Com preamplifiers such as ot series includes power as HLV-160/10 144MHz HLV-160/20 144MHz HLV-160/20 144MHz	tis non- its and mechanical and mechanical and mechanical and mechanical and the second strength of the second str	ical ical ical is charac id for VH able in II LUS DE 132 1: .50 4 ftt.\$134. .50 4 ftt.\$134. .50 PL State P ear oper ay Time xiternal c 0 & SP-77 it for non s0 W Out t0 W Out t0 W Out	teristics HF, UHF & s price cla <b>8 Loss pe</b> 296 233 .63 6.1 00 1001 259 / N-F <b>OWER</b> atton, Ove tor SSB & ontrol of m 000's. The stop cont Linear Ar Linear Ar Linear Ar	50 ohm El Series Series	ations. 5000 10.39 252.00 10.03 Sinks, ilt-in TR d mostet n! 569.00 649.00 150.00
AIRCOM PIUS is th coaxial cable that every is talking about. Due to outstanding electrical an apedifications and its uit AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor Section 2012 (1997) Cost per 100ft .27 25 Mtrs/82ft. 371.00 AIRCOM Connectors: BEKO MUtra LINEA BEKO Amplifiers feature VSWR Protection, Switc relays, Vox or PTT Con preamplifiers such as oc series includes power si HUV-160/10 1440HHz HLV-160/25 144MHz HLV-160/25 144MHz HLV-160/25 144MHz WIMO / SHF DES SSB Electrone LISA is of SSB Electrone LISA is of	tis is one is direction income y suite orms any c income y 145 4 1.37 2 50Mrs/16 50Mrs/16 50Mrs/16 2 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8	ical is charac d for Vh able in It LUS DE 432 1: .50 4 4ft.\$134,1 .000 PL State P ear oper ay Time ear oper ay Time to Mout 0 & SP-7 1t for non s0 W Out 0 W Out 0 W Out 0 W Out	teristics 4F. UHF 8 s price cla 8 Loss per 296 233 .63 6.1 00 1000 259 / N-F OWER ation, Ove for SSB & on rool to ross & stop control of n 000's. The stop control of range inverse at the stop control of range the stop control of range stop control of	50 ohm El SHE applic Iss. r 100 feet 04 3000 55 7.62 Mirs/328ft si emale / BNC AMPLIFIE raize Heat S CW/FM, bui nast-mounter high power test operation pplifier supply 2, GBS Desent In	ations. 5000 10.39 252.00 10.00 <b>RS</b> Sinks, ilit-in TR d mosfet n! 569.00 649.00 150.00
AlrCom Plus is the coaxial cable that everys is talking about. Due to outstanding electrical an appedifications and its uit AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM CONSTRUCTION AIRCOM Connectors: BEKO Amplifiers featur VSWR Protection, Switc relays, Vox or PTT Con preamplifiers such as oc series includes power si HLV-160/25 144MHz HLV-160/25 144MHz HLV-160/25 144MHz HLV-160/25 144MHz HLV-160/25 144MHz HLV-160/25 144MHz HLV-800 144MHz WIMO / SHF DES SSB Electronic USA is p VIHF / UHF / SHF Anten	the hew the solution of the so	ical is charac d for VH able in II LUS DE 432 1: .50 4 4ft.\$134.1 .00 PL State P ear oper ay Time external co 0 & SP-7.7 It for non 80 W Out 0 & SV Out 0 W Out 0 W Out 0 W Out 0 W Out 10 W Out 10 Preci	teristics 4F. UHF 8 s price cla 8 Loss per 296 233 .63 6.5 00 1000 259 / N-F OWER ation, Ove for SSB & on rool to rs SB & stop control of n 000's. The .stop control Linear Ar Linear Ar Linear Ar Linear Ar Mover sison YA IMO / SHI es of Yag	50 ohm Ei Sohm Ei Sohm Ei Sohn Ei S	ations. 5000 10.39 252.00 2000 10.00 <b>RS</b> Sinks, ill-in TR d mosfet nt 569.00 569.00 649.00 150.00 e of sature:
AIRCOM PLUS is the coaxial cable that everys is talking about. Due to outstanding electrical an appecifications and its ult AIRCOM PLUS is extre AIRCOM PLUS subserfor AIRCOM PLUS autoeffor AIRCOM PLUS autoeffor AIRCOM CONSTRUCTION AIRCOM CONNECTOR BEKO UITRA LINEA BEKO Amplifiers featur VSWR Protection. Switc relays, Vox or PTT Con preamplifiers such as oo serles includes power si HLV-160/10 144/Hz HLV-150/25 144/Hz HLV-150/25 144/Hz HLV-150/25 144/Hz HLV-150/25 144/Hz HLV-150/25 144/Hz HLV-150/25 144/Hz WIMO / SHF DES SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized design	the hew the she have the hew the she hew the she have the second	ical is charac id for VH able in It LUS DE 132 1: .50 4 ftt.s134. .000 PL State F eatroper ay Time xtemal c 0 & SP-7 It for non 0 W Out 0 W Out 0 W Out 0 W Out 10 W	teristics IF, UHF 8 s price de 296 230 63 6.1 00 1001 259 / N-F ation, Over ation, Over to SSB & ontrol of n 000's. The stop cont Linear Ar Linear Ar Linear Ar MMO / SHI ess of Yag WU, preci-	50 ohm Ei 50 ohm Ei 51 ohm Ei 52 ohm Ei 53 sHF applicitists r 100 feet 54 3000 55 7.62 Wits/328ft Si emale / BNC/ AMPLIFIE Fraize Heat S CW/FM, bui high power test operation pplifier pplifier pplifier 5 Sign Lini 6 antennas fe 5 Sign Lini 7 Sign L	ations. 5000 10.39 252.00 10.00 <b>RS</b> Sinks, dd <b>TS</b> 569.00 649.00 150.00 e of sature: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
AIRCOM PLUS is the coaxial cable that every is talking about. Due to outstanding electrical an aspecifications and its ult AIRCOM PLUS is extre AIRCOM PLUS subserfor AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM CONNECTION BEKO UITRA LINEA BEKO Amplifiers feature VSWR Protection, Switc relays, Vox or PTT Con preamplifiers such as on preamplifiers such as on preamplifiers such as on series includes power si HLV-160/10 144MHz HLV-150/10 144MHz HLV-150/10 144MHz WIMO / SHF DESS SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized desig drilling, element length to SHF DESIGN * ELIMIN	the new 1-12 ins dimechan ra low los emely suite orms any comparison of the suite of the suite of the suite all range of the range of t	ical is charac is ch	teristics IF, UHF & s price de 296 230 63 6.1 00 1001 259 / N-F OWER ation, Over outpot SB & outpot SB & Inear Ar Linear Ar Linear Ar Linear Ar MMO / SHI ess of Yag WU, predition 0.1m Gain Figure	50 ohm Ei 50 ohm Ei 51 ohm Ei 52 ohm Ei 53 ohm Ei 54 3000 55 7.62 Mits/3281 \$ 56 7.62 Mits/3281 \$ 57 7.62 Mits/3281 \$ 50 ohgh power 50 ohgh pow	ations. 5000 10.39 252.00 8 8 8 10.00 8 5 6 9.00 5 6 9.00 5 6 9.00 150.00 150.00 9 8 9 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
AIRCOM PLUS is the coaxial cable that every is talking about. Due to outstanding electrical an appeditications and its ult AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM CONNECTION BEKO UITRA LINEA BEKO Amplifiers featur VSWR Protection, Switc relays, Vox or PTT Con preamplifiers such as or series includes power sis HLV-160/10 144MHz HLV-160/2 144MHz HLV-160/2 144MHz HLV-160/2 144MHz WIMO / SHF DES SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized design drilling, element length to SHF DESIGN "ELIMIN SHF2328 1240 - 130 SHF2334 1240 - 130	tis di mechan ra low los mely suite orms any co IIRCOM P IAS 4 4 1.37 2 50Mtrs/16- Type-N_2 <b>7 Solid</b> <b>7 Solid</b> <b>7 Solid</b> <b>7 Solid</b> <b>7 Solid</b> <b>7 Solid</b> <b>1</b> Solid <b>1</b>	ical ical	teristics IF, UHF 8 s price dis 206 233 .63 6.1 00 1001 259 / N-F OVER ation, Ove tor SSB & ontrol of n 000's. The stop cont Linear Ar Linear Ar Linear Ar Sion YA IMO / SHI es of Yag WU, preci than 0.1m Gain Figu 5.25 foot 1 9.85 foot 1 9.85 foot 1	50 ohm Ei 50 ohm Ei 51 ohm Ei 52 ohm Ei 53 SHF applicit 55 7.62 55 7.62 Mits/3281 \$ 56 7.62 Mits/3281 \$ 57 7.62 Mits/3281 \$ 50 ohm Ei 50 ohm	ations. 5000 10.39 252.00 852.00 859.00 569.00 569.00 569.00 9 of sature: xom //EB Site 130.00
AIRCOM PIUS is th coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PIUS is extre AIRCOM PIUS is extre AIRCOM PIUS outperté AIRCOM Connectors: BEKO UItra LINEA BEKO Outra LINEA BEKO Amplifiers featur YSWR Protection. Switc relays, Vox or PTT Con preamplifiers such as or series includes power si HLV-160/10 144MHz HLV-160/10 144MHz HLV-160/10 144MHz HLV-160/10 144MHz WIMO / SHF DES SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized design drilling, element length fs SHF DESIGN "ELIMIN SHF2328 1240 - 130 SHF2337 1240 - 131	tis now the sheet of the sheet of the sheet of the second	Ical Ical	teristics IF, UHF 8 s price dis 206 233 .63 6.1 00 1001 259 / N=F OWER .ation, Ove tor SSB & ontrol of n 000's. The .stop cont Linear Ar Linear Ar Linear Ar W/power sion YA MMO / SHI es of Yag WU, preci than 0.1 fm 5.25 foot 1 9.85 foot 1 6.7 fo	50 ohm Ei Status a: SHF applicities a: SHF applicities a: SHF applicities ass. r 100 feet 14 3000 55 7.62 Whrs/328th s: emaile ( BMC) AMPLIFIE Amplifier mplifier mplifier mplifier mplifier plifier Supply 2. GIS F Design Lin i antennas fe sion CNC bo m. com soom soom	ations. 5000 10,39 252,00 252,00 252,00 252,00 252,00 252,00 2559,00 569,00 569,00 569,00 569,00 569,00 155,00 155,00 155,00
AIRCOM PLUS is the coaxial cable that everys is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM Connectors. BEKO UItra LINEA BEKO OITRA LINEA BEKO Amplifiers featur YSWR Protection. Switc relays, Vox or PTT Con preamplifiers such as or series includes power si HLV-160/10 144MHz HLV-1602 144MHz HLV-1502 144MHz WIMO / SHF DES SSB Electronic USA is p VIHF / UHF / SHF Anten multiple optimized design drilling, element length to SHF DESIGN "ELIMIN SHF2328 1240 - 133 SHF2337 1240 - 133 SHF2337 1240 - 134 SHF2344 1240 - 134 SHF2342 2300 - 244	with the same its is a mechan ra low los mely suits present and the same same of the same of the same same of the same of the same of the same same of the same of the same same of the same of the same o	Ical Ical	teristics IF, UHF 8 s price dis 206 233 .63 6.1 00 1001 259 / N-F OWER .100 .100 .259 / N-F OWER .100 .100 .100 .100 .259 / N-F OWER .100 .25 foot .25 foot .25 foot .25 foot .25 foot .25 foot .25 foot	50 ohm Ei 50 ohm Ei 51 ohm Ei 52 ohm Ei 53 ohm Ei 54 ohm Ei 55 7.62 57 7.62	ations. 5000 10,39 252,00 252,00 252,00 252,00 252,00 252,00 2559,00 569,00 569,00 569,00 569,00 569,00 155,00 155,00 155,00 155,00 137,00 371,00 371,00
AlrCom Pitus is the coaxial cable that every is talking about. Due to outstanding electrical an apedifications and its uit AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor Stream 100ft .27 25 Mtrs/82ft. 371.00 AIRCOM Connectors: BEKO Mitra LINEA BEKO Amplifiers feature VSWR Protection. Swite relays, Vox or PTT Con preamplifiers such as oc series includes power si HU-160/10 1440HHz HU-160/25 144MHz HU-160/25 144MHz HU-160/25 144MHz HU-160/25 144MHz WIMO / SHF DES SSB Electronic USA is p VIF / UHF / SHF Anten multiple optimized desig drilling, element length to SHF 2360 "ELIMIN SHF2324 1240 - 13 SHF2341 1240 - 13 SHF2345 1240 - 13 SHF1340 2300 - 24	the hew the she is a more she is a mechanic she is a mechanic she is a methy subserved she is methy subserved she is a methy subserved she is a me	ical is charace do for VH cable in II LUS DC LUS DC II LUS DC II L	teristics IF, UHF 8 s price de 206 230 .63 6.1 000 1001 259 / N-F OWER ation, Ove lor SSB & ontrol of n 000's. The -stop cont Linear Ar Linear Ar Linear Ar Linear Ar Linear Ar Sion YA Imo / SH 100 / SE Sion YA Imo / SE Sion YA Imo / SH 100 / SE Sion YA Sion	50 ohm Ei SHF applic iss. r 100 feet 04 3000 24 3000 24 3000 24 3000 24 3000 24 3000 24 3000 25 7.62 Wirs/3281 \$ semale / BNC <b>AMPLIFIE</b> rsize Heat S CW/FM, bui nast-mounter set operation polifier oplifier applifier supply 2. GIS F Design Lin i antennas fe sion CNC bor mo res on our W soom soom soom soom	ations. 5000 10,39 252,00 10,30 252,00 8 30,40 8 30,40 569,00 569,00 569,00 569,00 150,00 150,00 110,00 10,00 110,000 110,0000 110,000 110,000 110,0000 110,0000 110,0000 110,0000 110,00
Alrecom Pitus is the coaxial cable that every is talking about. Due to outstanding electrical an apecifications and its ult AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM CONSTRUCTION BEKO Amplifiers feature VSWR Protection, Switc relays, Vox or PTT Con preamplifiers such as oo series includes power si HLV-160/10 144/HL2 HLV-150/25 144/HL2 HLV-150/25 144/HL2 HLV-150/25 144/HL2 HLV-150/25 144/HL2 HLV-150/25 144/HL2 HLV-150/25 144/HL2 WIMO / SHF DESI SSB Electonic USA is p VHF / UHF / SHF Anten multiple optimized design drilling, element length to SHF2344 1240 - 130 SHF2344 1240 - 130 SHF2345 1240 - 130 SHF1347 2300 - 244	the hew the she is an end of t	Ical ical is charace id for VH LUS Di LUS Di id for VH LUS Di LUS Di id for VH tal 2 ital 3 ital 2 ital 3 ital 3	teristics IF, UHF 8 s price de 206 233 .63 6.1 00 1001 259 / N=F OWER ation, Over ation, Over ation, Over Statum, Over ation, Over Statum, Over ation, Over Statum, Over	so ohm Ei so ohm Ei sis r 100 feet 34 3000 55 7.62 Mins/3281 sis emale / BMC/ AMPLIFIE raize Heat S CW/FM, bui high power test operation mpliffer npliffer npliffer polifier sion CNC be im. res on our W soom soom soom Soom	ations. 5000 10,39 252.00 255.00
Alrecom Provide Sisting about. Due to coaxial cable that every is talking about. Due to outstanding electrical an apecifications and its ult AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS autoeff EFRO MHZ. 100 Loss per 100ft .27 25 Mrs/82ft. S71.00 IAIRCOM Connectors: BEKO UITRa LINEA BEKO Amplifiers feature VSWR Protection. Swite relays, Vox or PTT Con preamplifiers such as ou series includes power si HLV-160/25 144MHz HLV-12010 144MHz HLV-160/25 144MHz HLV-160/25 144MHz WIMO / SHF DESI SSBE Electronic USA is p VHF / UHF / SHF Anten multiple optimized design diffing, element length to SHF2342 1240 - 130 SHF2345 1240 - 130 SHF2365 1240 - 130 SHF346 2300 - 244 SSBB ELL WWW.SSDUS	the hew the she is an or she is	Ical ical is charane id for Vi US Di US Di State F State F State S State S State S State S State S State S State S S State S S S S S S S S S S S S S S	teristics IF, UHF 8 s price de 206 233 .63 6.1 00 1001 259 / N=F OWER ation, Over tor SSB & ontrol of n 00°s. The stop com Linear Ar Linear Ar Linear Ar Sion YA IMO / SHI es of Yag WU, preci than 0.1 MIMO / SHI es of Yag S.25 foot 1 9.85 foo	so ohm Ei so ohm Ei sis. r 100 feet 34 3000 55 7.62 Mirs/328/f \$ emale / BNC/ AMPLIFIE rsize Heat S CW/FM, bui high power high power best operation mplifier optifier son CNC be in res on our M soom soom soom soom Soom Soom Soom	ations. 5000 10.390 252.000 RS 210.00 RS 210.00 RS 569.00 649.00 150.00 10
Alrecom Provide Sisti coaxial cable that every is talking about. Due to outstanding electrical an appecifications and its ult AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS autoeffor a prevident state Freq. MHz. 100 Loss per 100ft .27 25 Mrs/82ft. S71.00 I AIRCOM Connectors: BEKO Ultra LINEA BEKO Amplifiers featur VSWR Protection. Switc relays, Vox or PTT Con preamplifiers such as ou series includes power si HLV-160/10 144/MHz HLV-160/25 144/MHz HLV-160/25 144/MHz HLV-160/25 144/MHz HLV-160/25 144/MHz HLV-160/25 144/MHz HLV-160/25 144/MHz HLV-160/25 144/MHz HLV-160/25 144/MHz WIMO / SHF DESS SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized design drilling, element length of SHF DESIGN "ELIMIN SHF2348 1240 -133 SHF2340 2300 -244 SHF1367 2300 -244 SSBB EL WWW.SSDUS NEW Hours:	the hew the she is an end of t	Ical ical is channed id for VH idable in II UUS DE idable in II UUS DE idable in II UUS DE idable in II UUS DE idable in II ILUS DE idable in III	teristics IF, UHF 8 s price de 206 233 .63 6.1 201 201 259 / N=F OWER ation, Ove tor SSB & ontrol of n 000's. The stop cont Linear Ar Linear Ar Linear Ar Linear Ar Unear Si Linear Ar Unear Si Linear Ar Si Cont 18 50 18 500 19 50 18 500 19 50 10 50	so ohm Ei sis. r 100 feet 34 3000 55 7.62 Whis/328ft si emale / BNC/ AMPLIFIE raize Heat S CW/FM, build high power least operation pplifier operation pplifier son CNC bo m. res on our W soom soom soom soom Soom Soom Soom Soom	ations. 5000 10.39 252.00 <b>RS</b> 510.00 <b>RS</b> 569.00 569.00 569.00 150.00 150.00 150.00 150.00 150.00 150.00 150.00 150.00 150.00 150.00 199.00 210.00 <b>SA</b> 643.30 210.00 <b>SA</b> 643.30 210.00 <b>SA</b> 643.30
Alrecom Provide Sisti coaxial cable that every is talking about. Due to outstanding electrical an appecifications and its ult AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM CONNECTION BEKO UITRA LINEA BEKO UITRA LINEA BEKO Amplifiers featur VSWR Protection, Switc relays, Vox or PTT Con preamplifiers such as on series includes power si HLV-160/10 144MHz HLV-160/20 144MHz HLV-160/21 144MHz WIMO / SHF DES SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized desig drilling, element length to SHF DESIGN "ELIMIN SHF2387 1240-133 SHF2344 1240-133 SHF2345 1240-133 SHF340 2300-244 SSBB ELL WWW.SSDUS NEW Hours: NEW Hours: NEW Hours:	tis di mechan ra low los ormely sulte ormely sulte ormely sulte ormely sulte ormely sulte ormely sulte ormely sulte ormely sulte of a sultra Lin thable Del trol, plus eu r SP-2000 upply, Buil 2 to in 16 2 to in 16 2 to in 16 10 in 60 10 mHz. 4 00	Ical Ical is characterized for V Ical is characterized is characterized Ical is characterized Ical is characterized Ical is characterized Ical is characterized Ical is characterized Ical is characterized Ical	teristics IF, UHF 8 s price dis 206 233 .63 6.1 00 1001 259 / N=F OWER ation, Ove for SSB & ontrol of n 000's. The stop cont Linear Ar Linear Ar Linear Ar Uneor SI MIMO / SHI es of Yag WU, predi than 0.1 front 5.25 foot 1 9.85 foot 1 0.25 Tool 1 0.25 To	so ohm Ei sis. r 100 feet 34 3000 55 7.62 Whis/328/f si emale / BNC/ A 3000 55 7.62 Whis/328/f si emale / BNC/ AMPLIFIE Fraize Heat S CW/FM, bui high power isst operation polifier oplifier oplifier supply _ 2. GIS Design Lin i antennas fe sion CNC bo m. res on our W poom poom Soom CUS 868-55 0:00PM 2 stomps fo	ations. 5000 10.39 252.00 RS Sinks, 10.00 RS Sinks, 10.00 RS S69.00 449.00 150.00 150.00 150.00 150.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 SA 643.00 210.00 21
Alrecom Provide Sisting about. Due to coaxial cable that every is talking about. Due to outstanding electrical an specifications and its ult AIRCOM PLUS is extree AIRCOM PLUS is extree AIRCOM PLUS is extree AIRCOM CONSTRUCTION EXCOMPTION SISTER BEKO UITR LINEA BEKO Amplifiers feature YSWR Protection, Switch relays, Vox or PTT Con preamplifiers such as or series includes power sister NEW TO 144MHz HLV-16021 144MHz HLV-16021 144MHz WIMO / SHF DES SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized design 4HF 025160 * "ELIMIN SHF 2328 1240 - 133 SHF 23467 1240 - 137 SHF 23467 1240 - 137 SHF 23467 1240 - 137 SHF 23467 1240 - 137 SHF 2347	the new rate one of the second	Ical Ical is characc a s cha	teristics IF, UHF 8 s price dis 206 233 .63 6.1 00 1001 259 / N-F OVER ation, Ove for SSB & ontrol of n 000's. The stop cont Linear Ar Linear Ar Linear Ar Linear Ar Silon YA IMO / SHI es of Yag WU, preci than 0.1 m 6an Figu 5.25 foot 1 9.85 foot 1 5.25 foot 1 9.85 foot 1 5.25 foot 1 9.85 foot 1 5.25 foot 1 0.45 foot 1 5.25	so ohm Ei so ohm Ei sis. r 100 feet 14 3000 55 7.62 Wirs/3281 \$ emale / BNC AMPLIFIE rsize Heat S CW/FM, bui set operation high power set operation high power set operation bigh power set operation polifier mplifier mplifier so of the set operation (GIS F Design Lin i antennas fe sion CNC bui (GIS F Design Lin i antennas fe sion CNC bui com soom soom soom Soom (C US) 868-5 0, OPOPM 2 stamps fo p, Pa. 18	ations. 5000 10.39 252.00 <b>RS</b> Sinks, 10.00 <b>RS</b> S68.00 150.0
AIRCOM PLUS is the coaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS outperfor AIRCOM PLUS outperfor AIRCOM CONSTRUCTION ESTIMATION INFORMATION INFORMATION INFORMATION BEKO UITRA LINEA BEKO UITRA LINEA BEKO Amplifiers feature YSWR Protection. Switch relays, Vox or PTT Con preamplifiers such as or series includes power si HLV-160/10 144MHz HLV-150/2 144MHz HLV-150/2 144MHz HLV-150/2 144MHz WIMO / SHF DES SSB Electronic USA is p VHF / UHF / SHF Anten multiple optimized design SHF DESIGN "ELIMIN SHF2328 1240 - 133 SHF2341 1240 - 133 SHF2341 1240 - 133 SHF2341 1240 - 134 SHF2345 1240 - 133 SHF2347 1240 - 134 SHF2347 1240 - 134 SHF2347 1240 - 134 SHF2347 1240 - 134	the hew the she is a more she is a mechan ratio was any complexity of the she is any complexity. But is a list of the she is a she s	Ical is characcolority is char	teristics IF, UHF 8 s price dis 206 233 .63 6.1 .00 1001 .259 / N-F OVER ation, Ove tor SSB & ontrol of n 000's. The stop cont Linear Ar Linear Ar Linear Ar WDower sion YA IMO / SHI es of Yag WU, predi fan Figu 5.25 foot 1 9.85 foot 1 5.25 foot 1 9.85 foot 1 5.25 foot 1 .25 foot	so ohm Ei sis. r 100 feet JA 3000 55 7.62 Wirs/328th si emale ( BMC) A 3000 55 7.62 Wirs/328th si emale ( BMC) AMPLIFIE rsize Heat S CW/FM, bui sets operation sets operation ( GIS F Design Lin i antennas fr sison CNC bui ( GIS F Design Lin i antennas fr sison CNC bui ( GIS F Design Lin i antennas fr sison CNC bui Soom Soom Soom Soom Soom C US 2 stamps fo p, Pa. 18	ations. 5000 10.39 252.00 <b>RS</b> Sinka, 10.00 <b>RS</b> S69.00 449.00 155.00 155.00 155.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b>
Alrecom Provise is the ocaxial cable that every is talking about. Due to outstanding electrical an specifications and its uit AIRCOM PLUS is extre AIRCOM PLUS outperform the stress of the stress of specifications and its uit AIRCOM PLUS outperform the stress of the stress of specifications and its uit AIRCOM PLUS outperform the stress of the stress of specifications and the stress of specifications and the stress of series includes power as HLV-160/10 1440HHz HLV-160/10 1440HHz HLV-160/10 4320HHz HLV-160/10 4320HHz SSB Electonic USA is p VHF / UHF / SHF Anton multiple optimized design drilling, element length to SHF1340 2300 - 244 SHF1340 230 - 244 SHF	is no she its dimechan ra low los mely sulta Software any complexity informed sulta rate of the second information of the second rate of the secon	ical is charace able for U table in II US DC able in II SC Able in II SC Abl	teristics IF, UHF & sprice de IS price de Solution of m Solution of m Soluti	so ohm Ei sis. r 100 feet J4 3000 55 7.62 Wirs/328th si emale ( BMC) A 3000 55 7.62 Wirs/328th si emale ( BMC) AMPLIFIE rsize Heat S CW/FM, bui set operation set operation set operation set operation (GIS F Design Lin i antennas fe sion CNC be res on our W soom c US 868-5 0:00PM 2 stamps fo, Pa. 18	ations. 5000 10.39 252.00 <b>RS</b> Sinka, 10.00 <b>RS</b> S69.00 40.00 <b>RS</b> S69.00 40.00 <b>RS</b> S69.00 210.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 643.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00 <b>SA</b> 645.00
Arrcom Program Signature S	is no she its dimechan ra low los ormely suits orms any comely suits of the suits of the the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of the suits of t	Ical ical is charane d for VH LUS DC LUS DC if also in it LUS DC if also in it LUS DC if also in it LUS DC if also in it LUS DC if also in it if or non- there is a spectra if the non- if the non- if also in it if or non- if or non- if or non- if or non- if or non- if or non- if or non-	teristics IF, UHF 8 s price de 206 230 .63 6.1 000 259 / N=F OWER ation, Over tor SSB & ontrol of m 000's. The -stop comt Linear Ar Linear Ar Linear Ar Linear Ar Linear Ar Sion YA Imo / SHI es of Yag WU, preci han 0.1 B.85 foot 1 5.25 foot 1 5.25 foot 1 5.25 foot 1 5.25 foot 1 5.25 foot 1 0.85 foot 1 0.98 foot 1	so ohm Ei so ohm Ei sis r 100 feet 34 3000 55 7.62 Mirs/3281 si emale / BMC/ AMPLIFIE risize Heat S CW/FM, bui high power (CW/FM, bui high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst-mountet high power (Set) asst- asst-mountet high power (Set) asst-	ations. 5000 10.39 252.000 252.000 252.000 252.000 RS Binks, Ilich TR d mosfet and 649.00 199.00 199.00 199.00 199.00 199.00 199.00 199.00 210.00 SA 64.3 or Byer 8707
Arrcom Program Sister coaxial cable that every is talking about. Due to outstanding electrical an apecifications and its uit AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS is extre AIRCOM PLUS outperfor Sister Sister BEKO Annulfilers featur VSWR Protection, Switc relays, Vox or PTT Con preamplifiers such as oc series includes power sis HU-160/10 144/HHz HLV-160/25 144/Hz HLV-160/25 144/Hz SSBB ELL WWW.SSDUS NEW Hours: MCVUSA Prices sul 124 Cherrywood	is no one international and in	Ical is charace id of or Vi us charace id for Vi us charace id	teristics IF, UHF 8 s price de 206 233 .63 6.1 00 1001 259 / N=F OWER ation, Over ation, Over ation, Over Sion SB 8 iontrol of n 000's. The stop comt Linear Ar Linear Ar Linear Ar Linear Ar Linear Ar MMO / SHI ess of Yag WU, preci than 0.1m Gain Figu 5.25 foot 1 9.85 foot 1 9.85 foot 1 0.25 (0.1 - 1) 0.25 (0.1 - 1) 0.2	so ohm Ei so ohm Ei sis. r 100 feet 34 3000 55 7.62 Mirs/328th si emaile / BMC AMPLIFIE raize Heat S CW/FM, bui high power (CW/FM, bui high power supply 2. GIS GIS GIS GIS GIS GIS GIS GIS GIS CU/FM, bui high power soom soom soom soom soom soom 2 damps fo b, Pa. 18 CHI 2 damps fo b, Pa. 18	ations. 5000 10,39 5252.00 10,39 5252.00 RS Sinks, iin

• 2 3/8-inch diameter X 33-inch tall mast section.

 Dual adjustable arms allow installation on a wide range of sloped surfaces.

5 JV • 512-754-9150

VISA

• Use it to support a vertical, a small Yagi, a dish (up to 1-meter in diameter) or wire antennas.

Special Pricing:

\$12.00 each (plus S&H) Volume Pricing is available. With that perfect size and feel so many HT enthusiasts have grown to love, the 'W32A is the right radio for demanding users. Built mil spec tough, and loaded with the features for all your communication requirements. See your authorized ICOM dealer today and find out what you've been missing.

# ack by Popular Demand!

EM TRAN

SKIP

MR

6.90 443.50

BAND

CEB MHz

VFO

COM

2M/70CM 5W Output Power V/V, U/U, V/U

IRLP Compatable

Crossband Repeat\*

Guide Function

200 Alphanumeric Memories

CTCSS Encode/Decode w/Tone Scan

Save

Limited time offers. Visit your

authorized Icom dealer for details.

IC

Setting a new standard www.icomamerica.com

ICOM

S.MW

SETA

HIL

DUPV

TONE

MN-W >

D M·N

CAL

2

9

\*For searce information about acceptable crossband repent operation, please cail our literature request hortine or 425-450-6088 and ask for our crossband repent brocknee. ©2002 ICOM America, Inc. 2380 116th Ave NE, Bellevue, WA 98004, 425-454-8155, The ICOM logo is a re-estered trademark of ICOM, Inc. All specifications are subject to change without notice or obligation. TW321202

#### BATTERIES AMERICA Ph: 800-308-4805 March 2003 Specials !

www.batteriesamerica.com

	- The I	UDO-9000 Ch es / Condition	aryer!
	Adjus	r NIMH batte	contacts!
Setter 1	Car ci Şmart	garette lighte quick charge	r! ewith
For YAESU VX-5R / VX-	Auton	dtic shut-off	\$ 49.95 - NEW I)
FNB-58Li (Li-Ion) For Vertex (YAESU) VX-	7.2v 110/15	1200mAh	\$39.95 120
FNB-V57x NIMH pk.	7.2v	1650mAh	\$39.95
FNB-72xh NIMH pk.	9.6v	2000mAh	\$49.95
FOR YAESO VX-1R etc : FNB-52Li (Li-lon)	3.6v	<b>750</b> mAh	\$25.95
For YAESU FT-50 / 50R FNB-41xh SW NIMH PK	/ 50RD / 9.6v	40R / 10R etc 1100mAh	\$45.95
FNB-47xh NIMH pk.	7.2v	2100mAh	\$45.95
FNB-25x NIMH pk.	7.2v	<b>1100</b> mAh	\$28.95
FNB-27x 5W NIMH pk 1 For YAESU FT-411/470	2.0v	1100mAh 3/23 etc :	\$39.95
FNB-10 NICd pk.	7.2v	800mAh	\$20.95
FBA-10 6-Ce For ICOM IC- V8 etc :		case	\$14.95
BP-210 6W NIMH pk For ICOM IC- T8A / T8A	7.2v -HP/T	1650mAh	\$39.95
BP-200 SW NIMH pk	9.6v	760mAh	\$49.95
BP-19/N 5-Cell F For ICOM IC-Z1A / T22A	/T42A	5e (new!) / W31A / W32	5/29.95 A / T7A :
BP-180xh NIMH pk	7.2v	1100mAh	\$39.95
For ICOM IC-W21A, V21	AT, 2G)	(A, 2GXAT etc	500.0E
BP-131h NIMH (Black) BP-131h NIMH (Grey)	7.2V 7.2V	1650mAh 1650mAh	\$28.95
For ICOM IC-02AT etc &	Radio S 8 Av	hack HTX-20.	2/404 : \$32.95
BP-202h pk (HTX-202)	7.2v	1400mAh	\$29.95
For KENWOOD TH-F6A PB-42L LI-ION pack	Tri-Ban 7.4∨	d & F7 (NEV 1550mAh	\$39.95
EMS-42K Desktop Rap	id Charge	or for PB-42L	\$39.95
PB-39 NIMH pack	9.6v	1100mAh	\$46.95
For KENWOOD TH-79A PB-33xh NiMH pk.	/ 42A / 2 6.0V	22A etc : 2100mAh	\$39.95
PB-34xh 5w NIMH pk.	9.6v	1100mAh	\$39.95
PB-37(Kenwood-brand) 1	2.0v	950mAh	\$29.95
PB-36(Kenwood-brand) For KENWOOD TH-78A	7.2v /48/28	950mAh	\$22.95
PB-13xh NIMH pk.	7.2v	1650mAh	\$39.95
BC-15A KENWOOD	2.0V brand Fa	ast Charger	\$39.95
For KENWOOD TH-77A, PB-6x (NIMH, w(cbs lack)	75, 55, 7.2v	46, 45, 26, 25 1500mAh	etc: \$34.95
PB-8xh (NIMH, w/ jack) 1	2.0v	1650mAh	\$44.95
PB-2h (NIMH, w/chg jack)	8.4v	1600mAh	\$39.95
For KENWOOD TR-2500 PB-25s (NIMH, w/ lack)	//2600 8.4∨	1600mAh	\$39.95
For ALINCO DJ-V5 / DJ-	/5TH :	(NEW !)	\$30.95
For ALINCO DJ-195,HP.R	/ 196 / 4	146 / 493 / 490	595.95 / 596 etc :
EBP-48h NIMH pk. For ALINCO DJ-G5TD,TH	9.6V	1650mAh 07,70,7H / 191	539.95 T,TD,TH:
EBP-36 5w NIMH pk.	9.6v	750mAh	\$36.95 480 etc :
EBP-20X NIMH short pk	7.2v	1650mAh	\$28.95
EBP-22xh sw NIMH pk 1 EDH-11 6-Ce	2.0V	1650mAh case	\$42.95
For ADI HT-600 & REA	LISTIC 2 OV	HTX-204:	\$39.95
For STANDARD C228, C	528, C5	58; ADI HT-20	1, 401 etc:
NEW NEW	1.2V V- the IQ-	9000 Charger &	\$22.95
	esktop un to 4 NIMH	it can charge or o or NiCd cells!	condition
(2) H. (3) P.	as selecta rovides sa	ble conditioning fe, quick charge	feature I for celis! charge!
(4) A (5) U	L-listed po	ower supply inclu	ided!
Call, write, e-mail, or Fax BATTERIES AMERICA 2211	D Parvie	rour FREE C	ATALOGI WI 53562
Order Toll Free	: 80	0-308-	4805
Fax: 608-831-1082 E	-mail: e	hyost@cho	rus.net

# **Index of Advertisers**

ADVERTISING DEPARTMENT STAFF Hanan Rayyashi, KB1AFX, Advertising Supervisor/Accounts Manager Joe Bottiglieri, AA1GW, Accounts Manager Carol Patton, KB1GAT, Advertising Traffic Coordinator

#### 1-800-243-7768

Direct Line: 860-594-0207 e-mail: ads@arrl.org Fax: 860-594-4285 Web: http://www.arrl.org/ads

Advanced Specialties: 136 Alinco: 17 All Electronics Corp: 153 Alpha Delta Communications: 151, 154 Amateur Electronic Supply LLC: 117, 119, 121 Am-Com: 150 ARRL: 10, 18, 22, 23, 26, 110, 112, 114, 116, 118, 120, 122, 123, 126, 128, 130, 132, 133, 134, 136, 156 Ameritron: 8 Antique Radio Classified: 150 Associated Radio Communication: 124, 125 Atomic Time: 130 Austin Amateur Radio Supply: 124, 125 Autek Research: 148 B & D Enterprises: 110 Bilal Co: 148 Bosun Supplies: 156 Buckmaster Publishing: 146, 152 Burghardt Amateur Center: 131, 136 Buylegacy.com: 110 C & S Sales: 138 CABLE X-PERTS: 128 CAT 5 JV: 157 Circuit Specialists: 155 Code Quick: 148 ComDaC: 124, 125 Command Technologies: 155 Communication Headquarters: 152 Cubex Company: 136 Cutting Edge: 136, 148, 151 Diamond Antennas: 3 Digital Communications: 136 DX Engineering: 128 Elecraft: 151 EOF Software: 156 E-Z Hang: 115 Fluidmotion Antenna Systems: 140 Fort Smith Hamfest: 126 GAP Antenna Products: 120 Glen Martin Engineering: 142 Greater Baltimore Hamboree: 126 Ham Radio Outlet: 106, 107, 108, 109 Ham Station, The: 113, 134 Hamtronics: 146 Heil Sound: 123 High Sierra Antennas: 118 Hy-Gain: 6,7 ICOM America: Cover II, 1, 153, 155, 157 Idiom Press: 132 IIX Equipment Ltd: 118, 136 Intuitive Circuits LLC: 150 Joplin Hamfest: 132 Jun's Electronics: 156 K1CRA Radio WebStore: 111 K2AW's "Silicon Alley": 136 K-Y Filter Co: 152 Kanga US: 112 Kenwood USA Corp: Cover IV KJI Electronics: 129, 146 KK7TV Communications: 136 Lakeview Company: 150 LDG Electronics: 116 Lentini Communications: 124, 125 Logic: 132

M & S Computer Products: 152 M<sup>2</sup> Antenna Systems: 152 Maha: 2 Martin Electric: 118 Mayberry Sales & Service Inc: 115 Memphis Amateur Electronics: 114 Metal & Cable Corp: 148 MFJ Enterprises: 27, 137, 139, 141, 143, 145, 147 Micro Computer Concepts: 115 Mr NiCd: 158 N3FJP Software: 152 N4XM, XMatch Antenna Tuners: 136 NARTE: 140 National RF: 151 New Communications Solutions: 114 ONV Safety Belt: 155 Osmotec: 112 Palomar Engineers: 154 Palstar: 110 PC Electronics: 120 Peet Bros Company: 118 Personal Database Applications: 132 Pulver: 116 QSLs By W4MPY: 116 QSLShop: 126 R & L Electronics: 149 Radio Bookstore: 150 Radio City: 124, 125 Radio Club Of JHS 22 NYC: 133 Radio Daze: 151 Radio Era Archives: 111 Radio Works: 132 Rapidan Data Systems: 111 RF Parts Co: 3, 25 SGC: 111 SSB Electronic: 157 Star Quality QSLs: 146 Surplus Sales of Nebraska: 116 Syspec Inc: 138 Tashjian Towers: 156 Ten-Tec: 19 Tennadyne: 126 Teri Software: 134 Texas Towers: 127, 159, 160 TGM Communications: 154 Tigertronics: 142 Tower \* Jack: 150 Traffie Technology: 156 US Tower: 144 Universal Radio: 124, 125 Vectronics: 135 Vibroplex: 151 W & W Manufacturing Co: 134 W2IHY Technologies: 144 W5YI: 146 W7FG Vintage Manuals: 115 W9INN Antennas: 136 Warren Gregoire & Associates: 136 West Mountain Radio: 115, 133 Wheeler Applied Research: 148 Wireman: 156 Yaesu USA: Cover III, 11 Yost & Co. EH: 158 Zapchecker: 151

If your company provides products or services of interest to our Members, please contact the ARRL Advertising Department today for information on building your business. Your customers are reading.....QST!

April Issue: May Issue Deadline: February 17, 2003 Deadline: March 17, 2003 Ships Mid March 2003 Ships Mid April 2003

# **SAVE BIG ON ANTENNAS, TOWERS & CABLE**

#### 

#### **BENCHER / BUTTERNUT**

Skyhawk, Triband Beam \$1129
HF2V, 2 Band Vertical \$239
HF5B, 5 Band Minibeam \$349
HF6VX, 6 Band Vertical \$329
HF9VX, 9 Band Vertical \$349
A1712, 12/17m Kit \$54
CPK, Counterpoise Kit \$129
RMKII, Roof Mount Kit \$159
STRII, Roof Radial Kit \$125
TBR160S, 160m Kit \$119
More Bencher/Butternut-call

#### **COMET ANTENNAS**

GP15, 6m/2m/70cm Vertical \$149
GP6, 2m/70cm Vertical \$139
GP9, 2m/70cm Vertical \$179
B10NMO, 2m/70cm Mobile \$36
SBB224NMO, 2m/220/70cm \$69
SBB2NMO, 2m/70cm Mobile \$39
SBB5NMO, 2m/70cm Mobile \$55
SBB7NMO, 2m/70cm Mobile \$75
Z750, 2m/70cm Mobile \$55
Z780, 2m/70cm Mobile \$69
Much more Comet in stock-call

#### **DIAMOND ANTENNAS**

D130J/DPGH62	\$79/139
F22A/F23A	\$89/119
NR72BNMO/NR73BNMC	0 \$39/54
NR770HBNMO/NR770R	A \$55/49
X200A/X3200A	\$129/210
X500HNA/X700HNA	\$229/369
X510MA/X510NA	\$189/189
X50A/V2000A	\$99/149
CR627B/SG2000HD	\$99/79
SG7500NMO/SG7900A	\$75/112
More Diamond antenna	is in stock

#### **GAP ANTENNAS**

Challenger DX	\$289
Challenger Counterpoise	\$29
Challenger Guy Kit	\$19
Eagle DX	\$299
Eagle Guy Kit	\$29
Titan DX	\$329
Titan Guy Kit	\$29
Voyager DX	\$409
Voyager Counterpoise	\$49
Voyager Guy Kit	\$45
Quick Tilt Ground Mount	\$75

#### WEEKDAY HOURS: 9 AM-5 PM CST

#### SATURDAY HOURS: 9 AM-12 NOON CST

A Di

CREDIT CARDS: M/C, VISA, DISCOVER

#### **CUSHCRAFT ANTENNAS**

13B2/A148-10S	\$149/85
A270-6S/A270-10S	\$79/99
A3S/A4S	\$449/539
A50-3S/5S/6S	. \$95/169/259
A627013S	\$189
AR2/ARX2B	\$49/69
AR270/AR270B	
R6000/R8	\$319/449
X7/X740	\$679/289
XM240	
Please call for more (	Cushcraft items

### M2 WHE/UHE ANTENNAS

#### 144-148 MHz

2M4/2M7/2M9 ........ \$95/115/125 2M12/2M5WL ...... \$159/209 2M5-440XP, 2m/70cm ....... \$169 420-450 MHz

440-70-5W/420-50-11 ..... \$135/93 432-9WL/432-13WL ..... \$175/229 440-18/440-21ATV ...... \$125/145 Satellite Antennas

2MCP14/2MCP22 ......\$175/229 436CP30/436CP42UG .... \$229/269

#### M2 ANTENNAS

#### 50-54 MHz

6M5X/6M7		\$209/299
6M7JHV/6M	19KHW	\$259/469

#### HO LOOPS

6M/2M/222/432 ...... \$95/45/45/45

#### **HF ANTENNAS**

10/15M4DX, 4 Element ... \$389/439 20M4DX, 4 Element 20m ...... 529 KT36XA, Triband Beam ...... \$1249 More M2 models in stock-please call

#### MF

259B, Antenna Analyzer	\$219
269, Antenna Analyzer	\$299
941E, 300W Antenna Tuner	\$109
945E, 300W Antenna Tuner	. \$99
949E, 300W Antenna Tuner	\$139
969, 300W Antenna Tuner	\$169
986, 3KW Antenna Tuner	\$289
989C, 3KW Antenna Tuner	\$309
1798, 80-2m Vertical	\$249
1796, 40/20/15/10/6/2m Vert	\$189
<b>Big MFJ inventory-please</b>	call

#### **LAKEVIEW HAMSTICKS**

9106 ..... 6m 9115 ... 15m 9130 ... 30m 9110 ... 10m 9117 ... 17m 9140 ... 40m 9112 ... 12m 9120 ... 20m 9175 ... 75m All handle 600W, 7' approximate length, 2:1 typical VSWR ... \$24.95

#### **HUSTLER ANTENNAS**

4BTV/5BTV/6BTV .... \$129/169/199 G6-270R, 2m/70cm Vertical ... \$169 G6-144B/G7-144 ........ \$109/179 Hustler Resonators in stock-call

#### FORCE 12-MULTIBAND

C3	10/12/15/17/20m, 7 el \$599
C3E	10/12/15/17/20m, 8 el \$649
C3S	10/12/15/17/20m, 6 el \$539
C3SS	10/12/15/17/20m, 6 el \$559
C4	10/12/15/17/20/40m, 8 el . \$759
C4S	10/12/15/17/20/40m, 7 el . \$679
C4SXL	10/12/15/17/20/40m, 8 el . \$979
C4XL	10/12/15/17/20/40m, 9 el \$1119
C19XR	10/15/20m, 11 el \$959
C31XR	10/15/20m, 14 el \$1299
Please	call for more Force 12 items

#### **BOHN TOWER**

25G/45G/55G	\$89/189/239
25AG2/3/4	. \$109/109/139
45AG2/4	\$209/225
AS25G/AS455G	\$39/89
BPC25G/45G/55G	\$75/99/110
BPL25G/45G/55G	\$85/109/125
GA25GD/45/55	\$68/89/115
GAR30/GAS604	\$35/24
SB25G/45/55	\$39/89/109
TB3/TB4	\$85/99
Please call for mo	re Rohn prices

#### **GLEN MARTIN ENGINEERING**

	Hazer Elevators for 25G	
H2,	Aluminum Hazer, 12 sq ft	\$359
13,	Aluminum Hazer, 8 sq ft	\$269
44,	HD Steel Hazer, 16 sq ft	\$339

#### **Aluminum Roof Towers**

RT424, 4 Foot, 6 sq ft	\$159
RT832, 8 Foot, 8 sq ft	\$239
RT936, 9 Foot, 18 sq ft	\$389
RT1832, 17 Foot, 12 sq ft	\$519
RT2632, 26 Foot, 9 sq ft	\$869

#### COAX CABLE

RG-213/U, (#8267 Equiv	/.) \$.36/ft
BX-MINI, Mini RG-8 Foa	m \$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Please Call
Please call for more coa	x/connectors

#### **TIMES MICROWAVE LMR® COAX**

LMR-400	\$.59/ft
LMR-400 Ultraflex	\$.89/ft
LMR-600	\$1.19/ft
LMR600 Ultraflex	\$1.95/ft

#### **ANTENNA ROTATORS**

M2 OF	7-2800PDC	\$1249
Yaesu	G-450A	\$249
Yaesu	G-800SA/DXA	\$329/409
Yaesu	G-1000DXA	\$499
Yaesu	G-2800SDX	\$1089
Yaesu	G-550/G-5500	\$299/599

#### **ROTATOR CABLE**

R62 (6, #18) .....\$.32/ft. R81/82 ....\$.25/.39 R84 \$.85/ft

#### TRYLON "TITAN" TOWERS

<b>SELF-SU</b>	PPORTING STEEL TOWERS
200-64	64', 15 square feet \$1099
200-72	72', 15 square feet \$1299
200-80	80', 15 square feet \$1499
200-88	88', 15 square feet \$1769
200-96	96', 15 square feet \$2049
300-88	88', 22 square feet \$1989
400-80	80', 34 square feet \$1899
500-72	72', 45 square feet \$1799
600-64	64', 60 square feet \$1699
lany mo	pre Trylon towers in stock!

#### **US TOWER**

MA40/MA550	\$849/1399
MA770/MA850	\$2359/3649
MM433SS/HD	\$1139/1379
MM541SS	\$1499
X438/TX455	\$979/1579
X472/TX489	\$2459/4579
HDX538/HDX555	\$1269/2269
IDX572MDPL	\$5899
Please call for help	p selecting a US
lower for your n	eeds. Shipped
actory direct to s	ave you money

#### **UNIVERSAL ALUMINUM TOWERS**

4-40'/50'/60'	\$539/769/1089
7-50'/60'/70'	\$979/1429/1869
9-40'/50'/60'	\$759/1089/1529
12-30'/40'	\$579/899
15-40'/50'	\$1019/1449
23-30'/40'	\$899/1339
35-30'/40'	\$1019/1569
Bold in part	number indicates
windload capa	city. Please call for
other Universa	al models. Shipped
actory direct 1	to save you money!

#### **TOWER HARDWARE**

3/8"EE / EJ Turnbuckle .......\$11/12 1/2"x9"EE / EJ Turnbuckle ......\$16/17 1/2"x12"EE / EJ Turnbuckle .....\$18/19 3/16" / 1/4" Preformed Grips .....\$5/6 Please call for more hardware items

#### **HIGH CARBON STEEL MASTS**

5 FT x .12" / 5 FT x .18"	\$35/59
10 FT x .18" / 11 FT x .12"	\$129/80
16 FT x .12" / 16 FT x .18"	\$119/179
20 FT x .25	\$315
22 FT x .12" / 21 FT x .18"	\$149/235

#### **PHILYSTRAN GUY CABLE**

HPTG12001	\$.45/ft
HPTG2100I	\$.59/ft
PLP2738 Big Grip (2100)	\$6.00
HPTG4000I	\$.89/ft
PLP2739 Big Grip (4000)	\$8.50
HPTG6700I	. \$1.29/ft
PLP2755 Big Grip (6700)	\$12.00
HPTG11200	. \$1.89/ft
PLP2758 Big Grip (11200)	\$18.00
Please call for more info or	r help se-
lecting the Phillystran size y	you need.

#### LOCAL CALLS: (972) 422-7306

EMAIL ADDRESS: 74 sales@texastowers.com

> INTERNET ADDRESS: www.texastowers.com

		R	T			R
ision of Texas	RF Distrib	utors, Inc. • 1	108 Summit	Avenue, Sui	te #4 • P	lano, TX 750
	80	O) 2	72-	-34	67	

# X



#### C-756PR02

The Icom IC-756 PRO2 is an all mode HF and 6m transceiver featuring 32-bit digital signal processing, automatic antenna tuner, 100 watts RF output, digital twin PBT, 5" multifunction color TFT LCD display with band scope function, built-in CW and SSB memory keyers, and more. Supplied with a hand mic and DC power cord.

in Stock!

#### **New Lower Price**

The Icom PW-1 is a 1000 watt solid state linear amplifier for HF and 6m operation, featuring a high power automatic antenna tuner, built-in power supply, and a removable front control panel, and more.



IC-706MK2G . . Icom Special The Icom IC-706MK2G is a compact HF/ 6m/2m/70cm all mode transceiver with digital signal processing, automatic repeater offset, built-in CW keyer, built-in CTCSS tone encode/decode/scan, 107 memory channels and more. A detachable front panel offers convenient mounting, even in compact vehicles.

#### ... New Lower Price!

The Icom IC-718 is an all mode HF transceiver featuring a front panel mounted speaker, IF shift, optional DSP module, multiple scanning modes, noise blanker, RIT, and more.



#### C-T7H **Icom Speciall** Small 6W 2m/70cm, with full CTCSS tone.

IC-T2H Sport	Great Price!
IC-T90A	New, In Stock!
IC-V8	New, in Stock!
IC-W32A	In Stocki

#### WEEKDAY HOURS: 9AM-5PM CST

**SATURDAY HOURS: 9AM-NOON CST** 

**CREDIT CARDS: M/C. VISA. DISCOVER** 



#### IC-746PR0 in Stock!

The Icom IC-746PRO is an all mode HF/ 6m/2m trasceiver with 32-bit IF level DSP. The radio features a built-in auto tuner, builtin RTTY demodulator and decoder (reads out on the radio's LCD display), auto notch, digital twin PBT, and more. Supplied with up/down hand mic and DC power cord.

#### . In Stock! IC-910H.

All-mode 2m/70cm dual band transceiver, featuring dual data inputs, CTCSS encode/ decode, CW keyer, satellite mode, scan, sweep display function, optional 23cm module, optional DSP, and more. Supplied with up/down hand mic and DC power cord.



Dual band 2m/70cm FM XCVR. Features removeable control panel, CTCSS tone encode/decode/scan, cross band repeat, 1200/9600 bps data jack, dual RX, extended RX, 212 memory channels, and more. Supplied with DTMF hand microphone, mounting brackets, and power cord.

New

#### . New. In Stock! IC-V8000 ....

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.



#### . Great Low Price! IC-207H A great 2m/70cm dual band mobile XCVR. featuring CTCSS tone encode/decode, 182 memories, removable control panel, and more. With a back-lit DTMF hand mic, mounting bracket, and a DC power cord.

IC-2100H .... . Great Low Price! Rugged 2m mobile XCVR with CTCSS tone encode/decode/scan, DTMF paging/ squeich, 113 memory channels, and more.

IC-PCR1000 ...... Icom Special! IC-R8500/R75 ..... \_\_\_ In Stock! In Stock!

A Division of Texas RF Distributors, Inc.



#### FT-1000MP-V ..... Yaesu Special!

Competition class HF DSP transceiver with auto tuner, 200 Watts RF output, and more!

FT-1000MP-V Field ... New Low power (100W) version of the FT-1000MP-V, with built-in power supply.

#### FT-920 . Yaesu Special

All mode HF/6m XCVR featuring DSP, automatic tuner, and more. With up/down hand microphone and DC power cord.

#### Quadra System .... Lower Price! Solid state 1 kW autotuning amplifier.



#### FT-8900R New, In Stock

Quad band mobile XCVR covers 10m/ 6m/2m/70cm, with cross-band repeat, tone encode/decode, and removable control panel for remote mounting.

#### .... Great Low Price! FT-90R .

Ultra-compact 2m/70cm mobile XCVR. With removeable control head.

#### FT-2800M

Rugged 2m mobile XCVR, built to MIL-STD 810, with 65 watts RF output.



#### G-2800BXA

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	
0.550	\$200



#### FT-897

"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

Now in Stock!

#### FT-897 is a truly self-contained portable! . Yaesu Special! FT-847.

Great all-mode XCVR covering HF/6m/2m/ 70cm! The radio is perfect for satellite operation, and features DSP, CTCSS tone encode/decode, and more. Supplied with up/down microphone and DC power cord.



#### FT-100D **Vaesu Special!**

Ultra-compact all mode XCVR for HF/6m/ 2m/70cm.Features DSP, CW memory keyer, tone encode/decode, 200 memories, VOX, and more. Supplied with a DTMF hand mic, DC power cord and mounting bracket.

#### FT-817 .

New

#### **Now in Stock!**

A truly tiny self-contained all mode HF/6m/ 2m/70cm QRP XCVR featuring tone encode/decode, 200 memories, VOX, and more! With hand mic, DC cord and bracket.



FT-50RD	New Lower Price!
VR-120D	
VR-500	
VX-18	New Lower Pricel
VX-58	Yaesu Special!
VX-150	Vaesu Sueciall
VX-78	New In Stock!

#### LOCAL CALLS: (972) 422-7306

**EMAIL ADDRESS:** sales@texastowers.com

**INTERNET ADDRESS:** www.texastowers.com

S TOWE

(800) 272 - 3467

# HF EXCITEMENT **INTRODUCING YAESU'S ALL NEW HF MOBILE**

Blending leading-edge technologies developed on the FT-897 and MARK-VFT-1000MP transceivers, the FT-857 is the world's smallest\* HF/VHF/UHF Multimode Transceiver, and it's available now! \*Jan. 2003

#### FT-857 DESIGN HIGHLIGHTS

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

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

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

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

-----



#### New Remote Control

DTMF Microphone MH-59A8J (Option) The optional MH-59AsJ Remote Microphone provides control of the major functions of the FT-857 from the microphone's keypad. The MH-59AsJ includes a rotary control knob for adjusting the operating frequency and the receiver volume level. HP/DWN keys



### **ULTRA-COMPACT HF/VHF/UHF 100 W\* ALL-MODE TRANSCEIVER** (HF/6 m 100 W, 2 m 50 W, 70 cm 20 W)

ARCONCE (MILL)

Actual Size

YAESU Vertex Standard **US Headquarters** 10900 Walker Street

Cypress, CA 90630 (714)827-7600

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

CELECA

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

ID SU

USB

JF0a

DNR

13.8V

295.00

