DEVOTED ENTIRELY TO AMATEUR RADIO

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JUNE 2009 WWW.ARRL.ORG

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Official Journal of ARRL The national association for AMATEUR RADIO

D-STAR:
CONNECT ACROSS MILES INSTEAD OF METERS!

D-STAR ready

NEW ID-880H

2m & 70cm DUAL BANDER

- 50/15/5 Watts
- RX: 118-173.995, 375-549.995, 810-999.99MHz**

3G | D-STAR

NEW HANDHELD AND PORTABLE D-STAR RIGS WITH IMPROVED USER INTERFACE!

COMMON TO BOTH THE IC-80AD AND THE ID-880H

- D-STAR repeater list and DR mode operation
- 1052 memory channels, 8 character names
- 26 memory banks with selected bank and bank link scanning
- Up to 50 channel per second scanning
- LCD and keypad backlighting
- Auto repeater function & WX CH, WX alert*
- One touch D-STAR reply function
- D-STAR digital voice (DV) & simultaneous, up to 950 bps data
- CS-80/880 free download software www.icom.co.jp/world/support/index.html

D-STAR ready

NEW IC-80AD

2m & 70cm DUAL BANDER

- 5/2.5/0.5/0.1 Watt
- RX: 0.495-999.990MHz**

Shown with opt. HM-189 GPS mic

3G | D-STAR

ID-RP2C
REPEATER CONTROLLER

The cornerstone of the D-STAR system. Handles up to four RF modules. Basic in-band or cross-band operation. Linking capabilities through the internet and future 10GHz backbone products.

ID-RP2D
1.2GHZ DATA MODULE

Access point with a data rate of up to 128kbps. Depending on the system setup, set up an email and/or file server for EmComm support. Perfect for web applications or support via internet connection.

ID-RP2V
1.2GHZ DIGITAL VOICE MODULE

ID-RP2000V
2M DIGITAL VOICE MODULE

ID-RP4000V
70CM DIGITAL VOICE MODULE

Finally, commercially available crossband systems! Together, with proper call sign programming in any D-STAR compatible mobile or portable, the Icom D-STAR system will automatically route your signal to any other RF module connected to a common RP2C. With simple system commands, you can direct your communications through any of the RF modules or across the world via the gateway.

Visit your Icom dealer today!

Free literature: 425.450.6088

or www.icomamerica.com

ICOM®

*US versions only. **Frequency coverage may vary. Refer to owner's manual for exact frequency specs.

Take your hobby with you!

At the Track

IC-RX7 Stylish Scanner with Smart Interface

Sleek, fast, and able to hit the track even during a rainstorm, the 'RX7 is Icom's first receiver to achieve the IPX4 water resistant rating. Besides its sleek and aerodynamic design, it's what's under the hood that will really put you in the race – power and performance!

On Top of the World

IC-R5 Sport Wideband Receiver

Stay one step ahead and enjoy Mother Nature with the built-in weather radio function of the IC-R5 Sport. Made to fit in your pocket, this radio will keep you informed and give you hours of operation!

Stay on Task

IC-R20 The Pro's Scanner

Until the 'R20, the capability of monitoring two frequencies required two radios. Not anymore! There's plenty of features to tweak to your listening pleasure, and a built-in recorder (up to 4 hours) too! Monitor local public safety, listen to air traffic control, catch the play-by-play from your local radio station – and much more!

ICOM®

hy-gain® ROTATORS

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

HAM-IV

HAM-IV
$649.95

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER SERIES II

For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch max. mast.

T-2X
$799.95

T-2XD
$1229.95
with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II
$449.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

HAM-V

HAM-V
$1099.95
with DCU-1

For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

ROTATOR OPTIONS

MSHD, $99.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $39.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

AR-40

AR-40
$349.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

HDR-300A

HDR-300A
$1499.95

For ***king-sized*** antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power	5000 in.-lbs.
Brake Power	**7500 in.-lbs.**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight	61 lbs.
Effective Moment (in tower)	**5000 ft.-lbs.**

Digital Automatic Controller

DCU-1
$749.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-35 Rotator/Controller

AR-35
$89.95

For UHF, VHF, 6-Meter, TV/FM antennas. Includes automatic controller, rotator, mounting clamps, mounting hardware. 110 VAC. One Year Warranty.

NEW! Automatic Rotator Brake Delay

RBD-5
$29.95

Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

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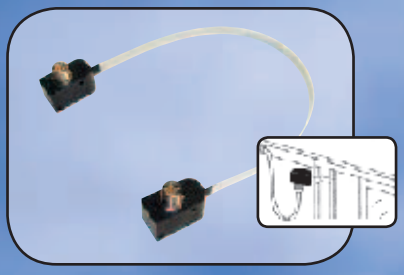
Life is a JOURNEY, Enjoy the ride!



NEW! COMET CTC-50M
Window Gap Adapter!

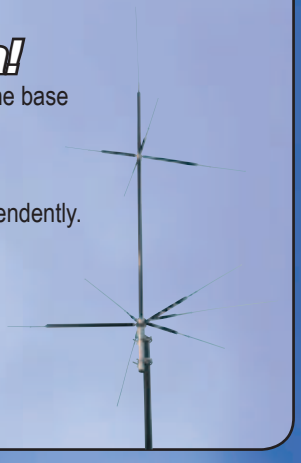
Max Power: HF 100W PEP
VHF: 60W FM
UHF: 40W FM
900MHz - 1.3GHz: 10W
VSWR: <500MHz 1.3:1
>500MHz 1.5:1
Impedance: 50Ohm
Length: 15.75"
Conn: 24k Gold Plated SO-239s

MALDOL HVU-8
Ultra-Compact 8 Band Antenna!

Unique ground radial system rotates 180 degrees around the base if building side mounting is required.

Max Power: HF 200W SSB/100W FM
6M - 70cm: 150W FM
TX: 80/40/20/15/10/6/2M/70cm
Impedance: 50 Ohm
Length: 8'6" approx
Weight: 5lbs 7oz
Conn: SO-239
Max Wind Speed: 92MPH

Each band tunes independently.
Approx 2:1 band-width:
80M 22kHz
40M 52kHz
20M 52kHz
15M 134kHz
10M 260kHz



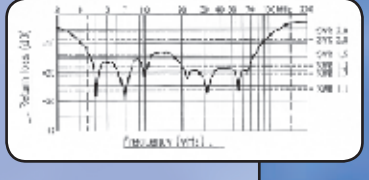
COMET CHA-250B
Broadband HF Vertical!

3.5 - 57MHz with SWR of 1.6:1 or less!

- ***NO ANTENNA TUNER NEEDED***
- ***NO RADIALS***
- ***NO TRAPS***
- ***NO COILS***

If you suffer in an antenna restricted area, must manage with space restrictions or you simply want to operate incognito you will be forced to make significant antenna compromises. The CHA-250B makes the most of the situation, making operating HF easy!!

Max Power: 250W SSB/125W FM
TX: 3.5– 57MHz
RX: 2.0– 90MHz
Impedance: 50Ohm
Length: 23'5"
Weight: 7lbs 1 oz
Conn: SO-239
Max Wind Speed: 67MPH



NEW! COMET H-422
40/20/15/10M compact, broadband, rotatable dipole!

Assemble in either a "V or horizontal ("H") configuration.
CBL-2500 2.5kW balun and heavy duty hardware included.

Max Power: 1000W SSB / 500W FM
SWR: Less than 1.5:1 at center frequency
Rotation Radius: "V" 12' 6" "H" 17' 5"
Length: "V" 24' 5" "H" 33' 10"
Weight: 11 lbs 14 ozs
Wind load: 3.01 sq feet
Max Wind Speed: 67 MPH

COMET and Maldol

For a complete catalog, call or visit your local dealer.

Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
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This Month in QST

June 2009 ♦ Volume 93 Number 6

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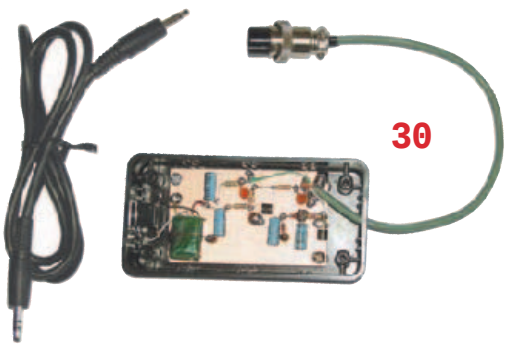

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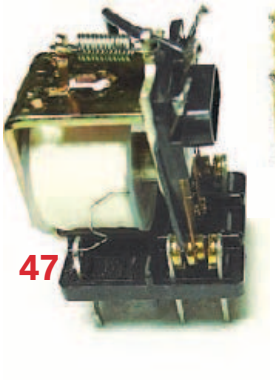
Radiosport



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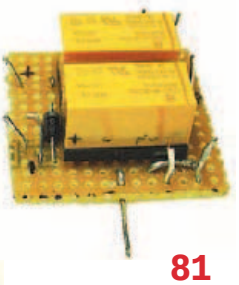

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Our Cover
Joan Hauser, KCØYUZ/HB9TYY, Ueli Hauser, KB9TTI/HB9TTI (in hat), and Jack Ciaccia, WMØG, of the Boulder Amateur Radio Club, WØDK, take it outdoors for the 2007 ARRL Field Day. Photo by Ken Long, NØQO. The 2009 Field Day is June 27-28 — where will you be? If you're looking for a site, or you want to publicize your Field Day event, be sure to check out page 69 for a handy one-page guide to Amateur Radio's most popular operating event.

Departments

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

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Compact Field Radio with Top Mounted LCD and Loud Audio

Actual Size

- Compact Design with Top mounted LCD Display
- 5 Watts of Stable RF Power with Minimum Components for Reliability
- 700 mW of Loud Audio for outside field environments
- 200 Memory Channels for serious users
- Yaesu Exclusive Power Saving Circuit Design Guarantees Longer Operating time
- Hands Free Operation with Optional VC-25 VOX Headset

ULTRA-COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-250R

Size: 2.3" (W) x 4.3" (H) x 1.0" (D) / Weight: 12.4 oz.

Wide Range of available Options includes:
- **External DC jack for Cigarette-Lighter adapter E-DC-5B or DC cable E-DC-6**
- **6 X AA size Alkaline Battery Case FBA-25A**

NEW

2m MONO BAND

Technical specs subject to change without notice. The FT-250R has not been approved by the FCC. This device may not be sold or leased, or offered for sale or lease, until FCC approval has been obtained.

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

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

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Commercial Grade Field Radio
Submersible Construction

- Large Backlit LCD Display for easy operation
- 5 Watts of Stable RF Power with Minimum Components for Reliability
- 800 mW of Loud Audio for noisy field operations
- 200 Memory Channels for Serious users
- Commercial Grade Receivers Performance
- Submersible Construction (3 ft. for 30 min)
- Yaesu Exclusive Power Saving Circuit Design Guarantees Longer Operating time
- Hands Free Operation with Optional VC-24 VOX Headset

Actual Size

VHF FM 5 W COMPACT HANDHELD TRANSCEIVER

FT-270R

Size: 2.4" (W) x 4.7" (H) x 1.3" (D) Weight: 13.8 oz.

Wide Range of available Options includes:

- CD-26 Charger Cradle
- VAC-370B 1.5 Hour Desktop Rapid Charger
- External DC Jack for Cigarette-Lighter adapter E-DC-5B or DC Cable E-DC-6
- FBA-25A Alkaline Battery Case (for 6 X AA cells)
- FTD-7 DTMF Paging Unit

NEW

2 m MONO BAND

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Best Selling, Reliable Mobile

- 55 Watts of Solid RF Power within a compact footprint
- Loud 3 Watts of Audio Output Power for noisy enviroments
- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users

Actual Size

NEW

ULTRA RUGGED 55 W 2 m FM TRANSCEIVER

FT-1900R

Size: 5.5" (W) x 1.6" (H) x 5.8" (D) / Weight: 2.2 lb

2 m MONO BAND

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Choice of the World's top DX'ers℠

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Public Service

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Education

Technology

Membership

"It Seems to Us"

Coexistence

"Radio spectrum management is a difficult business. The most useful part of the spectrum has been fully allocated for decades, yet new uses continue to be developed. Where can they go? It's a question that requires ever more imaginative answers."

As one of the oldest incumbent radio services, Amateur Radio is constantly on the defensive. We are hardly alone. Consider broadcasting, for example. After the 1947 Atlantic City Radio Conferences the bands 470-585 and 610-940 MHz were allocated exclusively to broadcasting, worldwide — and with additional regional allocations (585-610 MHz in Region 2) to boot. With the completion of the transition to digital television this month, the frequencies in this range that remain available to US broadcasters have been whittled down to 470-608 and 614-698 MHz, with one or two 6-MHz channels in the 470-512 MHz band also used by land mobile in a number of metropolitan areas. Broadcasting has lost about half of its allocations in this valuable part of the spectrum. In addition, wireless microphones and similar low-power devices have had the use of vacant TV channels for years, and these channels — so-called "white spaces" — soon will be used for broadband data services as well.

The amateur service arguably has fared a bit better, although we are secondary in our three allocated bands between 420 and 1300 MHz. We lost 1215-1240 MHz in 1979 but picked up a whole new band at 902-928 MHz. These bands have other occupants, and some of them are primary. We are obliged to not interfere with the primary services and we must accept whatever interference their operations may cause to us, but we still get a lot of use out of them.

Of the three, the 420-450 MHz (70 cm) band is by far the most popular among amateurs. In a 2003 survey, half of the respondents who were active said they used the band. There are more than 8,000 FM, digital and television repeaters operating on 70 cm, along with simplex FM, satellite, and weak signal operators using CW, SSB and a variety of digital modes.

Historically we have managed to coexist with military radars, although recent upgrades to the Pave Paws installation at Beale AFB have created some issues for repeater operators in northern California. Wind profiler radars, which beam straight up to measure wind speed and direction as a function of time and altitude, were engineered into the upper 2 MHz of the band several years ago and will be coming on line as NOAA funding permits. The federal government also operates a secure spread spectrum network, the Enhanced Position Location Reporting System (EPLRS), in the band.

The 420-450 MHz band has been a popular target for a variety of unlicensed, low-power devices. As a licensed service we enjoy priority over them, so while they can be a nuisance (particularly when the devices are designed for use in Europe or elsewhere and do not conform to the FCC regulations) they have not posed too much of a regulatory threat. When a regulatory threat does arise, normally we can count on being joined in opposition by the federal agencies that also use the band.

Not every proposed use of the 420-450 MHz poses an equal threat. We already share the band, and some potential sharing partners are more compatible than others. A compatible sharing partner may actually strengthen our position against subsequent proposals.

We should consider a current FCC rulemaking proceeding, ET Docket No. 09-36, in that light. In response to a petition filed by the Alfred Mann Foundation, a leading medical research organization, the FCC is seeking comment on the feasibility of allowing up to 24 MHz of spectrum between 413 and 457 MHz to be used on a secondary basis as part of the Medical Data Radiocommunication Service in Part 95 of the FCC rules.

The desirability of the Mann Foundation's objective is beyond dispute. Their researchers have developed a wireless medical micro-power network to tie together tiny devices implanted in victims of paralysis, creating an artificial nervous system to restore sensation, mobility, and function to paralyzed limbs and organs. The Mann Foundation argues that the frequency range just above 400 MHz is optimum for their application, which requires no more than 1 milliwatt of RF spread across about 5 MHz of bandwidth. However, recognizing the presence of a variety of incumbent radio services in that range, specifically including the amateur service, they have proposed four channels for flexibility in avoiding localized interference. Two of the four channels are 426-432 and 438-444 MHz; the other two are above and below the 420-450 MHz band.

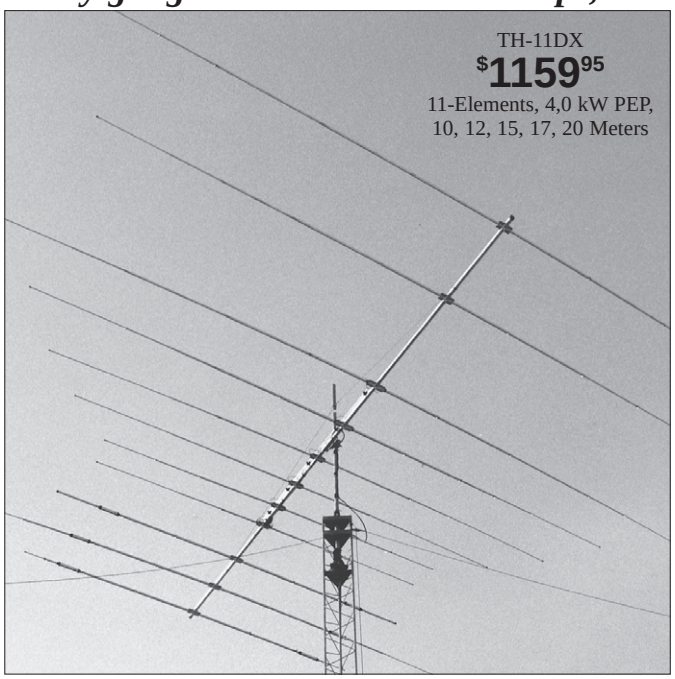
The FCC's proposed rules raise two concerns. First and foremost, the devices would be required to accept interference only from stations authorized to operate *on a primary basis*. The Mann Foundation has assured us that amateur stations will not cause its system to malfunction, so we see no reason why this cannot be reflected in the rules even though our allocation is on a secondary basis. Second, while the Mann Foundation researchers appear to have done their homework, others who try to take advantage of the new rules may not be as rigorous.

The FCC is allowing 90 days for public comment after publication of the Notice of Proposed Rulemaking (NPRM) in the *Federal Register*. Of course, the ARRL will be filing comments; members are welcome to share their thoughts with us for possible inclusion in the League's submission. You also may file comments directly with the FCC as individuals or clubs — but if you do, please *read* the NPRM first and respond to the questions that the Commission has posed. Form letters and expressions of opposition without anything to back them up will serve no useful purpose when weighed against the hopes and dreams of paralyzed veterans.

David Sumner, K1ZZ
ARRL Chief Executive Officer

hy-gain HF BEAMS . . .

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



TH-11DX
$1159.95
11-Elements, 4,0 kW PEP,
10, 12, 15, 17, 20 Meters

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

The choice of top DXers.

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

Handles 2000 Watts continuous, 4000 Watts PEP.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

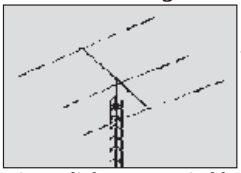
***BetaMATCH*™** provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled.

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

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

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

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



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

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

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

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

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

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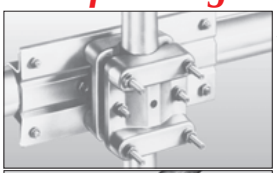
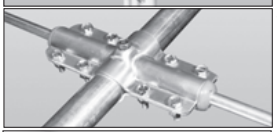
1. Hy-Gain's famous super strong *tooled* die cast *Boom-to-Mast Clamp*



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.

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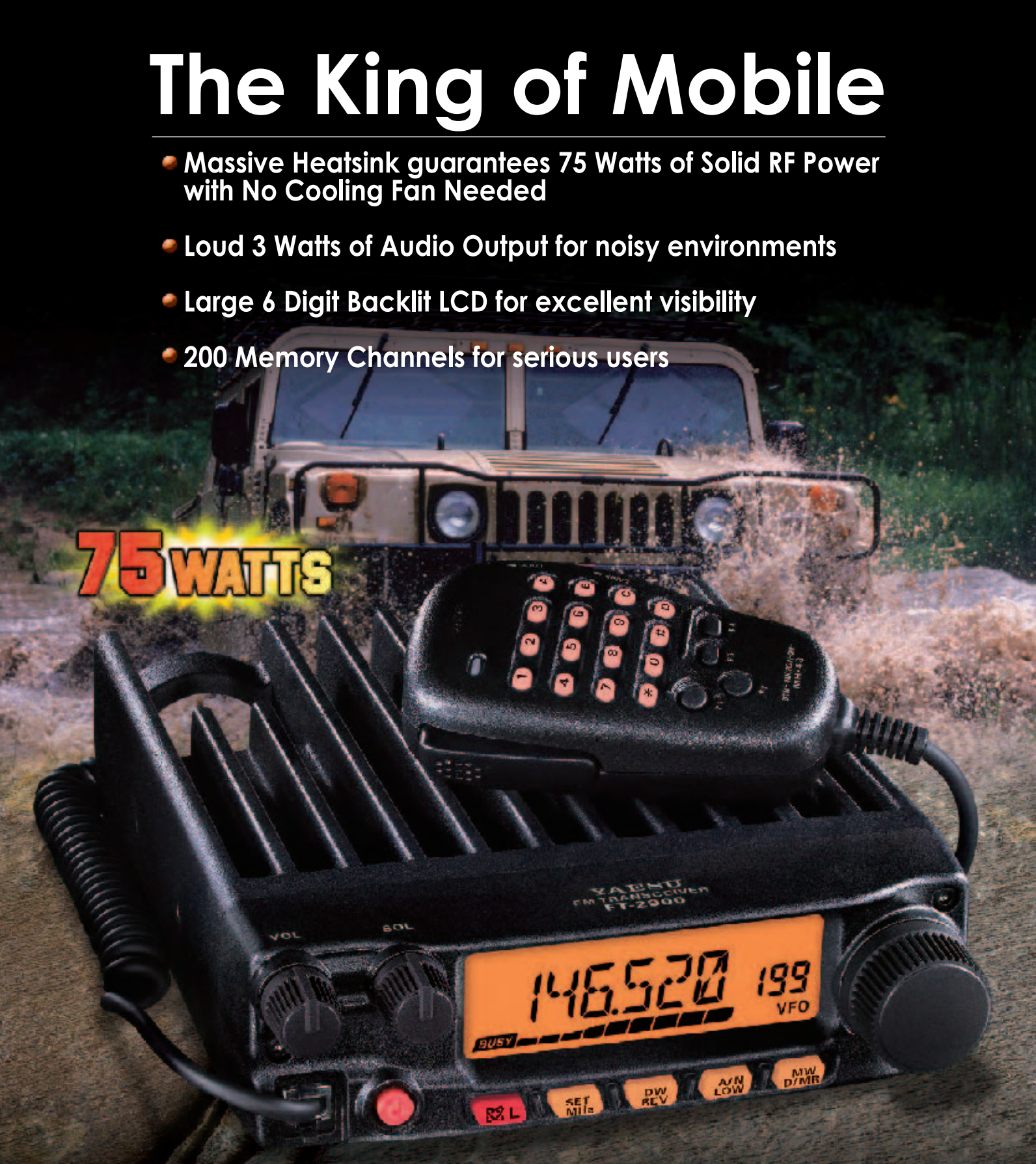

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- Ham radio operators provided backup communications in the San Jose, California area during an infrastructure emergency caused by sabotage.
- In response to an FCC invitation to interested parties to submit comments concerning the Commission's consultative role in the broadband provisions of the American Recovery and Reinvestment Act of 2009, the ARRL expressed concern as "the threshold for what constitutes 'broadband' is a critical determination that will inevitably determine the success or failure of the [Broadband Technologies Opportunities Program] BTOP program going forward."
- In March, the FCC invited comments concerning the establishment of a comprehensive rural broadband strategy as part of the Department of Agriculture's Food, Conservation and Energy Act of 2008, commonly known as the 2008 Farm Bill. In response, the ARRL expressed several concerns about broadband over power lines (BPL) that the FCC has yet to satisfactorily address.
- As tornados swept through the southeastern part of the country on April 10, hams in Alabama, Tennessee, Arkansas and Georgia were on the air providing assistance to the National Weather Service (NWS).
- More than 250 hams and emergency communications professionals enjoyed two days of focused programs at the 11th Annual Communications Academy in Seattle.
- As the Red River rose to near record flood levels, hams in Minnesota and North Dakota provided communications support to various government agencies over several weeks.
- Following a devastating earthquake that killed about 300 people in L'Aquila, the capital of Italy's Abruzzo region, hams set up HF and VHF emergency stations to assist with critical communications.
- In April, the ARRL Foundation Board of Directors voted unanimously to award the prestigious William R. Goldfarb Memorial Scholarship to Dean LaBarba, KI6CUX, of Long Beach, California.
- The Dayton Amateur Radio Association (DARA), host of the Dayton Hamvention®, announced the winners of their three 2009 annual awards — Amateur of the Year, the Technical Excellence Award and the Special Achievement Award. Hamvention (and the concurrent ARRL National Convention) will be May 15-17.
- The 31st Annual National Hurricane Conference took place April 6-10 in Austin, Texas.
- Two new video Public Service Announcements (PSAs) — one promoting ARRL Field Day and another showing the technical side of Amateur Radio — are now available from the ARRL Web site.
- Two US Senators have introduced a bill in the Senate that would mandate an inventory of radio spectrum bands managed by the National Telecommunications and Information Administration and the Federal Communications Commission.
- Citing personal and professional reasons, Amateur Radio on the International Space Station (ARISS) International Chairman Frank Bauer, KA3HDO, has stepped down from his ARISS duties
- The winner of the *QST* Cover Plaque Award for March is Byron Black, W4SSY, for his article "The W4SSY Spudgun."
- These online course sessions began May 1: Amateur Radio Emergency Communications Level 1; Radio Frequency Interference; Antenna Design and Construction; Technician License Course; Analog Electronics, and Digital Electronics.

Media Hits

Allen Pitts, W1AGP

- It has been a very busy and productive month for Amateur Radio, and this is reflected in the numbers and quality of the media hits. Jim Walker, NØXDA, was quoted in the *Daily Times-Call* (Longmont, CO) article "Ham is handy in emergencies," as saying, "The hams showed up, and their stuff worked." *The Mercury News* (San Jose, CA) also reported on ham radio's capabilities when other communications failed in a missing person search for an 8 year old. The Tracy (CA) CERT team with Dave Coursey, N5FDL, provided critical communications between the groups involved.

  But emergencies come in all flavors, and when someone cut fiber optic cables in Santa Cruz County, California it cut off "hundreds of thousands of AT&T, Verizon, Nextel and Sprint customers with land lines, cell phones and Internet services. 911 calls were also affected. The *Santa Cruz Sentinel* led reporting of the incident and told how ham radio operators were dispersed to hospitals, the NETCOM center and the ARC offices. More hams from Morgan Hill and Gilroy became involved to provide communications between the two towns. Hams came in to help from Palo Alto and Mountain View. Several officials in Santa Clara and Monterey counties were quoted praising the hams, including Jennifer Ponce, Morgan Hill's Coordinator of Emergency Services, and Dale Foster, Fire Chief for Gilroy — both went on record in praise for the hams' response and actions in the crisis.
- The *Mesquite Local News* (Mesquite, NV) reported another crisis resolved with the aid of Amateur Radio on March 14 when Hal Whiting, KI2U, was stopped while traveling out in the desert by a frantic driver. There had been an ATV accident with injuries and cell phones were not functional. Hal not only called it in, but coordinated the helicopter navigation to the scene. At the opposite weather extreme were the floods in North Dakota and the *Forum* of Fargo, North Dakota praised the hams serving in the city EOC with "Hams show chops in flood."
- Amateur Radio's emergency capabilities were noted in the March issue of the Association of Public Safety Officials (APCO) magazine, *Public Safety Communications.* "Hams at the Inauguration" reported on the ARES/RACES activities in and around Washington in support of the presidential event. Our unique capabilities were also displayed in the spring issue of Subaru's *Drive* magazine, thanks to Rick Savage, KB1LYJ.
- Other notable hits included Dave Bermann, W6PS, in the *Paradise Post* (CA); Jim Crisco, WA4YIZ, and Cliff Brommer, WD4PIC, in the Lake Norman *News* (NC); and Dee Logan, W1HEO, in the *Bridge* magazine published by the Lake County Council on Aging (OH).
- Finally, a "Ya dun gud!" to Jill Niemeier, ACØMX, of Kennett, Missouri who got into the *Daily Dunkin Democrat* for using ham radio emergency activities to win not one, but *three* major awards at the regional senior level science fair in one day.

This Year's AES Superfest a Success

Attendance was healthy at the 2009 Superfest, sponsored by Amateur Electronic Supply in Milwaukee. Steve Ford, WB8IMY, Diane Petrilli, KB1RNF, and I had twice the amount of space we normally have at the ARRL booth, which helped us talk to more visitors. In fact, we processed exactly 100 memberships! — *tnx Don Michalski, W9IXG, ARRL Wisconsin Section Manager*

DON MICHALSKI, W9IXG

ARRL Membership Manager Diane Petrilli, KB1RNF, helped staff the ARRL booth at this year's AES Superfest. The other HQ representative, Publications Manager Steve Ford, WB8IMY, gave two talks on digital communications.

"DXpedition" for a Good Cause

In February, ham radio operators were among the volunteers who traveled to three remote villages in Honduras to provide medical and dental services as well as eyeglasses. The trip was sponsored by the International Health Service. The hams who took part were Nichol Wilson, KI6VKC (Pharmacist); Virginia Wilson PhD, KI6VKD, General Helper; Alison Shelley, KS6Q, Radio, and Kelley Shelley, KS6Z, Engineer, all of Susanville, California.

There were a total of 10 teams spread out over Honduras with a total of 130 volunteers from the US, Britain, Canada and Argentina. Alison and I provided radio communications with other teams and the Net Control Station in La Ceiba to coordinate medical/dental needs, and PACTOR e-mail home for team members. The e-mail was the main communications tool because of propagation and interference on SSB voice nets. We served 1717 patients while in the remote villages. — *Kelley Shelley, KS6Z*

ALISON SHELLEY, KS6Q

Kelley Shelley, KS6Z, was one of four California hams who traveled to Honduras in February to assist members of the medical team. The group provided medical and dental services to several remote villages.

Inside HQ

Emergency Communications Courses Update

Field Day is an exercise in emergency preparedness. Although we retain the original idea of Field Day by setting up and operating our own equipment over a 24 hour period, today's Amateur Radio emergency communications are more likely to occur at a state-of-the-art EOC (Emergency Operations Center) or in a served agency's sophisticated mobile communications center. These facilities are staffed by trained Amateur Radio operators who are knowledgeable in both traditional and modern communications. Amateur Radio's role in Emergency Communications has changed considerably over the past five years.

Because of these changes, we have been reviewing the ARRL's Amateur Radio Emergency Communications training program. We have been reviewing both our current methods of course delivery and their content. We have received many questions about these changes, so let's review them again.

We plan to continue offering the Emergency Communications Level 1 course. This course still provides a solid introduction to Amateur Radio Emergency Communications. We will continue to offer the course on an online distance learning platform and through field instruction and examination. Online mentors will still be assigned to each online course enrollee. Both the EmComm Level 1 online course and the printed manual will continue to be updated as required. Essentially, Emergency Communications Level 1 will retain the same delivery platforms and curriculum that it has today.

While we previously had three EmComm courses, we will now have two: Level 1 which will become the "Basic" course, and a new course, "Advanced Emergency Communications." The Advanced course will replace the current Level 2 and Level 3 courses. We are discontinuing the current Level 2 and Level 3 courses now because they are quickly becoming outdated.

The delivery method for the Advanced course has not been determined yet because we are still working with government agencies to determine how we might align our training with their learning objectives. We have already determined that we will need to make procedural changes to provide more consistency and integrity in the training and examination processes.

Our goal is to develop a widely accepted training program for the emergency communication component of Amateur Radio. We need to decide the form the new course will take and the requirements that must be addressed for instruction. Nevertheless, we are planning to release this new course in the last quarter of this year.

It has taken time to revise the EmComm course material so that it is current and relevant. And, now we are adding the additional component to meet new requirements. I assure you that the ARRL staff are diligently working and meeting with representatives of all involved agencies to complete the project as soon as possible.

We believe that these steps will result in more effective Emergency Communications training that will better meet the needs of the Amateur Radio community and the organizations that we serve.

73,

Harold Kramer, WJ1B
ARRL Chief Operating Officer
wj1b@arrl.org

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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.

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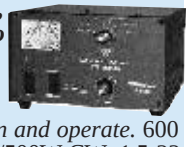

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A Tale of Two Field Days

Balloon Experiment Brings Field Day Elation and Frustration

Bill Coté, WD8NYW, **cote@msu.edu**

Field Day is a great time to experiment with unusual types of antennas, even when — or especially when — Murphy is cleverly working to thwart plans: Just ask Central Michigan Amateur Radio Club members about their experiences with balloons and kites. Bob Berger, K8RDN, and Ron Harger, WD8BCS, achieved roller-coaster emotions of elation and intense frustrations as they led new explorations during the group's 2008 event in Lansing.

DONNA COTÉ

Bob Berger, K8RDN (left) and Ron Harger, WD8BCS, of the Central Michigan ARC launch their balloon and kite-launched antennas in this autumn exercise. Mixed results at 2008 Field Day prompted them to work out some refinements for the 2009 FD.

Bob's daylight team ventured first with kites, hauling up 26 gauge wire on parafoil kites to operate a half-wave antenna on 30 meters. They completed two contacts with 70 W on CW, one with a local ham and the other with a mobile operator in Washington, DC — in spite of shifting winds that caused the one or two kites to swerve and swoop frequently.

Come dark, Ron's unit put up latex helium balloons with 32 gauge wire to operate QRP as a vertical quarter-wave antenna on 80 meter CW. The operators were delighted to make some 75 contacts. Unfortunately, as they shifted over to 40 meters come dawn, someone spotted the coax connector for the balloon lying unconnected on the ground. They had indeed made 75 contacts — but on the conventional 40 meter dipole — not the balloon!

It was a sobering discovery, but WD8BCS was more determined than ever to test out balloon antennas again. During the November Sweepstakes he staked out a full quarter-wave balloon vertical on his own rural property — and racked up 22 CW contacts in 17 states on 80 meters.

For comparison purposes Bob and Ron made contact with each other and compared Ron's trap vertical with the balloon vertical. The results were good, with the full quarter-wave vertical winning easily with an additional 3-4 S-units. An RF spectrum analyzer clearly indicated the balloon vertical averaged between 10 and 12 dB increase in received signal strength over the conventional setup. "No wonder I was having problems on the trap vertical after I took the balloons down," Ron said. "Five watts goes a heck of a lot farther with that much gain."

Bob was very pleased with the kite results, noting his basic intention simply was to demonstrate how well a half-wave end-fed antenna might work under FD conditions. The balloons, Ron said, seemed an ideal way to launch an antenna in a hurry without the need for structures or trees.

In all, the experimenters found Field Day, coupled with subsequent refinements, an excellent way to try out novel transmission methods that might prove useful in real emergency conditions.

Greenhorn Field Day

Steve VanDenAkker, W4SJV, **steve@w4sjv.com**

ARRL Field Day 2008 dawned as do most other late June days in Santa Rosa County, Florida: already hot and muggy with the possibility of thunderstorms. So Field Day and the weather were a perfect match for the Navarre Community Emergency Response Team (CERT) and its 2 month old Amateur Radio Club, KC4ERT. Navarre was near ground zero for Hurricanes Erin and Opal (1995), Ivan (2004) and Dennis (2005). It was because of Hurricane Ivan that the Navarre CERT was formed. Current membership is at about 65, including 15 hams.

We used the Milton KOA campground as our FD site, starting with coffee and a brief class on antennas and HF propagation for the less experienced among us. Then we moved outdoors, and pretty soon 15, 20 and 40 meter antennas dotted the landscape. The newer hams were tested with several "What's wrong with this picture?" exercises.

At the magic hour, the most experienced operators Steve, W4SJV; Ray, K1HG, and Gene, KK4IB, took the microphones to make the first few contacts as the newer hams looked on. Pretty soon everyone started taking turns. The 10 year old granddaughter of Chris, KJ4CHH, really got into it and made a few contacts despite the band conditions. Everyone got to make at least one contact and certainly got a lot of practice at trying!

Although a couple of folks had to leave early, most of the team hung in. The youngster and her mom stayed longer than originally planned, as mom had much difficulty dragging daughter away from her newfound fun.

To abide by campground noise restrictions, we shut down the generator around 2100. As fate would have it, lightning had started appearing in the distance, signaling the end of Field Day for KC4ERT. By that time we had made 58 contacts in 31 sections across 30 states and were already talking about things we might do at Field Day 2009. Thanks to the operators of those stations we contacted for being patient with a bunch of greenhorn hams!

STEVE VANDENAKKER, W4SJV

John, KJ4CHG (left) and Ray, K1HG, are interviewed by a local newspaper reporter at FD 2008.

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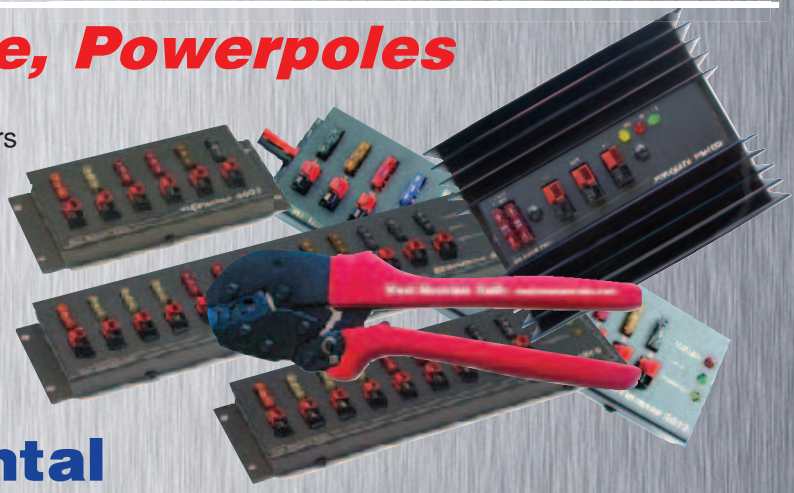

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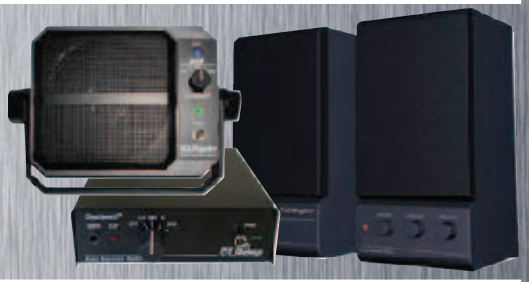

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CORRESPONDENCE

OPEN SESAME?

♦ Murray Green, K3BEQ, would like to see owners of closed repeater systems open the repeaters to non-members ["Correspondence," March 2009, page 24]. The issue of "closed" repeaters and systems comes up often, and the reasons they are needed are not often presented. The frequency is not owned by the repeater group, but the group, however, has unrestricted use of the machine or system on the frequency. Many of these closed repeaters are part of complex, integrated linking systems that require considerable expertise to operate. In these systems, all operators are trained as control operators. This assures that the repeater operation is being constantly monitored by control operators whenever it is being used, as required by FCC regulations. Anyone is free to use that frequency for simplex operation (on a not-to-interfere basis). Repeater coordination groups exist throughout the country to assure that repeaters make the best use of the allowed spectrum and accommodate as many repeaters as possible without interference.

Green noted that the cost and physical labor associated with the creation and upkeep of these complex systems are significant. An inadvertent or malicious operator can create havoc with many linked repeaters, causing chaos and inoperability to the subscribing users. Likewise, the extreme cost of supporting sites makes some method of financial support necessary. Site access fees, building rental, utilities, equipment procurement, configuration, installation, repair and maintenance at these sites costs a lot. Often, each linked remote base repeater system will have eight or more radios, controllers, telephone and Internet access, as well as a complex array of towers, antennas, duplexers, filters, power supplies, backup power systems, generators and the requisite safety and security support mandated by the site owners. Distributing these costs and responsibilities across a number of users is the only way to ensure they can continue to operate.

There are many open repeaters and systems serving most every urban area throughout the country. I realize that it can rankle many amateurs when they happen upon a closed system and are asked to refrain from use. Hopefully the control operators who handle such encounters will do so tactfully and graciously.

So when you happen upon a closed repeater system and are asked to leave — hopefully in a gracious manner — please recognize the need of these organizations to continue to keep their systems in order and operation.

RICK PAQUETTE, W7RAP
Tucson, Arizona

CAN YOU HEAR ME NOW?

♦ Peter Chadwick, G3RZP, voices seldom-heard, but well-taken wisdom, when he cautions us against slavish adherence to the International Phonetic Alphabet ["Correspondence," April 2009, page 24]. Indeed, it's fine to use standard phonetics in most circumstances. But if you've ever spent even one weekend in a major international contest, you've almost certainly encountered some unpleasant combination of marginal conditions and unfamiliar accents.

That's where the IPA often falls short. When the bands are less than ideal — hardly a rare occurrence these days — it's too easy to confuse Alfa and Oscar (especially when pronounced, "Osskah") and lose short words like "Golf" in fading signals. By the same token, an unfamiliar accent can turn Yankee into "JAHN-kay," Hotel into "HAWT-ul," Tango into "TAHN-gah" and so forth.

Let's remember, our main goal is to communicate, not to treat the IPA as The 26 Commandments. And sometimes it's simply more efficient to substitute phonetics that contain the sound of the letter, such as Able, Easy, Ocean and Peter. Another common clarifier is to use well-known geographic names with lots of syllables, such as America, Guatemala, Honolulu, Ontario and Yokohama. Don't get me wrong: I'm not advocating cutesy phonetics such as "Woohoo-9-I-Need-Dames" in place of the IPA list. But we have to keep our eyes on the prize. If you keep repeating, "Alfa! Alfa! Alfa!" and the other op keeps saying, "What? What? What?" then it's time to try some trusty alternatives such as "Able! Able! America! America!"

The bottom line is, we're not going to earn any brownie points if we end up declaring, "Well, the other op gave up on me after 10 tries and I lost the QSO, but at least I stuck stubbornly to the International Phonetic Alphabet!"

BRIAN D. SMITH, W9IND
Greenwood, Indiana

A GIFT TO THE COMMUNITY

♦ I recently checked with the local high school library in Panama City Beach, Florida, to see if they had a subscription to *QST*. When I found out that they did not, I decided to give them a two-year gift subscription. I encourage other ARRL members to do the same.

JOE PREWITT, WØTUT
Panama City Beach, Florida

Editor's Note: If you would like to give *QST* as a gift subscription to an institution, such as a local library or school, please contact the ARRL Circulation Department via e-mail at **circulation@arrl.org** or by phone at 1-888-277-5289. Gift subscriptions to institutions are billed at the same annual rate as ARRL memberships.

LOOKING FORWARD TO ANOTHER 25 YEARS

♦ January 31 marked my 25th year as an Amateur Radio operator. To this day, I remember the weather outside; it was a bit cold and gray as I ripped open the very official looking envelope from the FCC that held my first license, KA1LHC. My grandfather, the original K3BRJ (later W2CPY) put a lot of time into me, elmering me, before he died; I like to think he's looking down on me as I operate.

These past 25 years have not only seen me operate as "The Guy Next Door," but my license has allowed me to experience the other sides of Amateur Radio, too. I've been a member of numerous local clubs and ARES®, and now I am District Emergency Coordinator for my area. I'm also a brand new member of the Quarter Century Wireless Association.

But all this makes me wonder: In this age of cell phones and emerging technologies, will Amateur Radio even exist in the next 50, 75 or 100 years? I for one certainly hope so, because as I see it, Amateur Radio is indeed very necessary to our communities, our country and our world.

H. MICHAEL GRUTEKE, K3BRJ
Derby Line, Vermont

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.

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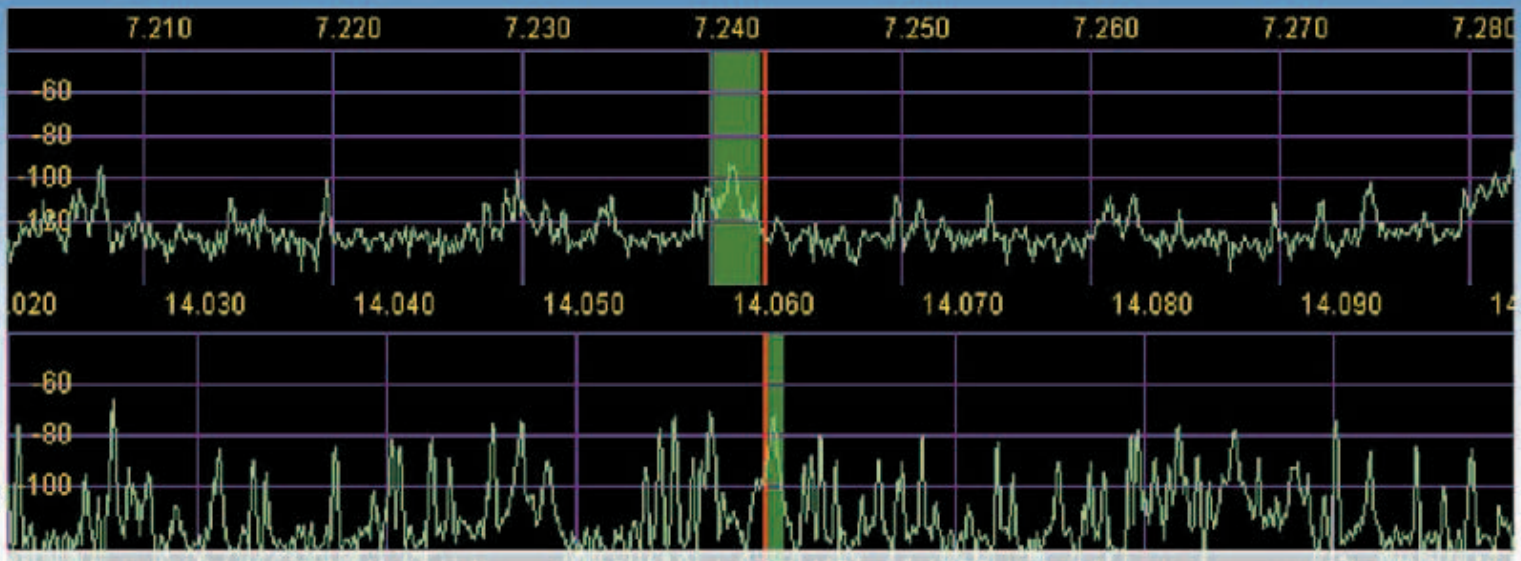

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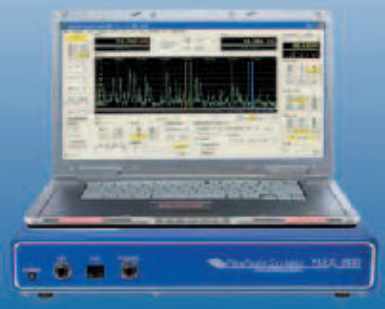

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Specifications

Frequency:
1.8 ~ 28MHz all amateur bands including WARC bands and 50MHz
Mode:
SSB, CW, RTTY
RF Drive:
85W typ. (100W max.)

Output Power:
HF 1kW PEP max.
50MHz 650W PEP max.
Circuit:
Class AB parallel push-pull
Cooling Method:
Forced Air Cooling

AC Power:
AC 240V default (200/220/235) – 10 A max.
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Dimensions:
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Specifications

Frequency:
1.8 ~ 28MHz all amateur bands including WARC bands
Mode:
SSB, CW, RTTY
RF Drive:
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Output Power:
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CW 600W.
RTTY 500W (5 minutes)
Final Transistor:
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(MOS FET by ST micro)
Circuit:
Class AB parallel push-pull

Cooling Method:
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- Automatic simplex checker
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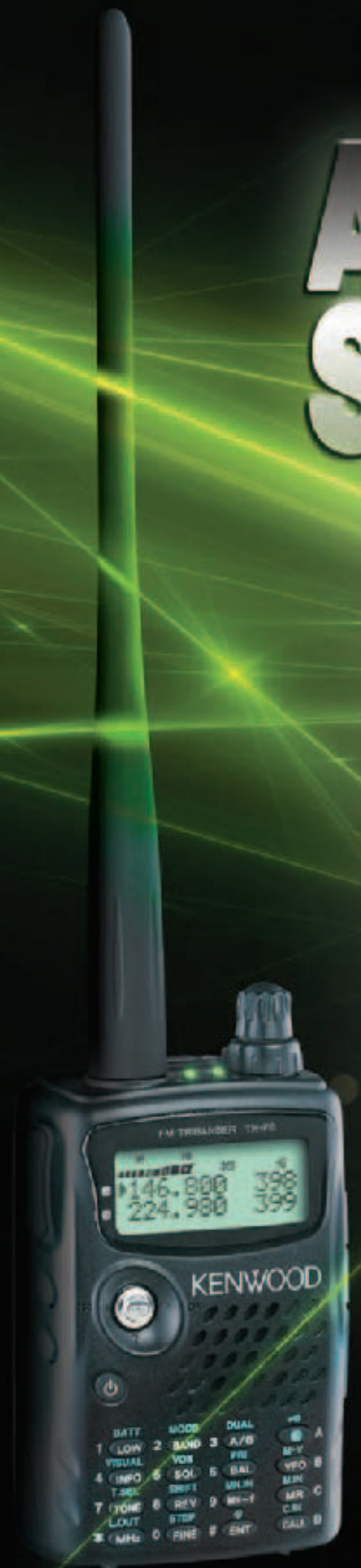
[1]Note that certain frequencies are unavailable. [2]5W output



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ADS#06309

A Sound Card Interface for FM Transceivers

Add an audio-triggered transmit/receive switch to your FM rig and give digital operating a try.

Howard "Skip" Teller, KH6TY

While looking for a way to enable more people to use the Narrow Band Emergency Messaging System (see **www.w1hkj.com/NBEMS/**) on 2 meters, it became clear that the lack of VOX in most FM-only transceivers was a serious stumbling block. That's because NBEMS relies on sound-card-based software. In addition to creating the audio signal for transmission, the software must also have access to a hardware interface that would allow it to switch the FM transceiver into transmit and back to receive.

You could use a commercial or home brew sound card interface for this application, but many of these interface devices require computer serial (COM) ports to function. If your computer lacks a COM port (most new laptops don't have them), you'd have to use a USB port, which, in turn, requires a USB-to-Serial converter to create a virtual serial port for the digital software to use.

I decided to try an easier, more elegant approach, one that would work not only with NBEMS software, but also with *Digipan* for PSK31 on HF and other sound-card modes such as DominoEX with the free *Fldigi* software (**www.w1hkj.com/Fldigi.html**). DominoEX in particular has demonstrated intriguing performance when used on VHF FM, rivaling even "weak signal" SSB in some instances (see the sidebar "Try "Weak Signal" Digital FM"). Of course, you could also use this interface for sound-card packet radio with *AGW Packet Engine* (**www.sv2agw.com/ham/agwpe.htm**) software. No COM or USB ports required!

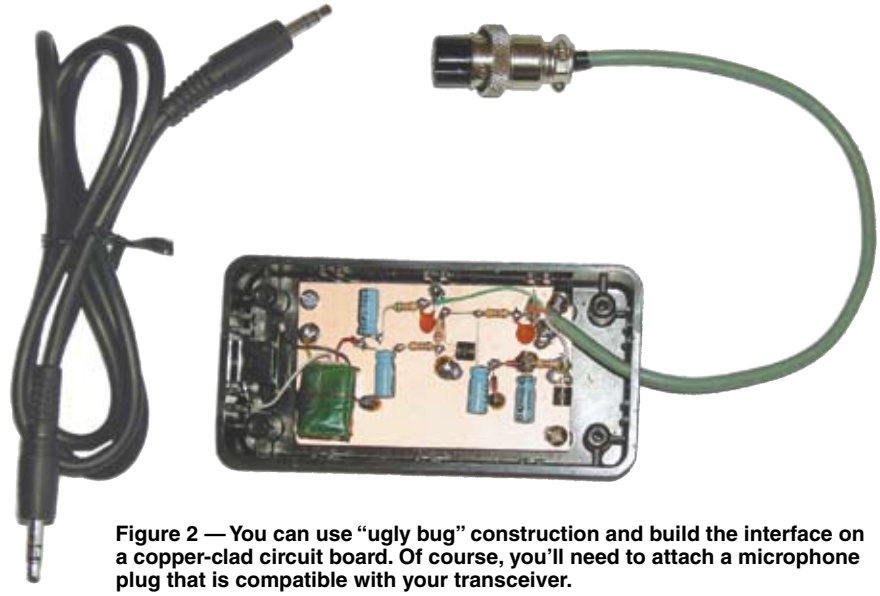

Figure 2 — You can use "ugly bug" construction and build the interface on a copper-clad circuit board. Of course, you'll need to attach a microphone plug that is compatible with your transceiver.

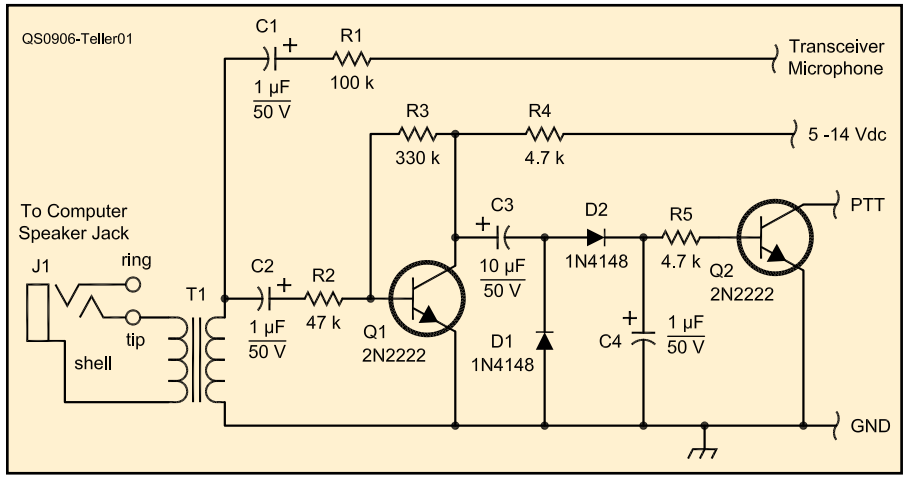

Figure 1 — FM transceiver interface schematic and parts list.

C1, C2, C4 — 1 µF, 50 V electrolytic capacitor.
C3 — 10 µF, 50 V electrolytic capacitor.
D1, D2 — 1N4148 switching diode.
J1 — Panel mount ⅛ inch stereo jack.
Q1, Q2 — 2N2222A or any small NPN audio transistor.
R1 — 100 kΩ ¼ W resistor.
R2 — 47 kΩ, ¼ W resistor.
R3 — 330 kΩ, ¼ W resistor.
R4, R5 — 4.7 kΩ, ¼ W resistor.
T1 — 1:1 audio isolation transformer (Mouser 42LX016-RC).

Let the Audio do the Work

Most digital modes work by modulating the transceiver with an audio tone, and that tone can also be used to switch the transceiver in and out of transmit automatically by using a *voice-operated switch* (VOX) circuit.

First the audio tone must be amplified to get enough signal to detect and switch a transistor for the transmit/receive line. In order to amplify the tone, there needs to be some convenient source of dc voltage to power the amplifier. A review of the schematic diagrams for modern transceivers revealed that most have a voltage on the push-to-talk (PTT) line that can power the switching transistor. For those transceivers that have a DTMF tone generator built into the microphone, there is also 8 Vdc available at the microphone jack, and this voltage can be used to power the necessary

Try "Weak Signal" Digital FM

Here's an application for your newly built interface that you and your friends can try right away. All you need are ordinary 2-meter FM voice transceivers.

Tell everyone to go to **www.w1hkj.com/Fldigi.html** and download and install *Fldigi*. This free multimode software package is available for *Windows, MacOS* and *Linux* operating systems. Once everyone has their software running successfully, set up some times to meet on the air. One suggested frequency is 145.00 MHz, simplex. (When selecting a frequency, always follow the band plans that are in effect in your area and listen carefully before transmitting.)

When you're ready, fire up *Fldigi*, choose either the DominoEX8 or DominoEX4 modes and start enjoying keyboard-to-keyboard text conversations. What you're likely to discover is that you can span a remarkable range with this setup, much farther than with FM voice alone.

If you really want to push the envelope, use 50 W FM transceivers (or add "brick" amplifiers to the radios you are using now) and horizontally polarized Yagi antennas (short 4 or 5 element Yagis will do). Depending on the terrain in your area, you may find that you can have DominoEX chats over astonishing distances! — *Skip Teller, KH6TY*

amplifier as shown in Figure 1.

The transmit audio from the sound card SPEAKER or LINE OUT jack is fed into a 600:600 Ω isolation transformer to eliminate the possibility of hum or ground loops between the computer and transceiver. The isolated audio signal is passed through C1 and attenuated to microphone levels by R1 before reaching the transceiver microphone input. A portion of the signal is also coupled via C2 and R2 to the base of Q1, where it is amplified to a level of several volts. This ac voltage is peak detected by D1 and D2, which form a voltage doubler, generating enough voltage across C4 to cause the base of Q2 to go high and switch the PTT line to ground, thereby switching the transceiver into transmit mode. When the tone is stopped by the software, Q2 is turned off and the transceiver returns to receive state.

Construction

There are only a few parts to the interface, so one method is to use "ugly bug" construction and handwire the circuit on a piece of copper-clad circuit board material. A small RadioShack project enclosure was used to hold the interface circuit board, mount the stereo audio input jack so it is insulated from the circuit board, and protect the interface circuitry (see Figure 2).

If you'd prefer a cleaner approach, a fiberglass circuit board with plated-through holes, parts legend and solder mask is available (Figure 3). Send $5 with a self-addressed, stamped envelope to: KH6TY, 335 Plantation View Ln, Mount Pleasant, SC 29464.

The interface terminates in a 4-wire cable and a microphone connector to match whatever transceiver is going to be used. For transceivers using the plastic RJ-45 or RJ-12 microphone jacks, existing CAT-5 or telephone jumper cables can be cut in half, eliminating the need to purchase a crimping tool.

Installation

Installing the VOX interface couldn't be easier. A standard stereo audio patch cable is connected between the sound card SPEAKER or LINE OUT jack and the stereo jack on the interface, and the interface microphone connector is plugged into the transceiver microphone jack. For receive audio, a separate cable must be connected between the sound card MICROPHONE or LINE IN jack and the transceiver earphone/external speaker jack.

Using the *Windows* Volume Control panel, the WAVE and VOLUME CONTROL sliders are adjusted while running the software in the transmit or tune mode until the transceiver goes into transmit, and then raised a little higher. This should provide the right level of audio for the transceiver. If the level is too low, R1 can be reduced in value to increase the audio drive to the transceiver.

Although I designed this circuit for digital operating with FM transceivers on the VHF and UHF bands, nothing would stop you from putting this interface to work for HF digital as well. All you need to do is supply 5 to 14 V dc for the amplifier stage.

Figure 3 — A version of the VOX interface using the circuit board provided by the author.

Howard ("Skip") Teller, KH6TY, is an ARRL member and was first licensed in 1954. He received his commercial First Class Radiotelephone license in 1959 and worked his way through college as chief engineer of several radio stations. He holds a BS degree in electrical engineering from the University of South Carolina and is retired from running a factory in Taiwan, where he manufactured the weather alert radio that he originated in 1974 and is still sold by RadioShack and many other companies. Skip enjoys developing digital software, such as DigiPan and NBEMS, and designing 2 meter transceivers and antennas. He is currently studying the potential of working 2 meter DX on FM using digital modes. You can contact Skip at 335 Plantation View Ln, Mt Pleasant, SC 29464: **kh6ty@comcast.net**.

The *No Excuses* 160 Meter Vertical

Stop procrastinating.
Build this fun antenna and get on the top band train.

John Miller, K6MM

"My lot size is too small." "I can't compete with the Big Guns." "I don't have the time." "Too complicated." "Too expensive." Sound familiar? It's easy to become a top band curmudgeon — avoiding putting up a 160 meter antenna because it may be more work than fun. Well, if you're having a difficult time putting a decent signal on 160 meters, here's a possible solution to get you up and running on the "gentleman's band," while leaving all those excuses behind.

Background

My first exposure to a helically wound vertical (HWV) was Gary Ellingson's 1972 *QST* article describing a 75 meter antenna.[1] His unique *no loading coil* approach eliminated the need for guying. I first tried this antenna design while living in Pennsylvania years ago and obtained reasonable results for local contacts using low power.

For many years, I dropped the HWV approach in favor of dipoles or inverted Vs for 80/75 meters, but became interested again when reading about Jack Swinden's, W5JCK, clever *broomstick with a top hat portable antenna* design.[2] He used ½ wavelength of wire for a targeted resonance frequency of 3.800 MHz and emphasized the importance of carefully calculating and measuring the number of turns around the antenna. Jack's meticulous attention to construction detail was inspiring, and this became my second homebrew HWV project. My Yaesu FT-847 HF/VHF/UHF transceiver at 100 W with this little portable antenna was a fun combination for ARRL Field Day and short trips. There's always something satisfying about a homebrew antenna that generates memorable contacts.

Overcoming My Excuses

I'm an avid contester, but had no antenna for 160 meters. In fact, I was a bit cynical about ever being able to put up an effective 160 meter antenna on my rather small California city lot. My Northern California Contest Club (NCCC) contesting buddies, however, convinced me that I was missing out on some big time fun with great conditions during our sunspot lull, not to mention the ARRL 160 Meter, CQ 160 Meter and Stew Perry top band Challenge contests. No more excuses. It was time for me to get on the top band train too.

A review of the literature on 160 meter antenna designs leads to the usual discussion of dipoles, inverted Ls, Ts, Vs, loops, deltas and verticals. After thinking about my own location's constraints I found myself revisiting the HWV option and settled upon a design often discussed but not often deployed in the US — a helically wound vertical antenna using PVC tubing.

It appears that most HWV antennas for 160 meters have been homebrewed in the UK, where the limitations of their small gardens are common. Phil Sidwell, MØVEY, describes his top band homebrew helical, including a fairly elaborate earth ground system.[3] This type of antenna appears to have gained widespread popularity throughout the UK and Europe.

Wire Wisdom

There is no hard and fast formula for determining the amount of wire needed to establish resonance in a helical antenna. The relationship between the length of wire needed for resonance and a full quarter wave at the desired frequency depends on several factors. Some of these are wire size, diameter of the turns and the dielectric properties of the form material. Experience has indicated that a section of wire approximately one half wavelength long, wound on an insulating form with a linear pitch (equal spacing between turns) will come close to yielding a resonant quarter wavelength. Therefore, an antenna for use on 160 meters would require approximately 260 feet of wire, when spirally wound on a support.[4]

Add other possible challenges such as narrow SWR bandwidth, low feed-point impedance and radiation resistance, efficient top hat capacitance, mechanical constraints, sufficient ground radial system — and you could easily become a top band curmudgeon. But then you'd miss out on building this fun antenna — one that really works!

To try to get a first approximation on a final HWV design, I used modeling software developed by Reg Edwards, G4FGQ.[5] His program models and predicts the performance of a helically wound vertical antenna, mounted immediately above a ground plane, top-capacitance-loaded with a vertical rod or whip. Enter these variables — height and diameter of the helical coil, number of turns and diameter of wire, length and diameter of the end loading rod — and you get back theoretically useful data. Outputs include ¼ wave resonant frequency, length of wire needed, helix wire pitch, capacitance and inductance data, feed-point impedance and expected bandwidth.

Version 2.0 — Looking Better

This article describes the construction and

[1]Notes appear on page 36.

performance of a very simple but effective HWV antenna for 160 meters. In a nutshell: The antenna is made by telescoping three 10 foot PVC sections together, helically winding it with ½ wavelength of antenna wire, attaching a capacitance hat to the top and feeding it with a 50 Ω feed line against eight ground radials. The entire construction can be easily completed in just one day using very simple tools.

Construction

Step 1 — PVC Painting

The antenna is made from three 10 foot sections of readily available PVC tubing in three diameter sizes: The top section is 1 inch, the middle section 1½ inches and the bottom section 2 inches. To make this antenna stealthy and environmentally friendly, the three PVC sections were spray painted green by suspending each 10 foot section from two pieces of nylon rope between two branches of a convenient backyard tree. Brown paint might work just as well, depending on the hues of your foliage. All three 10 foot sections were allowed to dry thoroughly before I proceeded.

Step 2 — Bottom Section — Coax, Antenna and Ground Connections

The bottom 2 inch PVC section is prepared for both ground and coax connections by drilling the necessary mounting holes. A PVC cap is placed on the bottom of the 2 inch diameter PVC tube and then, using a felt tip marker, a circle is drawn around the PVC just above the border between the bottom cap and PVC section. This marker ensures that subsequent drilled holes will clear the bottom PVC cap.

Coax Connection: The PVC cap is then removed, and holes are drilled for the SO-239 UHF type bulkhead connector and four attachment screws. The SO-239 hole is centered about 2½ inches above the marker (see Figure 1).

Bottom Antenna Binding Post: One ⅛ inch hole is drilled for the antenna binding post, placed 2 inches above the marker. A red binding post was used for the antenna connection.

Ground Binding Posts: Two ⅛ inch holes are drilled for the ground posts. Each is placed 1½ inches above the marker. Black binding posts were used for ground connections.

Summary: The three binding post holes (one for the antenna wire, two for the radial connections) are placed equidistant from each other around the PVC section. The antenna post and ground posts are staggered vertically by about ½ inch to avoid any possibility of shorting (see Figure 2).

Step 3 — Wiring the Coax Connector and Antenna Post

One end of a 4 inch piece of 14 gauge wire is soldered to the center connector of the SO-239. The other end is then soldered to either a spade or ring lug. The wire is then pushed through the prepared SO-239 hole in the 2 inch PVC tube, and the SO-239 connector secured to the PVC tube using only three of the four mounting holes. The free end of the insulated wire is connected to the inner section of the red antenna post using the spade or ring lug. After you have secured the antenna post with a binding nut, the connection can be soldered.

Step 4 — Wiring the Coax Connector and Ground Post

A 6 inch section of 14 gauge insulated wire is soldered (or crimped) to spade lugs on both ends. One end is connected on the outside of the PVC to the remaining SO-239 screw and secured to the PVC. The other end of the #14 wire is connected to the closest black ground binding post on the outside of the PVC.

Inside the PVC, another piece of 14 gauge wire is attached between the two ground binding posts. This essentially connects both ground binding posts and the coax base together. Check to be sure the antenna and ground connections inside the PVC are clean and not touching each other. Braided coax, such as RG-58, can also be used instead of the #14 wire for ground post connections. At this point, the SO-239 and all binding posts should be tightened and secured. For extra strength and protection, the binding posts can also be glued to the PVC, both inside and outside.

Figure 2 — Binding posts and internal wiring arrangement.

Step 5 — PVC Mast Preparation and Assembly

The top, middle and bottom sections are assembled using a high tech solution — duct tape. I actually used Gorilla Tape 10 for wrapping because it uses two layers of adhesive and two layers of fabric backing to make it much stronger than standard duct tape.[6]

First, the 1 inch diameter PVC tubing is shortened from 10 feet to 7 feet 6 inches by cutting off 2 feet 6 inches from one end. Duct tape is then wrapped around the tubes as follows:

- For the top section apply two wrappings. The first wrap should be 2 inches from bottom of tube. The second wrap from 9½ to 11½ inches from the bottom of the tube (see Figure 3).
- For the middle section also apply two wrappings. The first wrap at 2 inches from the bottom of the tube. The second wrap from 22 to 24 inches from the bottom of the tube.

The three PVC sections are then telescoped together. When assembled, the middle section will extend 24 inches into the bottom section, and the top section will extend 11½ inches into the middle section. It's important to use enough duct tape to ensure a good fit between the PVC sections (see Figures 4 and 5).

Figure 1 — Details of SO-239 UHF coax connector attachment.

Figure 3 — PVC sections wrapped with duct tape to make a tight fit.

Figure 4 — PVC sections telescoped together and ready for final assembly.

Figure 5 —Dimensions of PVC section telescoping overlap.

Figure 6 — Wire wrapped around pole and taped to maintain position.

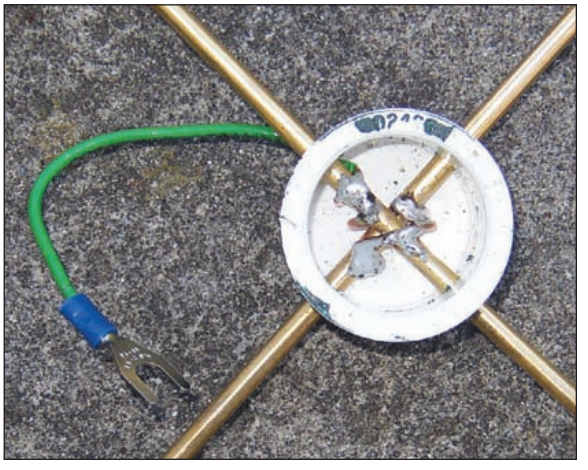

Figure 7 — Detailed view of inside of top of PVC cap showing soldered connections.

The next step in PVC assembly is to further secure the joints with a bolt and nut. The lower joint, between the middle and bottom sections, is secured by drilling a ¼ inch hole through both PVC sections about 12 inches from the top of the 2 inch diameter top PVC section, and using a 3¼ inch bolt, washer and self locking (acorn) nut to fasten the sections together. Avoid over-tightening.

The middle joint, between the middle and top sections, is secured by drilling a similar hole, about 6 inches down from the top of the 1½ inch diameter middle PVC section. Use a similar attachment arrangement, this time with a 2¾ inch bolt.

Top antenna binding post: This is similar to the bottom antenna post previously described. The top antenna post is prepared by drilling a ⅛ inch hole 1 inch from the top of the top PVC section. A red capped binding post is attached to it using a nut and glued to secure it. The helically wound antenna wire will be connected to this post, which will also be the antenna to capacitance hat attachment point.

Step 6 — Helically Winding the PVC

With the sections assembled and fortified, the antenna is ready to be helically wrapped with wire. As previously mentioned, experimentation with HWVs has shown that a ½ wavelength of wire is often needed for ¼ wave resonance, assuming the turns are evenly spaced. At a desired resonant frequency of 1.825 MHz, 256 feet 5 inches of wire is required for a 160 meter vertical, using the formula 468/f. For this first version of the antenna, I chose 22 gauge insulated wire — I had a good supply sitting in the garage.

Using our kitchen table, which measures 5 feet long and a coffee can with 2 large screws protruding from sides at the top and bottom 180° apart to keep the wire from falling off the can as it was being wound, my wife unwound the wire from the supply spool while I wound it onto the coffee can. We went 50 times across the kitchen table for 250 feet plus an additional 6 feet 5 inches. The wire was cut, adding a few extra inches for experimentation, but keeping the 256 feet 5 inch point marked.

Wrapping begins by first attaching the antenna wire to the bottom antenna binding post of the 2 inch PVC section using a spade or ring solder lug. The wire is then wound from bottom to top, being careful to keep the winding pitch as consistent as possible, and avoiding the bolts near the two PVC joints. A spacing of about ½ inch seemed to work well. Wire wrapping is not a difficult step, but does require a bit of patience. It's best not to rush this part of the project. Duct tape is helpful here every few feet to keep the windings secure (see Figure 6). In a later version of this antenna, I hot-glued the antenna wire to the PVC for even better protection.

The end of the wire at the top of the antenna is then soldered to a spade or ring terminal and attached to the top antenna binding post with the red cap at the top of the 1 inch PVC section.

Option for Portability: It's possible to make the antenna portable by cutting the antenna wire at the two PVC joints. Then, after removing wire insulation, alligator or quick disconnect clips are attached to the antenna wire ends. The antenna can then be pulled apart, moved, re-telescoped together, and the full antenna wire length restored by

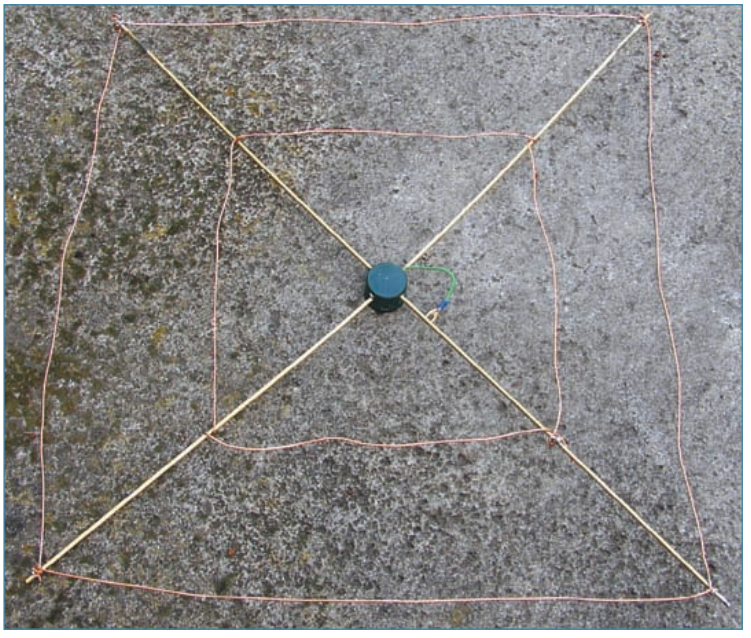

Figure 8 — Completed square capacitance hat ready for installation.

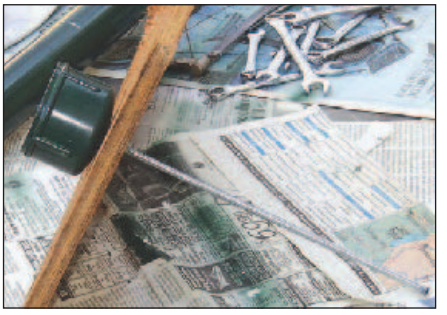

Figure 10 — View of threaded rod that will secure the antenna to the ground.

simply connecting the antenna clips together.

Step 7 — Top Cap Preparation, Capacitance Hat

There are several designs for a suitable HWV capacitance hat to provide capacity termination and reduce noise. At first, I chose the circular hat design described by Jack Swinden, W5JCK, in which six 12 inch brass rods are spaced equally around a PVC cap, and soldered together.[7] I eventually settled on a simpler square hat design using two 36 inch brass rods spaced 90° apart and connected together with 14 gauge copper wire.[8] Either of these methods work well.

The square hat construction begins by drilling four ⅛ inch holes 90° apart in the 1 inch PVC cap, about 1 inch from the bottom. An additional ⅛ inch hole is drilled next to one of these holes. The brass rods are inserted into the cap, forming an ×. A pair of pliers is helpful here, as it will be a snug fit, which is what you want.

Next, a 6 inch piece of 14 gauge insulated wire is stripped on one end, and soldered to a spade or ring lug on the other end. The stripped end is slipped through the remaining ⅛ inch hole and wrapped securely around the × junction of the two brass rods inside the PVC cap, where everything is securely soldered (see Figure 7). The brass rods are tied together externally by connecting them together with 14 gauge bare copper wire in two places — the tips of the rods and also midway between the rod ends and the PVC cap. The bare copper wire is soldered to the brass rod at all eight intersections to complete the square hat (see Figure 8).

Finally, the PVC cap is attached to the top section of the antenna, and the capacitance wire secured to the top antenna binding post using the spade or ring lug. For best results, it's important to have a good electrical connection between the antenna wire and the capacitance hat.

Figure 9 — Bottom cap on plywood lower support member.

Step 8 — Bottom Cap Preparation

The bottom cap is used to support and protect the antenna. A ¼ inch hole was drilled in the center of a 1 foot square piece of scrap plywood. Another ¼ inch hole was drilled in the bottom of the 2 inch PVC cap. The threaded aluminum rod was trimmed to 12 inches and run through the bottom PVC cap, and then through the plywood (see Figure 9). Nuts and washers were attached on the threaded rod inside the cap and also on the other side of the plywood. When it was tightened, only 2 inches of rod was left inside the cap, to ensure that the antenna and ground wiring in the bottom section of the mast would not be disturbed (see Step 2). About 10 inches of threaded rod was left sticking out from the bottom of the plywood (see Figure 10). The plywood base serves as a stabilizing platform to ease final installation of the vertical. By gently standing on it and pushing, you can easily drive the 10 inches of threaded rod into most ground.

Step 9 — Erecting the Antenna

After the PVC sections were bolted together, and completely wire wrapped, the capacitance hat was attached to the top of the antenna, including the capacitance wire to antenna binding post connection. The antenna is now ready for final installation (see Figure 11). The bottom 2 inch PVC cap with the plywood base was set in the ground at its mounting location. Bracing the bottom against the ground, the 27 foot antenna was carried to the PVC cap base and carefully set into the PVC cap. One person can carry and mount the antenna but it's a bit easier with two folks.

My location required bracing the mast to my back fence and securing it at the 6 foot point with nylon rope. To keep the antenna vertical, a section of nylon rope was also attached at 12 feet using a convenient tree limb and the rope secured at ground level. Final guying and bracing details will depend upon your antenna placement.

Radial Wires

This antenna does require some ground radials. Of course, use as many as you can fit in your location. I started with four ¼ wavelength ground radials cut for 160 meters and have expanded that number now to eight, using 16 gauge stranded insulated wire. Spade lugs are soldered to ground radials that are then attached to one of the two ground posts. Because of the geometry of my property, my radials cover only a 180° arc but they work pretty well.

Initial Readings

After attaching a 6 foot piece of 50 Ω coax, an MFJ 249B antenna analyzer showed resonance close to 1.790 MHz. The antenna wire was adjusted at the bottom to bring the resonance closer to 1.830 MHz. Running 500 W through this antenna without a tuner showed a 50 kHz bandwidth, with less than

Figure 11 — Antenna fully assembled and ready to erect.

Figure 12 — Latest version of 160 meter vertical. Installed and neighbor friendly.

a 2:1 SWR. With a tuner, the antenna can achieve an SWR under 2:1 anywhere from 1.800 to 1.900 MHz.

Version 3.0 — Update

After a few months of use, I took down the antenna and decided to fortify the antenna wire by hot gluing it to the PVC. While on the ground again, the entire antenna was re-wrapped using four conductor 18 gauge stranded wire — I had a good supply sitting in the garage. At each end of the antenna the ends of the four conductor wire were twisted and soldered together before wrapping and attaching to the top and bottom antenna binding posts. I also added two elevated radials around the fence line (see Figure 12). While it seems to work better with four conductors, the single conductor is just fine.

On the Air

So how does this helically wound vertical perform? From the West Coast, it's a solid performer throughout North America. I have worked all 50 states, Canada and Mexico during the last year with it, almost all confirmed via Logbook of The World (LoTW). I was awarded First Place, Single Operator, Low Power for the Santa Clara Valley section in the 2007 ARRL 160 Meter Contest. In the 2009 CQWW 160 Meter Contest, I worked 46 states and 7 countries using 600 W in just a few hours of operating. For DX, with limited operating time, I have worked 30 countries. Overall, this antenna plays well to the Far East, South Pacific, Eastern Russia, Caribbean and Central/South America. Europe is the most difficult region to reach from my location, but that's generally true for most West Coast stations.

Am I the loudest signal on the band? No. Can I compete in pileups with folks having better antennas or higher power? No. But am I having fun on top band using a homebrew antenna that generates memorable contacts. You bet!

Summary

A helically wound vertical is not the perfect antenna for 160 meters, but for a small lot or where antenna restrictions are enforced, this easy to build vertical is a good alternative to an inverted L or dipole. During the last year, I have helped other hams around the country get on the air with this HWV design for 160 meters.[9]

This unsolicited comment from Armand Sun, K6IP, is typical of the feedback I've received:

"I finally put up the HWV antenna and I'm happy to report that it works FB. Mine has two feed options: ladder line or coax. I'm currently feeding with ladder-line and one elevated radial from leftover wire on the spool and the results are excellent! It takes a kW from 1.8-1.9 MHz. I painted mine olive drab with black 14 gauge wire so it's pretty stealthy. I would imagine brown would be good too. Sometimes the traditional designs just don't blend well with the existing antenna farm. A helically wound vertical is a good option for small lots or for those with antenna restrictions. Thanks for the design. It was fun to build and just what I needed for a top band solution."[10] So, no more excuses for Armand — nor me. Now how about you?

Notes

[1]G. Ellingson, WAØWHE, "A Helically Wound Vertical Antenna for the 75 Meter Band," *QST*, Jan 1972, p 32.

[2]J. Swinden, W5JCK, **w5jck.com/broomstick_antenna/80m_helical_antenna.html** and **www.dxzone.com/cgi-bin/dir/jump2.cgi?ID=19786**.

[3]P. Sidwell, MØVEY, **uk.groups.yahoo.com/group/topband-helical/**.

[4]R. D. Straw, N6BV, Editor, *The ARRL Antenna Book,* 21st Edition, p 6-38. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9876. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

[5]R. J. Edwards, G4FGQ, "Model and Predict Helically Wound Vertical Antennas," **www.smeter.net/antennas/helical-modeling.php**, Aug 2, 1997, and "Very Short, Helically Wound, Monopole Antennas," **www.smeter.net/antennas/short-helical.php**, May 19, 2006.

[6]Gorilla Tape. **www.gorillaglue.com/tapes.aspx**.

[7]See Note 2

[8]I am especially grateful to Jon Sims, N7ON, for sharing his ideas and experiences with me. J. Sims, N7ON — Personal communications, Jan 2006.

[9]A downloadable construction manual is posted on the author's Web site at **k6mm.com/antennas/160M.pdf**.

[10]A. Sun, K6IP, e-mail communication, Jan 29, 2009. Quoted with permission.

John Miller, K6MM, is an ARRL member and the President of the Northern California Contest Club, which sponsors the California QSO Party every October. He was first licensed in 1958 as WV2BQJ in Syracuse, New York, Ohio (WB8CHZ), Pennsylvania (WA3VTM) and California (WA6OMA and KE6MI), and now holds an Amateur Extra class license.

John recently retired after careers in research, marketing and sales in the pharmaceutical, medical diagnostics and human resources industries. He holds BS and MS degrees from Syracuse University, an MBA from Pepperdine University and a PhD in chemistry from Case Western Reserve University. His hobbies today, in addition to his four grandchildren, include the radiosport of contesting, experimenting with antennas, and exploring the back roads of the Bay Area on his Harley. His personal Web site is at **www.k6mm.com**. *You can reach John at 6349 Slida Dr, San Jose, CA 95129 or at* **k6mm@arrl.net**.

Vocal Keyer

Build this stand-alone contesting accessory for your radio and conserve your voice.

Allen Baker, KG4JJH

The June 2008 ARRL VHF contest provided a golden opportunity to try my newly assembled Elecraft 222 MHz transverter and homebrew Yagi antenna. The equipment performed well, but points for this band were hard to get as repeated CQs over the contest period netted a raspy voice and only five contacts.

After the contest I began looking at commercially available voice keyers to take the brunt out of calling CQ. Most voice keyers are now of the PC soundcard variety, but I wanted the ability to operate without a computer. Searching the Internet I found an assortment of voice recording chips. The HK828 caught my eye with claims of multiple messages and an 8 kHz sampling rate. Unlike some other voice memory devices, this chip can be easily configured for two, four or eight fixed duration messages without a microcontroller.[1]

I ordered the required components and breadboarded the circuit. A printed circuit board was then developed and the assembled board was mounted in a small enclosure. Connection to my Yaesu FT-857 transceiver was made using a short CAT-5 cable. The keyer was built with all new parts for about $75 and boasts the following features:

- Two 16 second messages with an 8 kHz sample rate and 4 kHz bandwidth (or four 10 second messages with a 6.4 kHz sample rate and 3.2 kHz bandwidth).
- Built-in audio amplifier and speaker.
- MESSAGE push buttons.
- PLAY/RECORD switch and LED indicators.
- Transmit ON/OFF switch.
- Uses the radio microphone.
- Transformer isolated audio output with level control and automatic PTT switching.
- Message 1 repeat with a 2 to 25 second delay interval.
- Suitable for any radio with appropriate RJ-45 adapters for the microphone and radio.

[1]Notes appear on page 40.

Circuit Description

The HK828 provides high quality, single-chip record and playback for 32 to 60 second messaging applications. The device includes an oscillator, microphone preamp, automatic gain control, anti-aliasing filter, smoothing filter, speaker amplifier and a high density multi-level storage array. Recordings are stored in nonvolatile memory, which provides zero power message storage. A schematic diagram of the keyer is shown in Figure 1. A complete parts list is available on the *QST* Web site.[2]

Controls

All user controls are accessible from the front panel as shown in the lead photo. Audio volume and power are controlled by potentiometer R18 (VOL) with integral switch that turns on DS1 (PWR) whenever power is applied. The transmit level sent to the radio is set by potentiometer R17 (XMT LVL). Potentiometer R19 (DELAY) sets the time interval between message 1 repeats. Momentary push buttons S1 and S2 provide recording and playback of message 1 and message 2, respectively. Locking push button S3 selects between PLAY and REC, and switches the microphone input to U1 or to the radio. Locking push button S4 allows message monitoring without transmitting (XMT ON/OFF). Red LED DS2 flashes while recording or playing messages.

U1, Recording IC HK828

The sampling rate determines voice quality and is set by the sampling clock oscillator frequency resistor (see Table 1).

Random access mode can be configured for two, four or eight fixed length messages by tying the MESL1 and MSEL2 pins high or low. Since most radios have an audio bandwidth of 2.5 to 3 kHz, one of the two highest sampling rates should be used to ensure good audio fidelity. Each message length is equal to the total recording time divided by the number of messages. For this project R6 is 24 kΩ, which yields a sampling rate of 8 kHz and 32 seconds of recording time. Random access mode for two 16 second messages is achieved by tying pin 24 (MSEL1) low and pin 25 (MSEL2) high. For slightly less voice quality change R6 to 38 kΩ, tie pin 24 high and pin 25 low, resulting in four 10 second messages. Two additional SPST momentary push buttons on pins 3 and 4 will then control messages 3 and 4. Solder jumper JP1 across the ON pads to enable the message beep function or across the OFF pads to disable the beep.

The addition of a built-in electret microphone is simple and inexpensive and is documented on the HK828 datasheet. If a microphone element is soldered to the PC board, however, it picks up *all* noises including push button actuations. For this reason, and to simplify the design, the decision was made to use the radio microphone.

U2, Monostable Multivibrator MC14538B

The MC14538B is a dual monostable multivibrator or one-shot. Triggering can occur from either the rising or falling edge of an input pulse, resulting in an output pulse over a wide range of widths. Pulse duration

Table 1
Setup Parameters for U1, the HK828

OscR R6 (kΩ)	Sampling Frequency (kHz)	Input Bandwidth (kHz)	Recording Time (Sec)	Number of Messages	MSEL1 (Pin 24)	MSEL2 (Pin 25)
84	4.2	2.1	60	8	+5 V	+5 V
38	6.4	3.2	40	4	+5 V	Ground
24	8.0	4.0	32	2	Ground	+5 V

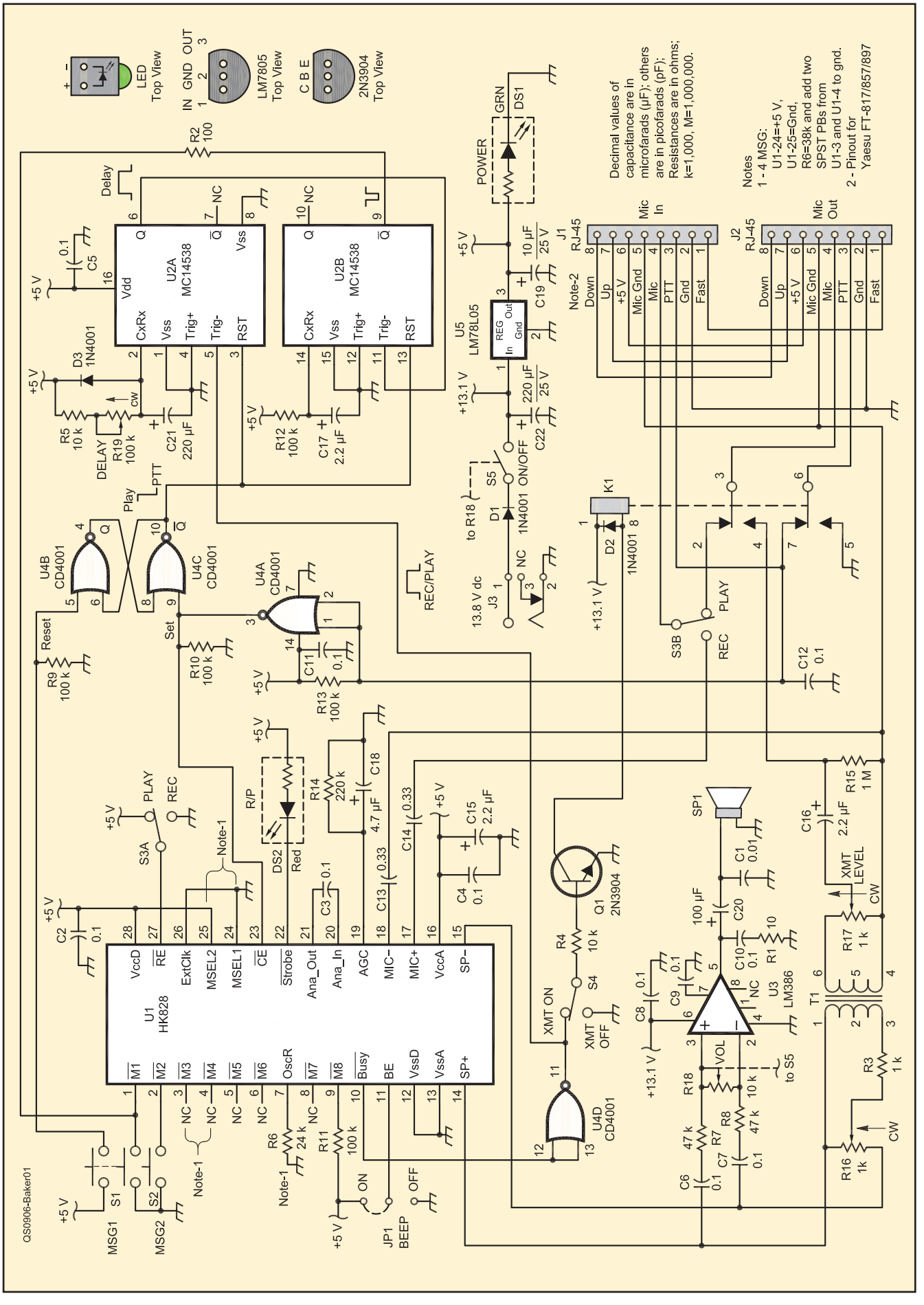

Figure 1 — Schematic diagram of the Vocal Keyer. A fully sourced and priced parts list is available on the *QST* Web site.

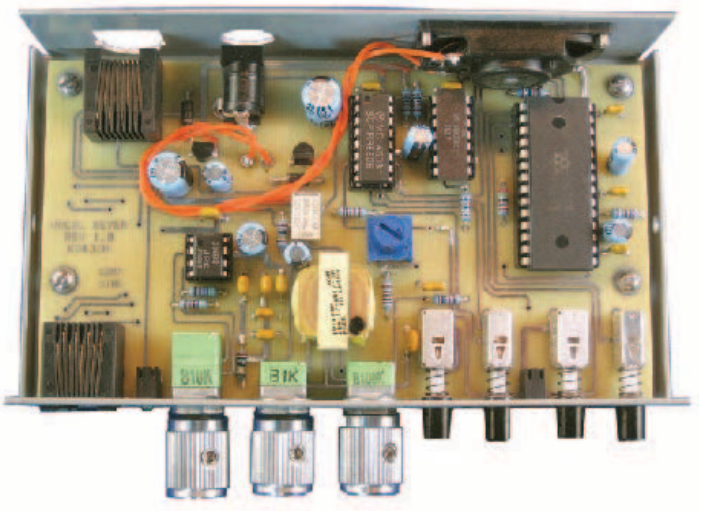

Figure 2 — Inside view of the PC board mounted in the enclosure.

Figure 3 — Rear of cabinet showing the speaker location and the POWER and MIC OUT connectors.

and accuracy are determined by external timing components on the RxCx pins. The pulse width in seconds is equal to R × C, where R is in ohms and C is in farads.

The BUSY signal from U1 provides a low-going pulse during message recording and playback. This pulse is inverted by U4D and fed to U2A to provide the trigger for the time delay between messages. The end of the delay output pulse from U2A triggers U2B to provide a 0.2 second low-going pulse that restarts message one. Diode D3 protects the chip from power-down transients when using large capacitors.

U3, Power Amplifier LM386

The speaker output from U1 provides 12 mW into a 16 Ω load. I found this power level to be inadequate so U3 was added to boost the level to ½ W. The amplified audio signal is then sent to an 8 Ω speaker.

U4, Quad NOR Gate CD40001

NOR gates U4B and U4C are configured as a set-reset latch and control the message repeat in conjunction with the MSG1 push button and microphone PTT switch.[3] When the MSG1 push button is pressed the LATCH RESET line is pulsed high, which forces the $\overline{Q}$ output high and enables the U2 delay interval. The inverted PTT signal from U4A stops message playback (by pulling the CE pin of U1 high) and pulses the LATCH SET input high. This forces the LATCH $\overline{Q}$ output low, which disables the U2 delay interval.

U5, Voltage Regulator LM7805

The 13.8 V dc power is supplied via J3. Reverse polarity protection diode D1 then distributes 13.1 V dc to U3, relay K1 and voltage regulator U5. The total load on the 5 V voltage regulator is approximately 75 mA.

K1, DPDT Relay

When the signal from U4D goes high during playback, Q1 turns on and actuates relay K1. One set of relay contacts switches the audio from U1 through transformer T1 to the radio and a second set of contacts grounds the PTT line.

T1, Transformer

Transformer T1 provides isolation between the audio output of U1 and the microphone input of the radio. The output ground of T1 is isolated from the PTT ground.

Construction

A PC board layout has been developed and is the preferred method for assembling the circuit, but perf board construction is feasible for those wishing to cut costs.

The LMB aluminum enclosure is just large enough to house all components. Print the full size templates from the *QST* Web site and fasten them to the panels using a glue stick or rubber cement. Next, center punch and drill all holes. A small half round file easily cuts the soft aluminum to get the rectangular holes to shape. Use a countersinking bit to improve the appearance of the drilled holes. An inside view is shown in Figure 2 with a rear view shown in Figure 3.

Labeling can be added using dry transfer letters or a labeling machine. The PC board is mounted inside the enclosure using ¼ inch hex male/female standoffs and hardware. To minimize RFI, scrape the paint away from the inside of the enclosure around the four standoff holes to allow the PC board ground to make contact with the enclosure. Also, ensure that the top of the enclosure is grounded by scraping the paint away from the outer two enclosure screw holes.

Yaesu FT-817/857/897 owners can plug the standard MH-31 microphone directly into the Vocal Keyer. Connection to the radio is made using a standard CAT-5 Ethernet cable. Adapters for other microphones and radios can be fabricated with a short CAT-5 cable cut in half and the appropriate connectors attached on each end. This setup reduces the size and complexity of the keyer and allows the amateur to have separate cables for each radio without the need to reconfigure jumper blocks. A few radio microphone pinouts are shown in Table 2 and connectors are listed in the parts list. Figure 4 shows some popular microphone interconnections.

Setup

To power the unit, connect 13.8 V dc from the radio power supply to a 2.5 × 5.5 mm plug. Initially, set trimpot R16 at 12 o'clock. For recording, set the controls as follows:

- Set the VOL control to 12 o'clock, which applies power and lights the green LED.
- Set the XMT LVL to 12 o'clock.
- Set the DELAY control fully clockwise.
- Set the MODE switch to REC.
- Set the XMT switch to OFF.

Press and hold the MSG1 push button, speak into the microphone and then release the push button when finished. The microphone PTT switch does not need to be pressed on most radios. A single beep (if enabled) will signal the start and end of a successful recording. If two beeps are heard before releasing the push button the recording time has been exceeded and the message should be recorded again. Next, set the MODE switch to PLAY, press and release the MSG1 push button, and adjust the VOL control for a comfortable level. Adjust the distance to the microphone or speaking volume if the audio is distorted or weak. When you are satisfied with the quality of the recording, record the final version. Minimize dead time before and after the message as this will be sent each time the message is transmitted.

Press MSG1 and adjust the DELAY for an interval of approximately 2 to 25 seconds between messages. Press the microphone PTT switch at any time to halt all message playbacks and stop the message 1 repeat. Resume the auto repeat by pressing MSG1. Message 2 does not have auto repeat and will play one

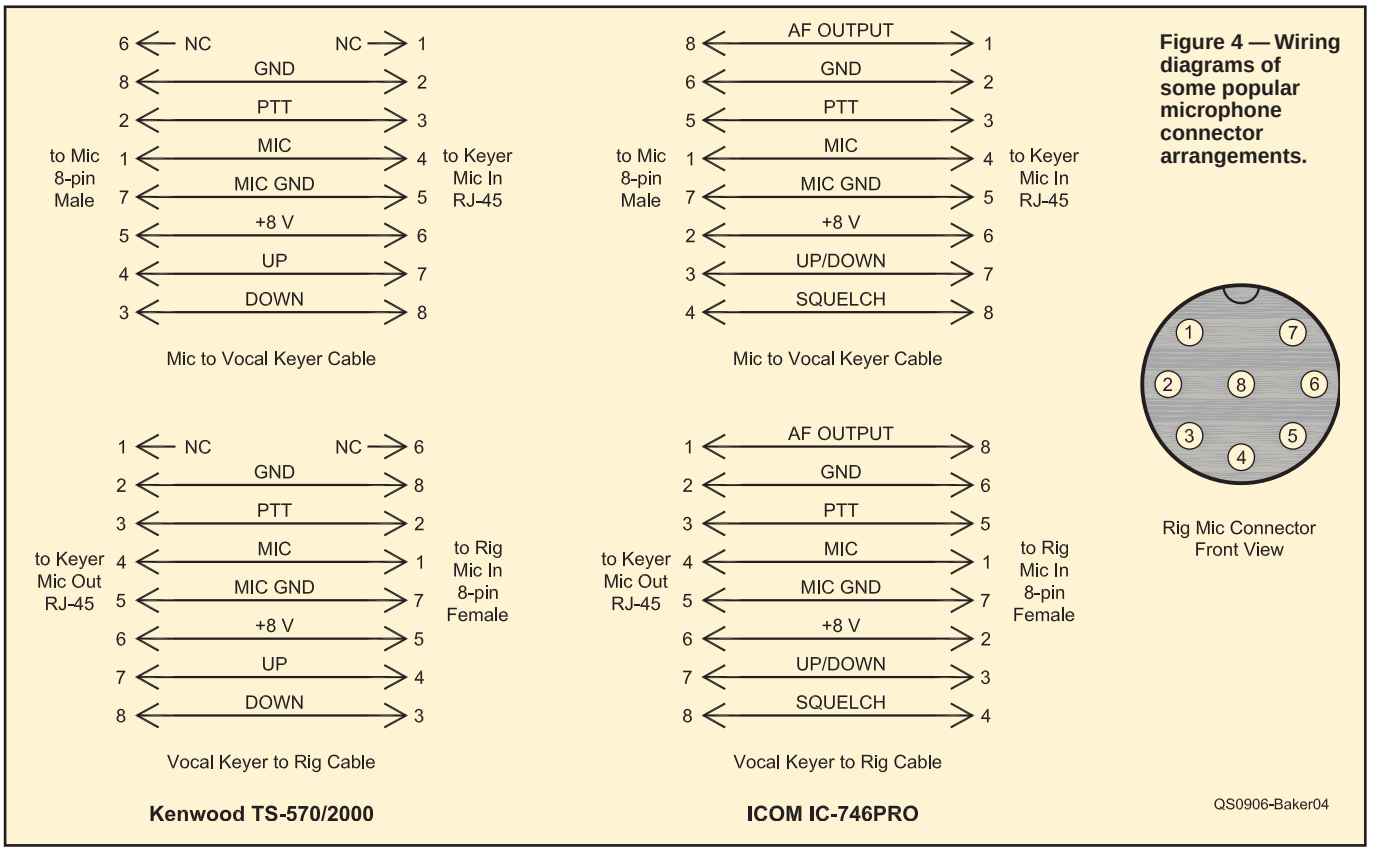

Figure 4 — Wiring diagrams of some popular microphone connector arrangements.

Table 2

Popular Mic Pinout Connections

Pin	*Yaesu FT-817/857/897 (8-Pin RJ-45)*	*Kenwood TS-570/2000 (8-Pin Round)*	*ICOM IC-746PRO (8-Pin Round)*
1	Fast	Mic Input	Mic Input
2	Ground	PTT	+8 V
3	PTT	Down	Up/Down
4	Mic Input	Up	Squelch
5	Mic Ground	+8 V	PTT
6	+5 V	NC	Ground
7	Up	Mic Ground	Mic Ground
8	Down	Ground	AF Output

time for each press of its push button. If a message is playing and its respective push button is pressed the message will stop. If a message is playing and a different message push button is pressed the unit will beep, stop playback of the first message and then play the new message after a short delay.

Operation

With the radio connected to a dummy load, place the XMT switch in the ON position. Press MSG1 or MSG2 to play the message and adjust the XMT LVL control to match the modulation level observed on a live microphone signal. Trimpot R16 may need to be adjusted if the final XMT LVL setting is near the beginning or end of its range. With the radio connected to an antenna, check the quality of the transmitted audio during a contact and make any refinements as needed. Make a note of the final control settings for future use. For contests I set up message 1 as a CQ message and reserve message 2 for common reports such as grid square, location, equipment or other appropriate information.

If a response to your CQ is heard between intervals press the microphone PTT switch (suspending the message one auto repeat) and begin transmitting. At the conclusion of the contact, press the MSG1 push button to resume the message loop.

Conclusion

The keyer has proven to be a huge success in contest work. This stand-alone unit gives the user complete control over all parameters with LEDs providing visual feedback. The unit can be built for two or four messages and adapter cables can interface to different radios. On the air reports have been very favorable with listeners unable to tell any difference between the quality of the recorded and the live voice. For your next contest, take some of the work out of repeated CQs and rest your vocal chords while the Vocal Keyer does the talking.

Notes

[1]HK828, Voice Record/Playback IC, Jaycar Electronics, Part #ZZ8200 (order two chips to meet the $25 minimum order), **www.jaycar.com/products_uploaded/ZZ-8200.pdf**.

[2]**www.arrl.org/files/qst-binaries/**.

[3]"Simple Set-Reset Latches," Wikipedia, **en.wikipedia.org/wiki/Latch_%28electronics%29**.

ARRL member and General class licensee Allen Baker, KG4JJH, received his license in 2000, after a lifelong dream of becoming a ham. He holds a BS in Industrial Engineering from Tennessee Tech and works as an Instrumentation & Controls Engineer for the company that operates the US Department of Energy weapons plant in Oak Ridge, Tennessee. Allen is active on SSB and the digital modes, enjoys the challenge of working QRP and loves to experiment with antennas and radio gear. He can be reached at 211 Brochardt Blvd, Knoxville, TN 37934 or at **kg4jjh@arrl.net**.

Build a Homebrew Radio Telescope

Explore the basics of radio astronomy with this easy to construct telescope.

Mark Spencer, WA8SME

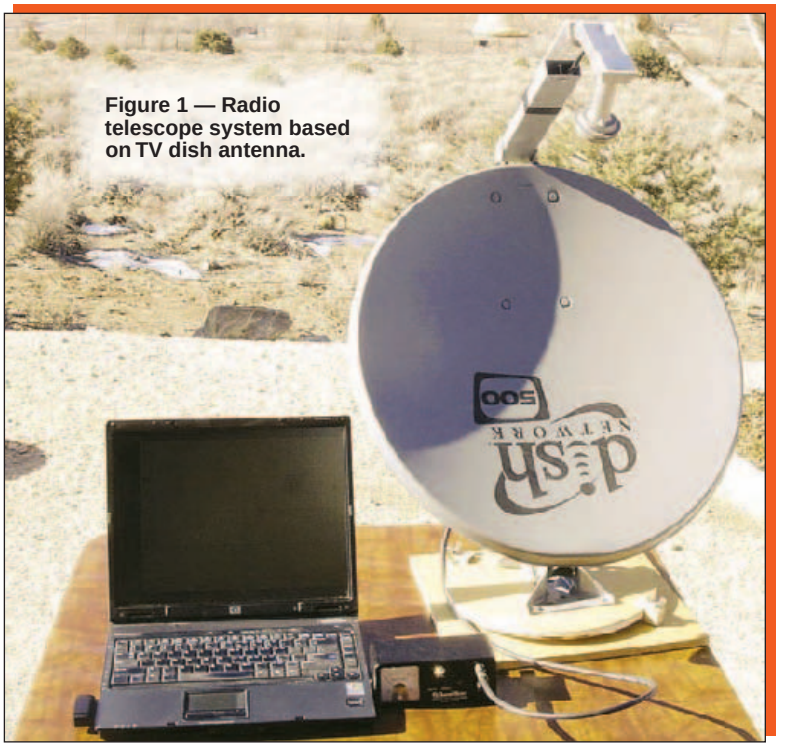

Figure 1 — Radio telescope system based on TV dish antenna.

There are many ham radio related activities that provide a rich opportunity to explore and learn more about the science of radio. One of those opportunities is radio astronomy.

All matter emits radio frequency (RF) energy dependent on the temperature and makeup of the matter, including the matter in space. The foundation of radio astronomy is to study the heavens by collecting and analyzing the RF energy that is emitted by bodies in space, very much as optical astronomers use light energy collected by telescopes. It sounds complicated. While professionals use very sophisticated and expensive equipment, you can, with some simple equipment and a little investment, build a radio telescope that will allow you to learn and explore the fundamentals of radio astronomy.

A Homemade Radio Telescope

In this article, I will build on an existing design of a radio telescope made from one of those ubiquitous TV dish antennas that you see around your neighborhood. The radio telescope (RT) project described here can easily be reproduced. Although this is not a fully capable RT, it can provide a wonderful learning opportunity for you, or perhaps students in your local school.

Figure 1 shows the radio telescope set up. The major components include a modified TV dish antenna mounted on a wooden support structure to allow pointing the antenna, a commercial satellite signal strength detector that displays the signal strength of signals collected by the dish on a meter and an interface that converts the signal strength into a amplitude modulated tone. The tone is fed into a computer sound card and finally a computer and software graphically displays the signal strength as a function of time.

The TV dish modifications are structural, and any available TV dish system can be used. The signal strength detector costs between $40 and $65 and is widely available from Web retailers. The interface circuit, which will be described shortly, is easily duplicated and costs approximately $20. Finally, the display software is free.

Figure 2 — Dual LNB mount. Note two coax connectors.

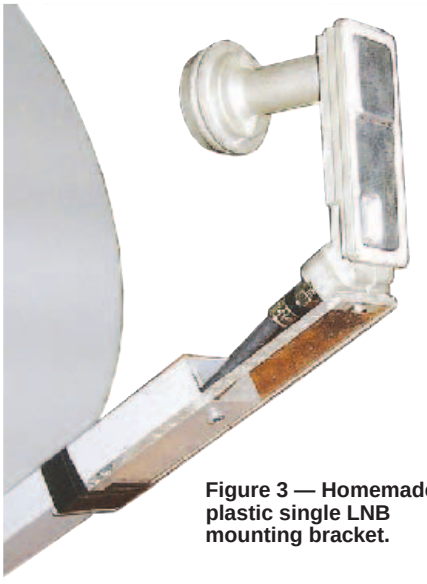

Figure 3 — Homemade plastic single LNB mounting bracket.

What it Can Do

The following is just a sample of what you can do with this simple RT:

- Use the sun to study and determine the beamwidth of the dish and verify the mathematic formula that is used to predict dish antenna performance.
- Measure the radiation intensity of the Sun and perhaps detect changes in solar activity.
- Measure the relative changes in the surface temperature of the moon.
- Learn about and explore a common radio astronomy collection technique called the *drift scan*.

Figure 4 — Dual coax connector configured LNB. Terminate one connector with a dummy load.

Figure 5 — CM satellite signal strength meter.

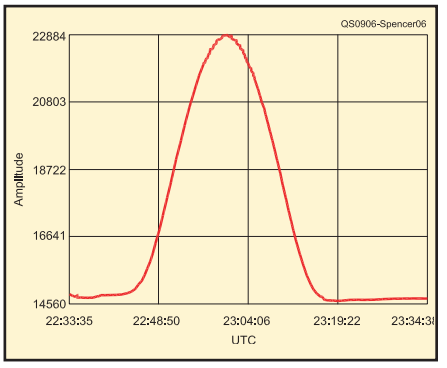

Figure 6 — *SkyPipe* screen showing antenna response.

- Explore the fundamental principle of energy emission as a function of temperature by detecting the relative differences between the temperatures of emitting bodies.
- Detect satellites parked along the Clarke Belt in geosynchronous orbit and illustrate how crowded space has become.
- Detect the Earth's rotation around the Sun and the Earth's spin on its axis by comparing daily drift scans of the horizon.

Antenna Subsystem

The basic RT system is based on the "Itty-Bitty" design that is described in two Web pages.[1,2] The TV dish is an offset 18 inch dish that has down converter(s) mounted at the focal point of the dish. The down converter is called a low noise block (LNB). The LNB is a preamplifier/down converter that converts the satellite signals from around 12 GHz down to around 2.4 GHz. Most modern dishes have two or more LNBs to access more than one TV satellite at a time without changing the pointing of the dish (Figure 2). The LNBs are mounted to share the focal point of the dish. Since only one LNB is required for the RT, I made a minor adjustment to the published Itty-Bitty design to position the single LNB at the dish focal point. Mounting the single LNB at the focal point really helps in pointing the antenna.

I used the existing LNB housing and mounting bracket as a template to determine the distance between the edge of the mounting arm to the mounting hole of the LNB. I then used a piece of plastic to fabricate a new mounting bracket for the LNB as shown

[1]Notes appear on page 45.

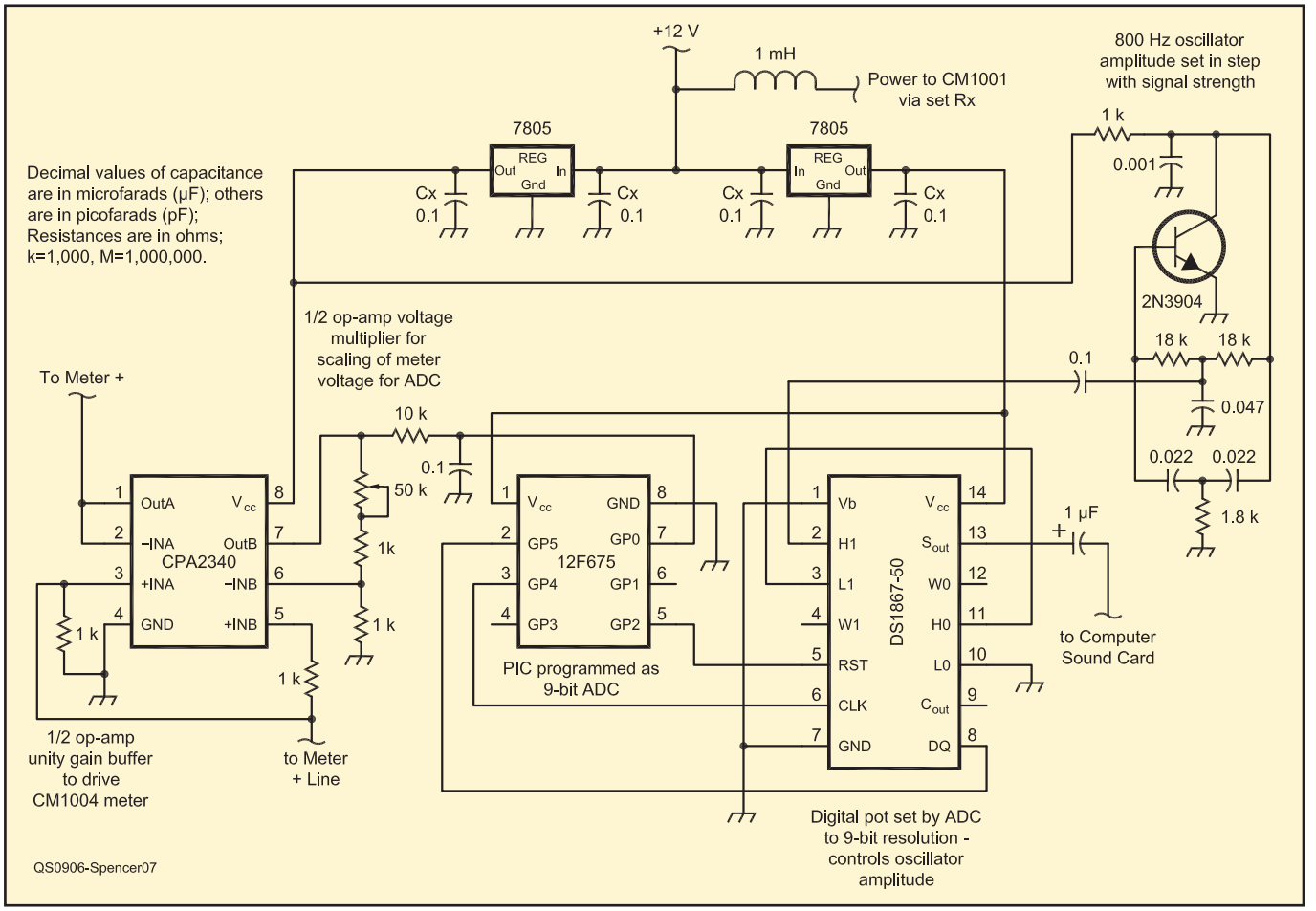

Figure 7 — RT Interface circuit diagram.

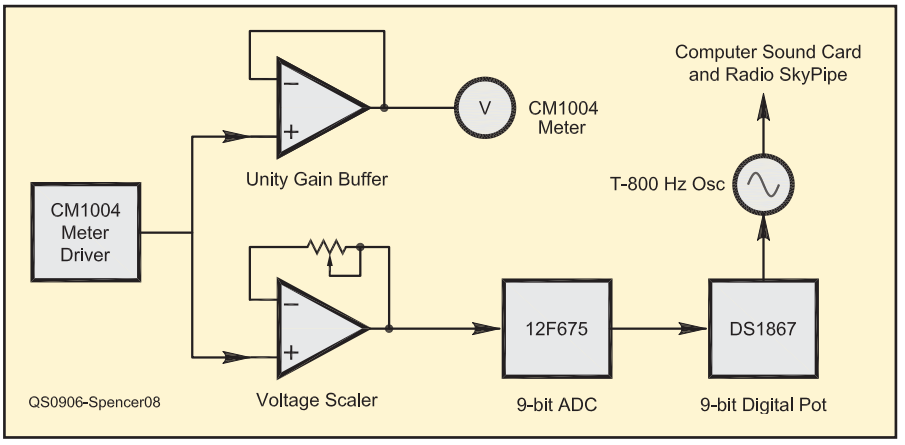

Figure 8 — RT Interface block diagram.

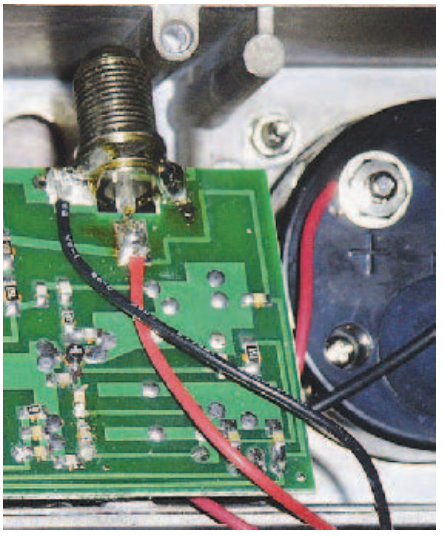

Figure 9 — Power and ground connection to CM board.

in Figure 3. The dimensions are not super critical, but careful placement certainly will improve the RT performance.

Some LNBs have two coax connectors. Only one will be used in the RT (Figure 4). It is a good idea to terminate the extra coax connector with a 75 Ω dummy load plug to balance the load on the LNB. The dummy loads for F type TV coax connectors are readily available from electronic parts retailers.

Note that the dish is mounted upside down. Though this orientation is not ideal for receiving satellite signals, this arrangement helps with pointing the dish in its radio telescope role.

Satellite Detector

The detector used in this project is the Channel Master (CM) satellite signal level meter model 1004IFD (Figure 5).[3] The CM is connected to the LNB. Power is supplied to the LNB through the coax connection from the CM. The CM detects the signal coming from the LNB and gives a meter indication of the signal strength and also varies the frequency of an audio tone to help technicians point the dish at the desired satellite. As you move the dish through the beam coming from the satellite, the meter indication will increase and then decrease coincident with the pitch of the audio tone.

The Itty-Bitty plans detail how to connect power to the CM and in turn connect power to the LNB (this power connection is handled by the interface in this project). Though somewhat effective, the CM meter and variable frequency tone indications provide limited utility in detecting changes in signal strengths required for radio astronomy.

Display

To really study the signals received by the RT, you will need to see them displayed graphically on a strip chart. There is an excellent software package called *RadioSkyPipe* that is posted on radio astronomy Web sites.[4] The free version of this software is a good place to start. *SkyPipe* uses the computer sound card to measure the incoming signal strength and graphically displays the signal strength as a function of time. Figure 6 is illustrative of a signals detected by the RT. *SkyPipe* is very easy to use but some study of the HELP files will make it easier for you to fully tap into the capabilities of this software.

SkyPipe requires audio signals to be fed into the sound card MICROPHONE jack. The output of the CM detector is either an analog meter reading or a frequency modulated (constant amplitude) tone that is not really compatible with *SkyPipe*. An interface is required.

Interface

What is required to make the CM output work with *SkyPipe* and a sound card is to convert the signal level into an amplitude varying audio tone. The interface designed to do this is shown in Figure 7 and as a block diagram in Figure 8. Refer to the block diagram during the description of the interface function.

The unity-gain op-amp is used as a buffer between the CM meter driver circuit and the analog meter. The other op-amp is used as a voltage multiplier to scale the CM meter driver output voltage to match the 5 V reference voltage of the following analog to digital converter (ADC). The variable resistor in this voltage multiplier circuit is used to calibrate the CM to *SkyPipe*. The voltage from the multiplier is fed to a programmable interface controller (PIC) that is programmed as a 9-bit ADC to covert the analog voltage that is a function of received signal strength to a 9-bit digital word that is used to control a digitally controlled variable resistor. The interface includes a simple Twin-T audio oscillator circuit that provides a tone of approximately 800 Hz that is fed to the computer sound card. The amplitude of this audio oscillator is varied by the digital pot that is being controlled by the PIC. The result is the audio amplitude being varied in step with the signal strength detected by the CM.

The circuit provides power to the CM and the LNB. A 12 V source in the CM is tapped through an RF choke and this is connected to the LNB coax connector inside the CM (Figure 9). The 12 V is also regulated to 5 V to provide power to the interface. Though probably not required, there are two 5 V sources, one for the digital components of the interface, and the other for the analog components with one common ground point. This arrangement is used to isolate potential digital and analog noise sources within the circuit.

The interface is built on a circuit board and mounted right inside the CM box

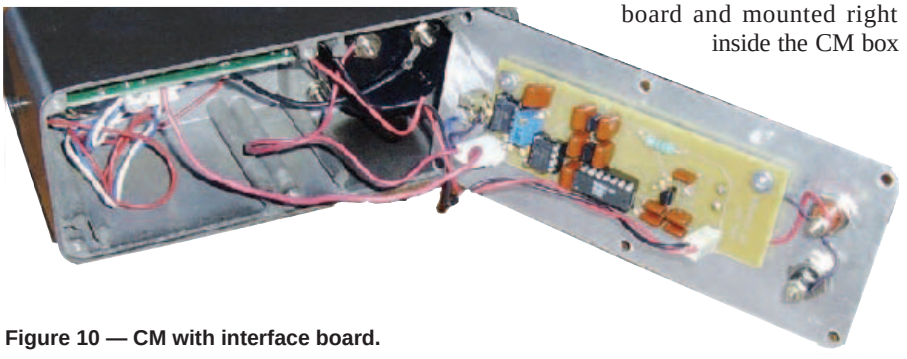

Figure 10 — CM with interface board.

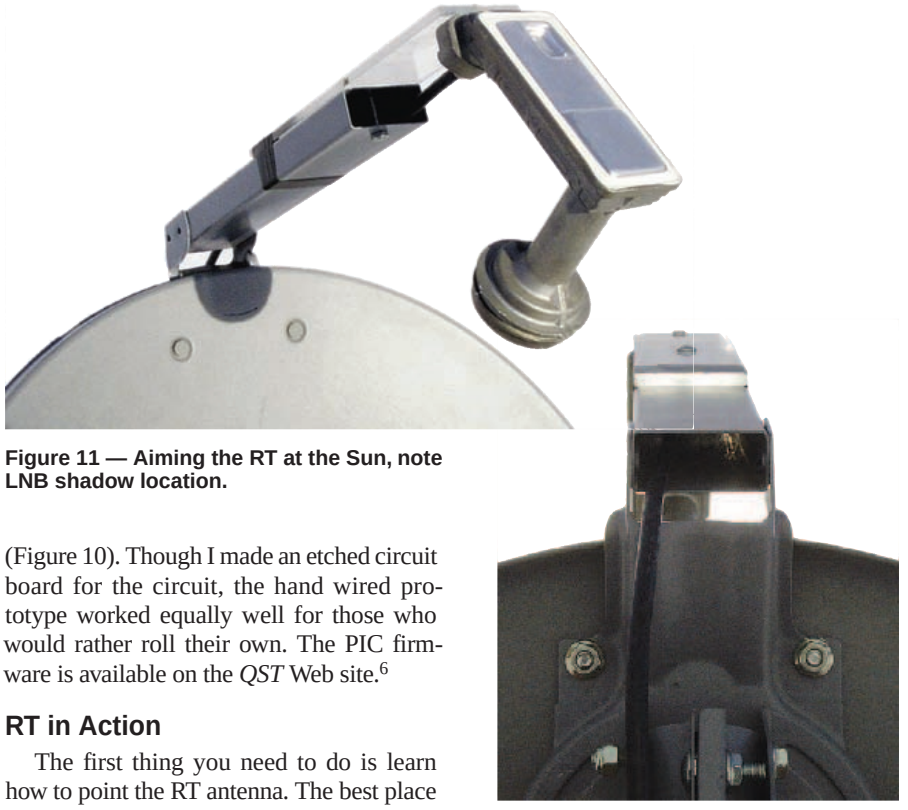

Figure 11 — Aiming the RT at the Sun, note LNB shadow location.

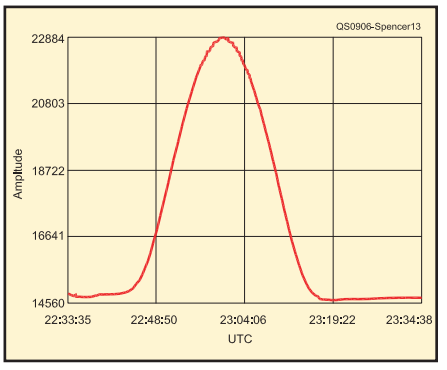

Figure 13 — Drift scan of the Sun indicating antenna's azimuth pattern.

(Figure 10). Though I made an etched circuit board for the circuit, the hand wired prototype worked equally well for those who would rather roll their own. The PIC firmware is available on the *QST* Web site.[6]

RT in Action

The first thing you need to do is learn how to point the RT antenna. The best place to start is to connect the CM to the antenna and point the antenna at the Sun. *Caution*: Do not look into the Sun as you do this, or at any time. Adjust the pointing angle and elevation until you get peak signal strength as indicated on the CM meter or hear the highest pitch audio tone. With the antenna pointed directly at the Sun, take note of the position of the shadow of the LNB on the surface of the dish (left in Figure 11). If you look from behind the dish, along the LNB

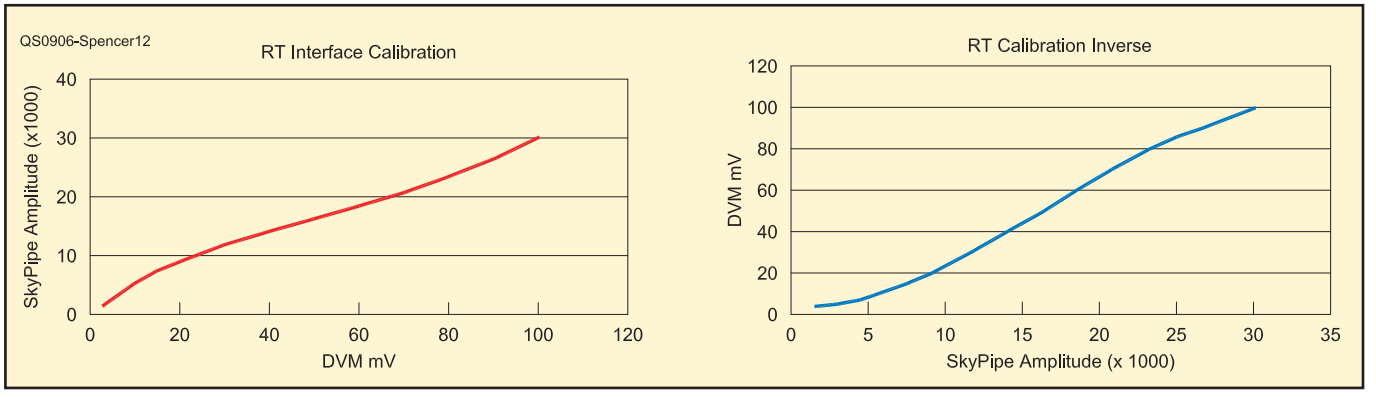

Figure 12 — Example calibration curves.

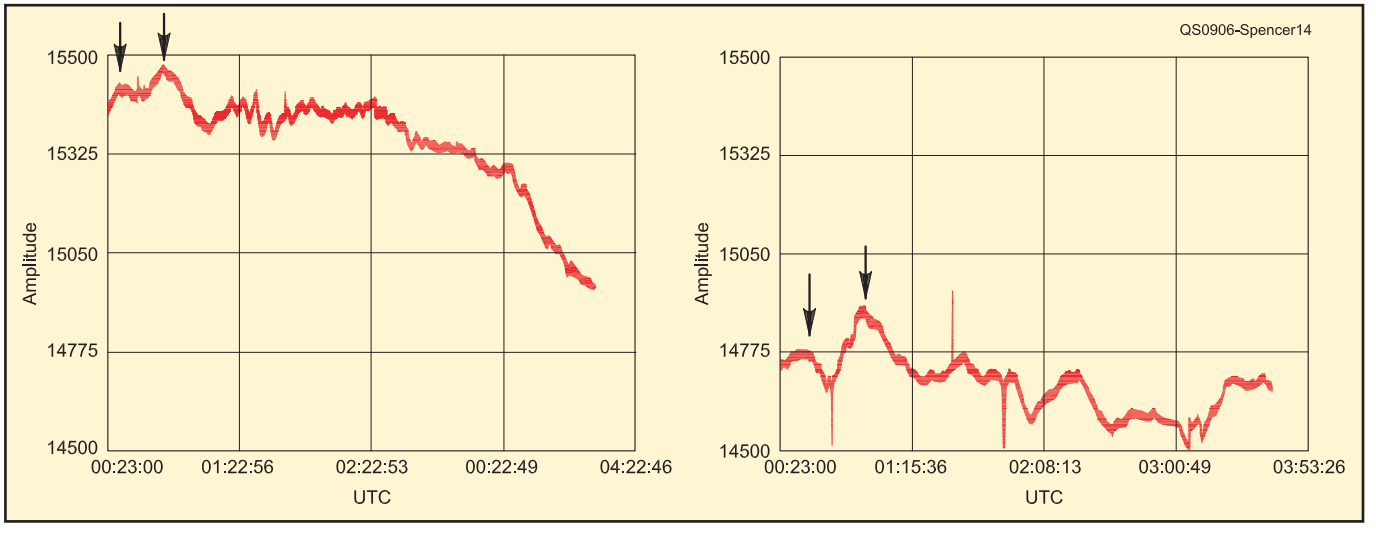

Figure 14 — Sequential drift scans. Note the time offsets between the peaks.

supporting arm (between the arm and the rim of the dish), you will see the Sun being blocked by the LNB.

Once you have the RT set up, it needs to be calibrated to match the output of the CM to *SkyPipe*. I have developed an *Excel* spreadsheet template to help with the calibration and a few of the other activities that you can accomplish with the RT (also available from the *QST* Web site). Turn the RT to a signal source, the Sun, or the side of a building would work. Turn the gain control of the CM to set the meter to maximum. Run *SkyPipe* and adjust the variable resistor on the interface board until you get a reading on the *SkyPipe* graph vertical (y) axis of approximately 32,000. With the maximum value set, adjust the CM gain control through the voltage range (0 to 100 mV) in 10 mV steps and record the corresponding y axis value on *SkyPipe*. This data is entered into the *Excel* spreadsheet to compute the calibration curve between voltage and y axis value. Both voltage and y axis values are used in analyzing recorded signal strength data (Figure 12).

A good first activity is to do a drift scan of the Sun. A drift scan means that you set the antenna azimuth (AZ) and elevation (EL) to some fixed pointing angle and allow the Earth to serve as the rotator to drag the antenna across the sky. To do a drift scan of the Sun, first set the elevation and azimuth to point directly at the Sun (maximum signal) and then move the azimuth toward the west

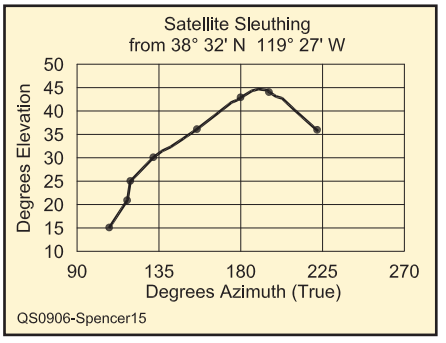

Figure 15 — Clarke Belt plot — tracking down satellites.

(leave the elevation set) until you are off the peak signal. Now start *SkyPipe*. In about 15 minutes, the Sun will pass through the antenna pattern beam width and the result will be as illustrated in Figure 13. You can also use this collection technique to explore the antenna performance parameters.

A good second activity is to do two drift scans of the night sky on two consecutive nights (beginning the scans at the same time each night) using the same fixed antenna azimuth (AZ) and elevation (EL). Figure 14 shows two such drift scans. Although at first glance they may not seem similar, there are some interesting features that are pointed to by arrows. If you compare the time that these two peaks occurred, the time difference is about 4.5 minutes. This shift is the result of the distance the Earth had traveled during the 24 hours between collections. This illustrates that the Earth's rotation as well as its travel in orbit needs to be considered when comparing drift scans. Enough to make your head spin (pun intended)?

A final good starting activity is to point the antenna toward the Clarke Belt and find all the satellites in geosynchronous orbit transmitting on 12 GHz. If you record signal strength peaks and AZ and EL for each peak, you will develop a graph of the Clarke belt as illustrated in Figure 15.

I have only scratched the surface, and the sky is the limit of this little project. The RT project can certainly broaden your horizons and expand your understanding of our universe. If you would like more detail than can be presented here, please contact the author.

Notes

[1]**www.setileague.org/articles/lbt.pdf**.
[2]**www.aoc.nrao.edu/epo/teachers/ittybitty/procedure.html**.
[3]**www.pctinternational.com/channelmaster/0612/satellite.html**.
[4]**radiosky.com/skypipeishere.html**.
[5]**en.wikipedia.org/wiki/Geostationary**.
[6]**www.arrl.org/files/qst-binaries/**.

Mark Spencer, WA8SME, is ARRL Education and Technology Program Coordinator. He is an ARRL member and holds an Amateur Extra class license. You can reach Mark at 774 Eastside Rd, Coleville, CA 96107 or at **wa8sme@arrl.org**.

In The May/June 2009 Issue:

■ Bob Melvin, W6VSV describes his "Backyard Antenna Test Range" and how he measures gain and radiation patterns for UHF and microwave antennas.

■ Thomas Alldread, VA7TA, completes the description of his "NimbleSig III" dual output DDS RF generator. This circuit provides signals over a range from 100 kHz to 200 MHz, with 1 Hz resolution. In the concluding part of the series, Tom describes the control-software command set in detail and provides the final calibration procedures.

■ Gary Steinbaugh, AF8L, continues his description of "A Cybernetic Sinusoidal Synthesizer." In this installment, Gary tells us about the design and operation of the oven-stabilized, crystal-controlled oscillator portion of the circuit. By mounting the crystal, a resistive heating element and a temperature sensing IC in a separate foam insulated enclosure, Gary is able to maintain the crystal at a constant 75°C, right at the most temperature stable point of the specified crystal.

■ Professor Dr Thomas Baier, DG8SAQ, presents "A Simple S-Parameter Test Set for the VNWA2 Vector Network Analyzer." This circuit is a handy addition to the "Small, Simple, USB-Powered Vector Network Analyzer Covering 1 kHz to 1.3 GHz" that he presented in the Jan/Feb 2009 issue. Now you can measure the S parameters of a circuit without changing the input and output ports of the device.

■ Bob Hillard, WA6UFQ, presents his "Universal VFO Controller." If you have built or are considering building the AM QRP Club's DDS-30 or DDS-60 synthesizers or using the newer Silicon Labs Si570 DDS ICs, this project will control the VFO for you.

■ Rudy Severns, N6LF, presents more of his research in "Experimental Determination of Ground System Performance for HF Verticals." Part 4 compares the performance of five different vertical antennas. Each antenna was tested with a single four foot ground stake, and then adding radials in the progression 0, 4, 8, 16, 32 and 64. Don't miss any part of this series if you use, or have thought about using, vertical antennas on HF!

■ Ray Mack, W5IFS, continues his software defined radio column. In this installment of "SDR: Simplified," Ray takes us through the software installation and set-up to begin our experiments with the Blackfin BF537 Stamp evaluation board.

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A Lightweight Homemade Keyer Paddle

Enjoy CW with this easy to duplicate, low cost paddle.

Alan Bloom, N1AL

A perennial problem with Morse code paddles, both old-fashioned mechanical "bugs" as well as newer electronic keyer paddles, is that they tend to walk around the table as you swipe the paddle back and forth. Big ham-fisted guys like me seem to have particular problems. The traditional solution is to make the base as heavy as possible and use gummy rubber feet to grip the tabletop.

A Better Mousetrap

A much more elegant solution is to use the operator's own keying hand to hold the paddle in place as shown in Figure 1. With this design I find there is no tendency for the paddle to "walk." Another advantage is that, unlike with some of the other methods, you're not tied to one particular position on the operating desk — the paddle can instantly be moved wherever desired. I have spent 40 years trying the various traditional solutions for a "walking" paddle with limited success. I don't know why I didn't think of this sooner.

Once you eliminate the need for a heavy base, the device can be made wonderfully light weight. This model weighs less than 5 ounces, which makes it perfect as a companion to a small low power (QRP) rig on backpacking trips. I use it with my Wilderness Radio Sierra QRP transceiver on self supported long distance bicycle tours. I look for a camp site with trees so I can throw up a simple wire antenna and make a few contacts before hitting the sleeping bag for the night.

You don't have to copy this exact design to take advantage of the basic idea of a hand rest platform that is attached to the paddle. Several articles have been published over the years on how to homebrew your own mechanism, both all electronic touch key types,[1-3] or more traditional mechanical designs.[4-7] You can also get ideas from some of the over 60 photos of homebrew keys and paddles that Gerd Lienemann, DF9IV, has posted on the Internet at **www.morselabor.de/42396.html**.

Why Not Build Your Own?

The simplest solution of all is simply to bolt a commercial paddle to a sheet of metal or fiberboard. Commercial units tend to be quite expensive, however, so you can benefit both your pocketbook as well as your sense of personal satisfaction by building your own. Detailed fabrication drawings and a parts list are available on the *QST* binaries Web site.[8]

N1AL

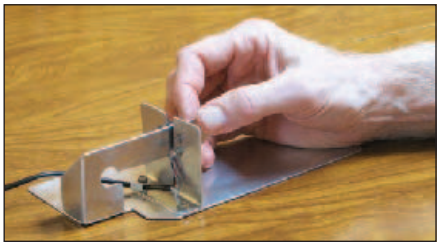


Figure 1 — This lightweight keyer paddle is held in place by the weight of the operator's own hand. It is fabricated from two pieces of sheet metal and some snap action switches.

N1AL

Figure 2 — The paddle can also be used as a straight key by rotating it 90°.

Using snap action switches for the contact points greatly simplifies the construction. While this method does not give as smooth a feel as a $150 commercial keyer paddle, I find it perfectly usable. The switches are hermetically sealed, so the contacts never get dirty. In addition, the entire assembly is much more rugged than most conventional paddles. One issue is that the switches do make a slight clicking sound with each key closure, which might be annoying to someone else in the same room.

Note that this is a single lever paddle. It is not possible to close the dot and the dash contacts at the same time. That means that while you can still use it with an iambic keyer, you won't be able to use the iambic feature. I actually prefer it that way. Since I originally learned on a single lever paddle, if I try to send using iambic mode I sometimes feel like the keyer is controlling me rather than the other way around!

This paddle is also designed to be used as a straight key. The edge of the plate that holds the switches aligns with the edge of the base so that you can rotate the whole device 90° and treat the paddle arm as a straight key (see Figure 2). Just insert the plug into the key jack instead of the paddle jack on the transceiver. Note that the dash contact must be wired to the tip connection of the stereo phone plug for that to work.

Nothing about the construction is critical. You won't need a machine shop to build one of these. While a bending brake makes nice neat bends, you can make a perfectly functional unit by folding the sheet metal over a table edge with a block of wood. Make the mounting holes for the switches a little oversized so you can adjust the position such that the switch actuator buttons just touch the paddle arm. The cost is minimal. If you can scrounge the sheet metal, then the rest of the parts should cost no more than about $7. Give it a try — you may be surprised how cheap and easy it is to build a fully functional, rugged and lightweight keyer paddle.

Notes

[1]A. Baker, KG4JJH, "Touch Paddle Keyer," *QST*, Mar 2007, pp 28-31.
[2]M. Cram, W8NUE, "Rugged Touch Sensor Keyer Paddle," *QST*, Jul 2004, pp 28-31.
[3]R. Lewallen, W7EL, "An Ash-Proof Keyer Paddle — Something New for CW Operators!" *QST*, Aug 1981, pp 30-31.
[4]A. Harvey, W8OJN, "A Homemade Keyer Paddle" (Hints and Kinks), *QST*, May 1984, pp 43-44.
[5]J. Baker, VE3CJB, "VE3CJB Keyer Paddle" (Hints and Kinks), *QST*, Mar 1976, pp 40-41.
[6]K. Klopf, KL7EVD, "Electronic Keyer Paddle" (Ham Notebook), *Ham Radio*, Sep 1972, pp 68-69.
[7]F. Chase, W3NK, "A Homebrew Keyer Paddle," *Ham Radio*, May 1969, pp 43-47.
[8]**www.arrl.org/files/qst-binaries/**.

Alan Bloom, N1AL, was first licensed while in high school, in 1968. He received a Bachelor's degree in physics, then a Master's degree in electrical engineering, the latter while working as a W1AW operator. He designed amateur and commercial equipment for the R. L. Drake Company and has spent the last 26 years at Hewlett-Packard, designing RF and microwave test equipment. He is a life member of the ARRL and an ARRL Technical Advisor. You can contact the author at **n1al@arrl.net**.

Low Cost QSK Conversion for the Ameritron ALS-600 HF Amplifier

Listen between transmitted code elements with this full break-in adapter.

Phil Salas, AD5X

I've been using an external full break-in (QSK) switching unit with my Ameritron ALS-600 linear amplifier for a while now and it sure has been nice for CW contesting and DXing.[1] But while that unit has served me well, I've never cared for the clutter of the additional external box and cabling necessary — especially since this amplifier is so small. I decided it was time to build the QSK switching capability directly into my ALS-600.

In the external QSK unit, I'd found the very fast and inexpensive Panasonic DS2E-M-DC12V miniature signal relay to use for transceiver switching, while the amplifier output switching was handled with a vacuum relay. As I began planning how to mount the necessary components inside the ALS-600, I wished that I could just use all miniature signal relays and do away with need for the vacuum relay.

Unfortunately, the Panasonic signal relay can only handle 3 A per contact. At 600 W output into 50 Ω, the amplifier output relay needs to carry at least 3.5 A. A quick calculation indicated that the worst case current for a 2:1 SWR (the point at which the ALS-600 protects itself) could be close to 5 A. But then I had a brilliant idea. Since these are DPDT relays, why not parallel two sets of contacts for the amplifier output relay? This gives 6 A of current carrying capacity, which is more than sufficient for the ALS-600. These relays can also handle 1000 V RMS between open contacts and between the contacts and coil, which is also more than sufficient for the worst case 2:1 SWR condition.

The Internal QSK Solution

With miniature signal relays, the ALS-600 QSK design and implementation becomes very simple. The existing open-frame TR relay is simply replaced with a perf board assembly consisting of a pair of signal relays wired as shown in the schematic of Figure 1. One relay controls the transceiver output and amplifier bias switching, and the second relay (with paralleled contacts) controls the amplifier output switching. With operate-and-release times of approximately 3 ms, these signal relays are as fast or faster than most vacuum relays — perfect for QSK operation!

In order to provide time for an amplifier to switch to transmit mode, transceivers provide a delay from the time the external amplifier keying contacts close to the time RF output is obtained. As an example, I measured the amp enable to RF output time delay of an ICOM IC-7000 at 8 to 10 ms, and 12 to 15 ms for an IC-706MKIIG transceiver. My Yaesu FT-1000 MKV has a default delay of 5 ms (adjustable from 0 to 30 ms).

So the 3 ms relay switching time ensures that the relay has fully operated prior to RF becoming available for these radios. But just to make sure there is no possibility of *hot switching* the amplifier, I added a diode in series with the transceiver/bias relay's control voltage input, which gives a very

[1]P. Salas, AD5X, "External Amplifier Break-in Keying," *QST*, Feb 2008, pp 76-78.

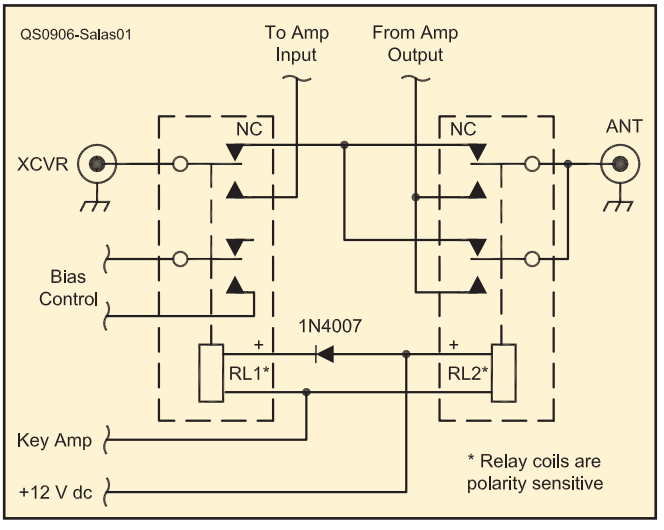


Figure 1 — Schematic showing relay interconnections. RL1, 2 are DS2E-M-DC12V signal relays available from Allied Electronics (www.alliedelec.com, part number 788-1053). The two 16-pin IC sockets are also available from Allied, part number 900-0008.

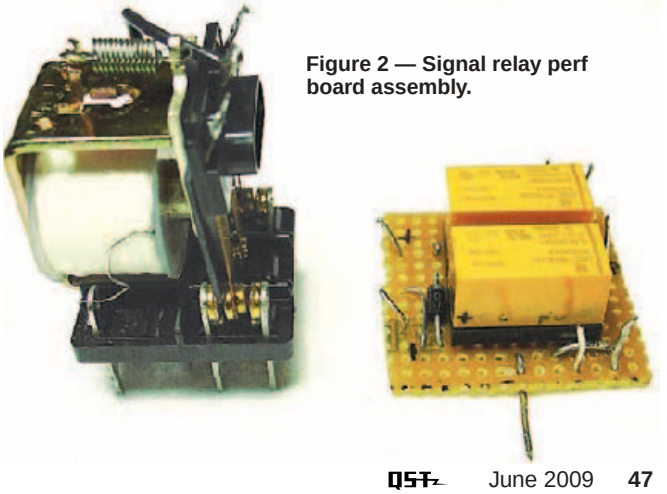


Figure 2 — Signal relay perf board assembly.

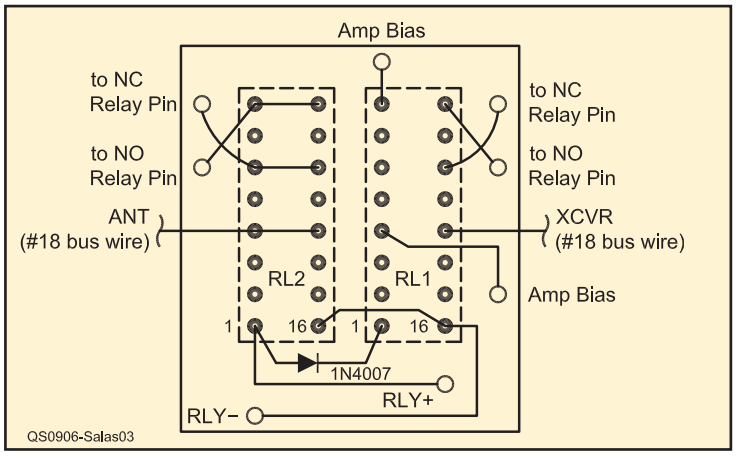


Figure 3 — Relay perf board assembly, backside wiring.

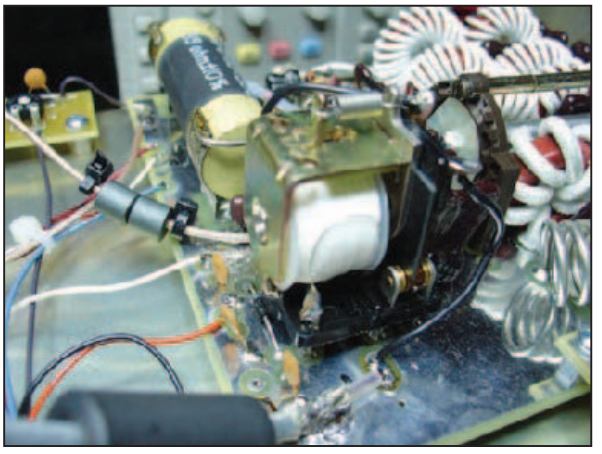


Figure 4 — Original open-frame relay.

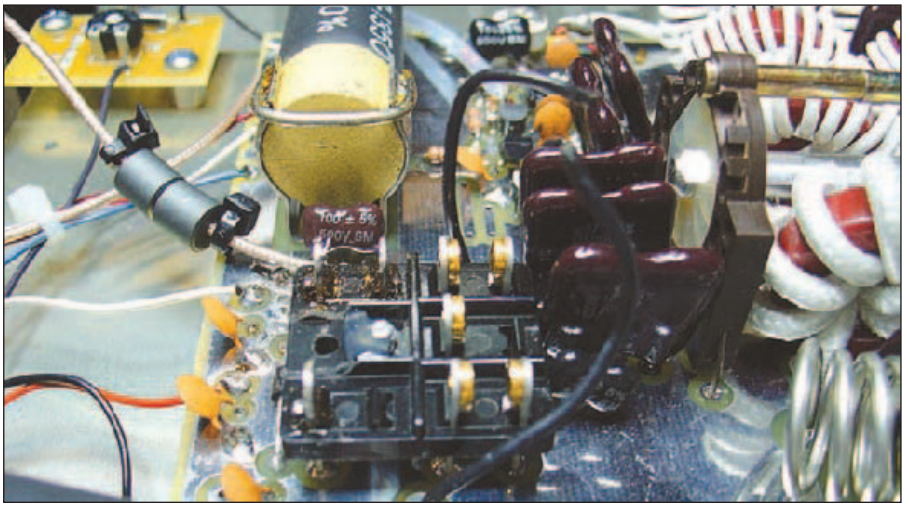


Figure 5 — Relay base after relay removal.

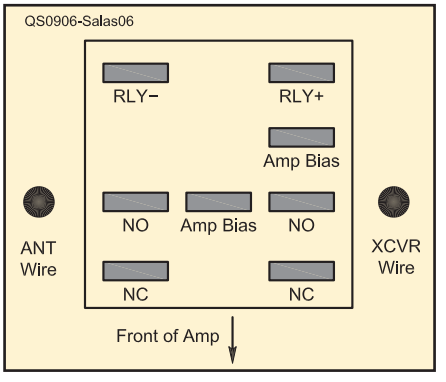


Figure 6 — Top view of relay base.

slight enable delay and slight early drop out of this relay. This ensures that the amplifier is always connected to the antenna prior to RF being applied and removed, though this shouldn't be an issue due to the fast relay switching speed.

Construction

I mounted the two relays in 16-pin IC sockets on a 1.4 × 1.4 inch piece of perf board as shown in Figure 2. Figure 3 shows the perf board wiring. I used 20 gauge bus wire for all wiring. Note that the NO/NC relay contacts require a crossover of the wires on the perf board to match the contacts on the original relay socket. Also note that the relay coil is polarity sensitive (relay pin 1 is positive, and pin 16 is negative).

Since the new relay board assembly replaces the existing ALS-600 TR relay, you must remove most of the existing open frame relay leaving just the relay plastic base with its PC-mounted pins. To do this, first unsolder all wires attached to the open frame relay as

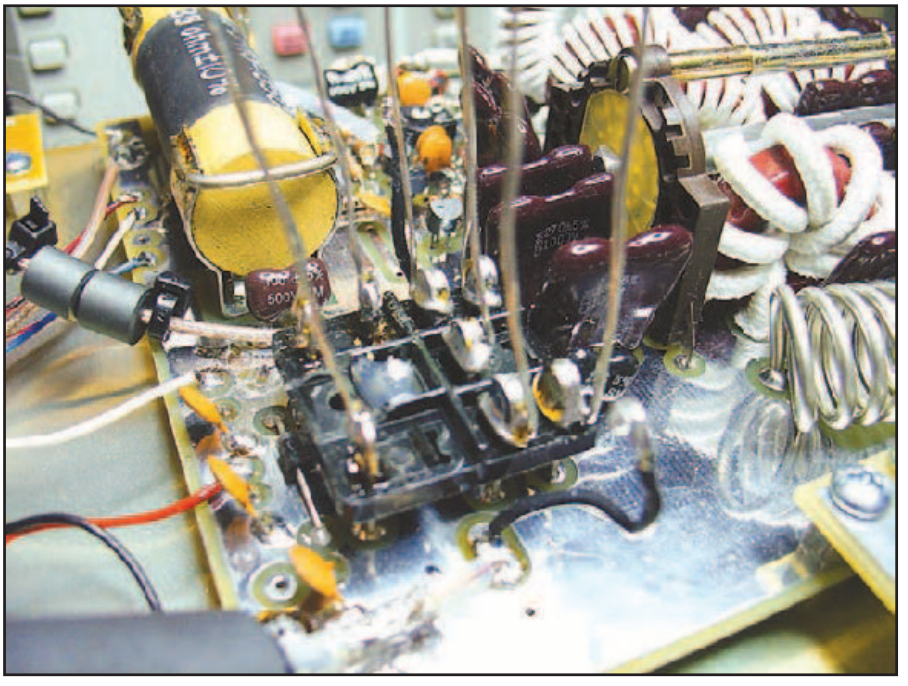


Figure 7 — Relay base with wires attached.

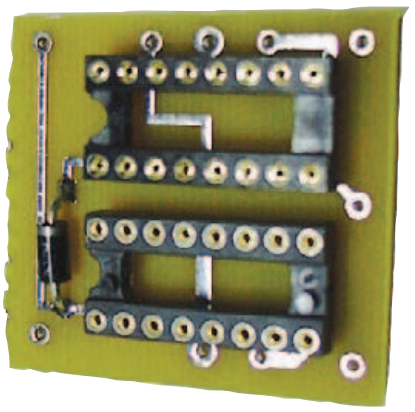


Figure 8 — PC board version without relays.

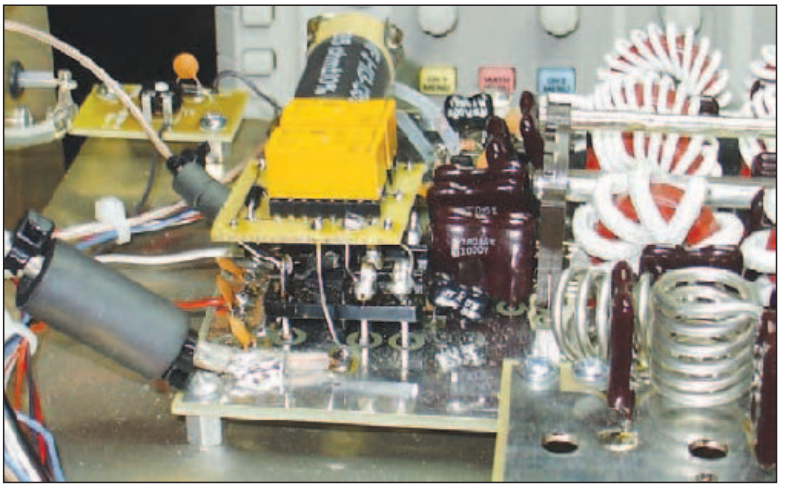


Figure 9 — PC board mounted in ALS-600.

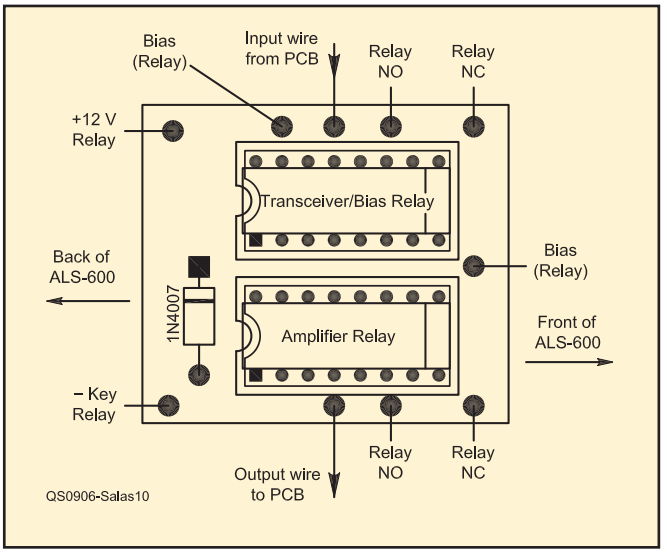


Figure 10 — Top view of PC board showing wiring interfaces.

shown in Figure 4, including the relay coil wires. Next, unhook one end of the small spring and remove the movable relay contact assembly. Now grab the metal frame of the relay with needle nose pliers and bend the frame back and forth until the screw attaching the relay coil bracket to the plastic base strips out of the bracket letting the coil and bracket come off the base (see Figure 5). Put some hot glue or epoxy over this screw so that it doesn't rattle around (the screw is too long to pull out from under the relay base).

Next, solder four 4 inch lengths of 24 gauge bare wire to the dc and bias posts of the relay base, and solder four 4 inch lengths of 20 gauge bare wire to the four RF relay NO/NC posts. Figure 6 shows the location of the relay base connections. Orient the wires vertically. Add a ½ inch length of sleeving over the middle bias wire. Figure 7 shows the relay base with the wires soldered in place. Now you can slide the new relay assembly over the wires, passing the relay wires through holes on the perf board close to the desired connection points.

The right side *bias* wire from the bias relay post needs to be bent over slightly to reach the right-side bias hole position on the perf board. Minimize clearance between the bottom of the perf board and the relay pins, but ensure the wires stay relatively straight and are not shorted to each other or to any wiring on the perf board. Solder these relay wires to the proper connections on the perf board wiring. Now resolder the input/output black wires from the main ALS-600 PC board to the bus-wire inputs and outputs on the perf board.

Clip excess wire lengths and insert the relays, orienting the relay bands as shown. Then carefully recheck all wiring using an ohm meter. Finally, connect up the amplifier and verify that it is working correctly. As with any relay based QSK switch, you will hear the relays operating; however, I found that the relay noise was noticeably less than the shock-mounted vacuum relay noise in my previous QSK implementation. Incidentally, the new relay assembly drops the ALS-600 keying requirements from 12 V dc at 100 mA to 12 V dc at 70 mA.

To make this QSK modification easier to implement, I laid out a printed circuit board for the new relay assembly. Figures 8 and 9, respectively, show the PC board and the PC board assembly mounted in my ALS-600. The connection points for this PC board are shown in Figure 10. E-mail the author (see below) if you are interested in acquiring a PC board or complete kit of parts.

Timing Measurements

Prior to installing the relay board, I measured the relay timing just to make sure everything worked as required. Using my triggered 'scope, I confirmed that the relay operates within 2 to 3 ms after the keying signal is presented, and releases about 3 to 4 ms after the keying signal is terminated.

Conclusion

This simple and inexpensive modification to the ALS-600 turns this amplifier into a true QSK amplifier. You'll also wind up with a lower current keying requirement, and the ability to easily replace the relays should they ever fail. Spend a couple of hours putting this all together. The results are well worth it!

Amateur Extra class operator and ARRL Life Member Phil Salas, AD5X, was first licensed as WN3BCQ in 1964. Ham radio became the reason he subsequently pursued a career in electrical engineering. Phil earned BSEE and MSEE degrees from Virginia Tech and SMU, respectively, and worked in new product development for the next 33 years. Phil is now retired and spends his days split between ham radio related projects and enjoying time with his wife, Debbie, N5UPT. You can reach Phil at 1517 Creekside Dr, Richardson, TX 75081 or at **ad5x@arrl.net**.

New Books

6 METRE HANDBOOK

Reviewed by Bill Smith, WØWOI
1967-1974 Editor, World Above 50 Mc

◊The *6 Metre Handbook* joins the proliferation of Amateur Radio books, both general and very specialized, on every facet of our wide-ranging hobby. This newly published Radio Society of Great Britain (RSGB) book, authored by Don Field, G3XTT, entitled simply *6 Metre Handbook*, is a specialized volume, as its title suggests.

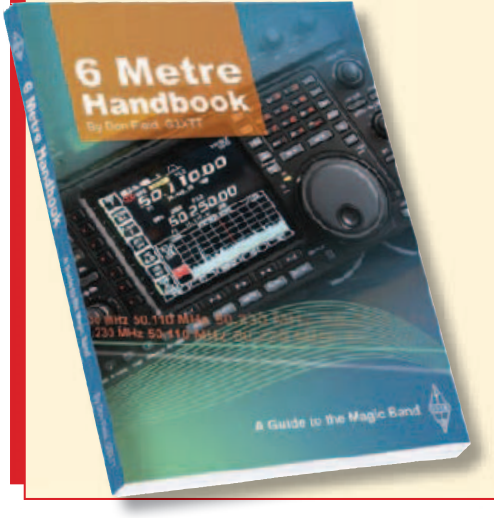
Aside from being possibly mistitled, as it is really a 6 meter manual, Don's work is among the very best I've read on any amateur-related topic, and in particular VHF. The *6 Metre Handbook* is timely, given the increased allocation and use worldwide of the 50 MHz band, thanks largely to inclusion of 6 meters on many currently marketed transceivers. It is more of an operating manual rather than a handbook. It is not a book on how-to-build this and that, but a manual on how to assemble a 6 meter station and operate it effectively, on all modes, using equipment manufactured by worldwide suppliers.

The *6 Metre Handbook* covers all aspects of 6 meter propagation, terrestrial and extraterrestrial, including the new, JE1BMJ designated Summer Solstice Short-path Propagation (SSSP), using conventional SSB, CW and WSJT (weak signal communication by K1JT). There are excellent treatments on the use of digital modes for meteor scatter and EME. Throughout the book, he provides specific details and makes frequent reference to additional information sources, many of which are on the Internet. There are separate hints for operating 6 meters from Europe, specific USA regions, South America, Oceania, Asia and Africa. G3XTT also shares operating ethic wisdom, sadly often overlooked in today's society.

In short, this manual has valuable "how to" information for new and intermediate 6 meter fans worldwide on utilizing the latest equipment, propagation techniques and operating modes.

Nothing else published today is like G3XTT's *6 Metre Handbook*. It reminds me of *The Radio Amateur's VHF Manual*, by Ed Tilton, W1HDQ (SK 1997) published in 1968 as ARRL's first VHF book. Ed's book was a practical boost to those hams interested in populating the VHF bands. The *6 Metre Handbook* does the same for 6 meters globally today. The *6 Metre Handbook* belongs in every 6 meter shack.

Published by the RSGB, 176 pages, First edition, 2009, ISBN 9781-9050-8647-4. Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order no 0340, $24.95. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.



THE WORLDWIDE LISTENING GUIDE

Reviewed by Steve Ford, WB8IMY
QST *Editor*

◊*The Worldwide Listening Guide* by John Figliozzi is a unique publication. In fact, I've never seen anything quite like it.

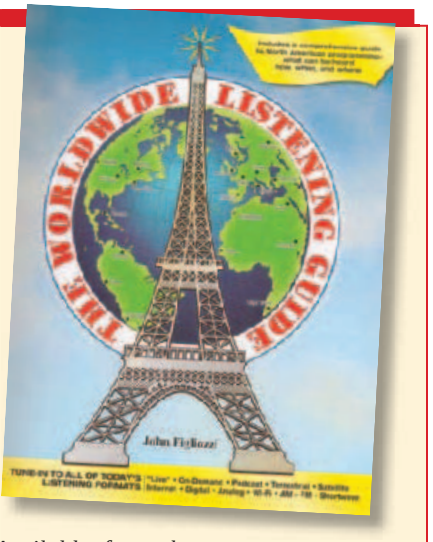
At first glance I muttered, "Oh boy. Another shortwave listening guide." But as I began browsing the spiral-bound volume, I realized that there was much more to *The Worldwide Listening Guide* than a mere listing of shortwave broadcasts. Yes, Figliozzi does indeed supply shortwave program information, but he doesn't stop there. The guide also includes AM, FM, satellite and "Internet Radio."

Such a broad swath of media information would demand a gigantic book, unless the scope was restricted in some fashion. To keep *The Worldwide Listening Guide* at a reasonable 112 pages, Figliozzi limits the number of media outlets and further restricts the listings to English language programming. Even so, the result is fascinating and informative.

I particularly enjoyed the section that listed programming by topic, everything from healthcare to philosophy. (I didn't know, for instance, that Radio Australia offered a program on philosophy titled "The Philosopher's Zone.") You could spend considerable time browsing the topics and sampling the actual programs on the air or over the Internet.

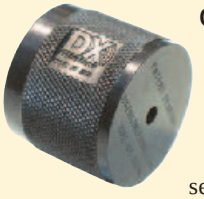
The Worldwide Listening Guide is not a DXer's book. Instead, it is geared toward listeners who actually…well…*listen*. It is the content of the media that matters most in this book, not necessarily the broadcast point of origin.

Published by Master Publishing, 6019 W Howard St, Niles, IL 60714; tel 847-763-0916; **www.masterpublishing.com**.



*Available from the W5YI Group (***www.w5yi.org***), Amazon.com and Amateur Radio dealers nationwide. Suggested list price: $24.95.*

New Products



COAXIAL CABLE/ CONNECTOR TOOLS FROM DX ENGINEERING

◊ DX Engineering has introduced a series of tools for assembling coaxial cable connectors. The DXE-UT-8213 coaxial cable stripping tool prepares RG-8, RG-213, 9913F7, LMR-400 and other similar size coaxial cable for installation of a PL-259 connector. The large diameter knurled handle provides a good grip, and sharp cutting blades make a clean cut. The UT-808X is a similar tool for use with RG-8X size cables and PL-259 connectors with UG-176 reducers. The cable stripping tools are $39.95 each.

A companion to the DXE-UT-8213, the DXE-UT-80P tool allows easy threading of a PL-259 connector sleeve onto the vinyl jacket of RG-8, RG-213, LMR-400 and other similar size cables. The knurled handle provides a good grip, and the tool protects the connector from damage sometimes encountered when installing connectors with pliers. A visual guide at the end allows you to see the cable center conductor to determine the proper depth of installation. The DXE-UT-80N is a similar tool for use with two piece N connectors. The UT-80P and UT-80N are $22.95 each. For more information, or to order, visit **www.dxengineering.com**.

PRODUCT REVIEW

ICOM IC-7200 HF and 6 Meter Transceiver

Reviewed by Steve Sant Andrea, AG1YK
ARRL Assistant Editor

The IC-7200 combines some of the IC-7000's brains with the IC-718's brawn.[1,2] With the '7200, ICOM has created a transceiver with many of the digital features users expect in a modern radio, but packaged in a compact, rugged IC-718 size case that just begs to be taken along for the ride. With receiver coverage from 30 kHz to 60 MHz and transmitter coverage from 160 to 6 meters at 100 W in SSB, CW and RTTY and 25 W in AM, the IC-7200 will keep you on the air whether from home, car or boat.

Front Panel

The IC-7200's front panel is neat and uncluttered. On the left are the front-firing speaker, microphone and headphone jacks and two dual function knobs. The center section contains the display, six function buttons and the main tuning dial. The right hand section contains a group of 17 buttons and a dual function knob.

As with all microprocessor controlled radios, the number of controls belies the complexity beneath. Most of the buttons serve two functions. The primary function is selected with a short *press* of the button; the secondary function by *holding* it down for about a second. Each action, *press* or *hold*, activates a different set of functions. This control philosophy has been used on ICOM radios for quite a while and quickly becomes second nature.

Additionally, ICOM has made the front panel water resistant. While not waterproof, it will tolerate an occasional blast of spray on your boat or a spilled coffee cup during a contest.

Rear Panel

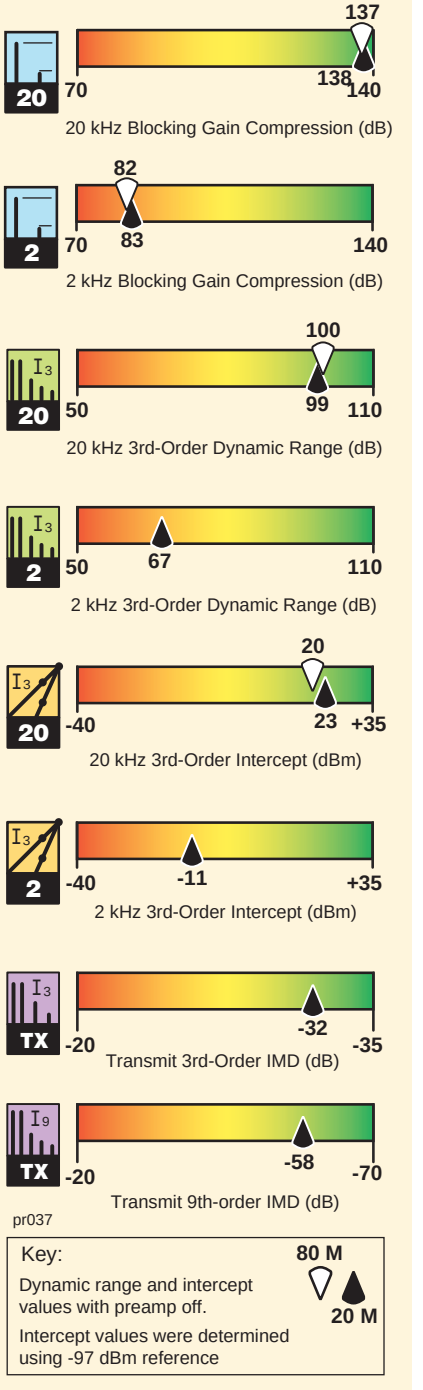
The '7200 runs on 13.8 V dc and requires about 20 A. A fused power cable is supplied. The radio incorporates an electronic keyer with the KEY jack on the rear panel. The external speaker jack accepts a 3.5 mm plug. A single SO-239 UHF connector is provided for the antenna connection. The rear panel has a bumper that protects the connectors from rough handling.

Here's a new feature: a universal serial bus (USB) interface. Transmit and receive audio can be sent over the USB interface, along with CI-V commands for transceiver control. In order to use the USB interface, you must download free driver software from ICOM, and a detailed manual is available too. This driver looks like a standard sound card to applications software, so your existing digital mode software should work

[1]M. Wilson, K1RO, "ICOM IC-7000 HF/VHF/UHF Transceiver," Product Review, *QST*, May 2006, pp 64-71. *QST* Product Reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

[2]S. Ford, WB8IMY, "ICOM IC-718 HF Transceiver," Product Review, *QST*, Jul 2000, pp 63-67.

Key Measurements Summary



Bottom Line

The IC-7200 is a compact, easy-to-operate HF and 6 meter transceiver that offers many features for voice, CW and digital mode operating. Rugged, water-resistant packaging makes it attractive for portable and emergency stations.

Mark J. Wilson, K1RO ♦ Product Review Editor ♦ k1ro@arrl.org

with this interface — eliminating the need for an external computer/radio interface for digital modes such as PSK31 or RTTY.

A traditional ICOM REMOTE jack provides another means for control of the '7200 from your computer if you have the appropriate CI-V interface and software. Jacks for ALC (automatic level control) and SEND (TR relay control) are available for connection to a linear amplifier. A TUNER connector provides an interface to control an optional external antenna tuner.

The ACC jack is a 13-pin connector that provides a transmit control line, a data line and keying line; ALC voltage line; a 1 A, 13.8 V dc output; RTTY keying control; a modulation input; an audio line output and a squelch control output. A matching plug is supplied with the '7200, providing a set of color-coded pigtails for the accessory connector inputs and outputs.

Band Selection

The '7200 includes a stacking register for each band, selected with the numeric keys. Holding the BAND button activates stacking register selection and the word BAND is displayed. Pressing the numeric key for the band you want will automatically set the active VFO to that band with the same configuration (frequency, mode, filter, preamplifier, and so on) that you last used on that band.

The '7200 has two separate VFOs (A/B) and a 7 + 1 digit frequency display (a 1 Hz digit is displayed in some situations). Frequency can be set manually with the main tuning dial or entered directly using the numeric keys. A one button equalizer copies VFO A into VFO B.

While using the main tuning dial, there are three methods of controlling the tuning step (rate) of the main dial: tuning step, auto tuning step and ¼ tuning function. The dial can also be locked by holding the SPCH button. The default is a 10 Hz step.

Pressing the TS button activates the tuning step, which is indicated by a ▼ symbol. Holding the button gives you the choice of five tuning steps: 0.1, 1, 5, 9 and 10 kHz.

The auto tuning step function senses when you are rotating the main dial rapidly and increases the tuning step. This is convenient, for example, to move from the CW to the phone portion of the band more quickly. The auto tuning step speed varies between two and five times the normal rate, depending on its settings.

Finally, the '7200 includes a ¼ tuning function used in the SSB data, CW and RTTY modes. While ¼ tuning is active, the tuning step of the main dial is reduced to about 370 Hz per turn. This permits the precise tuning required by some digital modes.

Direct frequency entry is activated by pressing the F-INP ENT button, entering the frequency and pressing the F-INP ENT again to set the active VFO to the entered frequency. If you make an error, pressing SET returns you to the previous frequency.

The receiver incremental tuning (RIT) feature permits you to "trim up" the sound of a received signal to maximize readability. The RIT control is located at the lower right and can adjust the receive frequency about ±10 kHz.

A final tuning aid is a band edge marker. When activated, the '7200 will issue a beep whenever you cross the edge of the current amateur band.

Modus Operandi

The '7200 has seven mode choices: LSB/USB, CW/CW-R (CW Reverse; shift to the opposite sideband), RTTY/RTTY-R and AM; FM is not included. Pressing the MODE button changes the operating mode in a circular fashion, LSB-CW-RTTY-AM-LSB and so on. To access USB and the reverse modes, press MODE to select LSB,

Table 1
ICOM IC-7200, serial number 0201073

Manufacturer's Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 0.03-60 MHz; transmit, 1.8-2, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7.0-7.3, 10.0-10.15, 14.0-14.35, 18.068-18.168, 21.0-21.45, 24.89-24.99, 28.0-29.7, 50-54 MHz.	Receive and transmit, as specified. Reduced receiver sensitivity below 500 kHz.*
Power requirement: 13.8 V dc ±15%; receive, 2 A (max audio); transmit, 22 A (100 W out).	At 13.8 V dc: 1.15 A receive (max audio), 16.5 A transmit (100 W out). Operation confirmed at 11.7 V (max 75 W out).
Modes of operation: SSB, CW, AM, RTTY.	As specified.
Receiver	***Receiver Dynamic Testing***
SSB/CW sensitivity, preamp on, filter shape sharp,10 dB S/N: 1.8-29.7 MHz, <0.16 μV; 50-54 MHz, <0.13 μV.	Noise Floor (MDS), 500 Hz bandwidth: *Preamp off / Preamp on* 1.0 MHz –121 dBm / –131 dBm 3.5 MHz –131 dBm / –141 dBm 14 MHz –132 dBm / –141 dBm 50 MHz –135 dBm / –142 dBm
Noise figure: Not specified.	14 MHz, preamp off/on: 15/6 dB
AM sensitivity, 10 dB S/N: 0.5-1.799 MHz, <13 μV; 1.8-29.7 MHz, <2 μV; 50-54 MHz, <1 μV.	10 dB (S+N)/N, 1-kHz, 30% modulation: *Preamp off / Preamp on* 1.0 MHz 4.8 μV / 1.5 μV 3.8 MHz 1.6 μV / 0.5 μV 50 MHz 0.9 μV / 0.4 μV
Blocking gain compression: Not specified.	Gain compression, 500 Hz bandwidth: *20 kHz offset Preamp off/on / 5/2 kHz offset Preamp off* 3.5 MHz 137/133 dB / 101/82 dB 14 MHz 138/135 dB / 102/83 dB 50 MHz 135/125 dB / 89/76 dB
Reciprocal Mixing (500 Hz BW): Not specified.	20/5/2 kHz offset: –103/–92/–85 dBc.

ARRL Lab Two-Tone IMD Testing**

Band/Preamp	*Spacing*	*Input level*	*Measured IMD level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz/Off	20 kHz	–31 dBm	–131 dBm	100 dB	+19 dBm
		–19 dBm	–97 dBm		+20 dBm
14 MHz/Off	20 kHz	–33 dBm	–132 dBm	99 dB	+17 dBm
		–17 dBm	–97 dBm		+23 dBm
		0 dBm	–51 dBm		+26 dBm
14 MHz/On	20 kHz	–44 dBm	–141 dBm	97 dB	+2 dBm
		–25 dBm	–97 dBm		+11 dBm
14 MHz/Off	5 kHz	–49 dBm	–132 dBm	83 dB	–7 dBm
		–34 dBm	–97 dBm		–2 dBm
		0 dBm	–28 dBm		+14 dBm
14 MHz/Off	2 kHz	–65 dBm	–132 dBm	67 dB	–31 dBm
		–36 dBm	–97 dBm		–11 dBm
		0 dBm	–20 dBm		+10 dBm
50 MHz/Off	20 kHz	–34 dBm	–135 dBm	101 dB	+17 dBm
		–22 dBm	–97 dBm		+16 dBm

Second-order intercept: Not specified.	Preamp off/on: +78/+78 dBm.

Receiver	Receiver Dynamic Testing
DSP noise reduction: Not specified.	Variable, 10 dB maximum.
Notch filter depth: Not specified.	Manual notch: > 75 dB, Auto notch: 50 dB†; attack time 168 ms.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 67.8 μV; preamp on, 14.3 μV
Squelch sensitivity; SSB: Not specified.	At threshold, preamp on: SSB, 1.0 μV
Receiver audio output: 2.0 W into 8 Ω at 10% THD.	2.3 W at 10% THD into 8 Ω.
IF/audio response: SSB BW = 2.4 kHz: >2.4 kHz/–6 dB, 3.6 kHz/–60 dB; CW BW = 500 Hz: >500Hz/–6 dB, <900 Hz/–60 dB.	Range at –6 dB points, (bandwidth):‡ CW (500 Hz): 384-816 Hz (522 Hz); Equivalent Rectangular BW: 486 Hz USB: (2.4 kHz) 279-2756 Hz (2477 Hz); LSB: (2.4 kHz) 273-2750 Hz (2477 Hz); AM: (6 kHz) 188-3049 Hz (2861 Hz).
Spurious and image rejection: HF and 50 MHz: 50 MHz: >70 dB.	First IF rejection, 14 MHz, 113 dB; 50 MHz, 94 dB; image rejection, 14 MHz, 62 dB; 50 MHz, 76 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: HF and 50 MHz: SSB, CW; 2-100 W; AM carrier power, 1-25 W.	SSB/CW, 1.4-103 W typical; AM, 0-28 W typical.
Spurious-signal and harmonic suppression: >50 dB on HF, >63 dB on 50 MHz.	HF, >57 dB; 50 MHz, 68 dB. Meets FCC requirements.
SSB carrier suppression: >50 dB.	>70 dB.
Undesired sideband suppression: >50 dB.	>70 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order (worst case band): HF: –32/–31/–43/–58 dB PEP; 50 MHz: –30/–36/–44/–61 dB PEP.
CW keyer speed range: Not specified.	6 to 58 WPM.
CW keying characteristics: Not specified.	See Figures 1 and 2.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 30 ms. Unit is suitable for use on AMTOR.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 13 ms.
Composite transmitted noise: Not specified.	See Figure 3.

Size (height, width, depth): 3.8 × 9.5 × 12 inches, incl protrusions, without rack handles.

Weight: 12.1 pounds.

Price: $1100.

*Preamp off/on: 505 kHz, –121/–128 dBm; 137 kHz, –116/–95 dBm; 30 kHz, –77/–66 dBm. The preamp does not improve sensitivity below approximately 250 kHz.

**Receiver testing was performed with the bandwidth set to 500 Hz and the filter shape to sharp. ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using –97 dBm reference.

†Single beat note. Reduces two beat notes by 40 dB with attack time of 230 ms.

‡Default values, medium filter, sharp setting. Bandwidth is variable; smooth setting is available. CW bandwidth varies with PBT and pitch control settings.

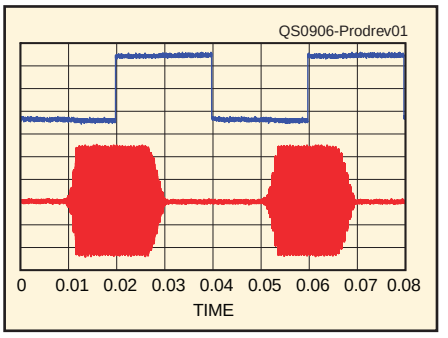


Figure 1 — CW keying waveform for the IC-7200 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

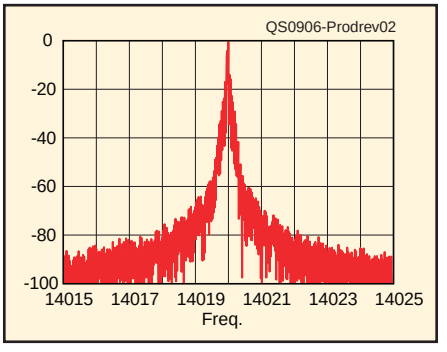


Figure 2 — Spectral display of the IC-7200 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

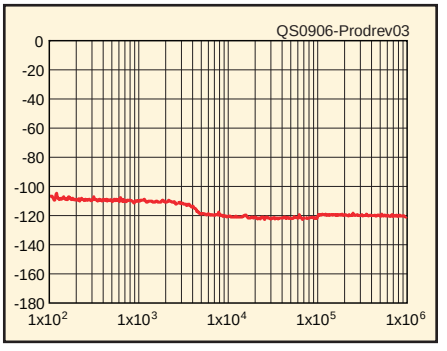


Figure 3 — Spectral display of the IC-7200 transmitter output during composite-noise testing. Power output is 100 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

CW or RTTY and then hold MODE to access the alternate mode.

For CW operation, pitch, sidetone level, key type, break-in type, keyer speed and CW sideband (LSB/USB) can all be configured. For RTTY, the '7200 includes a twin peak filter, preset for 2125 Hz and 170 Hz shift; three FSK mark tones, four shift widths and selectable keying polarity are also available.

To further improve the flexibility of the '7200, each mode (SSB, CW, RTTY and AM) can be separately disabled. So, for example, if your operating style doesn't include RTTY, you can disable it and it will not be included when stepping through the modes. The '7200 also has a data mode for SSB and AM. When activated, the modulation for SSB and AM is taken from the MOD input of the accessory connector or the USB interface.

CW-R and RTTY-R, once selected, will remain selected even after changing modes; SSB mode defaults to the normal mode, LSB on 160, 75/80 and 40 meters, USB elsewhere for each go-around.

Keeping Track

The IC-7200 is equipped with 201 memory channels. Channels 1 through 199 are memories that can store the transmit and receive frequencies and the operating mode. The remaining two (P1, P2) are band edge channels used as upper and lower frequency limits for the scanning feature.

Programming the memory channels is simple. In VFO mode, set your frequency, rotate the M-CH knob to select a channel and hold the MW (memory write) button. The '7200 will respond with three beeps when the frequency is stored. That's it! Now you never have to look up that net frequency again. Programming memory channels in memory mode is similar except you first select the channel to program and then set up the frequency.

Recalling the channel is just as simple — press the V/M button to activate the memory mode; MEMO will display. Use the M-CH knob to select the channel you want and you're there. In less time than it takes to say DX, the selected frequency is transferred to the active VFO and you are ready to radio!

Once you have 201 frequencies stored, a scanner becomes a necessity. The '7200 is equipped with two scanning modes: programmed and memory. The programmed scan uses the band edge channels (P1 and P2) as its lower and upper limits, scanning each frequency between those two points. The memory scan steps through only those frequencies stored in memory channels. It starts from the lowest programmed channel and continues to the highest, then jumps back and starts over.

When it reaches an active frequency, it stops. The scan resume function controls the stop time. With scan resume OFF, the scan stops at the first active frequency and the scan is canceled. If scan resume is ON, the scan will stop on the active frequency and wait. If the frequency remains active for 10 seconds or goes quiet for 2 seconds, the scan will resume.

Configuring the Radio

There are many aspects of the '7200's operation that can be customized to meet your operating style. The Set Mode (SM) menu is where you convert the stock radio into *your* radio. The Set Mode includes 41 items that are of the set-and-forget type. This is where you adjust settings such as LCD backlighting, meter peak hold and the internal keyer's dot/dash ratio.

There is also a Quick Set Mode (QSM) in addition to the regular set mode. QSM is where you find those items that change often, RF power output or keyer speed for instance. QSM items vary according to the operating mode in use. Pressing SET opens the QSM, and holding SET opens the SM.

Figure 4 — The rear panel of the IC-7200 includes antenna and power connectors, ALC and TR control for a linear amplifier, provisions for digital modes and computer control.

Interfering with Interference

The '7200 has many interference fighting features, most of which use its digital signal processing (DSP) system. The IF passband width is DSP controlled, according to the operating mode, from 50 Hz to 8000 Hz. Each mode has three filter widths — narrow, middle and wide. Each width is separately adjustable. I'm primarily a phone operator and found the default phone widths of 1800, 2400 and 3000 Hz to be very good choices. For those CW folks out there, the narrow CW filter default is 250 Hz. This is thoroughly up to date compared to the IC-718 with its limited selection of optional crystal filters and DSP add-on for notch filter and noise reduction

Passband Tuning

The DSP passband tuning (PBT) feature allows you to shift the entire IF passband slightly higher or lower in frequency or to narrow and enlarge the passband width.

PBT is controlled by the TWIN PBT dual knob located on the upper left of the front panel. The inner knob adjusts PBT1 (the high frequency edge of the passband) and the outer knob PBT2 (the low frequency edge). The manual's description of the PBT is somewhat thin, so some clarification is in order.

The neutral position for the PBT is with both the inner and outer knobs at detent. In this position the IF passband is centered on the IF frequency and the width is set to the filter passband width setting. If you move both knobs simultaneously counterclockwise (ccw), you move the passband *lower* in frequency without changing its width. Moving both knobs clockwise (cw) shifts the entire passband *higher* in frequency. So if an interfering station appears slightly below your receive frequency, rotating both knobs cw will move the passband higher in frequency, eliminating the interfering signal.

The width of the passband can be changed by adjusting the knobs separately. If you turn the inner (high edge) knob cw you are *raising* the *upper* frequency limit — widening the passband. If you turn the outer (low edge) knob cw you are *raising* the *lower* frequency limit — narrowing the passband.

Notch Filters

The automatic and manual notch filters are DSP functions used to notch out a very narrow sliver from within the IF passband. This allows you to remove an interfering carrier that is too close to your desired signal for PBT manipulations to eliminate. The digital notch filters are more useful against heterodynes, CW and digital signals than voice modulation.

The automatic notch filter (ANF) scans the IF passband, detects up to two interfering signals and notches them out with between 40 and 50 dB of attenuation. The ANF will also track interfering signals as they move across the passband.

The manual notch filter (MNF) is operator controlled using the MNF knob at the lower right. You rotate the knob, moving a stationary notch of 75 dB attenuation across the passband, until the interfering signal is removed. The MNF can only notch one signal at a time and will not track a moving signal, but it provides a noticeably deeper notch. The width of the MNF can be adjusted. The ANF and MNF cannot be used together.

Noise Reduction

The DSP noise reduction (NR) feature distinguishes between noise and a signal and then acts, digitally, to reduce the noise with minimal effect on the signal. It will only take one evening of operating on 80 or 160 meters to appreciate its usefulness. With a signal tuned in, just press the NR button to activate the feature, and then hold NR to open the adjusting menu. Turning the dial will vary the NR value between 0 and 15. Don't be tempted to crank the NR up to 15 and just leave it there, though. At low levels of NR, audio quality is not affected, but at the higher levels some audio quality will be lost. Begin with the lowest level of NR and raise it to get the best balance between noise and readability.

Last but not least is the noise blanker (NB) This is the great granddaddy of all noise controls and limits pulse type noise.

The NB will act on any strong signal and will distort a loud, nearby station so it should only be used when needed. The '7200's NB has two adjustments, level and width. These can be accessed directly from the NB key. NB level sets the level above which the DSP blanks out the noise spike; NB width sets the time the attenuation is applied.

Lab Testing

The bar for receiver performance in transceivers at all price points has been raised in the nine years since we reviewed the IC-718. Although test procedures and reporting have changed as well, checking comparable numbers in Table 1 against the IC-718 lab tests shows significant improvement in the IC-7200's dynamic range performance. The transmitter's third-order IMD is improved as well.

ARRL Test Engineer Bob Allison, WB1GCM, took this opportunity to visit Synergy Microwave and check the accuracy of the Lab's HP-3048 Phase Noise Test System against newer instrumentation. Dr Ulrich Rohde, N1UL (Synergy Microwave founder and chairman), and Michael Tracy, KC1SX (former ARRL test engineer and now on the Synergy staff) found good correlation between their equipment and the ARRL Lab test results shown in Figure 3.

Regular readers of this column will remember that Dr Rohde donated the HP-3048 to ARRL to replace the Lab's original setup, which was nearly 20 years old. (See May 2006 *QST*, page 70, for details.) ARRL greatly appreciates the technical assistance, consultation and equipment that Dr Rohde has provided over many years.

Operating Experience

My HF station uses a wire antenna and manual antenna tuner for multiband operation. I set the IC-7200 output to 20 W during adjustment, and the radio didn't seem to be disturbed by the momentary high SWR my antenna presents on some bands.

I began operating using the supplied hand microphone. I set the internal meter to ALC and found the audio was very low at the default setting of 50%. Ultimately I found that I needed to raise the microphone gain to 100% in order to get reasonable audio reports. At this point I decided to try using the internal speech compressor. I adjusted the compressor per the manual instructions operating into a dummy load and found that audio reports were much improved.

This issue also affects the voice operated transmitting (VOX) feature. Even with the VOX GAIN at 100% I still had to hold the hand microphone within a few inches of my mouth for reliable operation. I also noted a tendency to hit the UP/DN buttons on the microphone accidentally changing the frequency; this is further complicated by the fact that the dial lock doesn't lock the UP/DN buttons, although if set to act as a keyer, they will not do anything except in CW mode.

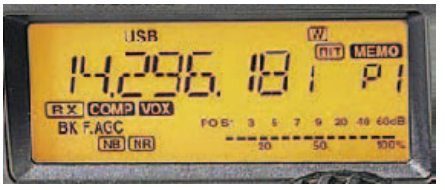


Figure 5 — The IC-7200's amber display is small but very readable. It includes indicators for often-used features and settings.

When trying CW I was flummoxed since keying the transmitter produced a sidetone but no output. I checked my cabling to be sure no problem had developed and found none. A few minutes digging in the manual revealed the solution. The default mode for CW is break-in OFF. With break-in OFF, an outboard TR switch (such as a foot switch) is required. The switch connection is prominently displayed in the manual's "Connections for CW" section. Having used the rig on SSB, I just plugged in a key expecting to configure the CW later. Lesson learned — read your manual.

The '7200 will accept straight key, bug or paddles. It has an internal keyer adjustable from 6 to 60 WPM, or you can use your favorite external keyer or computer software. While operating in either break-in mode, the clatter of the TR relay is quite noticeable. If you enjoy operating CW at speeds over 20 WPM in full break-in (QSK), I would suggest using headphones and closing the shack door.

For DXing, split frequency operation is accomplished using two buttons. Just tune in the DX station on VFO A and hold the SPLIT button to copy VFO A to VFO B. Then press the A/B button to display VFO B and tune it to the transmit frequency. That's it — you're split.

The 1 × 2.5 inch amber LCD is similar to the IC-718's display. It's definitely not the dazzling full color screen found on the IC-7000, but it's readable without difficulty and contrast is very good using the LO backlight setting. I found the HI setting too bright for indoor use, but for outdoor, bright sun venues it would probably be fine. The front-firing speaker produces unusually clear sound for a small, internal speaker. As an added aid, pressing the SPCH button generates a female voice that recites the radio's frequency, received signal strength and mode.

The IC-7200's utility as a portable rig will make it a good fit for emergency operations. I found its controls easy to understand and had the rig operating fairly quickly. A "cheat sheet" of basic procedures in the hands of an operator experienced with modern transceivers should allow them to get to their mission quickly. I must stress, however, that the '7200 should have its settings configured *before* the emergency as these settings greatly impact the rig's operation.

Thermal issues need to be kept in mind when operating the '7200. When operating high duty cycle modes, the heat sink on the rear panel will get quite hot. The fan is audible but quiet and produces a brisk air flow. ICOM says it is normal for the radio to get hot during high duty cycle modes and the radio does not require a reduction in power output. The transceiver includes thermal protection so that if the radio senses it is getting too hot, the drive is reduced automatically.

The Hard Stuff

The IC-7200 includes a hardcopy manual, which gives you a firm grounding in the transceiver's operation. The manual is of the cookbook variety that explains how to wire up the '7200 for various types of operation and options, basic operating procedures for getting on the air, advanced procedures to guide you with its finer points and general information about programmable features and troubleshooting. The manual includes little snippets of theory but primarily consists of the step-by-step operating procedures. The procedures are straightforward and include illustrations of the controls used, the displays that should appear and, in some cases, additional diagrams to help explain a particular function.

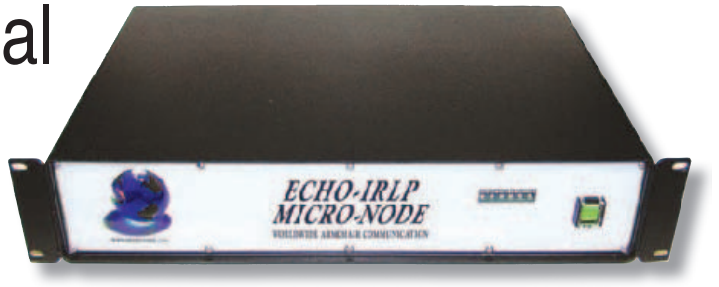
It does lack directions for the initial setup. I would suggest that once wired up, you start by reviewing the "Basic Operations" chapter to get a quick feel for the rig. When you are comfortable, hook up a dummy load and go to the "Receive and Transmit" chapter, then follow the referenced procedures to set up such basics as microphone gain, compressor level, CW pitch and other necessary adjustments for the modes you operate. This will make your initial excursions onto the bands much more enjoyable.

Last Thoughts

The IC-7200 is a rugged, compact rig that is packed with more digital flexibility than can be discussed here. It is well suited for portable operations and will make a good HF solution for your EmComm group. It should also be considered for recreational vehicle or apartment locations where its solid performance and small footprint will be an asset.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 800-872-4266, fax 425-454-1509, **www.icomamerica.com**.

Micro-Node International IRLP/EchoLink Node



Reviewed by Kent Johnson, W7AOR
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Smaller is better in the case of Micro-Node. This series of products is what developed when Mark Guibord, K7IZA, a microelectronics embedded systems engineer, was introduced to VoIP (Voice over Internet Protocol) communications. He collaborated with software engineers Brent Sylvester, K6IB and Rob Pectol, KK7AV, and mechanical engineer Hans Ehlert, AE6TV, to develop what they call "the world's smallest plug and play IRLP/EchoLink embedded solutions." Let's briefly review some background on amateur VoIP modes before getting to the details of the Micro-Node offerings.

VoIP Systems in Amateur Radio

VoIP is generally accepted as a tool to enhance the Amateur Radio experience. By using Internet links instead of HF radio links, a ham with a modest VHF FM radio can reliably communicate with stations hundreds or even thousands of miles away at any time of the day or night. The most common form of amateur Internet linking involves the exchange of audio using VoIP technology. This is the same technology used by Internet telephone services and by online voice "chat" applications. For more information, check out *VoIP: Internet Linking for Radio Amateurs* by Jonathan Taylor, K1RFD.[1]

The two most popular VoIP protocols are the Internet Radio Linking Project (IRLP, **www.irlp.net**) and EchoLink (**www.echolink.org**). Both operate networks of dedicated servers and nodes offering predictable worldwide voice communications.

[1]Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9264. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

Bottom Line

The Micro-Node line of IRLP/EchoLink embedded solutions offer an easy and compact way to establish a fixed station VoIP node or maintain communications on the go. You can get a unit that works with your radio, or one that includes a simplex transceiver or duplex repeater.

Each system has its unique features and applications. With the software installed on a sound card equipped computer, any ham can create an EchoLink node that others can access by radio. Hams can also join the network directly without using radios. They simply plug microphone/headsets into their computers.

IRLP also uses the Internet to establish VoIP links. The difference is that IRLP only permits access via RF nodes at repeaters or on simplex frequencies (all IRLP nodes are interlinked via a central Internet server). You must use a radio to access the IRLP network. *EchoIRLP* is a software add-on for IRLP that enables an IRLP node to operate either as an IRLP station or as an EchoLink station in sysop mode.

IRLP and EchoLink each have thousands of users worldwide. Many hams, like me, use both systems.

The Micro-Node Product Line

Micro-Node International offers a growing number of products for amateurs looking for a plug-and-play solution to establishing an IRLP or IRLP/EchoLink node. The product line includes a stand-alone package for use with your existing transceiver or repeater (see Figure 6) along with several versions that include integrated transceivers or repeaters.

All Micro-Node products are based on the Intel 1 GHz Mobile Celeron M processor with 4 GB flash drive and 512 MB RAM. They are shipped with the Micro-Node software package and *CentOS 4.7 Linux* operating system installed. The software includes an assigned IRLP node number (new or existing). A welcome feature of this software package is that it lets you set up, monitor and operate all aspects of the unit entirely in a visual point-and-click environment using any Web browser. You are never required to understand or deal with *Linux*.

The Micro-Node software package currently includes 45 built-in user-customizable functions. This means that you get all the add-on features that you are going to want without ever having to debug scripts or try to download and assemble a program in *Linux*. Some of the functions include "speaking" various parameters such as node status, time and date or last call received and enabling/disabling control features. APRS location reporting is built in.

Software updates are free, and they can be installed automatically as they become available. There's quite a bit of information available on the Micro-Node Web site, so

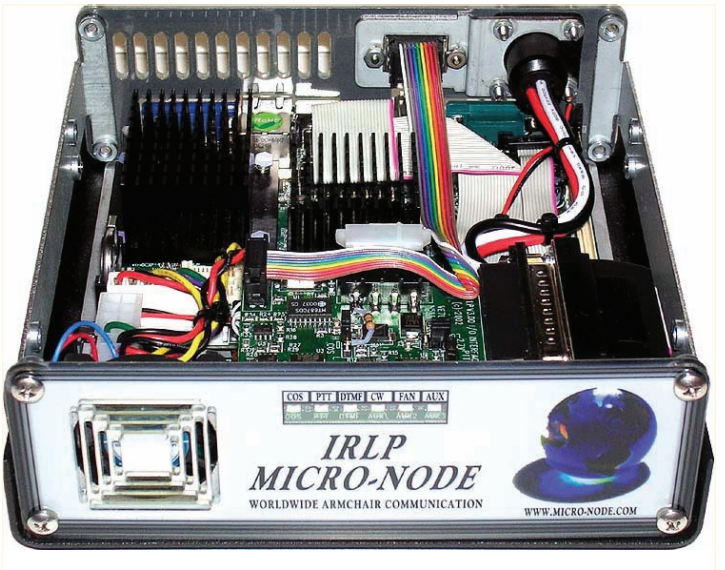

Figure 6 — The Micro-Node MN-1000 stand-alone embedded system measures only 2.4 × 6.9 × 7 inches and is ready to connect to your equipment for simplex or repeater operation.

Figure 7 — The Console is the main screen for monitoring and controlling all operations.

Figure 8 — The IRLP setup screen.

you can read about these features in detail.

Micro-Node Repeater

The version I use is the Micro-Node MN-3200 Rack Repeater Unit shown in the title photo. It is a fully integrated IRLP/EchoLink node computer and 70 cm repeater. The rack-mountable package includes a commercial grade, programmable full-duplex repeater that can run up to 10 W, along with a six-cavity duplexer rated for 50 W. Add an antenna, a 12 V dc power source, a broadband Internet connection and you ready for complete access to the IRLP and EchoLink VoIP systems.

The MN-3200 measures 3.5 × 17 × 12 inches (height, width, depth), small enough that I can mount the repeater in my SUV for mobile IRLP/EchoLink connectivity. A mobile broadband Internet connection makes the repeater truly mobile.

User Friendly Software

To access the Micro-Node interface program, you log on to the administration tool by pointing your Web browser to the IP address of your node. At that time you are presented with a Web page that shows your call sign and IRLP node number, as well as links to various screens for monitoring, control and set up.

The *Console* (Figure 7) is the main operation screen of the administration package. From here you can monitor and control the unit. It displays the node's current status, including the call sign of any connected node. The node's last connections, including call signs and when they occurred, are displayed. You can enter and execute any dual-tone, multi-frequency (DTMF) command directly from this screen. User defined buttons are included for direct connection to favorite nodes and to control special functions.

The *Audio* setup screen uses slider controls to adjust transmit and receive audio levels, as well as the CW ID pitch and audio level. It also has buttons to output several test tones and a test ID. From the *Schedule* screen you can program any function or node connection to run at a fixed date/time, or set up recurring schedules (for example, make a connection for a net each Tuesday at 7 PM). In addition to a time you may specify certain conditions be met, such as the node being idle or connected.

There is an IRLP setup screen (Figure 8) that allows you to set all of the IRLP environment variables as well as many other variables to customize the unit's built in features. These are set using a scrollable screen that contains an explanation of each variable and a box where the value is entered. Having the explanation on the screen for these variables makes the setup quite simple.

An EchoIRLP setup screen is provided to enable EchoLink operation on the unit. You just enter your EchoLink node information using this screen and click install. This automatically sets up the EchoIRLP software and EchoLink operation is ready to go.

Other screens set up DTMF tones to be used to control various functions, show a map of connected nodes, allow or deny node access, record voice and text messages, set network or server settings and reboot the system. The basic control of the node connections and selected voice status messages is also possible by sending DTMF commands from the user radio to the node receiver.

Easy Portability

Taking your Micro-Node into the field is quite easy, especially with one of the versions that includes an integrated radio or repeater. All that is needed is a broadband Internet connection and a travel router. With mobile broadband readily available in most cities and along major highways, you are good to go. I like the idea of being able to drive my VoIP linked repeater to any location where it might be needed to fill gaps in coverage for emergency communications purposes.

I took my Rack Repeater Unit with me in my SUV for a Thanksgiving vacation trip from Las Vegas to Sacramento. I was interested in trying the Micro-Node repeater in a mobile environment because I wanted to stay in contact with the IRLP Western Reflector (9250), which I own (see **www.narri.org**). I thought it would be much easier to enter the same DTMF 9250 on the same frequency to stay connected, as opposed to trying to locate IRLP equipped repeaters over the course of my 12 hour trip.

I use a Sprint Novatel Ovation U727 USB broadband card plugged into a Cradle Point CTR350 Mobile Router, which in turn plugs into the Micro-Node unit via a short CAT5 cable. The CTR350 also serves as a mobile wireless 802.11b/g router that can be used as a portable hot spot. I can run my laptop computer from the car, or in an emergency situation other amateurs equipped with wireless laptops can access my portable system.

The Micro-Node has a GPS input for use with your compatible GPS receiver. This setup allows for APRS transmission into the Internet giving the location of the mobile node. When traveling outside my repeater coordination area, I run the repeater RF output to a small dummy load to avoid causing interference to other systems. (As with any other repeater, you *must* work with your local coordination group before putting a Micro-Node repeater on the air.)

I was able to make VoIP connections for at least 90% of my travel time to and from California. There are a few mobile broadband coverage holes on the Interstate system. Thus, the only weakness is that mobile broadband it is not always available on the road, but that's improving with time.

For most users, I'd recommend a low-power simplex unit rather than a repeater for routine VoIP mobile operation. For example, the MN-2200 Mini Simplex Radio incorporates a 300 mW Alinco dual band handheld and is smaller, simpler and less expensive. That is the perfect power level for transmitting between the front seat and the trunk of your car using a handheld or installed mobile radio.

Manufacturer: Micro-Node International, 1000 N Green Valley Pkwy, Suite 300-249, Henderson, NV 89074; tel 702-528-4700; fax 702-263-9243; **www.micro-node.com**. *Price*: MN-1000 stand-alone node, $1195; MN-2200 Mini Simplex Radio, $1495; MN-3200 Rack Repeater Unit, $1995. QST

W1ZR

THE DOCTOR IS IN

Q Kevin, VE3RCN, asks: In Canada, amateurs are issued VE or VA prefixes. There is no indication if one is a Basic or Advanced class ham operator. What about amateur licenses in the US? Your prefixes are A, K, N and W. Do these indicate the class of license?

A The prefix does not indicate the class of license — although at one time Novice class operators had a second letter of "N" in their call. For example, in 1955, I was issued WN1KZR. After I upgraded to General class, my call was automatically changed to W1KZR. Now the FCC has divided call signs into "groups," A, B, C and D. Amateurs are assigned call letters based on the group that is associated with their license class and a number based on the region they live in (0-9), as in Canada. These are defined in **wireless.fcc.gov/services/index.htm?job=call_signs_1&id=amateur**.

Note, however, that the call sign group is not always an indicator of license class. This is because there is no requirement to change call letters upon advancement. It is also possible for people to request a vanity call sign, within their group or below, if available. To further muddy the waters, the FCC no longer requires US hams to keep the same number associated with their region, nor to change when they move.

But you can be sure if there is a so-called 1 × 2 (one letter, one number, two letters such as W1AA) or 2 × 1 (two letters, one number, one letter such as WW1A), that person has an Extra Class license. But an amateur with an Extra class license could have any other kind of call sign as well.

Q Ken, N2DF, poses a question: I plan to do some portable hilltop operating on the VHF and UHF bands with beams and loop antennas. The length of coax from the antennas to the radios would be about 20 feet. Would it be advantageous to use a low loss coax such as Belden 9913 or would smaller RG-58 or RG-6U suffice for such a short run ? I am trying to minimize any heavy weight on the vertical mast that would support several stacked antennas.

A If you are going to a hilltop, hopefully you will have long line of sight (LOS) paths to interesting places and a bit of coax loss won't make too much difference for LOS propagation, unless you are in competition with stronger stations. For some modes such as scatter or meteor trail propagation, it might make some difference — but it won't make a lot of difference with your short length.

Table 1
Attenuation (dB) of Popular Coax Cable Types (100 Feet)

Freq (MHz)	*100*	*1000*
RG-58 (7807A)	3.0	9.7
RG-58 (8259)	5.4	22.8
RG-6 (1694A)	1.8	5.9
RG-6 (8215)	2.7	9.8
RG-8 (7810)	1.2	4.0
RG-8 (9913)	1.3	4.5
RG-8X (7808A)	2.3	7.4
RG-8X (9258)	3.1	11.2
LMR-240	2.5	8.0
LMR-240UF	2.8	9.6
LMR-400UF	1.4	4.9

Table 1 provides the attenuation data from *The ARRL Antenna Book* for 100 foot lengths of some popular types of coax under matched conditions.[1]

Divide each value by 5 to obtain the attenuation for your 20 foot length, assuming you have matched systems. I show multiple types for each generic type, the numbers in parentheses are Belden product numbers. This is to highlight the fact that it is not sufficient to just compare "RG-6" to "RG-8," for example — you need to look into the specifications of the particular manufacturer to get the whole story. Of course, 75 Ω RG-6 TV cable will also add the complication of needing matching to work with 50 Ω systems.

I have also included some examples of the Times Microwave LMR series cables, since they are quite popular for operators looking for low loss.[2] The UF (ultra flexible) types may be particularly attractive for portable operation. Most dealers carry some types of LMR cable.

[1]R. D. Straw, Editor, *The ARRL Antenna Book*, 21st Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9876. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

[2]**www.timesmicrowave.com/content/pdf/lmr/lmr_catalog.pdf**.

Q Stewart, KD5LBE, asks: Can you use an incandescent light bulb as a dummy load to to see if your transmitter is putting out power? I'm talking about low power like 50 or 100 W. This is just to see if it is actually working. I got the suggestion from an antenna tuner manual and it worked for me, but friends have debated with me whether it is unsafe for a radio.

A A light bulb was the traditional "dummy load" during the '50s when the tube transmitters of the day had wide range pi-network output circuits that acted as an antenna tuner of sorts. The main problem is that a light bulb impedance changes with temperature, and is likely not close to the 50 Ω that a modern "no tune" transceiver wants to see.

If the transceiver has an antenna tuner, either internal or external, it would likely be able to compensate for the mismatch and should work. Note that the settings will be different at different power levels as the bulb heats. If you don't have a tuner, the SWR can easily be greater than about 2:1, and the transmitter will likely "fold back" and reduce output power to protect itself, but check your radio documentation to make sure. If so, it may not show that the transmitter is putting out full power, but is likely to illuminate enough to indicate that it is putting out something.

Q Tim, WAØOFM, asks: What is all the big deal with the 43 foot vertical monopole antennas? I see several manufacturers sell verticals of this length. I realize a great ground is essential to any vertical, but what is so special about the this particular length of radiator?

A Although there is nothing exactly magical about a monopole that is 43 feet high, it does have some interesting properties — especially for 20 meters and lower frequency bands. On 20 meters, it is close to ⅝ wavelengths (λ). That length provides the best low angle gain for a single element vertical monopole. Figure 1 compares the elevation

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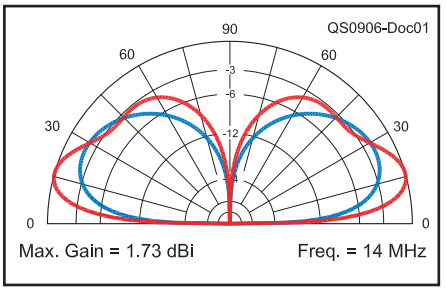


Figure 1 — Vertical radiation pattern of a 43 foot vertical on 20 meters (red), compared to a 16.5 foot ¼ λ monopole (blue). Note that the 43 foot, ⅝ λ, antenna has a peak gain about 2 dB higher, but often more importantly for long haul work, its peak is at a lower elevation angle (16°) than that of the ¼ λ monopole (27°).

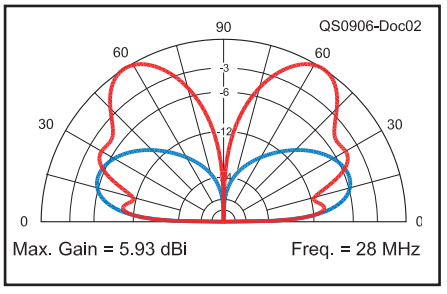


Figure 2 — Vertical radiation pattern of the same antennas on 10 meters. Note that the 43 foot antenna, 1¼ λ on 10 meters, has its energy focused upwards at 57°, perhaps useful for satellite communication, but not for long haul work. The 16.5 foot antenna is ½ λ on this band and will work quite well with its radiation centered at 20°.

patterns of a ¼ λ and ⅝ λ monopole over typical ground on 20 meters. Any longer and the maximum radiation moves away from the horizon into higher elevation angles that aren't as good for long haul propagation as shown in Figure 2.

On 60, 40 and 30 meters, it is a quarter wave or longer, and will work efficiently with simple tuning. On 80 or 75 meters, it is shorter than a quarter wavelength, but close enough to be pretty efficient with base loading and a lot easier to support than a full size (60 to 65 feet) ¼ λ monopole. Of course, for the bands higher than 20 meters, it is not particularly good for long haul — but it isn't too hard for most folk to get horizontal antennas for those bands high enough so they work well.

Q Bill, K2WT, asks: I would like to use a low noise receiving loop antenna for 160 meters and transmit on my inverted L. My new transceiver doesn't have a capability to have a separate antenna for receive. Is there a way I can do something outside the radio to facilitate this?

A Some transceivers have the capability to automatically switch to a separate receive antenna to allow signal to noise enhancing antennas such as the classic Beverage, Ewe or loop to improve reception on the lower bands, typically 160 through 40 meters. Unfortunately, your radio doesn't offer this feature.

Fortunately, it isn't too hard to make this happen. The secret is to use the connections that all transceivers have that are designed to switch or key a linear amplifier to also key an antenna switching relay. If you happen to have an older linear that draws too much current for your transceiver, this can also solve that problem "at no additional cost."

Figure 3 is a schematic of an arrangement that will make it all happen. The parts are inexpensive and it makes a good rainy weekend project. Note that the electromechanical relay will introduce a slight delay in keying your linear, however, the Panasonic DS2E-M-DC12V relays that Phil Salas uses (see his article in this issue) only takes 3 ms to open or close. This will rarely be a problem even if you do high speed full break-in CW and the transmit power comes out of the radio before the linear is fully switched. Some radios have a programmable delay that should be able to compensate for this. The other caution to observe with this approach is that if a wire should break, and the relay becomes inoperative, it will leave the transceiver always connected to the receive antenna — especially not a good idea if there is a preamplifier in your receive loop antenna!

In your radio, the linear out connector includes all the signals you need to make it happen. A small DIN connector on the radio rear has a pin with 13.8 V dc on it that you can use to supply the relay. You may want to add a switch that will keep the relay closed all the time so you can select to use the transmit antenna for receive as well, so you can confirm that there is an improvement in S/N. Figure 3 shows the way to hook it up.

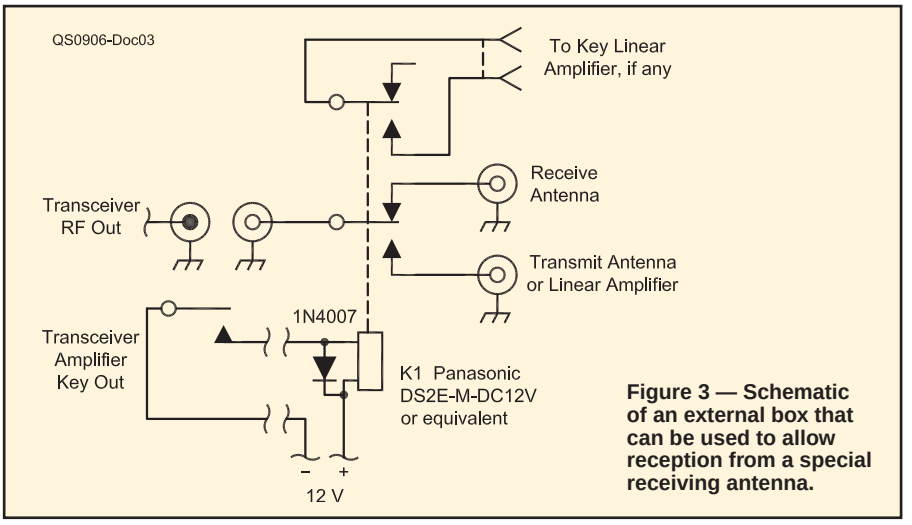


Figure 3 — Schematic of an external box that can be used to allow reception from a special receiving antenna.

Q Bob, AJ5C, thinks he remembers an early rule book that said an amateur license is required to work on ham radio gear. He wonders if this is the case.

A Part 97, the federal rules that regulate Amateur Radio in the US, defines who can transmit. There is not a requirement to have a license to own, build or work on amateur gear — just to transmit with it.

In the April column, I noted that I wasn't aware of amateur oriented dc power supplies that had provision for load sharing if hooked in parallel. A number of readers wrote in to let me know that their larger Astron 12 V supplies included a terminal on the back to connect to another Astron supply to equalize the loads if connected together. I didn't see that feature noted on their Web site so I wrote to Astron to get the story.

I received a prompt reply from Loren Pochirowski, the President of Astron Corporation, noting that the parallel terminal is provided on their RS-50, RS-70 RM-35, RM-50 and RM-60 supplies. Connecting these terminals on two supplies will equalize their output current while they are connected in parallel.

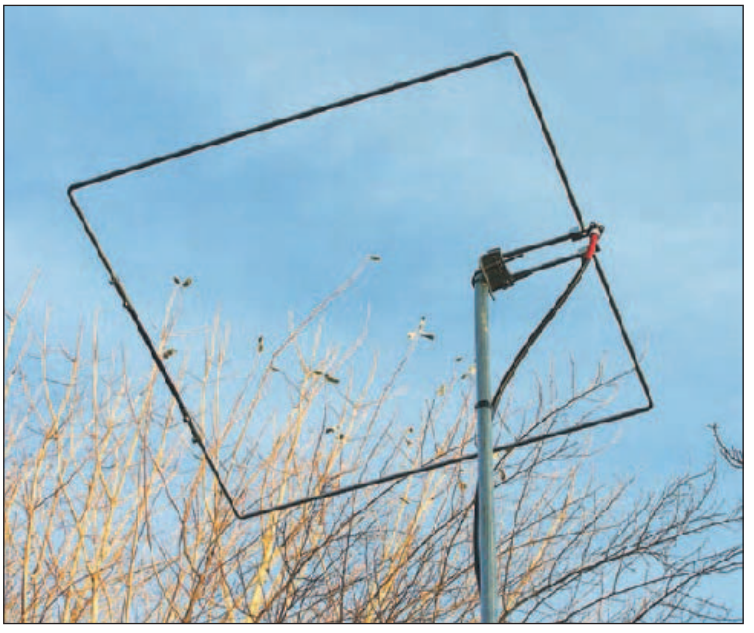
[3] *The ARRL* Extra Class License Manual, 9th Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 1532. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

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/. QST

SHORT TAKES

KU4AB Model SQ-50 6-Meter Antenna

In the April 2005 "Short Takes" we introduced the amateur community to KU4AB's innovative 2 meter and 70 cm loop antennas. In the four years since that review, Phil Brazzell has expanded his product line substantially. With Field Day and springtime sporadic-E band openings in mind, I thought it would be a good time to take a look at his Model SQ-50 6 meter antenna.



Simple Design, Simple Installation

The SQ-50 is a square (32 × 32 inch) loop antenna made of high-grade 6061t aluminum rod. The mounting hardware is stainless steel and will accommodate your typical 1½ inch mast.

The antenna arrives completely preassembled and there is no tuning required. You simply remove it from its shipping box, slap it onto a mast, connect your coaxial cable and you're on the air.

The ease of installation makes the SQ-50 particularly attractive for portable operating, either at a Field Day site or on the road as a VHF contest "rover." For this review, I attached the SQ-50 to a 20 foot mast among the trees in my backyard, feeding it with a length of 9913 coaxial cable. With an adjustable wrench in hand, the installation required all of 10 minutes. The finished product is relatively stealthy (read: hard to see), which is a definite plus.

Back at the radio, I measured the SWR curve, with the result shown in Figure 1. As you can see, the SQ-50 is designed for the low end of the band. It is possible to perform some limited adjustment if you need to shift the SWR curve higher, but I didn't attempt this. Unless you intend to try FM, most activity on 6 meters is well below 52 MHz.

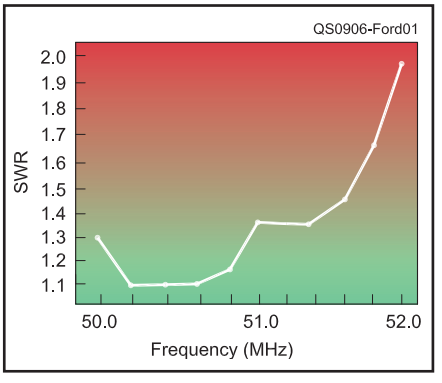


Figure 1 — The measured SWR curve of the SQ-50 installed at a height of 20 feet.

How Does it Play?

It had been a while since I had dabbled on 6 meters and I had forgotten what a difference a good antenna can make. Yes, the SQ-50 is omnidirectional; you can't expect the same performance you'd achieve with a directional antenna such as a Yagi. Even so, I was very impressed with this little loop.

Six meters is a quirky band. Much of the time it is dead quiet — until it suddenly bursts wide open and you hear signals from hundreds or even thousands of miles away. And then there is meteor scatter, which is relatively easy on 6 meters. You'd be surprised how far your signals will travel when they bounce off the ionized trails of disintegrating space debris. Digital meteor scatter makes this activity possible around the clock.

During the January ARRL VHF Sweepstakes I routinely worked distant stations while running only 100 W output. (The SQ-50 is rated at 1 kW, but I don't have that much RF muscle at my station.) Considering that no propagation "enhancements" were involved, I was pleased.

A week later the band lived up to its unpredictable reputation. As I listened during a quiet Saturday afternoon, signals began rising like ghosts out of the noise — a sporadic E opening was unfolding before my eyes! Within minutes I was working stations up and down the band. One of my contacts was W9ILY in Illinois who was also using a loop antenna (not an SQ-50). According to John, my signal was a solid S9 and I was receiving him equally well.

At other times I used the SQ-50 to work meteor scatter with the *WSJT* software suite (**http://physics.princeton.edu/pulsar/K1JT/**). Using *WSJT's* FSK441 mode, I successfully completed numerous contacts with the SQ-50. At the time this review was written, my best DX via meteor scatter with the SQ-50 was about 1000 miles.

A Rugged Performer for the Magic Band

The SQ-50 survived a particularly harsh New England winter without complaint. Ice and snow did increase the SWR at times, but those were temporary conditions. And with its 100 MPH wind rating, the SQ-50 had no difficulty handling the icy blasts.

If you are looking for more gain, it's possible to vertically stack two SQ-50s, so long as you can keep about 12 feet of separation between them. I didn't try this for the review, but the possibility is intriguing.

Since many HF transceivers now include 6 meters, all you need is a good antenna to enjoy the captivating strangeness of what some hams call the "Magic Band." The SQ-50 is one such antenna. It's small enough to fit into any setting and the price is easy on the budget, too.

Manufacturer: KU4AB.COM, 5664 State Route 849 East, Boaz, KY 42027, 901-270-8049; **www.ku4ab.com**. *$73.95.* QST

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

NØAX

HANDS-ON RADIO

Experiment #77 — Load Lines

Once past the very basic levels of transistor amplifier circuits, you'll encounter the *load line*, a graphical method of circuit design. This experiment shows you how the load line is determined and applied to circuit behavior.

Diode Load Line

A diode is the simplest semiconductor device for which a load line can be drawn. Figure 1(A) shows a diode in series with a resistor load, R_L. For any given combination of V_S and R_L, if we know the diode's forward voltage, V_F, we can solve for the diode current, $I_F = (V_S - V_F) / R_L$. V_F, however, depends on I_F, so we must solve the exponential equation for I_F as a function of V_F, shown as the diode's *characteristic I-V* curve in Figure 1(B).[1]

Figure 1(B) also shows the less precise, but easier to use, graphical method of load lines. The load line describes what happens to voltage and current in R_L. It is drawn between the maximum and minimum possible values of current and voltage across R_L. For example, if $I_F = 0$, there is no voltage drop across the diode and the voltage across R_L is V_S — that's point A on the load line. Similarly, if $V_F = 0$, then $I_F = V_S/R_L$ and that's point B on the load line.

The only point at which the load line intersects the curve is point C — the *operating point* for the circuit. The intersection is the solution of the diode's characteristic curve equation with the known value of R_L and V_S. If either V_S or R_L change, the slope or placement of the load line will change along with its intersection with the diode's characteristic curve. Let's try it!

[1]The Fundamental Diode Equation is presented in the "Analog Basics" chapter of any recent *ARRL Handbook*.

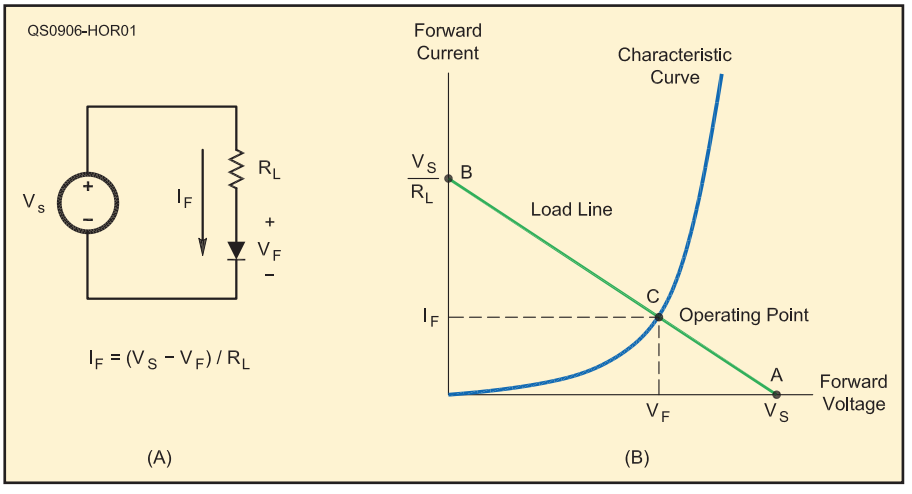


Figure 1 — The simple circuit at (A) can be used to determine the diode's characteristic curve at (B). The intersection of the load line and the characteristic curve is the circuit's operating point.

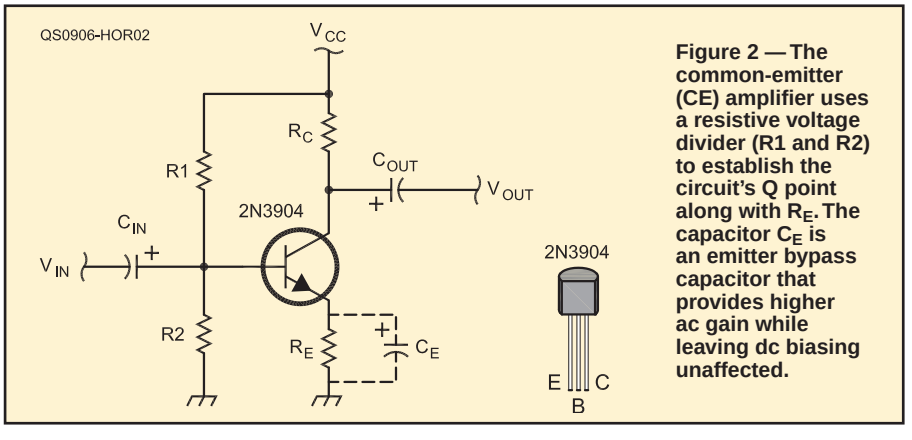


Figure 2 — The common-emitter (CE) amplifier uses a resistive voltage divider (R1 and R2) to establish the circuit's Q point along with R_E. The capacitor C_E is an emitter bypass capacitor that provides higher ac gain while leaving dc biasing unaffected.

Operating Point Control

Build the circuit in Figure 1(A) using a 1N4001 silicon diode rectifier, $V_S = 3$ V, and $R_L = 1$ kΩ. Prepare a graph with the I_F axis showing 0 to 50 mA and the V_F axis showing 0 to 10 V. Draw the load line between point A ($I_F = 0$ mA, $V_F = V_S = 3$ V) and point B ($I_F = V_S / R_L = 3$ mA, $V_F = 0$ V).

Measure the diode's forward voltage, V_F, and use Ohm's Law to calculate I_F from the voltage across R_L or measure it directly with a meter. The values should be somewhere around 0.6 V and 2.4 mA. When that point is plotted, it should be very close to or on the load line.

Vary V_S from 1 to 10 V in steps of 1 V, calculating point A and B and drawing a new load line at each step. Measure the diode voltage and circuit current as before, plotting the combination on the graph and confirming that each point is on a load line. You will start to see the diode's characteristic curve appear as the sequence of plotted points!

Return V_S to 3 V and change R_L to each of the following values, drawing a new load line at each step: 100, 220, 470, 1000, 2.2 k, and 4.7 kΩ. Measure and plot V_F and I_F at each step. This will fill in even more points, each very close to the load line for that value of R_L. As you can see, if you had enough values of R_L and sufficient power supply range, you could determine the diode's characteristic curve exactly!

You'll also have noticed that while you were only varying V_S, the load lines were parallel, but when R_L was varied, the load line slopes changed. That's because the slope of the load line is $-1/R_L$. Lower load resistance results in a steeper load line.

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Transistor Amplifier Load Line

The load line is much more useful in designing transistor circuits, since current and voltage can take wide ranges of values. The common emitter (CE) amplifier in Figure 2, from the first Hands-On Radio experiment is one you'll use frequently, so we'll use it as an example.[2] This circuit uses self bias and emitter degeneration to establish a stable *Q point* (the operating point with no input signal).

The characteristic curves for a typical 2N3904 NPN transistor in the CE configuration are shown in Figure 3. Instead of just having a single characteristic curve as did the diode, a transistor's I_C–V_{CE} characteristic curve can change. As base current varies, the height of the curve changes on the graph. The set of curves show "snapshots" of the transistor's characteristic curve, each at a different value of base current.

Because the load for the circuit is resistive (consisting of R_C+R_E), the operating point falls along the dc load line drawn on the characteristic curves. We'll get to the ac load line later. As with the diode circuit, the intersection of the load line with the characteristic curve corresponding to the value of base current is the circuit's operating point. If you imagine one of the constant base current lines moving up and down as an input signal varies the base current, you can see its intersection with the load line moving, too. When no signal is applied, the base current is fixed at the level of bias current chosen by the designer and that operating point is the circuit's Q point. In the case of our CE amplifier, the values of R_1, R_2 and R_E determine the location of the Q point by controlling the value of the base bias current.

V_{CC} and the values of R_C and R_E determine the orientation of the load line. The two end points of the load line correspond to transistor saturation [$I_{Csat} = V_{CC} / (R_C+R_E)$ on the I_C axis] and cutoff (V_{CC} on the V_{CE} axis). The slope of the load line is $-1/(R_C+R_E)$, because the output current of the transistor flows through both the collector and emitter resistors.

In order to experiment with the load line, here are a set of components that will result in a Q point of I_{CQ} = 4 mA, V_{CEQ} = 5 V and a voltage gain of –5 with V_{CC} = +12 V: R_E = 270 Ω, R1 = 39 kΩ, R2 = 6.8 kΩ, and RC = 1.5 kΩ. (10 µF capacitors will be fine for C_{IN} and C_{OUT}.) Download and print the sample 2N3904 characteristic curves from the Hands-On Radio Web site and draw the load line between cutoff and saturation in this circuit. (The Q point should be on the load line.)

Build the circuit and verify that the values of I_{CQ} and V_{CEQ} are about right. Apply a 1 kHz, 0.5 V_{P-P} sine wave at the input and verify that the output signal is about five times larger and inverted from the input. Increase the input voltage until the output waveform becomes clipped at either the top or bottom and then reduce the input voltage by about half.

Now move the Q point by changing the value of I_{BQ}. To do this without changing the load line, adjust the ratio of R1 and R2 to change V_B, keeping the sum of the resistors in the range of 20 k to 50 kΩ. (You can substitute a 50 kΩ potentiometer for R1 and R2, with the wiper connected to the transistor base.) Measure the new values of I_{CQ} and V_{CEQ}, locate the new Q point on the load line, and observe the effect on the output waveform. For example, doubling the value of R2 will raise the value of I_{BQ} dramatically and probably cause the output waveform to be clipped at the bottom. This is because the higher bias current has moved the Q point farther along the load line toward saturation (left), making it easier for an input signal to drive V_{CE} lower into the saturation region.

[2]Previous Hands-On Radio columns and a complete parts list for all experiments are available to ARRL members at **www.arrl.org/tis/info/HTML/Hands-On-Radio** and in Experiment #76 (see next note).

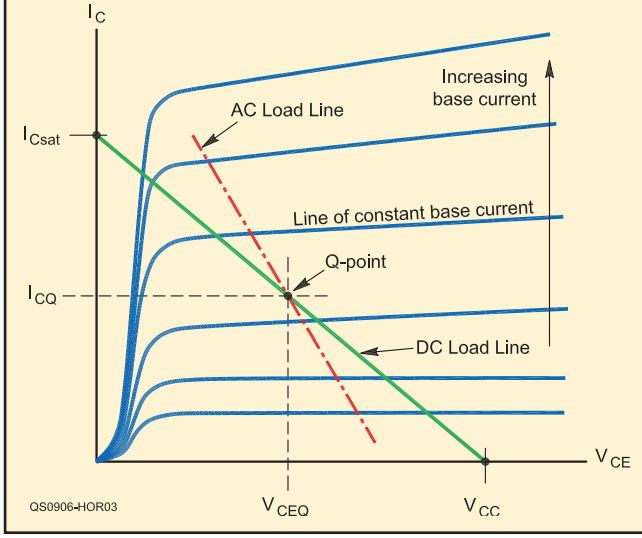


Figure 3 — The dc load line's end points correspond to transistor saturation (I_{Csat}) and cutoff (V_{CC}). The circuit operates somewhere on the load line depending on bias. The operating point with no signal applied is the quiescent, or Q point. By adding an emitter bypass capacitor, there is less load impedance for an ac signal, increasing the slope of the ac load line.

AC Load Lines

Figure 2 shows an *emitter bypass* capacitor, C_E, next to R_E. When C_E is connected across R_E, the circuit has a different ac voltage gain $A_V = -R_C/r_e$ (r_e is the internal emitter resistance of a few ohms) than dc gain $A_V = -R_C/R_E$. For an ac signal, the circuit operates on a separate ac load line as shown in Figure 3, because R_E has been effectively short circuited for ac signals. Without R_E, the slope of the ac load line is $-1/R_C$, steeper than for the dc load line. The ac and dc load lines intersect at the circuit's Q point because the circuit's ac and dc operation is the same if the ac input signal is zero.

Parts List[3]

- 1N4001 diode
- 2N3904 transistor
- 100, 220, 270, 470, 1000, 1.5 k, 2.2 k, 4.7 k, 6.8 k and 39 kΩ, ¼ W resistors
- 3 each 10 µF, 25 V electrolytic capacitors

Recommended Reading

Even for non-engineers, used copies of first- and second-year circuit engineering textbooks make fine workbench references for all sorts of circuit questions. Two of my favorites are Hayt and Kemmerly's *Engineering Circuit Analysis* and Millen and Grabel's *Microelectronics*, both published by McGraw-Hill. The former is good for basic R-L-C circuit mechanics and the latter for semiconductor circuits.

Next Month

You've heard terms before such as "SWR bridge," "noise bridge," "Wheatstone bridge" and so forth. We'll cross that bridge next month as we take a look at bridge circuits and why they are so useful.

[3]A parts kit for the first 61 experiments is available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 1255K. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**. QST

Strays

I would like to get in touch with...

◊ any Amateur Radio ops who are employed by Munich Reinsurance America Inc. — *Mike Haydon, AC2Q, 1420 Fairway, Rantoul, IL 61866, tel 217-892-1658*

AG1YK

HINTS & KINKS

MOUNTING PL-259 CONNECTORS

◊ My hint consists of two basic steps to simplify the assembly of PL-259 coax connectors onto RG-8/RG-213 coaxial cable.

The first step involves the tool used to separate the cable's outer sheathing from its shield. The procedure described in *The ARRL Antenna Book* suggests using a sharp knife.[1] That is the "old standby" method, but it is difficult to judge the requisite depth of the cut as the knife is moved around the periphery of the cable, often resulting in damage to the shield.

The procedure can be simplified somewhat, as previously described in your column, by replacing the knife with a small electrical conduit cutter.[2] The depth of the cut remains the same as the cutting tool is rotated around the outer sheathing of the coax and the depth is increased as the cutting routine progresses. Removal of the sheathing after the cut has been completed can be facilitated by using a sharp electrician's knife to make a continuous lengthwise cut into the sheathing. Then, open the sheathing along the lengthwise cut peeling it off the cable.

The second step consists of soldering the connector inner surfaces to the outer surfaces of the exposed shield braid. After the connector body is routinely rotated onto the end of the cable, the shield braid may be viewed through "solder holes," which in the parlance of the trade are called solder cups.

The problem arises that the solder cups often refuse to accept sufficient heat to bond the braid and the connector body. Oftentimes, the technician heats up the entire connector, trying to make the solder "stick."

The root cause for the problem is exposure to the atmosphere. A layer of oxidation impurities coats the connector surfaces. When heat is applied, the oxidation flakes off and creates a heat barrier between the iron and the connector.

I came across this problem early on in my various "careers" in and around electronics, and it was resolved by an Elmer's advice, which I am now passing on to Hints and Kinks readers. The gimmick involved hasn't failed me over the past 40-odd years.

Apply a few drops of lightweight machine oil (hardware stores stock it as "3-IN-ONE" oil; previously it was called "sewing machine oil") into the solder cup before applying the soldering iron and solder. The oil should cover the braid and the sides of the hole.

Dipping the nose of the hot soldering iron into the hole and holding it there for maybe 2 seconds maximum will cause the impurities to float to the top of the oil. Then, quickly apply the solder into the hole along the nose of the iron. The molten solder will "cup up," forcing some of the oil out of the solder hole. Instant removal of the solder and the hot iron will facilitate fast cooling of the braid-connector joint.

The job won't take more than 5 seconds — 10 max — and there's no need for any additional heat. If the cooled solder has risen over the top of the cup, slide the side of the soldering iron laterally across the solder to smooth it out. You may elect to wipe off any excess oil. I seldom bother, because the oil also serves as a corrosion inhibitor on the outer surface of the connector. Rotate the cable and duplicate the soldering application in as many holes as necessary (I usually stop at two).

I use a middleweight Weller iron, dual temperature, 100/240 W. It's more than enough. This "oil-n-heat" method can also be utilized when making ground connections on large chassis areas. Then it's convenient to prepare the solder spot by using a little child's (modeler's) clay to form a cup around it. That way, the oil isn't apt to migrate and a lot of impurities can be boiled off the mating surfaces. *— 73, Mike McAlister, KD6SF, 7570 Dartmouth Ave, Rancho Cucamonga, CA 91730-1534*

MFJ CUB DIAL LABEL

◊ I recently built a 40 meter MFJ Cub in the ARRL Laboratory. It's a great little radio to operate, but lacked dial calibration. An idea came to me after labeling a CD-ROM: Use the little donut left over after peeling off the CD label.

First, remove the tuning knob. Cut the donut to fit and place it around the tuning shaft. Rotate the tuning shaft fully clockwise. Position the tuning knob a little past the 4 o'clock position and tighten the knob to the shaft. Calibration marks can be carefully made by using a receiver with a digital readout and a fine point pen (you could also use an accurate signal generator). Removing the knob made writing the numbers on the dial a lot easier (see Figure 1). ARRL staff members who have built the Cub now use this method for dial calibration. Someone who is skilled with label making software could produce a label with a neater appearance. *— 73, Bob Allison, WB1GCM, ARRL Test Engineer,* **wb1gcm@arrl.org**

Figure 1 — Bob's Cub transceiver sporting its new, calibrated label.

PROJECT BOXES ON THE CHEAP

◊ How many times have you built a slick little circuit that needed just the right small project box? How many times have you dipped into the junk box only to come up with something that just plain old won't do the job?

What's worse, take the time to run down to your favorite discount electronics store (and in some cases, not so discount stores), only to find that the exact box you want is too expensive, too ugly or not there. Not that amateurs are "thrifty" or anything, but we would rather find the exact part in our junk boxes or at least find the parts rather inexpensively.

As we all know, hams are a resourceful lot. Some of us addicted to that resourcefulness, as alluded to above. This ham is very partial (I won't say addicted) to frequent trips to the local thrift stores. Visit the store of your choice —the Veterans, Goodwill, St Vincent de Paul, etc. Take a look in the "electronics" section. I find them often in the back or in the corner of the store where you will find the ubiquitous old black and white and color TVs and the equally ubiquitous VCRs (maybe even a Beta model). Occasionally you may run across some antique finds, such as a tube radio, lots and lots of AM/FM radios and recently a section for PCs and associated peripherals. Stop here.

If you were into PCs in the '80s and early '90s you will remember that printers were expensive, as were modems, and to share a video monitor, keyboard and a mouse was almost unheard of. To the rescue came a multitude of small well made switch boxes. I have found parallel switch boxes to share printers, serial switch boxes to share RS-232

[1]Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order no. 9876. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]R. Arnold, AF8X, "Preparing Coax," *QST*, Feb 2006, p 69.

Steve Sant Andrea, AG1YK ♦ Assistant Editor ♦ h&k@arrl.org

devices and even early model KVM (Keyboard, Video, Monitor) switches to share one set of peripherals with several CPUs. There are even video signal switchers.

The prices on these little jewels beat the socks off of the "discount" electronics store prices. I have spent from $1 to $3 for these boxes. My best find so far (and my last) has been at the local Goodwill store where I ran into a cache of 18 switch boxes still in bubble wrap and in their cardboard boxes for $1 each; total outlay was $18. My wife will not concede that I made a good purchase, but then, I'm not sure I have 18 cute little circuits to construct and put in my boxes!

Some of these boxes come with a few pretty good components. For instance, a big multiposition switch is almost always included (sometimes push button switches); several jacks, generally DIN, RS-232 or parallel ports; DB25s, and a pretty good adult sized knob. The boxes are generally small, say 6 inches wide × 2 inches high × 4 inches deep, and fit on the operating desk nicely.

My first attempt to use one of these small boxes was when I was re-experimenting with crystal radios. As a kid I was fascinated by the "free radio" that a crystal set provided. I had built many kinds of crystal radios and housed them in things like matchboxes and other small pill boxes. They worked very well.

I had just built a high performance crystal radio using toroids and even though the sensitivity and selectivity were very good for a crystal radio, I still found that strong stations nearby could really wipe it out. Harken back to the old AM days, where we (some of us who remember AM) used the "Exalted Carrier" method to bring up the weak stations. That same technique can be used with crystal radios. I found a slick oscillator circuit on the Web that I built and rebuilt, finally building it in one of the cast-off switch boxes. (Works well!)

Need a project box? Go to your local thrift store! — *73, Dennis Merritt, WB6UHQ, PO Box 247079, Sacramento, CA 95824-7079,* **wb6uhq@arrl.net**

DISPLAY SCRATCH REPAIR

◊ It is possible to remove scratches from a plastic display. Now that I am retired and no longer in the electronics servicing business, I will reveal one of our shop secrets. A product by the name of BRASSO is commonly available in stores that sell household cleaning products. A few wipes with a soft cloth moistened with BRASSO will make scratches disappear as if by magic. Use it on electronics, watch crystals, your spouse's tableware, etc. — *73, Harold Wade, W4NVO, 102 Edisto Dr, Summerville, SC 29485,* **halbwade@bellsouth.net**

SPRAY GREASE WARNING

◊ While reworking a rotator that survived Katrina, I decided to use up some spray lithium grease instead of buying a new tube of grease. Everything was fine until I reassembled it and tried it out on the bench. There was the kind of *"whump"* nobody wants to hear; it sounded like the kind of an arc that welds wires together and ruins circuit breakers.

After I reopened the case, I found nothing wrong. The fuse in the controller was intact and the gears ran fine. Then I noticed a spark in the contacts. The propellant in the spray can was petroleum-based and there was enough vapor dissolved in the grease to reach lower explosive levels inside the rotator case after I closed it up. If you use spray can grease on a rotator, give it an hour or so for the propellant to evaporate before reassembling it. — *73, Patrick Hamel, W5THT, and WD2XSH/6, 1157 East Old Pass Rd, Long Beach, MS 39560,* **pehamel@cableone.net**

Hints and Kinks items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given hint will work for your situation, we make every effort to screen out harmful information. Send technical questions directly to the hint's author.

QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **h&k@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether praising or criticizing an item, please send the author(s) a copy of your comments. QST

New Products

TIMES MICROWAVE FLEXIBLE LMR-400 COAXIAL CABLE

◊ LMR-400-UltraFlex-FR is a more flexible version of LMR-400 50 Ω coaxial cable from Times Microwave. The new cable has a stranded center conductor for greater flexibility and a fire retardant polyethylene jacket. LMR-400-UltraFlex-FR is also UL listed CMR (PCC-FT4) making it suitable for riser-rated installations. Loss is slightly higher than standard LMR-400, and the new version is compatible with standard LMR connectors, installation tools and accessories. Price: $1.95 per foot. For more information, see your favorite dealer or **www.timesmicro.com**.

MOBILE/BASE STATION DUPLEXERS FROM PALADIN RF

◊ Paladin RF offers two compact duplexers that can be used in mobile or base station environments. The PRF-D450-4 is a 100 W duplexer optimized for operation in the 70 cm amateur band but tunable from 406 to 470 MHz. Typical insertion loss is rated at 0.6 dB with 85 dB rejection for 5 MHz spacing. The PRF-D1270-4 is rated for 100 W and optimized for operation in the 1240-1300 MHz amateur band. Typical insertion loss is rated at 0.6 dB with rejection of 85 dB for 12 and 20 MHz spacing. Each unit measures 2.5 × 8.5 × 12.25 inches (HWD) and weighs 7.7 pounds. Price: $799 (Canadian). For more information, visit **www.paladinrf.com**.

AR-MINI HANDHELD RECEIVER FROM AOR

◊ The AR-Mini from AOR USA is a compact handheld radio capable of receiving signals from 100 kHz to 1.3 GHz (cellular blocked) in the AM, FM and wide FM modes. Features include a large display, 1000 computer programmable memory channels, up to 22 hours of battery life, a water-resistant case and two VFOs. Included is a built-in ferrite bar antenna for AM reception between 100 kHz and 5 MHz. A standard SMA connector may be used with the provided flexible antenna or with a mobile or outdoor antenna. Price: $299. For more information, see your favorite dealer or visit **www.aorusa.com**.

ALPHA 8410 AMPLIFIER

◊ The Alpha 8410 amplifier from Alpha Radio Products is rated for 1500 W output (50-55 W drive) and covers 160-10 meters. This manually tuned amplifier uses an enhanced version of the RF deck found in the Alpha 99 and features two 4CX1000 tetrodes. The 8410 also includes vacuum relay QSK, extensive fault protection, improved screen grid regulation and provision of USB and serial ports for remote monitoring and performance data logging. Price: $5895. For more information, visit **www.alpharadioproducts.com**.

Kids Day 2009: Fun for All Ages!

Your next opportunity to introduce a young person to Amateur Radio is Saturday, June 20, 2009.

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

We are pleased to introduce two new Kids Day managers: Mark Beckwith, N5OT, and David Hodge, N6AN.

"I listened to my first shortwave radio when I was 9 years old," Mark writes. "I loved learning at a young age that the world was made up of people who didn't all think the same things. When I was 11, I tuned across some people talking to each other in friendly conversation. It turned out one of them was in my own neighborhood. Boy was I hooked ... and got my license at 13! I think getting kids on the shortwave opens magnificent doors at a time when they are most receptive. My 12 year old daughter, Megan, loves Kids Day. Get a kid on the air!"

David is just at excited as Mark. "When given the chance to help promote Kids Day I didn't hesitate," David writes. "I was 14 when first licensed in 1969. Ham Radio is still a thrill 40 years later. My longtime friend, Mark, N5OT, and I hope to inspire you to get the kids in your life on the air. My 12 year old son, Alan, whose photo has appeared here, is my inspiration."

Look for Mark and David to provide lots of interesting items and suggestions for help get kids on the air during Kids Day…or any other day, for that matter!

RICHARD HAYMAN, WN3R

Three grandkids of Dick Hayman, WN3R, enjoy operating Kids Day back in January. Not only did they make some QSOs, they also built several kits!

Who Knew that Shouting Out your Favorite Color Could be so Much Fun?

For the parent ham or host:

- ✔ Use a CW reader program such as *CWGet* (**www.dxsoft.com/micwget.htm**).
- ✔ Have the kids make and exchange their own QSL cards.
- ✔ Make a special logbook for each kid.
- ✔ Be sure to request the participation certificate from BARC (see sidebar).

For the radio club host:

- ✔ Have an open house at the club station.
- ✔ Promote Kids Day in your newsletter.
- ✔ Give out your own certificates and blank logbooks.
- ✔ Sponsor a pizza party after the event.

For the kids:

- ✔ Mic fright? Make up cue cards and point to each thing to say.
- ✔ Bored? Share the station with a friend, operate in short stretches.
- ✔ "What's That Do?" Construct a "pretend radio" with knobs and switches.
- ✔ Break the ice by arranging a schedule with another local family

Find out more about Kids Day by visiting **www.arrl.org/FandES/ead/kd-rules.html**. Don't forget to check out the certificate at **www.arrl.org/FandES/ead/kids-day-survey.html**. We are always looking for pictures of the kids operating your station so that we can share them with others, so send them to **kidsday@arrl.org**.

Kids Day Rules

Date: Saturday, June 20, 2009

Time: 1800-2400 UTC. No limit on operating time.

Suggested exchange: Name, age, location and favorite color. You are encouraged to work the same station again if an operator has changed. Call CQ KIDS DAY.

Suggested frequencies: 3.740 and 3.940 MHz 7.270 MHz 14.290 MHz 18.140 MHz 21.360 MHz 24.960 MHz 28.390 MHz and 2 meter repeater frequencies (with permission from your area repeater sponsor). Observe third party traffic restrictions when making DX contacts.

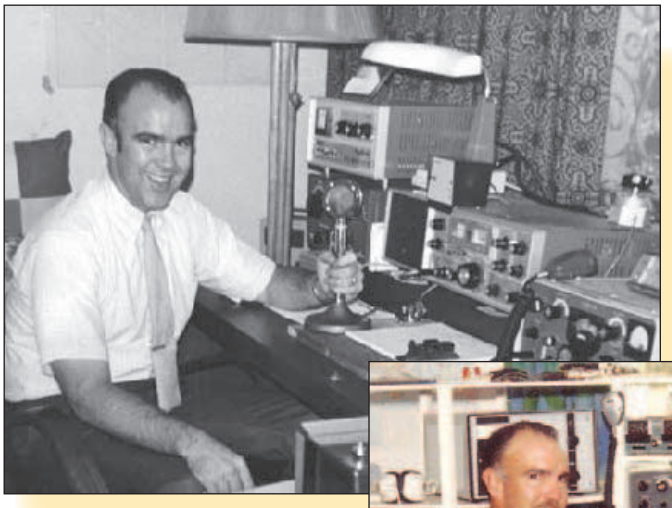
Awards: All participants are eligible to receive a colorful certificate (it becomes the child's personalized sales brochure on ham radio). Please visit **www.arrl.org/FandES/ead/kids-day-survey.html** to complete a short survey and post your comments. You will then have access to download the certificate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

N4HX: Amateur Radio Ambassador

A Foreign Service officer remembers his worldwide ham radio adventures.

J. R. "Bull" Bullington, N4HX (ex-HS5AFJ, N4HX/TT8, TYA11, 9U5JB, 5U7JB)

Ham radio helped point me toward a diplomatic career and it enriched my experiences in some of the exotic places around the world to which that career took me. It entertained me with the thrills of operating as rare DX, it connected me to family in the pre-Internet days of phone patches and on a couple of occasions it helped me get safely through dangerous situations. Today, from the vantage point of retirement in an antenna-restricted community, it ranks high among my pleasant memories.



Bull at HS5AFJ, Chiangmai, Thailand, 1972.

At TYA11, Cotonou, Benin, 1980.

My first awareness that there were such things as embassies and consulates developed when I talked to some Americans stationed at them in the late 1950s while visiting the ham shack of my high school buddy in Chattanooga, Jim Bishop, W4IES. This aroused my interest in both ham radio and the Foreign Service. I was licensed in 1958 as K4LSD (changed to N4HX in 1971 when I upgraded to Extra class) and I entered the Foreign Service in 1962, immediately after graduating from Auburn University.

From Washington to Southeast Asia

My initial assignment was in the State Department in Washington, where I shared a small apartment with some other young Foreign Service Officers. In Washington, I was unable to get on the air for several reasons (poverty and a portfolio of student loans to repay not least among them). My first overseas assignment was to Vietnam in 1965. There, too, ham radio was impossible, due to wartime restrictions.

After 3 years in Vietnam, a year at Harvard to get a Master's degree and a year of Thai language training at the Foreign Service Institute, in 1971 I was assigned to the US consulate in Chiangmai, Thailand. Fred Laun, K3ZO, a fellow Foreign Service officer, had just completed an assignment there and he left me some of his equipment as well as local ham contacts and tips on how to get licensed.

Soon, I became HS5AFJ. I built a Heathkit SB-101 transceiver and SB-220 amplifier, and homebrewed a 4 element triband cubical quad on a 30 foot boom. The quad worked magnificently, making me one of the bigger guns in the Southeast Asian DX community as well as gathering crowds of neighbors who watched its majestic rotations in awe, speculating on why the strange American would build such a contraption. The problem was not keeping it on the air but in the air, as my skills at fabricating a tower proved to be considerably short of what was required for this monster.

The third time the antenna blew down, one of the Thai employees at the US consulate, whom I had enlisted to help with erecting it, informed me that the problem was undoubtedly related to the fact that my house was on the site of an ancient battle between the forces of the Thai king and an invading army from Burma. The antenna was disturbing the ghosts of the soldiers buried there, he said. So, with his help and guidance, I engaged a group of monks from the local Buddhist pagoda to come to the house and perform a ceremony to propitiate those unhappy spirits.

The monks, chanting and burning incense as they strung a white ribbon around the yard, must have done their work well, since the next antenna erection survived until the end of my tour in Chiangmai in 1973. (Or perhaps it survived because I hired an instructor at the local technical school to build a new, professionally engineered tower. One never knows.)

Radio in the War Zone

After another assignment at the State Department and limited, TVI-plagued ham operations from a small house in Arlington, Virginia, I was assigned to Burma, first to the consulate in Mandalay and then to the embassy in Rangoon. The Burmese government, then as now, was a paranoid, xenophobic military dictatorship that totally prohibited ham radio. As Political and Economic Counselor at the embassy, I had some high level contacts among Burmese officials. I was vigorous and persistent in efforts to persuade them to let me operate, but to no avail.

Following a year of senior training at the

US Army War College, I was next assigned to another war zone, Chad, as Deputy Chief of Mission (that is, deputy to the Ambassador) at the embassy. Since there was no Ambassador there at the time, for the first several months I was Chargé d'affaires (that is, acting Ambassador). This put me in a good position to approach the Chadian government for a ham license.

But there was no functioning government, in the normal sense of that term. Chad was in the midst of a long-running civil war and the capital, Ndjamena, was ruled by a fragile coalition of mutually hostile warlords. Government ministries were headed by military chieftains, many of them illiterate, and staffed by gangs of armed desert warriors, many of them teenagers. My inquiries about ham radio were met with the silence of total incomprehension.

Nonetheless, I had brought ham equipment with me and I was determined to get on the air. I reasoned that in such politically fragile and dangerous conditions the embassy needed a backup communications system. So I set up my station in an unused embassy office, put a triband Yagi on the roof and proclaimed myself N4HX/TT8. After all, the embassy was sovereign US territory and I was in charge of the embassy, so why not?

Since there had been no ham operation from Chad in several years and I was the only TT8 on the air, I quickly created a considerable stir among DXers. Some questioned my legitimacy, including those in charge of the DXCC program. Eventually, I was able to explain the situation with sufficient persuasiveness that my operation was allowed for DXCC credit. It was during my year (1979-80) as N4HX/TT8 that Ghis Penny, ON5NT, became my QSL manager, a position he maintained throughout all of my subsequent ham operations.

My time in Chad came to an abrupt and exciting end when the warring factions that had temporarily come together as a coalition "government" in Ndjamena resumed their suspended civil war. Fighting was heavy in the city and we Americans and other foreigners, even though we were not specifically targeted, were unable to leave our homes, much less evacuate. By this time, a new US Ambassador had arrived and I was his deputy. Our houses were side by side in a single compound but the embassy communications officer lived on the other side of town. I had to exercise my ham skills to operate our VHF net among the 25 Americans in the city as well as a Collins KWM-2A transceiver that was set up in the Ambassador's house for emergency communications with Washington. My ham equipment was all at the embassy, and thus inaccessible.

After 3 days of nearly constant combat, my boss and the French Ambassador were able to persuade the warlords (amazingly, the local telephones still worked) to call a temporary truce to enable foreigners to evacuate. We hastily made our way to the French Foreign Legion base a few kilometers north of town and the next day the French Air Force flew us to Douala, Cameroon, where we were able to get a commercial flight back to the United States.

I always wondered if the desert warriors who looted the US embassy ever figured out what to do with my Yaesu FT-1000.

The German Ambassador, left, and Beninese Minister of Communications, center, visit Bull at TYA11, 1982.

At 9U5JB, Bujumbura, Burundi, 1983.

Ghis Penny, ON5NT, with Bull at TYA11, 1981.

A More Benign Benin

My next assignment was as Permanent Chargé d'affaires at the embassy in Benin, a country in western Africa between Nigeria and Togo. This was functionally equivalent to being Ambassador. The government of Benin was at that time (1980-82) a Marxist military dictatorship that was implacably hostile to the United States, so we had decided to maintain diplomatic relations at less than ambassadorial level in order to show our displeasure. Unlike in Chad, this was at least a functioning government and there was an office in the Communications Ministry that was authorized to issue ham licenses.

I soon discovered that the bureaucrats in this office were unwilling to license an American, particularly the chief American diplomat, without political authorization. So I arranged to call on the President to ask, as a personal favor, that he permit me to operate ham radio during my assignment. President Kerekou, formerly Sergeant Kerekou of the French Army, may or may not have understood what I was asking for, but fortunately for me he was in a good mood, having recently imbibed most of a bottle of French cognac. He told the Foreign Minister, who was sitting in on the meeting, to give me the necessary permission.

A Very Wrong Turn

A week later, I received a diplomatic note from the Foreign Ministry authorizing me to operate ham radio in Benin, with the call sign TYA11. The drafters of the note were manifestly not familiar with ham radio call signs and no one in the Communications Ministry had enlightened them as to their customary configuration. At least they got the TY prefix right.

My first contact, an American on 20 meters, told me to go back to the aviation bands where I belonged. Eventually, with a copy of the diplomatic note mailed to ARRL, I was able to establish my legitimacy in spite of the nonstandard configuration of the call sign.

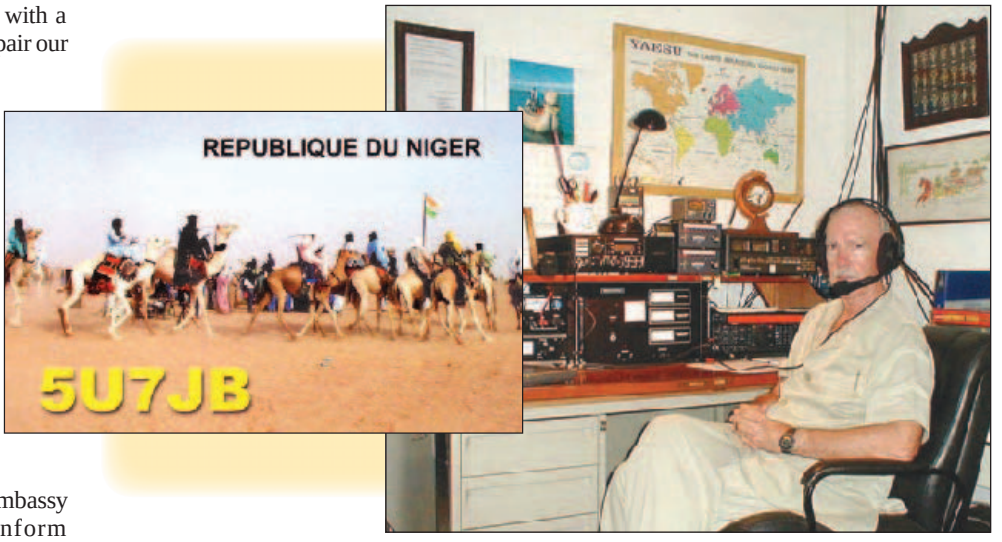
The Ambassador's residence in Cotonou, where I lived, is a large, two story house overlooking the Atlantic Ocean, with a flat roof that proved ideal for mounting antennas. I was very active on all HF bands and also hosted my QSL manager Ghis, ON5NT, and State Department communications engineer Karl Renz, K4YT, for visits. Since I wasn't a CW enthusiast Ghis and Karl supplied the demand for CW contacts.

On the evening of Thanksgiving, 1981,

our embassy communicator, together with a visiting technician who was there to repair our emergency generator, accidentally took a wrong turn on an unmarked road that led into a Beninese military camp. Rather than halting them for questioning, the guards shot into the car, seriously wounding the communicator. They took him to the local hospital and jailed the visiting technician, charging that the two of them were American spies.

I was informed of this incident about 8 PM. In the absence of the communicator as well as his backup person, who was on vacation, I was unable to access the embassy communications equipment to inform Washington of the situation. There was a US embassy regional emergency net, and I had a KWM-2A at my house to be used in such circumstances, but my repeated calls went unanswered — apparently no one was monitoring the designated frequencies. Consequently, I got on 15 meters and quickly contacted a ham in New York. I told him of our problem and asked him to telephone the State Department Operations Center and relay my request that they instruct our nearest neighbor embassy, in Lagos, Nigeria, to listen for my call on the emergency net frequency.

This worked. Within an hour I was in touch with the embassy in Lagos and they sent us a replacement communicator and a doctor, who arrived early the next morning. The Beninese had neglected to post a guard on the hospital room of our wounded communicator, so we were able to take him out of the hospital and transport him to Lagos before they realized what had happened. This saved his leg from amputation. The Beninese kept the generator repairman in jail for 3 weeks, until the State Department persuaded President Mitterrand of France (Benin's principal source of economic support) to intervene and request his release.



At 5U7JB, Niamey, Niger, 2003.

Hilltop Property with Five Acres

My final overseas assignment in the Foreign Service was as Ambassador to Burundi, a central African republic located between Rwanda, the Congo and Tanzania, 1983-86. We were on reasonably good terms with its government and I was quickly able to become licensed as 9U5JB.

The Ambassador's residence in Bujumbura, the capital, is on a hill overlooking Lake Tanganyika, in a 5 acre compound that afforded ample area for several antennas. I was very active on the air and again hosted visits by ON5NT and K4YT for CW operations. Happily, Burundi's long civil war remained on hold during the period I was there and we had no evacuations, shootings or other dangerous incidents.

After a final assignment in Washington, I retired from the Foreign Service in 1989 and took a job as Director of International Affairs for the city of Dallas, Texas. This was followed in 1993 by a move to Norfolk, Virginia, to become Director of a global business center at Old Dominion University, where I remained until 2000. During this period, I was not active in ham radio.

Africa Once More

I decided I wanted one last adventure overseas, including some hamming, so in 2000 I sought a job as Peace Corps country director. My application was accepted, and not surprisingly in view of my previous experience in Francophone Africa, I was sent to Niger, a former French colony on the southern side of the Sahara.

Despite my intentions, my return to ham radio was delayed for more than a year, as I concentrated on my new job leading and supporting 120 young American Peace Corps volunteers in Niger. By 2002, I was licensed as 5U7JB and began operations on all the HF phone bands. As in my previous DX incarnations, I was especially active in contests. Running a kilowatt into a rooftop jungle of homebrew directional wire antennas, I often scored at or near the top for Africa and in the top 10 globally. As one of only two active 5U7 stations, I was in considerable demand. K4YT again visited to make a few thousand CW contacts.

A ham highlight of my stay in Niger was hosting and assisting the Voodoo DX Club on their DXpeditions for the CQ WWDX CW Contests in 2004 and 2005. As serious, expert contesters, they made more than 17,000 contacts each year.

Throughout my diplomatic service I tried to contribute to the ham radio hobby by acquainting senior host country officials with it. When I invited cabinet ministers and other local leaders to dinners and other official functions I would usually take them to the ham shack to make a few contacts. It was unusual after-dinner entertainment for them and perhaps it helped smooth the way for subsequent ham operations. Except for Thailand, my efforts to recruit new hams from among local young people were not successful.

Radio Reflections

Reflecting on these years of operating as exotic DX from the posts to which my career took me, I recognize that ham radio was an ideal hobby, providing endless hours of relaxation and entertainment as well as practical help in emergencies. There was always a new antenna to try out, along with the challenge of building it from locally available material — mostly bamboo, wire and rope. Contests were a particular passion, but I also spent many hours working pileups and giving out contacts to those who needed a new country, ragchewing with old friends and chasing rare DX for my own logbook.

As I took down my antennas and disposed of my equipment in 2006, in preparation for leaving Niger and retirement in Virginia, I realized that this was the end of my last great ham radio adventure as well as the close of my full-time working career. But I cherish some extraordinary ham memories.

All photos courtesy of the author.

"Bull" Bullington, an ARRL life member, is currently retired in Williamsburg, Virginia, where he stays busy as editor of an online professional journal, American Diplomacy *and as a Senior Fellow at the US Joint Forces Staff College. He can be contacted at: 4715 Winterberry Ct, Williamsburg, VA 23188,* **jbullington@cox.net.**

Did you enjoy this article? Cast your vote at:
VOTE
www.arrl.org/members-only/qstvote.html

Find Yourself a Nearby (or a Faraway!) FD Site

Looking to get the word out on where you and your club will be holding Field Day? Traveling and looking for a Field Day site to visit? New to town and not sure where to find a Field Day operation to hook up with?

The ARRL is pleased to continue its online ARRL Field Day Site Locator. Last year over 1500 clubs, groups and individuals listed their Field Day information at **www.arrl.org/contests/announcements/fd/locator.php**. Sort by state and simply click on a club to find their information. Or scroll around the map to search for locations, marked by a red "pin."

5 Tips that Will Help You Get the Most out of FD2009

✘ Whether you're using logging software or a pencil with dupe sheets, make certain you're familiar with the logging process. Practice beforehand makes for an easier time during the heat of the battle.

✘ Be familiar with what exchange information you will be receiving from the other stations. To help, keep a list of ARRL Section abbreviations handy (in other words, this page!).

✘ Always remember: **Safety First!** Make sure guy wires and power cords are marked to prevent someone from tripping over them or inadvertently disconnecting them. And *never* fuel a portable generator while it is running (even so, keep a fire extinguisher on hand just in case).

✘ If you are welcoming visitors to your site, make sure you have someone to greet them and show them around. And don't forget to post your club's/group's information on the ARRL Field Day Site Locator.

✘ Field Day is about *fun!* Why not challenge each person who shows up to complete at least one QSO while they're visiting your site? With the assistance of a control operator, every visitor can be part of the on-the-air fun instead of merely watching others!

US/Canada Section Abbreviation List

Those new to the ins and outs of Field Day will find this list of Section abbreviations useful — for those in the US and Canada, they're an important part of the FD exchange, along with station call sign and class. Be sure to bring a copy of this Section Abbreviation List with you to FD 2009.

1

Connecticut	CT
Rhode Island	RI
Eastern Massachusetts	EMA
Vermont	VT
Maine	ME
Western Massachusetts	WMA
New Hampshire	NH

2

Eastern New York	ENY
Northern New York	NNY
NYC / Long Island	NLI
Southern New Jersey	SNJ
Northern New Jersey	NNJ
Western New York	WNY

3

Delaware	DE
Maryland – DC	MDC
Eastern Pennsylvania	EPA
Western Pennsylvania	WPA

♦Non US stations should be logged as DX for Field Day.

4

Alabama	AL
Southern Florida	SFL
Georgia	GA
Tennessee	TN
Kentucky	KY
Virginia	VA
North Carolina	NC
West Central Florida	WCF
Northern Florida	NFL
Puerto Rico	PR
South Carolina	SC
Virgin Islands	VI

5

Arkansas	AR
North Texas	NTX
Louisiana	LA
Oklahoma	OK
Mississippi	MS
South Texas	STX
New Mexico	NM
West Texas	WTX

6

East Bay	EB
San Diego	SDG
Los Angeles	LAX
San Francisco	SF
Orange	ORG
San Joaquin Valley	SJV
Santa Barbara	SB
Sacramento Valley	SV
Santa Clara Valley	SCV
Pacific	PAC

7

Alaska	AK
Nevada	NV
Arizona	AZ
Oregon	OR
Eastern Washington	EWA
Utah	UT
Idaho	ID
Western Washington	WWA
Montana	MT
Wyoming	WY

8

Michigan	MI
West Virginia	WV
Ohio	OH

9

Illinois	IL
Wisconsin	WI
Indiana	IN

Ø

Colorado	CO
Missouri	MO
Iowa	IA
Nebraska	NE
Kansas	KS
North Dakota	ND
Minnesota	MN
South Dakota	SD

Canada

Maritime	MAR
Saskatchewan	SK
Newfoundland/Labrador	NL
Alberta	AB
Quebec	QC
British Columbia	BC
Ontario	ON
Northern Territories	NT
Manitoba	MB

QST

A Green Field Day

Greenfield, Indiana club uses hydrogen power for an all green Field Day.

Gary Stouder, K9SG, and Greg Chaney, N9MOX

The fuel cell hissed and gurgled as the all green current flowed into our Field Day rigs and "CQ Field Day W9ATG" leapt into the air. The Hancock Amateur Radio Club (HARC) always holds Field Day in Greenfield, Indiana, the county seat of Hancock County, and operates as 2A IN. For the last 6 years, our club has used a fuel cell as a power source during Field Day and each year we have made improvements to *try* to reach our goal of operating Field Day totally on hydrogen power. This is the story of our quest to run a 100% "green" Field Day in Greenfield and our success in achieving it.

In 2002, Bob Perry, W9RWP, a business specialist with Central Indiana Power, entered an essay contest and won an Epac-500 hydrogen fuel cell made by H Power Corporation that has a power output of 500 W. Central Indiana Power really didn't need the fuel cell so Bob convinced them to lend it to our radio club for use during Field Day with free supplied hydrogen (see Figure 1).

Fuel cells use hydrogen and the 21% oxygen in our air as the raw materials to generate electricity. The H Power fuel cell is a polymer electrolyte fuel cell (PEM). It uses a solid polymer as an electrolyte and porous carbon electrodes containing a platinum catalyst to produce electricity very efficiently.

The Epac-500 Hydrogen Fuel Cell

The actual fuel cell stack develops about 55 V at no load and falls to below 40 V at full load. The device converts the dc voltage of the fuel cell stack to 120 V ac with an internal inverter. Unfortunately, the inverter cuts out if the fuel cell voltage drops below about 42 V. This has caused us problems during peak current loads when three rigs are transmitting at the same time. It takes about 5 minutes to get the fuel cell warmed up and producing power once it is started. This fuel cell continuously makes amusing gurgling and hissing noises as water drips out of the exhaust hose and oxygen depleted air is purged from the stack.

Six Years to Plug and Play

Since 2003 we have made changes in our Field Day setup in an attempt to use hydrogen as our only fuel source. In 2008 we were finally successful in reaching this goal. Here is the history of our fuel cell experience:

2003 — HARC used the fuel cell to run one rig most of Field Day and then two rigs for a short period of time. We determined how fast the hydrogen was consumed while the fuel cell was operational. HARC still used a gasoline powered generator most of the time.

2004 — We calculated that there was enough hydrogen in one tank to produce power for most of Field Day. We soon found that the fuel cell's 120 V ac inverter was overloaded and would cut out at peaks while operating multiple rigs. One or two rigs operated from just the fuel cell much of the night and 53 consecutive contacts were made by fuel cell power alone. The fuel cell was capable of running one rig all the time at full load, but two rigs would overload it if they both transmitted at the same time.

2005 — To improve the operation, individual power supplies and batteries were installed at each of three rig locations that were widely separated in two tents and a shelter. The fuel cell operated for 15 hours. During the slower periods it could keep up but the inverter still dropped out at times. If three rigs transmitted simultaneously it couldn't keep up and we had to use the backup generator.

2006 — More efficient switching power supplies were added to the system, but our fuel cell operation was limited to 6 hours due to a lack of fuel. The hydrogen supply tank that we thought was full hadn't been filled the year before. Again, the inverter on the fuel cell

GARY STOUDER, K9SG

Figure 1 — Bob, W9RWP, with the H Power Epac-500 hydrogen fuel cell he won in an essay contest. The red and green LEDs indicate that it is actually running in emergency mode.

GREG CHANEY, N9MOX

Figure 2 — From left, Field Day organizer Bill, N9TT, and power supply designer Jon, WB9CNE, install the current limited power supply system as Charlie, KB9SZX, and Stephen, KB9VOR, look on.

JON REEVES, WB9CNE

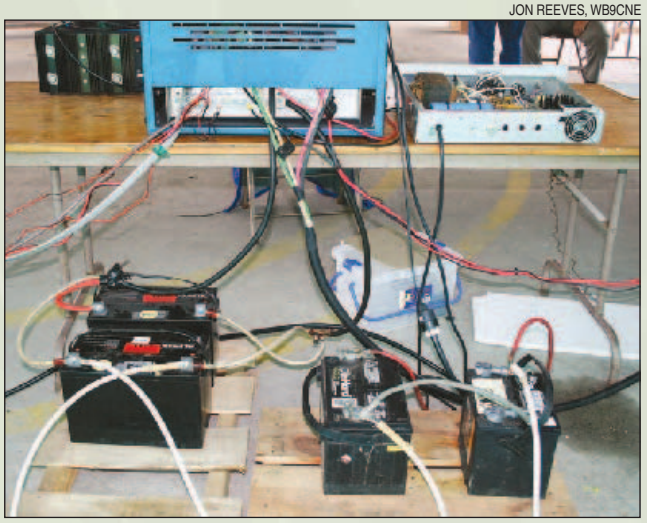


Figure 3 — The 2007 Field Day setup had four batteries connected to the blue distribution box on the table. The distribution box contained part of the 120 V ac to 13.5 V dc power supply with the rest of the power supply in the open box to the right.

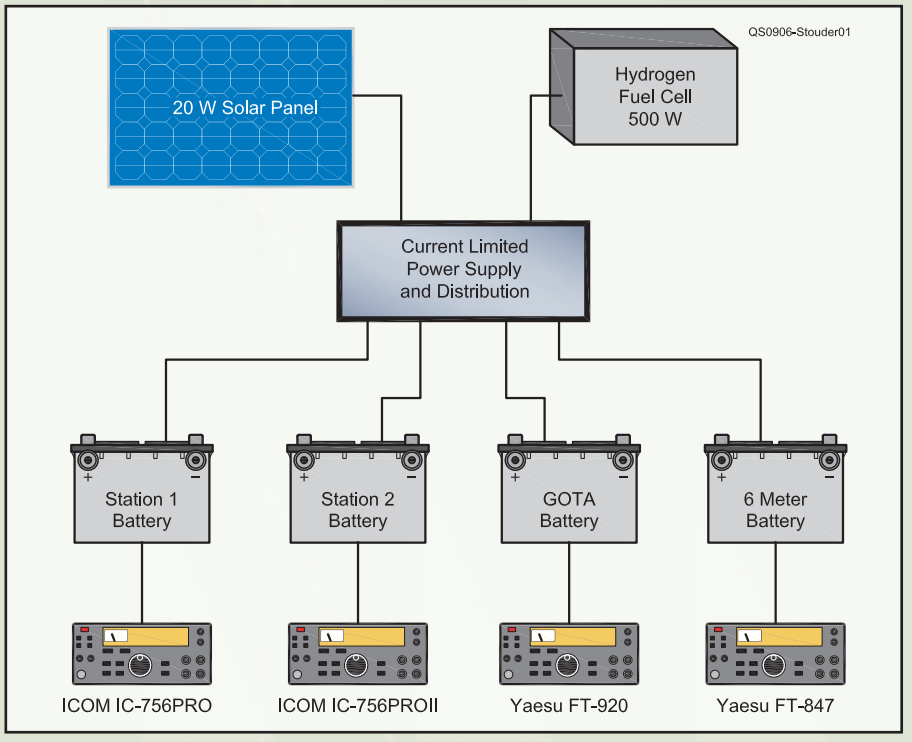


Figure 4 — Schematic for the HARC 2008 hydrogen fuel cell system.

would cut out periodically.

2007 — After 2006, Jon, WB9CNE, did some experimenting to determine how much time-averaged current we would need to operate the rigs. He designed a power supply that wouldn't exceed the maximum current supplied by the fuel cell and would be capable of keeping four large batteries in a central location fully charged while he was using three or four rigs (see Figure 2). Between 2006 and 2007 Jon built this power supply and distribution system and tested it prior to Field Day with the fuel cell. In 2007 all of our stations were moved within about 40 feet of each other inside an open pavilion so we could use a common dc bus. The fuel cell and power supply combination acted as a power supply and battery charger to keep the centrally located batteries charged (see Figure 3). Three rigs ran very successfully, but the power supply consumed so much power that we ran out of hydrogen about 5 hours before Field Day was over. Most of our 2007 Field Day operations were made using the fuel cell as the only power source.

2008 — We worked out the bugs and rented an extra hydrogen tank, since we had been successful the previous year until we ran out of hydrogen. The only significant change was placing one auto battery near each of the four rigs so we could reduce the size of the 13.5 V wiring between each battery and the power supply. With this configuration each battery would supply the peak current required during transmission periods and only a short length of power cable was needed (see Figure 4).

Other than a test of our backup gasoline generator and disconnecting the rigs for an hour during a thunderstorm, we ran 100% of Field Day with four rigs running all of the time. We kept a 20 W solar cell array donated by N9TT connected to the 13.5 V distribution bus during the day since it produced a tiny bit of free power and was indirectly powered by hydrogen fusion from the core of the sun.

The Final Counts

The Hancock Amateur Radio Club Field Day maximum hourly rate was 119 contacts per hour and we made 1181 contacts. All of these contacts were made on hydrogen power and we had enough hydrogen left over for at least 12 more hours of operation.

We aren't aware of any other Field Day groups that have run Field Day for the last 6 years with a fuel cell supplying a large percentage of their power. We were finally successful in running all of our Field Day operation using four auto batteries with a 500 W fuel cell as a power supply/battery charger. This arrangement enabled us to handle the peak loads that the fuel cell was unable to handle by itself.

The most pleasant benefit of using a fuel cell is the elimination of noise and fumes from a generator and the fact that the fuel cell can be right in our midst entertaining us with the gurgling and hissing noises.

Gary Stouder, K9SG, an ARRL member, has been licensed since 1991 and enjoys DXing and contesting. He was a member of the K5D DXpedition to Desecheo Island and the 3Y0X DXpedition to Peter I Island and is also a member of the Caribbean Contesting Consortium that operates PJ2T from Curacao. He is a family physician and has a part-time medical practice limited to diabetes treatment. Gary can be reached at 30 Pauls Ct, Greenfield, IN 46140, **k9sg@arrl.net**

Greg Chaney, N9MOX, an ARRL member, is primarily interested in local communications. He has been the ARES® Emergency Coordinator for Hancock County for more than 10 years. Greg's weather station data is available at **weatherlink.com**, *the Weather Underground and at the Citizen Weather Observer Program (CWOP) through APRS. He has operated Amateur TV, satellite and digital modes. Greg has been a development chemist for 32 years at Vertellus Specialties in Indianapolis where he does bench chemistry, scale-up, prototyping, instrumentation and equipment installation and modification. Greg is also the technical media coordinator for his church where he installed the current sound and video system. He can be reached at 523 N Windswept Rd, Greenfield, IN 46140-7994,* **xomeht@gmail.com**. QST

Out of the Frying Pan and Into the — *Pileup*?

A new ham sweeps up some fun in the Sweepstakes.

Larry Cody, N4LEC

November 16, 2008, 10 PM Eastern Time — with a mix of elation, contentment and more than a little relief I turn off my logging program, shut down the RIGblaster and back up my log file once more. I've passed a major milestone in my Amateur Radio "career." I've participated in what one contact called "probably the most difficult and challenging contest for a newcomer" — the ARRL November Sweepstakes (Phone)!

"Newcomer" is absolutely dead-on. Not only was this my first major contest but on top of that I'd been licensed for all of 6 months, having received both my Technician and General licenses earlier in 2008. It was actually amusing to hear stations ask "would you send that check again? Did you say 08?" and genuinely gratifying to hear "welcome and good luck" in the midst of the turmoil.

I'm sure the more enlightened of you are thinking I should have found some less intense contest to start with. But considering my first contacts were made on Field Day, I figured I'd take a shot at the big one. After all, how difficult could it really be? I mean, it's just talking on the radio, right?

Listen a Lot, Miss Little

First, I truly want to thank all those Elmers who hammer in the lesson *listen, listen, listen*. I figured out quickly that I was not going to be in the top 10 or even the top 10,000 in score or total contacts. Regular contesters must take courses in speed talking! For the first 30 minutes, I was lucky to get the call sign, let alone the entire exchange! Some of those early exchanges sounded like "CopyKilo-uhuhuhCheckuhuhQSL?" *Whew*, that QSO flew by so fast the State Police couldn't catch it.

After a while I got accustomed to the rhythm and was able to copy an exchange sufficiently well to write it down. Yes, that was my first "light bulb moment." Keep a notepad close and write down everything that doesn't change from QSO to QSO. Most of the big guns camp out on a particular frequency, so with a little patience you can write down the precedence, class, call sign, check year and state. All you need then is the sequence number.

Readability is in the Ear of the Receiver

The next blaze of intuition came when I realized that just because I could hear a station didn't mean they could hear *me*. I spent a good portion of an hour calling "November-Four-Lima-Echo-Charlie" to a station that probably didn't even register my signal. At this point I should mention my spouse, who is still having nightmares about "November-Four-Lima-Echo-Charlie." Happily, she's recovering well with therapy and medication.

So I'm on a roll, taking notes and making QSOs — then nature throws me a curve. I found out the hard way that as the day progresses stations move west with the sun, so stations you heard on 15 meters an hour ago are gone now. The point is that you have to plan around what band is open at what time to which area. I think they call this "prioritization," but to me it meant a few lost contacts and quite a bit of searching "dead air."

Finally in Gear

By early Sunday morning I had learned to know when to call, when to respond and when to change frequency. I was having the time of my short little ham life. I was enjoying making contacts and adding to my Worked All States list.

Only another Amateur Radio enthusiast will understand my excitement when I heard the flagship station of the ARRL responding to *me* and was able to log "W1AW 38 CT" or my absolute glee when 30-plus minutes of effort resulted in a solid QSO with WP4SK in Puerto Rico.

I learned a lot about the principles of Amateur Radio, got to see those principles demonstrated in the real world, made a few new contacts and maybe some new friends, but most importantly I had *fun*. After all, isn't that what we're supposed to be doing?

I'd like to thank those stations who worked hard to pull my signal out of the ether, those who paused long enough to say hello or welcome or the like, and especially those stations who had enough power and points to ignore me and my little 100 W class A station but didn't.

What was that, honey? Well, I've got to run now, time for the YL's meds. 73 and thanks for the QSOs!

Larry Cody, N4LEC, divides his time between 2 meter FM and chasing DX and WAS on 20 and 40 meters. Larry also dabbles in PSK31, EchoLink and IRLP. He is a member of the Paulding ARC, Carroll County ARES and the ARRL. Larry is currently a security professional with a global IT security firm. His spouse is a registered nurse and together they are active in several charitable organizations helping those in need. He can be contacted at 4147 Birch Bark Way, Douglasville, GA 30135, **n4lec@arrl.net**

Resources for New Contesters

If you're curious about Amateur Radio contesting, there are several resources available to help you get started. Stop by these Web sites for the "How-To" and join in on the fun!

- **www.arrl.org/contests**: The "ARRL Contest Branch" page includes access to official rules, log sheets and information on how to submit your contest log.
- **www.contesting.com**: The Web's home for serious contesting! Contesting.com includes information on all aspects of contesting.
- **http://rtavan.googlepages.com/radiocontesting**: An article by Rick Tavan, N6XI, explaining what Contesting is and why it is so appealing.
- Scott Herrick, K9JY, offers 30 contesting tips on his blog at **www.k9jy.com**.
- Each month in *QST*, Contest Branch Manager Sean Kutzko, KX9X, writes a column called "This Month in Contesting." Aimed at the contesting newcomer, Kutzko shares tips, tricks and operating techniques and solicits questions from readers.
- The ARRL maintains a list of Amateur Radio clubs that focus on contesting. They are an excellent resource for an amateur interested in getting started. You can see the club list at **www.arrl.org/contests/club-list.html**. — *KX9X*

When Vandals Strike Infrastructure, Hams Provide Communications Support

Just after midnight on April 9, someone climbed down four manholes in the San Jose, California area and cut underground fiber optic cables. The sabotage led to widespread disruption of phone service — including tens of thousands of land lines, an undetermined number of cell phones, Internet access and 911 emergency service — in southern Santa Clara County, as well as in Santa Cruz and San Benito counties. San Jose is the county seat of Santa Clara County. With the infrastructure disabled, local Emergency Management officials called on ham radio operators in their communities to provide back-up communications. According to the *San Jose Mercury News*, Santa Clara County called a local state of emergency, "but worst-case scenarios were successfully avoided through use of ham radios, door-to-door checks and extra-vigilant patrols."

In Santa Cruz County, just over the Santa Cruz Mountains from San Jose, Santa Cruz County District Emergency Coordinator Cap Pennell, KE6AFE, was awoken that Thursday morning just after 5 AM by uniformed police at his door. Sent by Dominican Hospital President Nanette Mickiewicz, the police officers escorted Pennell to the hospital for a brief on this situation: The fiber optic lines that had been cut in San Jose had affected the Santa Cruz hospital's communications infrastructure, cutting off communications from the hospital to the outside world. Santa Cruz is located on the northern edge of the Monterey Bay, about 72 miles south of San Francisco.

"While I was meeting with hospital department heads, Bob Wolbert, K6XX, had started our ARES Resource Net on the W6WLS/W6MOW linked repeaters," Pennell told the ARRL. "During the briefing, the hospital determined to implement HICS/SEMS for this emergency. There hadn't been telephones or Internet anywhere since about 2:30 AM. The hospital's phone system did work, but only within the hospital. Their internal computer local area network wasn't working either, so they were instantly on a 'paper system.'"

By 6:15 that morning, Pennell said they had established tactical radio links on the K6BJ/KI6EH linked repeaters between the Dominican Hospital Emergency Operations Center in Santa Cruz and the Watsonville Community Hospital emergency room; Watsonville is about 15 miles south of Santa Cruz via the Pacific Coast Highway. "We established HEARNET 155.385 simplex between both hospital ERs and County 911; HEARNET is the Hospital Emergency Administrative Radio Network. Once HEARNET (ER staff) and K6BJ repeater (hams) were staffed and operating at both hospitals, I left the hospital to become our initial ham operator at the County Emergency Operations Center and operated as ARES/ACS shift supervisor from there for the rest of the day," Pennell reported.

Throughout the day, Pennell said that hams — including some in Monterey County who had been working telephones — helped dispatch ambulances, conferred with the Poison Center on a children's poisoning case, ordered replacement blood supplies for two hospitals from San Jose Red Cross, relayed a complex major "whole hospital" day's food order to the supplier out of county, tracked down various doctors for emergency consultations and shared status updates from our area. "We did all this while in unity with the County government, public safety agencies and California Emergency Management Agency's Coastal Region," he said. All service was restored by 12:15 AM on Friday, April 10.

Vandalism Takes Out System

San Jose and San Carlos police are joined in their investigation of the cut fiber optic cables — now considered by authorities to be a coordinated act of sabotage — by the Santa Clara County Sheriff's Office and the FBI. The investigation also includes members of AT&T's security force, a handful of trained investigators working for the company. Authorities said on April 10 that evidence collection was complete, but would not elaborate on what exactly they are examining or whether new security measures are in place to prevent similar acts of destruction.

On April 11, AT&T issued a $100,000 reward for information, but bumped up the reward to $250,000 the next day when it discovered that the damage was more serious than originally thought. According to the new reports, some banks in the area were forced to temporarily close, while all service was disabled and hand-written receipts were offered to customers. Many businesses also were forced to either accept cash or close for a few hours, since credit card and ATM transactions were unavailable.

Community Leaders Praise Hams

Gilroy, the southernmost city in Santa Clara County, was also affected. City Administrator/Director of Emergency Services Thomas Haglund expressed his thanks to the Amateur Radio operators who assisted with communications support, saying, "This particular emergency situation underscores that our reliance on technology should be balanced with maintaining the very types of capabilities that you provided to us. Communication is an obvious key to adequately responding to any emergency and the efforts of the Mutual Aid Communicators and the Gilroy Police VIP's provided the necessary communication and public visibility in this instance and demonstrated just how

S. Khrystyne Keane, K1SFA ♦ ARRL News Editor ♦ k1sfa@arrl.org

important your training and skill is to our community. Thank you very much for your dedication and expertise."

Gilroy Police Chief Denise Turner echoed Haglund's comments: "We truly appreciated all of your help during this challenging event! Each of you played a key role in a successful operation. I feel better knowing we have dedicated volunteers like you that will come to our aid in time of need! Thank you!"

FCC CLARIFIES WHAT CONSTITUTES AN AMATEUR RADIO REPEATER

In December 2007, Gary Mitchell, WB6YRU, President of the Northern California Packet Association (NCPA), filed a Petition with the FCC, asking for the Commission to clarify the definition of a repeater. According to Part 97, Section 3(a)(39), a repeater in the Amateur Service is "[a]n amateur station that simultaneously retransmits the transmission of another amateur station on a different channel or channels."

Mitchell sought clarification on the word "simultaneously," asking if it referred to the signal information being retransmitted, or to the fact that the receiver and transmitter must both be active at the same time while acting on the same signal information. On March 23, 2009, the Commission clarified that even if there is a slight delay between what is received and what is transmitted (as in the case of D-STAR and other digital repeaters), it is considered simultaneous if the receiver and transmitter are both active at the same time.

Mitchell pointed out in his petition that while the Commission's Rules specify on which bands amateur repeaters may operate, "some amateur repeaters are operating on bands other than set forth in Section 97.205(b) with systems that are essentially voice repeater stations, but that digitize and retransmit the user's voice, on the theory that because there is a small delay in retransmitting the signal of another amateur station, the signal is not 'simultaneously' retransmitted and, therefore, the system is not a repeater."

In its reply, the Commission pointed out that prior to 1994, a repeater was defined as "[a]n amateur station that automatically retransmits the signals of other stations." This, the Commission told Mitchell, was revised to clarify "that certain accommodations for message forwarding systems do not apply to other operating activities such as repeaters and auxiliary stations." The Commission proposed to define a repeater as "[a]n amateur station that instantaneously retransmits the transmission of another amateur station on a different channel or channels." The FCC ultimately replaced "instantaneously" with "simultaneously" because commenters noted that there is always a small propagation delay through a repeater. As one commenter explained, "The word 'simultaneously' in this case means that the repeater is receiving and transmitting concurrently, whereas each signal might be slightly displaced in time between receive and transmit."

The Commission said that for a repeater to repeat another station's transmission, it "must be able to receive a transmission from another station and retransmit it. Because the word 'simultaneously' in the definition is used to modify 'retransmit,' we believe it refers to a repeater station's transmitter being active when retransmitting the signal received by the repeater station's receiver from another amateur station. We conclude, therefore, that 'simultaneously' as used in the definition of a repeater refers to the receiver and transmitter both being active at the same time."

NORTH DAKOTA HAMS HELP TO HEAD OFF RIVER FLOODING

Early on March 27, the Red River — the natural boundary separating North Dakota and Minnesota — rose to 40.32 feet, more than 22 feet above flood stage and inches more than the previous high water mark of 40.10 feet set April 7, 1897. According to Mark Johnson, KCØSHM, President of the Red River Radio Amateurs (RRRA), hams were "substantially involved" with the flood operations. "This flooding event impacted residents in both North Dakota and Minnesota" he told the ARRL. "National Weather Service forecasters predicted that during the flooding that the river might crest as high as 43 feet."

Johnson said that on March 22, officials in North Dakota's Cass County and Minnesota's Clay County requested the assistance of local amateurs. Hams set up local nets on the WØILO repeater system, using 444.875+ and 145.350–. "Initially, hams supported the area, helping out with coordinating food and water requests for the Salvation Army and Red Cross," he said. "In addition, Clay County hams have been heavily involved with coordinating sand and sandbag logistics."

As the river continued to rise and sandbagging operations neared completion, "ham activity morphed from dike preparations to developing emergency communications for evacuations. As of March 26, we were communicating between three hospitals, two county Emergency Operation Centers, volunteer centers, the Salvation Army, the American Red Cross, the Coast Guard and a helipad. The volunteer response has been enormous."

Johnson told the ARRL that on March 21, the Net was moved "to roughly 12 hour days, and dropped to only five locations. This is a huge help for staffing and we have begun turning volunteers away — but asked that they consider being available if the river starts its climb again, should we start operations back up."

Johnson praised both Minnesota and North Dakota area hams for helping out. "The Red River is a border between North

FCC News

♦**Commissioner Jonathan Adelstein to Leave FCC**: On March 20, President Barack Obama announced his intention to nominate Democrat FCC Commissioner Jonathan S. Adelstein to serve as Administrator for the Rural Utilities Service (RUS), of the United States Department of Agriculture; the nomination will need to be confirmed by the US Senate. It is speculated that Adelstein will not leave the five-member Commission until at least one of the three Commissioner vacancies is filled, since his departure would leave the FCC without a quorum.

According to his FCC biography, Adelstein is a "life-long public servant...[who] has dedicated his career to fighting for the public interest. As a Commissioner, his approach is guided by the key principle that the public interest means securing access to communications for everyone, including those the market may leave behind. Adelstein is a particularly strong advocate for media diversity and localism, and works diligently to encourage increased voices on the airwaves to support a well-informed citizenry. He has worked to promote access to telecommunications and media outlets by minorities, rural and low-income consumers, people with disabilities, and non-English speakers." As RUS Administrator, Adelstein would be responsible for distributing $2.5 billion in broadband stimulus grants.

MARK JOHNSON, KCØSHM

An Amateur Radio operator with the Red River Radio Amateurs Club (RRRA) in North Dakota provides communications support at an Emergency Operations Center in Fargo.

Dakota and Minnesota — we had a substantial number of volunteers and club members on the Minnesota side that worked just as hard. When the flooding situation began we temporarily dissolved any separation of Fargo/Moorhead and the states; we operated as a unified command for the community, not for state or town. This allowed the flexibility to tap into radio resources from both states. During much of the event, Fargo people manned stations in Moorhead, and Minnesota people manned stations in Fargo — we really just operated as if we were one town — going where and when we were needed."

FRANK BAUER, KA3HDO, STEPS DOWN FROM ARISS AND AMSAT DUTIES

Citing personal and professional reasons, Amateur Radio on the International Space Station (ARISS) International Chairman Frank Bauer, KA3HDO, announced on March 24 that he has stepped down from all his ARISS duties. Bauer served as ARISS Program Leader, ARISS International Working Group Chair and as the Radio Amateur Satellite Corporation's (AMSAT) Vice President for Human Spaceflight Programs, a position he has held since 1991. He was also one of two ARISS USA delegates, serving with ARRL ARISS Program Manager Rosalie White, K1STO.

Bauer is currently the Chief Engineer for the Exploration Systems Mission Directorate at NASA. This directorate is developing the next generation human spaceflight vehicles that will take NASA to the International Space Station (ISS) and then to the Moon, Mars and beyond. He is also providing some backup support to the Space Operations Chief Engineer who supports the space shuttle and ISS programs. "Work responsibilities, which have increased substantially over the past couple of years, coupled with some recent health issues within my immediate family, led me to the conclusion that I could not continue to provide the leadership and passion that has been characteristic of my past support to these Amateur Radio endeavors," Bauer explained. "This was a very hard decision. I will certainly miss the phenomenal ARISS international team and our mission to inspire the next generation of space explorers using ham radio as our platform. But I thought it would be best to step down at this juncture. Over the past 12 years, we have developed, mentored and matured an outstanding volunteer team with a wide breadth and depth. I am fully confident that they will keep the ARISS program running smoothly without missing a beat."

AMSAT-NA President Barry Baines, WD4ASW, selected Will Marchant, KC6ROL, as the next AMSAT Vice President for Human Spaceflight Programs and the AMSAT USA delegate of the ARISS International Working Group. ARISS International Vice Chair Gaston Bertels, ON4WF, is the new ARISS International Chairman. Bertels has been a leader of ARISS from its inception and serves as the Chairman of the ARISS-Europe team. He has established a close relationship between ARISS and the European Space Agency (ESA). This resulted in the development and the installation of ARISS L- and S-band antennas on the nadir of *Columbus*, the European Space Laboratory. Bertels also chairs IARU Region 1's Amateur Radio Space Exploration Working Group (ARSPEX).

ARISS International Chairman Frank Bauer, KA3HDO, resigned his ARISS and AMSAT positions, citing personal and professional reasons. In this photo, Bauer reviews the SuitSat-1 experience during the 2006 AMSAT Space Symposium.

ARRL President Joel Harrison, W5ZN, told Bauer that the amateur community and ARRL owed him "a great deal of gratitude and respect for the time and effort you have put into the program for many, many years. That effort has made ARISS — in conjunction with its predecessor SAREX — one of the longest most successful programs in Amateur Radio that focuses on science and education, and it is one that certainly attracts the interest of young and older persons alike to become familiar with Amateur Radio. I want to extend my most grateful appreciation for your work. Having been on the periphery of SAREX and ARISS for many years, I know the dedication and hard work you put into the program; its success today is due in no small part to that effort! On behalf of the ARRL and me personally, thank you."

In Brief

- **FCC, Indianapolis Police Department Address Unlicensed Operations**: In response to an investigation by the FCC, the Indianapolis Metropolitan Police Department (IMPD) has taken action to prevent further use of Amateur Radio frequencies by unlicensed officers. Any Amateur Radio equipment in the cruisers of unlicensed officers was removed by order of IMPD Chief of Police Michael T. Spears. According to the FCC, some IMPD officers were using the radios to supplement their normal communications channels, including using amateur frequencies for tactical communications during drug surveillance. As part of its inquiry, the FCC reminded the IMPD of the large number of tactical channels available on a secondary basis to police departments from the public safety pool of frequency allocations. "We are pleased that IMPD has put a stop to this unlicensed activity," said ARRL Regulatory Information Manager Dan Henderson, N1ND. "The investigation by the FCC, coupled with the expedient cooperation and correction of the problem by the IMPD, eliminates a situation that had raised serious concerns in the amateur community." The FCC stated they would monitor the situation and follow up appropriately if needed.

- **New Section Manager in South Dakota**: On March 16, South Dakota Section Manager Rich Beebe, NØPV, of Sioux Falls, passed away at age 46. Beebe had served as Section Manager since October 2002, running unopposed for each two-year term of office. After Beebe's death, Membership and Volunteer Programs Manager Dave Patton, NN1N, in consultation with Dakota Division Director Jay Bellows, KØQB, appointed Scott Rausch, WAØVKC, of Piedmont, as Section Manager effective April 7. Rausch had served as a South Dakota Assistant Section Manager since 2003; he is also an Emergency Coordinator and an Official Emergency Station within the Field Organization. His term of appointment as Section Manager continues through March 31, 2010. QST

Seniors Linking Amateur Radio and Storm Preparedness

Charles Burke, WA2SLK
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Senior citizens in the TV production program at the SCAN Learning Center, located in Eatontown, New Jersey, produce television shows that are distributed to approximately 500,000 potential viewers covering Monmouth and Ocean, two counties along the New Jersey shore. One of the regularly scheduled 30 minute programs that they produce is called *Safety Links*. This is in addition to three other totally different shows that are created on a regular basis.

The instructor, Charles Burke, WA2SLK, developed the original concept of *Safety Links* when he realized that there were many excellent presentations being made by police, emergency response organizations, medical representatives and social organizations that were not reaching as many people as they could because of budgetary or personnel restraints. It was also realized that through the use of television, a single presentation could be put on tape or a DVD and then repeatedly aired. This, of course, would enlarge the impact footprint to literally thousands of viewers. The best part of airing these programs on special cable television channels is that it could be done for free by utilizing the public, educational and government (PEG) cable access television channels.

Pulling all of these resources together, *Safety Links* was created using a simple format that makes it conducive to presenters. This approach was so successful that it opened the door to almost fifty 30 minute show segments.

Early in 2006, a speaker from the New Jersey State Police, Office of Emergency Planning, was invited to do a presentation on storm preparedness. This initial show was so informative and timely that it launched a series called *Storm Preparedness/Safety Links*. About a dozen segments have now been produced and the latest segment involves Amateur Radio and emergency communications.

In December, 2008, Dennis Dura, K2DCD, Manager of ARRL Emergency Response and Preparedness, was the guest. Working with the show's producer and host, Lois Humowitz, a 30 minute program was organized. We decided to utilize a host and guest interview format with roll-in footage taken from the ARRL's Public Relations resources. This footage describes how Amateur Radio operators helped when Hurricane Katrina struck the Gulf Coast on August 29, 2005. After a final review of the questions that would be covered in the interview, it was now "show time."

Behind the Scenes

For those who have never participated in the recording of a television show, the experience can be a bit confusing. While the finished program starts off and ends with standardized, digitally created segments (or bumpers), these may not be seen at all during the actual taping session. Along with the bumpers, the public service announcements as well as the roll-in video were not actually seen by those in the TV production studio.

CHARLES BURKE, WA2SLK

Figure 1 — Volunteers at the SCAN Learning Center direct the production of the TV show from the control room.

CHARLES BURKE, WA2SLK

Figure 2 — Volunteers operate the cameras from inside the studio where the 30 minute interview about Amateur Radio was conducted.

All of these unseen portions of the program were actually added to the body of the show in postproduction 2 days later (see Figure 1).

Adding to the confusion are microphone level checks, camera shot blocking and duties of all the technical staff (see Figure 2). This resulted in an experience that only vaguely resembled what the finished product would look like. Another unexpected happening is that sometimes, when producing TV shows, segments of a single show are taped individually and not as one long, flowing continuum. In the end, Dennis Dura was amazed at how quickly the time spent on camera passed and how easy it was to accomplish the goals that had been established. Once the equipment is shut down, lights turned off, the set cleared and everyone has left the building, the last stage of production begins. This involves editing, duplication and distribution of the program.

What makes this event noteworthy is that both of the initial goals were realized:

- Documenting the involvement of the Amateur Radio community in providing emergency assistance during disasters.
- Insuring this video program and the information that it contains will be repeatedly aired to a potential audience of over 500,000.

Produce a Show in Your Town

There are other potential outcomes from this project. One is that this effort can be replicated by radio amateurs in their own communities. While the program at the SCAN Learning Center covers a multiroom video production facility, this type of program can be accomplished by Amateur Radio operators or clubs using only a single, borrowed camcorder and a little imagination. Taking advantage of the PEG cable access stations, Amateur Radio operators can then reach out to their entire communities — and even beyond — by illustrating the work that they do as well as the social and professional character of those individuals or groups involved. Again, this can all be accomplished for free.

As an added benefit you can also achieve some totally unexpected results, which did happen in our case. The host of our show was so impressed by the work being done by Amateur Radio operators that she is now hoping to study for her own Amateur Radio license.

ROYAL HARBOR TV INTERVIEWS RESIDENT RADIO AMATEURS

John T Luebbers, K1AYZ
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The Royal Harbor Retirement Community in Tavares, Florida, now has a better understanding of Amateur Radio in general and the resident ham operators that live there. Royal Harbor is a gated community catering to retirees from all over the country who have moved to the City of Tavares, Florida, which is in Lake County. The people who live here are active in many avocations, one of which is Amateur Radio. The hams who reside here have banded together to form the Royal Harbor Amateur Radio Club and are gearing up to serve their communities' communication needs in times of natural disasters such as hurricanes and tornados.

Recently, members of this unique group were interviewed by the Royal Harbor Television Channel 7 to explain to other members of the community just what ham radio is all about and how ham operators can benefit the residents when and if the big blows occur. This community is made up of over 750 homes and is situated on Tavares' southern border on State Route 19.

When severe hurricanes or tornados occur, many times there is a loss of electrical power and telephone service. The normal public service departments such as police and fire can find it difficult to cope with communication needs between each other as well as with contiguous counties, state government and the various federal departments such as FEMA and Homeland Security. This is when Amateur Radio operators are asked to volunteer their communication skills.

These dedicated volunteers provide their personal radios, portable power equipment and radio traffic handling skills to man shelters, put up portable antennas, provide valuable information to emergency management centers and keep the flow of emergency information going to the places that it needs to go.

The ham operators in Royal Harbor have very close ties with other operators in Lake County through the Lake County Amateur Radio Association as well as Lake County Emergency Management personnel. They can often be seen in the community, training to set up portable radio stations so that when the time comes that they are needed they will know what to do.

JOHN T LUEBBERS, K1AYZ

Figure 3 — From left, Alfred Richter, W4ALR, Emergency Coordinator for Lake County, Florida; Carl DePoy, K8BBT, Royal Harbor ham, and Suzanne Cunningham, host for Royal Harbor Television Channel 7 in Tavares, Florida, conduct the TV interview.

On March 11, 2009, the ARRL Emergency Coordinator for Lake County, Alfred Richter, W4ALR, and Carl DePoy, K8BBT, sat down with Suzanne Cunningham, host of Royal Harbor Channel 7, to find out more about ham radio and help explain to the greater community how the Royal Harbor hams stand ready to help their neighbors when all other communication systems fail (see Figure 3).

Thanks to the following radio amateurs from Royal Harbor for helping to plan for this interview: Ken Secora, N9KS; Ted Luebbers, K1AYZ; Garret Collins, W2GGC, and Mike Ward, WA9VIQ. QST

Meet IARU Vice President Ole Garpestad, LA2RR

A vacancy was created when former IARU Vice President Tim Ellam, VE6SH/G4HUA, succeeded to the office of IARU President in February. After careful consideration by the IARU Administrative Council (AC), then-IARU Region 1 Chairman Ole Garpestad, LA2RR, was selected as the nominee for Vice President. After the votes were counted, Garpestad was declared unanimously elected, receiving 73 affirmative votes from IARU Member-Societies. Garpestad's term, as Ellam's, commenced May 9 and is for five years.

IARU Vice President Ole Garpestad, LA2RR

Garpestad joined the Norsk Radio Relae Liga (NRRL) — Norway's IARU Member-Society — in 1972, one year before he was licensed as LA2RR. His service as an NRRL volunteer includes time as a member of the NRRL Board of Directors from 1981-1992. While on the NRRL Board, Garpestad served as Secretary, ARDF Manager and IARU Liaison Officer. He also served as Chairman of the Second ARDF World Championship's Organizing Committee and as a member of the IARU Region 1 Conference's Organizing Committee for that meeting in Lillehammer in 1999. Garpestad topped off his service to the NRRL Board of Directors when he served as NRRL President from 2000-2002.

In 1999, Garpestad was elected to the IARU Region 1 Executive Committee, and was elected Chairman in 2002. He has represented Region 1 on the IARU's Administrative Council since 2001 and has attended IARU conferences in Regions 2 and 3. He has participated in European Conference of Postal and Telecommunications Administrations (CEPT) preparations for WRC-03 and WRC-07, attending both conferences as a Norwegian delegate representing Amateur Radio interests.

Garpestad is a telecom and radio engineer working with development, system design and program management of tactical communications systems for Thales Norway AS (formerly Alcatel). He holds an MSc in electronic engineering and radio technology from the Technical University of Norway in Trondheim.

"Congratulations to Ole Garpestad for his election as Vice President," Ellam said. "I am very pleased to have Ole as part of the officer team and know he will do an excellent job in his new position."

Both Ellam and Garpestad were scheduled to attend the 2009 Dayton Hamvention, their first official outing in their new IARU roles.

REPUBLIC OF THE CONGO AMATEUR RADIO ORGANIZATION APPLIES FOR IARU MEMBERSHIP

In the *IARU Calendar, No 188* dated March 11, 2009, IARU Secretary David Sumner, K1ZZ, reported that the Union des Radioamateurs du Congo (URAC) in the Republic of the Congo has applied to become an IARU Member-Society (IARU Proposal No 245).

Sumner said that the Republic of the Congo (whose capital is Brazzaville) is not to be confused with the Democratic Republic of the Congo (whose capital is Kinshasa); that country's amateurs are already represented in the IARU by the Association des Radio Amateurs du Congo (ARAC). The Republic of the Congo was formerly a part of French Equatorial Africa and became independent in 1960. Its ITU-allocated call sign prefix is TN.

URAC was formed in Brazzaville on October 8, 2008. Its officers are President Mao Monguimet, TN5MM; Secretary General Ulysse Yinda, and Treasurer Chynauldat Bangue. The URAC lists 15 members on its roster, including three licensed radio amateurs.

Sumner said that the URAC has stated to the IARU that it has the ability to meet its financial obligations as a member of the IARU through fees from members; that it is legally able to act in the furtherance of IARU objectives within the Republic of the Congo; that it will adequately represent the interests of radio amateurs throughout the country, and that it will adhere to the Constitutions of the IARU and of IARU Region 1. The IARU Region 1 Executive Committee has examined URAC's application and has found it to be in order and recommends that the two societies be elected to IARU membership. IARU Member-Societies have until August 11, 2009 to return their ballots.

According to the International Secretariat, IARU Region 1 has examined the applications of EARS and KFRR and found them to be in order, and recommends that the two societies be elected to IARU membership.

The IARU Constitution provides that a proposal is adopted "upon the casting of affirmative votes by a simple majority of the Member-Societies who have submitted, within the specified time, a vote or abstention, either on that proposal or in response to one of the three preceding issues of the *Calendar* which contained proposals for consideration by the Member-Societies." Past issues of the Calendar can be found on the IARU Web site (**www.iaru.org/calendars.html**). QST

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This Month in Contesting

Sean Kutzko, KX9X
ARRL Contest Branch Manager, kx9x@arrl.org

FIELD DAY — A GREAT TRAINING GROUND

Every fourth weekend in June, amateurs from all across North America — and several places around the world, frankly — take their rigs and antennas to a local park, pasture or mountaintop and operate away from the many comforts of home. This is Field Day, the largest on-air operating activity in the world.

Field Day can be approached in a variety of ways: emergency preparedness, public service and outreach, or simply a fun activity for your local club. Field Day is not a contest; no plaques or certificates are awarded, and no winners are recognized. However, many operators and clubs treat it as one. Indeed, Field Day has given many an amateur (including yours truly) a first taste of the thrill of running a pileup. For the Radiosport enthusiasts, here are tips for maximizing Field Day fun.

For the Operator

Field Day provides a great learning experience for the budding contester. Get hands-on experience with setting up an effective HF and VHF station under less than ideal circumstances. The difficulties all stations experience on Field Day (and learning how to overcome them) will teach valuable lessons for any amateur, including contesters. Here are just a few things you can get experience with at Field Day:

- *Working stations and logging* your QSOs by yourself on a computer at the same time.
- *A new mode*, such as CW, RTTY or other digital modes like PSK31.
- *Side-by-side comparisons* of different antennas (verticals vs dipoles, for example).
- *Propagation:* What bands open to what parts of the country at what time?
- *Troubleshooting:* Rig problems, interference from other stations at the site, etc. Identifying problems and fixing them "on the fly" is an experience common to every contest operation.
- *Efficient operating habits:* Does one person at your Field Day site seem to be working more stations than others? Why? Examine how they are approaching their time behind the mic or key.
- *Pileup busting:* Many Field Day operations occur without big antennas or amplifiers. Almost anybody can bust a pileup with a KW and a big yagi; learn efficient, ethical techniques for getting in the log without all the hardware.
- *The Old Timers:* Listen to what the Old Timers have to offer. Experience teaches wisdom…learn from the wisdom of others.

When I was cutting my teeth in Amateur Radio, I remember one of the great Old Timers, Jay Gooch, W9YRV (SK) would, for several years, bring a homebrew 75 meter vertical to Field Day in the Champaign, Illinois area. He and a friend would take all day to build it, slowly and methodically, then stay up most of the night making many, many QSOs. When somebody of that caliber kept doing something that seemed so meticulous and involved, and then netted the results that followed, you paid attention.

For the Contest Club

Contest clubs are always on the lookout for new talent. After all, a person who enjoys working stations in rapid-fire succession while still maintaining their composure is a highly-sought-after commodity. If your contesting club needs some fresh blood, here are some ways to use Field Day to get more amateurs involved in your contest club:

1) *Are you visiting your local club's Field Day site* and looking for operators who are enjoying running stations? Do they have the interest and the basic skills to take it to the next level? Approach them and be encouraging.

2) *Lead by example:* Participate in your local club's Field Day effort and promote contest-style operating. Bring some literature about your contest club and take the time to talk to those who express interest. Get e-mail addresses and phone numbers of those who do, and follow up with them.

3) *Provide exposure:* If your local club's Field Day effort is mostly HF SSB, set up a CW or digital mode station and work the pileups. If you're a VHFer, offer to set up a VHF station for the club. Class A stations with 2 transmitters or more are allowed a *free* VHF station, meaning it doesn't count as a transmitter for their entry class. Show the new Technicians (and the Generals and Extras, too) what VHF+ operation is all about.

4) *Have your contest club set up a Field Day site of their own*, with the emphasis on teaching budding contest operators. Spread the word to those who want to try a more serious approach to Field Day. Consider it an investment in your contest club's future. Be sure to register your club's activities at the ARRL's Field Day Site Locator, found online at **www.arrl.org/fieldday**.

Field Day is, above all else, about having fun! If your idea of having fun is to treat it like a contest, then take the next step and use it to refine your skills or find others who share your passion for Radiosport. You and your contest club will grow as a result.

Operating Tip of the Month

Know When To Say When. *Sometimes when you are running stations, you will get a caller who is just too weak to copy. Taking too much time to try to work them can kill your rate and possibly jeopardize your run frequency. If you're unable to get them in the log after considerable effort, it's probably best to ask them to try again later and work the stations you can hear.*

CONTEST CORRAL

in association with the *National Contest Journal*

June 2009

Start and Finish	HF	VHF+	Contest Title	SSB	CW	Dig	Exchange	Sponsor's Web Site
Jun 6, 0600Z - Jun 7, 0600Z	3.5-28		Australian Shires Contest	✘	✘		RS(T) and VK Shire or CQ Zone	groups.yahoo.com/group/vkshires
Jun 6, 1200Z - Jun 7, 1200Z	3.5-28		SEANET Contest	✘	✘	✘	RS(T), serial	www.sabah.net.my/seanet/the_contest.htm
Jun 6, 1500Z - Jun 7, 1459Z	1.8-28		IARU Region I Field Day		✘		RST, serial	IARU Society Web sites
Jun 6, 1600Z - Jun 7, 0400Z	1.8-28		Alabama QSO Party	✘	✘		RS(T) and county, state, province, or 'DX'	www.AlabamaQSOParty.org
Jun 13, 1500Z - Jun 14, 1500Z	3.5-28		GACW WWSA CW DX Contest		✘		RST, CQ zone	gacw.no-ip.org
Jun 13, 0000Z - Jun 14, 2400Z	3.5-28		ANARTS WW RTTY			✘	RST, UTC time, CQ zone	www.bartg.org.uk
Jun 13, 0000Z - Jun 14, 2359Z	1.8-28		WFF Green Days	✘	✘	✘	RS(T) and WFF number if available	wff44.com/en/contest/
Jun 13, 0000Z - Jun 14, 2400Z	3.5-28		Portugual Day	✘	✘		RS(T) and district code	www.rep.pt/concursos
Jun 13, 1100Z - Jun 13, 1300Z	14-21		Asia-Pacific Sprint	✘			RST, serial	jsfc.org/apsprint/aprule.txt
Jun 13, 1800Z - Jun 15, 0300Z		50+	ARRL June VHF QSO Party	✘	✘		Grid square	www.arrl.org/contests
Jun 14, 0600Z - Jun 14, 1200Z	3.5-28		Spanish Islands Contest	✘	✘	✘	RS(T), DIE number or serial	www.ea5ol.net/die
Jun 20, 0000Z - Jun 21, 2400Z	1.8-28		All-Asian DX Contest		✘		RST, operator age (YL may send 00)	www.jarl.or.jp/English
Jun 20, 0000Z - Jun 21, 2359Z		50	SMIRK QSO Party	✘	✘		Call sign, SMIRK number, grid square	www.smirk.org
Jun 20, 1400Z - Jun 20, 1800Z	3.5-28		Feld-Hell Monthly Sprint			✘	RST, Feld-Hell number, S/P/C	www.feldhellclub.org
Jun 20, 1600Z - Jun 21, 0200Z	3.5-28		West Virginia QSO Party	✘	✘		RS(T), WV county or S/P/C	www.qsl.net/wvsarc
Jun 20, 1800Z - Jun 20, 2400Z	3.5-28		Kid's Day	✘			Name, age, location, favorite color	www.arrl.org/FandES/ead/kd-rules.html
Jun 27, 1200Z - Jun 28, 1200Z	1.8-28		His Majesty King of Spain	✘			RS, serial or EA province	www.ure.es
Jun 27, 1800Z - Jun 28, 2100Z	1.8-28	50+	ARRL Field Day	✘	✘	✘	Category, ARRL/RAC section or DX	www.arrl.org/contests
Jun 27, 1800Z - Jun 28, 2100Z	1.8-28	50+	QRP ARCI Milliwatt Field Day	✘	✘	✘	Category, ARRL/RAC section or DX	www.qrparci.org

All dates refer to UTC and may be different from calendar date in North America. Times given as AM or PM are local times and dates.
Refer to the contest Web sites for full rules, scoring information, operating periods or time limits, and log submission information.
No contest activity occurs on 30, 17, 12 meters. Serial — Sequential number of the contact. S/P/C — State, Province, DXCC Entity.
Publication deadline for Contest Corral listings is the first day of the second month prior to publication.

Check for updates, additional contests and a downloadable PDF version online at www.arrl.org/contests

~ Kids Day is June 20! See page 65 in this issue for more info! ~

Sean's Picks

■ **State QSO Parties This Month:** Alabama, West Virginia
2009 is the Year of the State QSO Party! Visit **www.arrl.org/ysqso** *for complete info!*

■ **IARU Region 1 Field Day (June 6-7):** Taking your gear to the field has universal appeal. Help our ham brethren in Europe, the Middle East and Africa enjoy their own Field Day by working them!

■ **ARRL June VHF QSO Party (June 13-15):** This is the Big One for North American VHF SSB/CW ops! With Sporadic-E propagation on 6 meters, the band comes alive. 2 meters, 432 and even the microwave frequencies will get quite a workout this weekend. Operate from home, a hilltop or on the road. If your multi-band rig has VHF/UHF on it, this is the weekend to explore these bands. I *love* this event!

■ **ANARTS WW RTTY Contest (June 13-14):** Everybody works everybody in this summer RTTY spectacular. The ANARTS contest is being run by BARTG this year; who knows what the future will hold for this event?

■ **SMIRK QSO Party (June 20-21):** Sponsored by the Six Meter International Radio Klub, this 6 meter only contest occurs in the middle of the sporadic-E season. Throw a 6 meter dipole in a tree (they're only 9.4 feet long), listen for USB signals between 50.125 and 50.200, and work stations over 1000 miles away. The exchange is your Maidenhead grid square. This is a great contest!

■ **QRP Milliwatt Field Day (June 27-28):** Want the ultimate challenge? Try operating Field Day this year with less than 5 W of power! The folks at the QRP-ARCI run this event in tandem with ARRL Field Day, so get in on the fun!

In the May/June "Contesting 101"

This Month in the *NCJ*'s Contesting 101: SO2R: Single-Operator, Two Radios. Kirk Pickering, K4RO talks about how to get started in this style of operating, and why you would want to. Contesting 101 can be found in the *National Contest Journal*, published six times per year. For subscription information, visit **www.arrl.org/ncj**.

JUNE 2009 QUALIFYING RUNS

♦ W1AW Qualifying Runs are 10 PM EDT Friday, June 5 (0200Z June 6) and 7 PM EDT (2300Z) Wednesday, June 17. The West Coast Qualifying Run will be transmitted on 3581.5, 7047.5, 14047.5, 18097.5 and 21067.5 kHz by station K6KPH at 2 PM PDT (2100Z) Saturday, June 13 (40-10 WPM). Unless otherwise indicated, code speeds are from 10-35 WPM.

2008 ARRL November Phone Sweepstakes Results

75th Anniversary Edition brings out the crowds.

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The 75th anniversary edition of the ARRL Phone Sweepstakes was a record breaker in so many ways — increased activity, numerous records broken in all categories, challenging multipliers, and some of the closest races in recent memory. While the sunspot cycle remains stuck at the bottom, conditions were indeed improved over the 2007 running. In 2007, many participants bemoaned the long skip conditions on 75 meters.

This year, 75 meters was much better behaved, with nearby contacts being easy to complete and strong signals from coast-to-coast. Even 15 meters was improved this year, especially if you were fortunate enough to be on the East or West Coasts, Hawaii, or in the Caribbean. 20 meters took the brunt of the activity during the daytime hours, resulting, expectedly, in very crowded conditions.

To the surprise of many, the 2008 Phone Sweepstakes smashed the old record for the number of entries submitted — 1872 entries. Every year, more and more hams discover how much fun contesting is! This year, there were 38 new Section records, and 13 new Division records. (A complete list of new records is available in the Web version of this article.)

The Elusive Clean Sweep

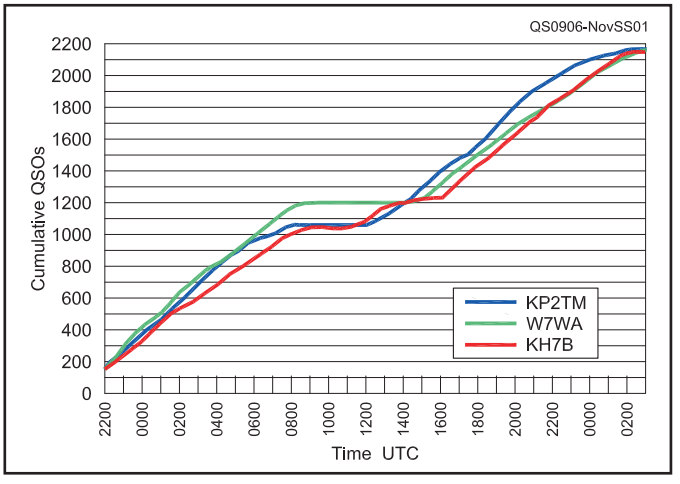
Of course, most participants don't expect to be setting a new record, but Sweepstakes does provide a meaningful goal for all — the "Clean Sweep" (working at least one station in each of the 80 ARRL sections). This year, like most years, there were a small number of sections that presented challenges for many participants. In fact, many lamented missing the Clean Sweep this year. One section really stood out this year for its relative rarity — Puerto Rico. For each of the previous 10 years, Puerto Rico was quite common. This year a number of Puerto Rican stations made QSOs in Sweepstakes, but the total number of contacts from KP4 was not large. Despite the challenges, 258 made the grade for a Clean Sweep this year and another 109 participants were disappointed to come so close, missing only one section.

Close Races

This year, the most exciting close race was for Low Power in Southern Texas. Rene, K5JX, edged out Phil, KD5MMM, by just a single contact! In Eastern Washington, Low Power, Jay, WAØWWW, finished with a seven QSO lead over Tony, WS7V. Only eight QSOs separated Richard, KV2R, from Manny, W2MF, in the Southern New Jersey, Low Power race. Similarly, in the West Virginia, Low Power competition, Marty, W8AKS, bested Gary, W8IVF, by eight QSOs while operating portable from an RV park! Ironically, Marty did not work a single West Virginia station! In Illinois, Low Power is always a competitive section and category, and this year was no exception as nine contacts separated Greg, WR9L, from John, N9LYE. You can't get much closer than a tie, and the Roanoke Division saw just that in 2008. Rich, NN3W (@N4RV) and Jeff, N8II, both scored 264,000 in the Single-op High Power category. Who buys the frosty malts in *that* battle?

High Power Category

After 10 consecutive High Power victories, concluding last year, WP3R took the year off. This opened up the High Power field to serious competition for the #1 spot. Looking at the top runner-ups for the previous years, W7WA, KP2TM (op K9TM), KH7B (op K4XS), K5TR, KDØS (op WDØT), WØSD (op WØDB) and K6NA (op N6ED) were all going to be gunning for the top spot in 2008. The result was the tightest race in any category that this author has seen in many years. Only 4% separated the #1 spot from the #5 spot. Only 26 QSOs separated Number 1 from Number 3.The race between Dan, W7WA; Tim, K9TM, at KP2TM, and Bill, K4XS, at KH7B can only be described as a classic.



The hour-by-hour progress for W7WA, KP2TM, and KH7B, who finished 1-2-3 in Phone Sweepstakes.

Figure 1 shows that KP2TM got off to a quick start, with a 20 QSO lead over W7WA in the first hour. The Caribbean advantage quickly vanished with the sunlight, however, and W7WA jumped ahead in the 2nd hour, a lead that Dan held throughout the evening and night. Surprisingly, KH7B was almost out of the running during the first 12 hours due to a 30-minute power outage during the second hour. At 0900Z, W7WA had a formidable 135 QSO lead over KP2TM, and a 151 QSO lead over KH7B.

Things got more interesting in the next six hours, with differing

	Score	QSOs	Mults	Hrs
Single Operator, QRP				
KC5R	111,520	697	80	24
N9KT	101,280	633	80	24
NX9T	92,400	600	77	23
K9ZO	72,228	463	78	21
NDØC	71,456	464	77	21
NØKE	68,888	436	79	18
W7YAQ	65,832	422	78	22
N8IE	64,622	409	79	21
KIØOV	62,900	425	74	22
KR2Q	62,216	404	77	20
Single Operator, Low Power				
W4AAA (KK9A, op)	237,280	1,483	80	24
K7ZSD	216,618	1,371	79	24
K1BX	211,360	1,321	80	24
N4PN	205,760	1,291	80	24
W3GH	195,604	1,238	79	22
NA4K	187,200	1,170	80	24
NØKK (@ NØAT)	172,220	1,090	79	24
W4LT	166,374	1,053	79	19
N8AA	155,532	997	78	16
ACØW	146,624	928	79	24
Single Operator, High Power				
W7WA	345,920	2,162	80	24
KP2TM (K9TM, op)	344,000	2,151	80	24
KH7B (K4XS, op)	341,760	2,141	80	24
N2IC (AA5B, op)	334,240	2,091	80	24
NR5M	331,520	2,073	80	24
K6NA (N6ED, op)	321,760	2,012	80	24
WØSD (WØDB, op)	313,760	1,961	80	24
KDØS (WDØT, op)	306,560	1,916	80	24
KH7X) (KH6ND, op)	302,080	1,888	80	23
N6BV	294,240	1,839	80	24
Single Operator, Unlimited				
K7RL	342,080	2,138	80	24
W7RN (WX5S, op)	282,240	1,764	80	23
WB1GQR (W1SJ, op)	280,160	1,751	80	24
NØQO	277,280	1,733	80	23
W3GRF (K3MM, op)	270,560	1,691	80	24
K6IF	269,280	1,683	80	24
N6DE (@ N6TV)	262,880	1,643	80	24
W4MR (AA4NC, op)	261,760	1,636	80	24
K6YT (WØYK, op)	258,080	1,613	80	24
N4ZZ	253,760	1,586	80	24
Multi-operator				
W6YI	350,880	2,193	80	24
K5NA	336,480	2,103	80	24
WØNO	286,240	1,789	80	24
K7PU	279,680	1,748	80	24
NØNI	278,400	1,740	80	24
K1LZ	258,962	1,639	79	24
W1AW	252,800	1,580	80	24
W2PV	252,640	1,579	80	24
K2NNY	249,280	1,558	80	24
N5DO	243,952	1,544	79	24
School Club				
KØHC	229,890	1,455	79	24
W1MX	156,262	989	79	24
W1YK	57,512	364	79	21
KD5VVI	43,878	309	71	19
K2CC	38,360	274	70	23
K4FAU	32,706	237	69	10
W8SH	32,292	234	69	16
W5YM	30,020	190	79	13
NØUNL (WDØBGZ, op)	26,936	182	74	9
KØVVY	26,288	212	62	20

off-time strategies. Dan took all six hours off in one break, from 0830Z to 1430Z. Tim took 4.5 hours off, from 0600Z-0630Z and 0800Z-1200Z. Bill chose an interesting strategy, taking only 2.5 hours of nighttime off-time. This left things much closer at 1400Z, with only 10 QSOs separating Bill, Tim and Dan. With daylight, Tim's Caribbean advantage came into play. There's nothing like having 15 meter propagation to nearly all of continental North America, simultaneously. By the time the sun set in St Croix around 2100Z, Tim had built up a monstrous 159 QSO lead over Dan, and a 179 QSO lead over Bill.

Three hours later, with only three hours left, Tim still had more than a 100 QSO lead. Then things got interesting. At 0130Z, the contest was over for KP2TM — he had operated his full 24 hours with 2162 contacts. For KH7B, the contest ended at 0200Z with 2154 QSOs. Meanwhile, remember that Dan took all six hours of off-time in one break. Like the tortoise-and-hare, Dan just kept pushing on in those last hours, eking out a 12 QSO lead—and his first SS Phone victory since 1987!

The rest of the Top Ten was only slightly behind Dan, Tim, and Bill. Bruce, AA5B, traveled to N2IC's southern New Mexico location, taking the #4 spot. George, NR5M, came out of a 15 year contest retirement, putting his new Houston super-station to use for fifth place. Craig, N6ED, operating from K6NA, was the top W6 station, in 6th place. Seventh and eighth places were the battle for South Dakota. This year, Joe Brown, WØDB, operating at WØSD, edged out Todd, WDØT, operating from KDØS. Year-after-year, these two guys are neck-and-neck. Two Hawaiian stations made the Top Ten this year, with Mike, KH6ND, placing number 9 from the KH7X station. Dean, N6BV, finished out the Top Ten list. The top East Coast score was in 11th place, with Bob, NA4BW, operating from K4SSU's station in Atlanta.

Low Power Category

The Low Power category continues to be the most popular category for SS participants. Again, this year more than twice as many logs were submitted for this category (817), compared to any other category. Those making the Low Power Top Ten came from all parts of the United States.

John, KK9A, using the W4AAA call sign, moved up from 3rd place to #1 this year, with 1483 QSOs. This is John's first Sweepstakes victory, as he continues to build his North Carolina station. Brad, K7ZSD, had a solid 2nd place showing from his snowy Oregon mountain QTH. Another Low Power veteran, Art, K1BX, had a little easier time with fickle New England propagation this year, taking the 3rd place spot. Art had a much lower error rate than any other Top Ten finisher, moving him up several places in the standings.

In his 55th year as a ham, Paul, N4PN, took the 4th place spot, with 1286 QSOs from Georgia. Bob, the "Green Hornet," W3GH, stung the competition, with a 5th place finish from Western Pennsylvania. Steve, NA4K, moved into the Top Ten this year, with 1170 QSOs from Tennessee and the #6 spot. Showing that the Top Ten can be made from Minnesota, Kirk, NØKK, placed 7th. Lu, W4LT, jumped into the Top Ten this year as number 8. Not only did he make more QSOs in less time than last year, but cut his error rate by two-thirds. Great show! Rounding out the Top Ten were John Comella, N8AA, from Michigan, and Bill Lippert, ACØW, operating from Minnesota.

Affiliated Club Competition

	Score	Entries
Unlimited Category		
Potomac Valley Radio Club	22,689,100	325
Northern California Contest Club	20,369,120	278
Society of Midwest Contesters	13,037,472	236
Yankee Clipper Contest Club	8,526,302	117
Minnesota Wireless Assn	6,087,726	95
Mad River Radio Club	4,457,660	55
Florida Contest Group	4,184,318	53
Tennessee Contest Group	3,280,172	51
Medium Category		
Southern California Contest Club	4,263,496	44
Frankford Radio Club	2,526,632	38
Alabama Contest Group	2,416,376	25
Central Texas DX and Contest Club	2,333,286	18
Western Washington DX Club	2,226,662	26
Contest Club Ontario	2,167,820	37
South East Contest Club	2,155,194	28
Grand Mesa Contesters of Colorado	2,121,586	25
North Texas Contest Club	1,919,074	16
Willamette Valley DX Club	1,618,276	17
Hudson Valley Contesters and DXers	1,318,338	22
Central Arizona DX Assn	1,302,442	17
BC DX Club	1,186,978	11
North Coast Contesters	934,984	10
CTRI Contest Group	926,560	13
Northern Rockies DX Association	923,926	8
Utah DX Assn	797,870	9
Rochester (NY) DX Assn	789,846	12
Louisiana Contest Club	771,160	7
Saskatchewan Contest Club	691,826	7
Kentucky Contest Group	624,766	13
Alberta Clippers	464,560	3
Iowa DX and Contest Club	457,956	3
Order of Boiled Owls of New York	414,390	9
Western New York DX Assn	412,548	8
Allegheny Valley Radio Association	373,002	12
Contest Club Du Quebec	311,550	6
Carolina DX Assn	310,098	10
Redmond Top Key Contest Club	305,054	4
Oklahoma DX Assn	287,780	10
Motor City Radio Club	271,950	12
East Coast Canada Contest Club	243,742	5
Eastern Iowa DX Assn	95,988	4
Bergen ARA	75,204	6
Local Category		
New Mexico Big River Contesters	1,028,508	10
Maritime Contest Club	617,332	10
Lincoln ARC	514,152	9
Spokane DX Association	321,422	7
Kansas City DX Club	234,374	3
Northern Arizona DX Assn	227,308	3
South Jersey Radio Assn	222,522	3
Sterling Park ARC	215,148	8
Ashe County ARC	208,316	5
Sussex County ARC	202,572	4
West Park Radiops	200,678	9
Green Mountain Wireless Society	198,934	3
Southwest Ohio DX Assn	153,814	3
Low Country Contest Club	152,024	7
Wireless Association of South Hills	146,042	6
Meriden ARC	143,108	6
Portage County Amateur Radio	126,982	6
Pocatello ARC	122,644	5
West Allis RAC	109,856	3
10-70 Repeater Assn	88,754	3
Bay Area Wireless Assn	85,346	3
Granite State ARA	77,888	3
Hazel Park ARC	70,300	4
Central Michigan ARC	65,766	5
Cedar Mountain ARC	64,392	4
Mile High DX Assn	57,424	3
Athens County ARA	49,734	3
Panhandle ARC	48,320	5
Albany ARA	45,620	3
Great South Bay ARC	9,280	3

Division Leader By Category

Q = QRP, A = Low Power, B = High Power, U = Single Operator Unlimited,
M = Multi-operator, S = School Club

Atlantic	KD4D	244,640	B	Atlantic	W3GRF (K3MM, op)	270,560	U
Central	WB9Z	271,840	B	Central	N2BJ	214,400	U
Dakota	WØSD (WØDB, op)	313,760	B	Dakota	KTØR (KØOB, op)	171,444	U
Delta	W5WMU	244,320	B	Delta	N4ZZ	253,760	U
Great Lakes	K8AO	175,868	B	Great Lakes	W8MJ	240,480	U
Hudson	N2LH	87,374	B	Hudson	W2RE	250,400	U
Midwest	KØDEQ	176,160	B	Midwest	WØTT	96,640	U
New England	NN1N	278,720	B	New England	WB1GQR (W1SJ, op)	280,160	U
Northwestern	W7WA	345,920	B				
Pacific	KH7B (K4XS, op)	341,760	B	Northwestern	K7RL	342,080	U
Roanoke	N8II	264,000	B	Pacific	W7RN (WX5S, op)	282,240	U
Roanoke	NN3W (@N4RV)	264,000	B	Roanoke	W4MR (AA4NC, op)	261,760	U
Rocky Mountain	N2IC (AA5B, op)	334,240	B	Rocky Mountain	NØQO	277,280	U
Southeastern	KP2TM (K9TM, op)	344,000	B	Southeastern	NF4A	203,360	U
Southwestern	K6NA (N6ED, op)	321,760	B	Southwestern	N6QQ	124,662	U
West Gulf	NR5M	331,520	B	West Gulf	N1CC	80,160	U
Canada	VY2TT (K6LA, op)	281,736	B	Canada	VY1EI	107,172	U
Atlantic	W3GH	195,604	A	Atlantic	K2NNY	249,280	M
Central	WR9L	73,154	A	Central	K9MOT	165,600	M
Dakota	NØKK (@ NØAT)	172,220	A	Dakota	KØFVF	131,140	M
Delta	NA4K	187,200	A	Delta	W5RU	216,160	M
Great Lakes	N8AA	155,532	A	Great Lakes	NT8V	204,320	M
Hudson	KU2M	108,724	A	Hudson	K2Z	236,000	M
Midwest	KUØG	92,960	A	Midwest	WØNO	286,240	M
New England	K1BX	211,360	A	New England	K1LZ	258,962	M
Northwestern	K7ZSD	216,618	A	Northwestern	K7PU	279,680	M
Pacific	AA6YX	72,072	A	Pacific	N6EE	205,600	M
Roanoke	W4AAA (KK9A, op)	237,280	A	Roanoke	KA1ARB	238,880	M
Rocky Mountain	WØETT	116,960	A	Rocky Mountain	K7VU	160,368	M
Southeastern	N4PN	205,760	A	Southeastern	W4QG	228,480	M
Southwestern	WAØKDS	132,800	A	Southwestern	W6YI	350,880	M
West Gulf	WD5K	144,960	A	West Gulf	K5NA	336,480	M
Canada	VA3DX	139,360	A	Canada	VE6EX	236,052	M
Atlantic	N3YD	52,976	Q	Atlantic	K2CC	38,360	S
Central	N9KT	101,280	Q	Central	N9GTC	17,446	S
Dakota	NDØC	71,456	Q	Dakota	KØVVY	26,288	S
Delta	KC5R	111,520	Q	Delta	W5YM	30,020	S
Great Lakes	N8IE	64,622	Q	Great Lakes	W8SH	32,292	S
Hudson	KR2Q	62,216	Q	Midwest	KØHC	229,890	S
Midwest	KIØOV	62,900	Q	New England	W1MX	156,262	S
New England	KA1LMR	27,528	Q	Southeastern	K4FAU	32,706	S
Northwestern	W7YAQ	65,832	Q	Southwestern	W6YV	8,464	S
Pacific	N6WG	20,532	Q	West Gulf	KD5VVI	43,878	S
Roanoke	NX9T	92,400	Q				
Rocky Mountain	NØKE	68,888	Q				
Southeastern	AA4W	23,450	Q				
Southwestern	N7JXS	6,318	Q				
Canada	VA3DF	50,516	Q				

QRP Category

Operating the Phone Sweepstakes with less than 5 W takes patience, skill and determination. This year, 62 entries were received in this challenging category.

Can you say three-peat? Congratulations to Al, KC5R, QRP operator extraordinaire, on winning the QRP category. While QRP involves hours of tedious search-and-pounce, Al was able to take advantage of a few holes in the QRM to run some stations, making 697 QSOs. Al was also one of only two QRP entries to make a Clean Sweep.

The 2nd place entry was also a "repeat performer" from last year. Dave, N9KT, was the other QRP Clean Sweep. Dave made 633 QSOs — not easy from the Indiana "Black Hole." Jeff, NX9T, moved up one place this year to number 3, with 600 QSOs, an increase of 81 from last year. Another Midwest Black Hole entry came in 4th place—congratulations to Ralph, K9ZO. Moving into the Top Ten this year is Randy, NDØC, with 464 contacts and 5th place.

There was very keen competition for the next five slots in the top-10, with only 9% separating 6th place through 10th place. Congratulations to Phil, NØKE; Bob, W7YAQ; Dan, N8IE; Dan, KIØOV, and Doug, KR2Q.

Unlimited Category

Thanks to the rivalry between two major contest clubs, Unlimited has become the second most popular category, with 391 entries this year.

After years of intense competition for the top spot, Mitch, K7RL, ran away from the pack in 2008. His 2138 QSOs was a personal best for Mitch. Washington was clearly a hot spot this year, with two category winners residing near Puget Sound.

Matt, WX5S, operating W7RN in Nevada, moved up to 2nd place this year. Mitch, WB1GQR, made many folks happy with the Vermont multiplier. Mitch moved up to 3rd place this year, thanks to outstanding conditions on 40 and 75 meters.

In 4th place was a newcomer—congratulations to Ken Long, NØQO! Ken has only been a ham for two years, but is already making a name for himself in contesting. The historic W3GRF call was proudly used by Ty, K3MM, for 5th place.

Three Northern California contesters, battled for the next 5 slots. Dan, K6IF, Dean, N6DE, and Ed, K6YT (WØYK, op) placed 6th, 7th and 9th, with only 70 QSOs separating them. Will, AA4NC, operating W4MR from North Carolina, battled stormy weather and high noise levels on the low bands, but still took the #8 spot. Don, N4ZZ, rounded out the Top Ten from Tennessee.

For More...

There is much more detail and analysis in the Web version of the writeup at **www.arrl.org/contests/results**.

Multi-operator Category

The Multi-operator Category has become an extremely popular and highly contested choice for many SS participants. It's a great opportunity to contest with friends and improve your operating skills.

The W6YI team of Jim, W6YI; John, K6AM; Dan, N6MJ, and Dennis, N6KI, were again the winners, with their best score ever. These guys have operated together for many years — clearly, a well-oiled team. Like Team Avis, 2nd place was also a repeat of last year. K5NA owners Richard, K5NA, and Susan, K5DU, were very happy to have Colin, KU5B, and Richard, N5ZC, do 99% of the operating, with their best score ever.

The Kansas team of WØNO moved up from 6th to 3rd place this year. Team StepIR, this year sporting the call K7PU, moved up to the number 4 slot this year. Only eight QSOs down, in 5th place, was the Iowa NØNI team.

The next four slots turned into the "Battle for New England." Congratulations to the K1LZ team for their 6th place finish. In 7th place was the W1AW HQ station, followed by another classic call, W2PV. In 9th place, was K2NNY from the rare Northern New York section. Another rare multiplier rounded out the Top Ten — many thanks to the N5DO ops for making West Texas an easy QSO.

School Club Category

The Hesston College Amateur Radio Club, KØHC, again won the school club category, with 1455 QSOs, an increase of 65 QSOs over the previous two years. A great job by Bob, WØBH; Eric NØLQU; Lorna, KØWHY, and a number of not-yet-licensed members.

The MIT Radio Society, W1MX, came in 2nd place, despite their very noisy city location. Third place went to Worcester Polytechnical Institute Wireless Society, W1YK. The Nacogdoches School Amateur Radio Club, KD5VVI, placed 4th, and the Clarkson College Amateur Radio Club, K2CC, placed 5th.

Other schools making the Top Ten were Florida Atlantic University, K4FAU; Michigan State University, W8SH; University of Arkansas, W5YM; University of Nebraska,

Plaque Winners

Thanks to the generous sponsorship of numerous clubs, individuals and Icom America — the principal awards sponsor for the 2008 ARRL November Sweepstakes — we are pleased to announce that the Overall and Division leaders in each category receives a sponsored Sweepstakes plaque. The ARRL wishes to thank the plaque sponsors for their continued commitment to the ARRL Plaque Program. Without their support and dedication, the Plaque Program would not be possible.

Division/Plaque Category	*Plaque Sponsor*	*Winner*
Overall		
Single Operator High Power Phone	Mike Fatchett, WØMU	W7WA
Single Operator Low Power Phone	Ken Adams, K5KA	W4AAA (KK9A, op)
Single Operator QRP Phone	QRP Amateur Radio Club International	KC5R
Single Operator Unlimited Phone	Icom America	K7RL
Multi-operator Phone	Icom America	W6YI
School Club Phone	Icom America	KØHC
Atlantic		
Single Operator High Power Phone	North Coast Contesters	KD4D
Single Operator Low Power Phone	Potomac Valley Radio Club	W3GH
Single Operator QRP Phone	Icom America	N3YD
Single Operator Unlimited Phone	Icom America	W3GRF (K3MM, op)
Multi-operator Phone	Mark Sickmeyer, KB3GJ Memorial	K2NNY
School Club Phone	Icom America	K2CC
Central		
Single Operator High Power Phone	Society Of Midwest Contesters	WB9Z
Single Operator Low Power Phone	Society Of Midwest Contesters	WR9L
Single Operator QRP Phone	Sean Kutzko, KX9X	N9KT
Single Operator Unlimited Phone	Icom America	N2BJ
Multi-operator Phone	Icom America	K9MOT
School Club Phone	Icom America	N9GTC
Dakota		
Single Operator High Power Phone	Minnesota Wireless Association	WØSD (WØDB, op)
Single Operator Low Power Phone	Minnesota Wireless Association	NØKK (@ NØAT)
Single Operator QRP Phone	Tod Olson, KØTO	NDØC
Single Operator Unlimited Phone	Minnesota Wireless Association	KTØR (KØOB, op)
Multi-operator Phone	In Memory of Jim Dokmo, KØFVF - Minnesota Wireless Association	KØFVF
School Club Phone	Icom America	KØVVY
Delta		
Single Operator High Power Phone	Icom America	W5WMU
Single Operator Low Power Phone	Icom America	NA4K
Single Operator QRP Phone	Icom America	KC5R
Single Operator Unlimited Phone	Icom America	N4ZZ
Multi-operator Phone	Icom America	W5RU
School Club Phone	Icom America	W5YM
Great Lakes		
Single Operator High Power Phone	North Coast Contesters	K8AO
Single Operator Low Power Phone	Mad River Radio Club	N8AA
Single Operator QRP Phone	Mad River Radio Club	N8IE
Single Operator Unlimited Phone	Icom America	W8MJ
Multi-operator Phone	Icom America	NT8V
School Club Phone	Icom America	W8SH
Hudson		
Single Operator High Power Phone	Icom America	N2LH
Single Operator Low Power Phone	Icom America	KU2M
Single Operator QRP Phone	Icom America	KR2Q
Single Operator Unlimited Phone	Icom America	W2RE
Multi-operator Phone	Icom America	K2Z
Midwest		
Single Operator High Power Phone	Icom America	KØDEQ
Single Operator Low Power Phone	Society Of Midwest Contesters	KUØG
Single Operator QRP Phone	Icom America	KIØOV
Single Operator Unlimited Phone	Icom America	WØTT
Multi-operator Phone	Icom America	WØNO
School Club Phone	Icom America	KØHC
New England		
Single Operator High Power Phone	Icom America	NN1N
Single Operator Low Power Phone	CTRI Contest Group	K1BX
Single Operator QRP Phone	QRP Club of New England	KA1LMR
Single Operator Unlimited Phone	Icom America	WB1GQR (W1SJ, op)
Multi-operator Phone	Icom America	K1LZ
School Club Phone	Icom America	W1MX
Northwestern		
Single Operator High Power Phone	Icom America	W7WA
Single Operator Low Power Phone	Icom America	K7ZSD
Single Operator QRP Phone	Icom America	W7YAQ
Single Operator Unlimited Phone	Icom America	K7RL
Multi-operator Phone	Icom America	K7PU
Pacific		
Single Operator High Power Phone	Icom America (K4XS, op)	KH7B
Single Operator Low Power Phone	Icom America	AA6YX
Single Operator QRP Phone	Icom America	N6WG
Single Operator Unlimited Phone	Icom America	W7RN (WX5S, op)
Multi-operator Phone	Icom America	N6EE
Roanoke		
Single Operator High Power Phone	Potomac Valley Radio Club	TIE: N8II and NN3W (@ N4RV)
Single Operator Low Power Phone	Raleigh Amateur Radio Society	W4DW W4AAA (KK9A, op)
Single Operator QRP Phone	NoVa QRP Group	NX9T
Single Operator Unlimited Phone	Icom America	W4MR (AA4NC, op)
Multi-operator Phone	Icom America	KA1ARB
Rocky Mountain		
Single Operator High Power Phone	Icom America	N2IC (AA5B, op)
Single Operator Low Power Phone	Icom America	WØETT
Single Operator QRP Phone	Colorado QRP Club	NØKE
Single Operator Unlimited Phone	Icom America	NØQO
Multi-operator Phone	Icom America	K7VU
Southeastern		
Single Operator High Power Phone	Icom America	KP2TM (K9TM, op)
Single Operator Low Power Phone	Icom America	N4PN
Single Operator QRP Phone	Icom America	AA4W
Single Operator Unlimited Phone	Icom America	NF4A
School Club Phone	Icom America	K4FAU
Multi-operator Phone	Icom America	W4QG
Southwestern		
Single Operator High Power Phone	Icom America	K6NA (N6ED, op)
Single Operator Low Power Phone	Icom America	WAØKDS
Single Operator QRP Phone	N6HE and W6DLD	N7JXS
Single Operator Unlimited Phone	Icom America	N6QQ
Multi-operator Phone	Inland Empire ARC	W6YI
School Club Phone	Icom America	W6YV
West Gulf		
Single Operator High Power Phone	Ken Adams, K5KA	NR5M
Single Operator Low Power Phone	Ralph "Gator" Bowen, N5RZ	WD5K
Single Operator Unlimited Phone	Icom America	N1CC
Multi-operator Phone	Icom America	K5NA
School Club Phone	Icom America	KD5VVI
Canada		
Single Operator High Power Phone	Icom America	VY2TT (K6LA, op)
Single Operator Low Power Phone	Icom America	VA3DX
Single Operator QRP Phone	Frank Mercerat, NA4CW	VA3DF
Single Operator Unlimited Phone	Icom America	VY1EI
Multi-operator Phone	Icom America	VE6EX

If you or your club would like to sponsor a plaque, or you wish to order a duplicate plaque, contact ARRL Contest Branch Manager Sean Kutzko, KX9X, at 860-594-0232 or by e-mail at **kx9x@arrl.org**. Plaques cost $75 (includes shipping).

NØUNL, and South Dakota School of Mines, KØVVY.

Club Competition

Activity in Sweepstakes is a long-standing tradition for many clubs. Without their promotion of Sweepstakes, there would be far less activity for us to all enjoy. It takes a tremendous amount of planning, promotion and execution to "beat the drums" and "bring out the troops" for Sweepstakes every year. Thanks!

Again this year, the Potomac Valley Radio Club (PVRC) and the Northern California Contest Club (NCCC) battled for the top spot in the Unlimited Club category. This year, the mid-Atlantic-based PVRC was victorious, with an amazing 317 entries and over 22 million points! Only 10% behind was the NCCC, with 278 entries and 20 million points. Honorable mention also goes to the Society of Midwest Contesters, for putting together 236 entries and 13 million points for 3rd place.

The Southern California Contest Club easily took 1st place in the Medium Club Category, with 43 entries and nearly 4 million points. The Tennessee Contest Group put together even more entries, 48, in their fine 2nd place showing. The next eight slots were remarkably tight. Just one or two more big scores could have moved any of these clubs into 3rd place !

In the Local Club category, the New Mexico Big River Contesters repeated last years' win with ten entries and 1 million points. Congratulations!

Acknowledgments

Many thanks to "Tree" Tyree, N6TR, for his hard work checking the logs, ARRL Contest Branch Manager Sean Kutzko, KX9X, for promptly answering my many questions, and Sweepstakes Contest Manager Ken Adams, K5KA, who maintains the SS records. In addition, a team painstakingly typed in the handwritten logs, so that they could be properly adjudicated.

2008 ARRL 160 Meter Contest Results

Top Band 'test draws record crowd December 5-7.

Gary Breed, K9AY
k9ay@k9ay.com

No sunspots? Who cares! If you thought the band seemed unusually crowded, you were correct — a record 1281 logs were submitted. While the solar minimum generally benefits lower frequency bands, this particular weekend didn't have great band conditions, but propagation was certainly good enough to hold the interest of newcomers and old timers alike.

No operator was more enthusiastic than Tomas Magyla, VK2CCC. Tomas scouted out a remote location three hours' drive out of Sydney, and with the help of some Aussie "locals" (see photo) got his antenna installed just before sunset. His adventure ended with poor conditions toward North America and only one QSO in the contest log, but he is undaunted and will surely do it again!

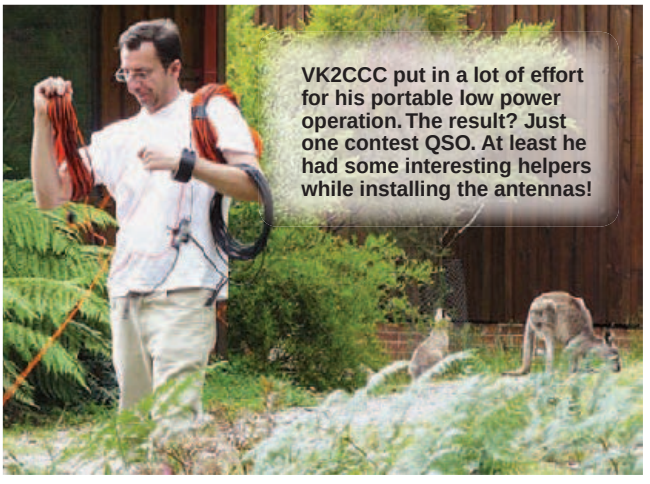
This is just one of many stories about special efforts to get on the air or put up special antennas for this contest as hams are inspired to do the best they can. Now, on to the results!

Multi-operator

In this single-band contest, a "multi-op" entry can be one operator with spotting assistance, a few friends sharing the operating load at one of their stations, or a whole team of operators and equipment. The top four spots represent all three styles. The top spot was captured by the KC1XX gang in NH. Operating from Matt's big station where the antenna systems are always being improved and refined, they made 1753 QSOs and collected 131 multipliers.

The 2nd place WE3C team from the EPA section included three operators who found the same number of multipliers, but fewer QSOs, than the leaders. Out in IL, another big team at WB9Z captured 3rd place, making the most QSOs of any multi-op entry and achieving a "personal best" result for that station. The 4th place finisher is Charles, K3WW, who demonstrated his experience in the style of one operator plus spotting assistance.

As the Top Ten shows, this was a highly competitive category, as the next six scores were within an 11 percent spread.



VK2CCC put in a lot of effort for his portable low power operation. The result? Just one contest QSO. At least he had some interesting helpers while installing the antennas!

Single Operator, High Power

"The last time I did a full-time effort in the ARRL 160 Meter Contest seems to have been 1974, my senior year in college, when I ran a sloper from the window of my 18th floor

Regional Scores

A = QRP, B = Single Op Low Power, C = Single Op High Power, D = Multi-operator. Columns represent Call sign, Score, QSOs, Mults and Class.

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

W3TS	66,856	554	61	A
N1BUG	49,662	386	62	A
AA1CA	40,915	419	49	A
K3TW	38,178	347	54	A
K2QO	28,567	273	53	A
N1UR	168,432	915	88	B
K1EP	168,432	907	88	B
N1IX	118,989	701	81	B
K2ZR	117,238	797	73	B
N3GJ	111,750	738	75	B
K1DG	573,780	1621	131	C
K1LZ	545,024	1584	128	C
W1UE	479,125	1434	125	C
K1ZZ	436,158	1464	123	C
W3BGN	383,933	1294	121	C
KC1XX	570,112	1753	131	D
WE3C	510,245	1567	131	D
K3WW	461,264	1528	127	D
NO2R	447,000	1455	125	D
W2GD	443,300	1577	124	D

Southeast Region (Delta, Roanoke and Southeastern Divisions)

W4TMR	49,434	373	66	A
K4ORD	37,077	360	51	A
N4AX	16,611	175	49	A
KW4JS	12,560	160	40	A
WK4P	12,423	149	41	A
N2WN	213,072	1120	92	B
WA4PGM	177,644	977	89	B
WO4O	111,160	792	70	B
W4AA	100,464	566	84	B
WA1FCN	99,408	647	76	B
K3ZM	565,370	1692	130	C
W4MYA	479,875	1632	125	C
N5RR	325,038	1434	109	C
K4TD	300,991	1321	107	C
WX4G	262,182	1099	111	C
N1LN	422,520	1589	120	D
AA4NC	315,280	1321	112	D
N4PN	266,832	1256	102	D
W4DR	206,664	802	109	D
N3UA	199,842	707	114	D

Central Region (Central and Great Lakes Divisions; Ontario Section)

K9NW	86,691	606	71	A
N8BB	73,584	660	56	A
W8VE	17,808	213	42	A
W9LO	15,826	197	41	A
VE3WZ	14,490	176	42	A
K9IG	207,270	1137	90	B
VE3NE	190,538	978	94	B
KF9D	143,528	927	77	B
K4FT	142,236	865	81	B
NE9U	141,588	865	81	B
K9DX	526,320	1822	129	C
VE3EJ	481,203	1590	127	C
VE3EY	407,480	1478	122	C
K1LT	386,631	1455	119	C
K9AY	329,616	1456	108	C
WB9Z	482,306	1832	121	D
K5ZG	442,062	1651	123	D
K8CC	344,877	1482	111	D
WØAIH	338,232	1609	102	D
W9IU	265,776	1324	98	D

Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

WØGJ	97,881	627	79	A
NØUR	66,688	523	64	A
WX7G	54,924	400	69	A
W7JI	47,192	356	68	A
KIØII	18,810	179	55	A
KØDI	177,633	1093	81	B
WØUO	159,375	926	85	B
ACØW	147,120	915	80	B
NC7W	140,371	916	77	B
N5OE	120,633	758	79	B
K5NA	373,520	1542	112	C
NR5M (NM5M, op)	361,600	1469	113	C
WØSD (WØDB, op)	350,168	1631	104	C
KØSR	270,908	1417	94	C
WØUA	255,668	1313	92	C
NØNI	348,140	1622	103	D
WØNO	310,373	1483	101	D
KDØS	171,108	1019	84	D
NI5T	166,240	1013	80	D
KØRC	157,358	953	82	D

West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

N7IR	52,895	367	71	A
VE7VV	17,300	174	50	A
K6EI	16,092	226	36	A
N6WG	12,996	184	36	A
K6MI	9,120	117	40	A
KB7Q	187,912	1125	83	B
W7RH	115,619	665	83	B
NT6K	105,612	660	78	B
W6JTI	87,549	556	77	B
N6RK	83,148	511	78	B
N6TR	235,405	1235	89	C
W7RN (W6EU, op)	169,420	946	86	C
KC7V	148,764	848	84	C
K7BG	137,615	799	85	C
W6XX	130,745	787	79	C
N7DD	166,584	916	88	D
N6RO	131,064	714	86	D
K7OX	129,444	754	84	D
KG7H	115,784	696	82	D
KH6LC	112,000	549	80	D

Single Operator, QRP

WØGJ	97,881
K9NW	86,691
N8BB	73,584
W3TS	66,856
NØUR	66,688
WX7G	54,924
N7IR	52,895
N1BUG	49,662
W4TMR	49,434
W7JI	47,192

Single Operator, Low Power

N2WN	213,072
K9IG	207,270
VE3NE	190,538
KB7Q	187,912
WA4PGM	177,644
KØDI	177,633
N1UR	168,432
K1EP	168,432
WØUO	159,375
ACØW	147,120

Single Operator, High Power

K1DG	573,780
K3ZM	565,370
K1LZ	545,024
K9DX	526,320
VE3EJ	481,203
W4MYA	479,875
W1UE	479,125
K1ZZ	436,158
VE3EY	407,480
K1LT	386,631

Multi-operator

KC1XX	570,112
WE3C	510,245
WB9Z	482,306
K3WW	461,264
NO2R	447,000
W2GD	443,300
K5ZG	442,062
N1LN	422,520
W2FU	421,776
N3KS	402,456

Affiliated Club Competition

	Score	Entries
Unlimited Category		
Yankee Clipper Contest Club	7,711,153	60
Potomac Valley Radio Club	6,154,139	73
Society of Midwest Contesters	5,003,334	76
Minnesota Wireless Assn	3,172,424	57
Medium Category		
Frankford Radio Club	3,838,297	32
Contest Club Ontario	2,743,694	32
Tennessee Contest Group	2,091,975	33
Mad River Radio Club	1,730,265	20
Northern California Contest	1,588,103	48
Florida Contest Group	1,219,221	14
Alabama Contest Group	1,071,655	14
Rochester (NY) DX Assn	958,802	10
South East Contest Club	941,314	14
North Texas Contest Club	698,976	9
Western New York DX Assn	625,357	8
Hudson Valley Contesters	524,705	10
Central Texas DX and Contest	490,400	5
Contest Club Du Quebec	489,003	9
Central Arizona DX Assn	414,698	11
Southern California Contest	324,476	12
Willamette Valley DX Club	285,564	4
Carolina DX Assn	284,217	4
North Coast Contesters	283,191	4
Kentucky Contest Group	239,673	4
Louisiana Contest Club	224,588	3
Utah DX Assn	171,850	3
Order of Boiled Owls	133,067	3
Oklahoma DX Assn	126,602	4
Western Washington DX Club	122,323	8
CTRI Contest Group	86,103	6
Allegheny Valley Radio Association	76,016	3
Local Category		
Central Virginia Contest Club	1,004,341	8
Mother Lode DX/Contest Club	367,830	6
Northern Rockies DX Association	351,809	4
Spokane DX Association	179,752	5
Low Country Contest Club	165,429	5
New Mexico Big River	141,487	4
Maritime Contest Club	134,220	7
Sterling Park ARC	123,942	3
Redmond Top Key Contest Club	123,800	3
West Park Radiops	106,263	4

dorm room..." reminisced Doug, K1DG. His renewed enthusiasm for Top Band resulted in the top spot in the High Power category from his Long Island, Maine vacation home, where proximity to salt water and a clear path toward Europe certainly helped his score.

The remainder of the High Power top finishers are a real "Who's Who" of 160 meter operators, exemplifying the value of experience on this unique band and of assembling effective stations. The East Coast took the first three positions, with Peter, K3ZM, and Krassy, K1LZ, finishing 2nd and 3rd from VA and EMA, respectively. Fourth place finisher John, K9DX, in IL is the farthest west of the Top Ten group, and his 1822 QSOs easily topped all competitors in this category.

Single Operator, Low Power and QRP

Working DX is a bit more difficult in the Low Power and QRP categories, so the number of QSOs and multipliers have a bigger effect on scoring, compared to High Power. With the stronger emphasis on domestic QSOs, the top finishers typically have a wide geographical spread. Every Low Power station on the Top Ten is from a different section, reaching from north in VT to TX in the south, from as far west as MT to VA in the east.

At the top is Julius, N2WN, in TN. He notes that contesting is certainly fun, but "What really makes a difference, for me, is the relationship I have with others who play in the same events and categories." Like many hams, Julius uses e-mail as well as radio to stay in touch, trading notes on operating and antennas. Other top Low Power finishers include Greg, K9IG, and Lali, VE3NE, who captured the 2nd and 3rd place spots from IN and VE3, while Gene, KB7Q, earned a 4th place finish from MT.

The band is open to more stories, comments, and photos in the expanded Web version of this article at **www.arrl.org/contests/results.**

At the top of the QRP category is Glenn, WØGJ, in MN, followed by Mike, K9NW, who operated from IN. Although a central location seems to be an advantage for QRP competition, there were excellent performances in the west, with David, WX7G, taking 6th place with his portable operation at the Great Salt Lake in UT, followed closely by Gary, N7IR, of AZ in the 7th position.

Club Competition

Contest clubs are important sources of encouragement and assistance that can really make a difference in the success of members who are new to the band, or have limited space for antennas.

This year, four clubs had enough entries to qualify for the Unlimited category. Two big eastern clubs topped the results, with the Yankee Clipper Contest Club capturing the gavel by amassing more than 7.7 million points. The Potomac Valley Radio Club earned the 2nd spot, with the Society of Midwest Contesters finishing 3rd with the highest participation (76 entries).

In the Medium category, the Frankford Radio Club's 32 entries totaled 3.8 million points to reach the top position. Reaching the 2nd spot is the active and enthusiastic Contest Club Ontario, while the Tennessee Contest Group made it into the 3rd position.

At the top of the Local category was the Central Virginia Contest Club, with eight entries and more than a million total points.

Summary

The 160 meter band remains a fascinating part of the amateur spectrum! It can be frustrating when conditions are poor or noise is high, and exhilarating when DX is plentiful and there is lots of activity. The 2008 ARRL 160 Meter Contest definitely generated lots of activity, with 507 Low Power entries, 448 High Power entries, 249 Multi-Operator entries and 77 QRP entries. And I'll bet most of them are already planning for the 2009 contest December 4-6! QST

Division Leaders by Category

A= Single Operator, QRP B= Single Operator, Low Power C = Single Operator, High Power D = Multi-operator

Single Op QRP			
Atlantic	W3TS	66,856	A
Central	K9NW	86,691	A
Dakota	WØGJ	97,881	A
Delta	KW4JS	12,560	A
Great Lakes	N8BB	73,584	A
Hudson	KR2Q	23,130	A
Midwest	W7JI	47,192	A
New England	N1BUG	49,662	A
Northwestern	KX7L	4,420	A
Pacific	K6EI	16,092	A
Roanoke	W4TMR	49,434	A
Rocky Mountain	WX7G	54,924	A
Southeastern	N4AX	16,611	A
Southwestern	N7IR	52,895	A
West Gulf	W5ESE	6,592	A
Canada	VE7VV	17,300	A
Single Op Low Power			
Atlantic	K2ZR	117,238	B
Central	K9IG	207,270	B
Dakota	ACØW	147,120	B
Delta	N2WN	213,072	B
Great Lakes	K4FT	142,236	B
Hudson	K2UF	75,348	B
Midwest	KØDI	177,633	B
New England	K1EP	168,432	B
Northwestern	KB7Q	187,912	B
Pacific	NT6K	105,612	B
Roanoke	WA4PGM	177,644	B
Rocky Mountain	ACØDS	107,569	B
Southeastern	W4AA	100,464	B
Southwestern	W7RH	115,619	B
West Gulf	WØUO	159,375	B
Canada	VE3NE	190,538	B
Single Op High Power			
Atlantic	W3BGN	383,933	C
Central	K9DX	526,320	C
Dakota	WØSD (WØDB, op)	350,168	C
Delta	N5RR	325,038	C
Great Lakes	K1LT	386,631	C
Hudson	N2ED	113,100	C
Midwest	NØTT	240,640	C
New England	K1DG	573,780	C
Northwestern	N6TR	235,405	C
Pacific	W7RN (W6EU, op)	169,420	C
Roanoke	K3ZM	565,370	C
Rocky Mountain	WØUA	255,668	C
Southeastern	K4TD	300,991	C
Southwestern	KC7V	148,764	C
West Gulf	K5NA	373,520	C
Canada	VE3EJ	481,203	C
Multi-operator			
Atlantic	WE3C	510,245	D
Central	WB9Z	482,306	D
Dakota	KDØS	171,108	D
Delta	K5FMC	189,371	D
Great Lakes	K5ZG	442,062	D
Hudson	NO2R	447,000	D
Midwest	NØNI	348,140	D
New England	KC1XX	570,112	D
Northwestern	K7OX	129,444	D
Pacific	N6RO	131,064	D
Roanoke	N1LN	422,520	D
Rocky Mountain	NI5T	166,240	D
Southeastern	N4PN	266,832	D
Southwestern	N7DD	166,584	D
West Gulf	AD5VJ	28,446	D
Canada	VY2/N3DXX	344,971	D

W3UR

HOW'S DX?

More on Midway

KH4 — MIDWAY ISLANDS UPDATE

In the April 2009 "How's DX" column (page 89) we announced the opening of Amateur Radio on Midway. We now have some updated information about the much anticipated October 2009 DXpedition to KH4. But first let me correct something from that April issue. The AH4/KH4, NH4 and WH4 prefixes were available to be used from Midway starting March 28, 1978 (not 1981 as reported). Thank you, Ron Notarius, W3WN (ex-WN3VAW) for bringing this to your editor's attention.

Nineteen operators, mostly from the US, will be heading to Midway Island (KH4) for an all band and mode DXpedition for 10 days in October of this year. The multinational team will be led by Tom Harrell, N4XP, and Dave Johnson, WB4JTT, and will use the special 1×1 call sign K4M. The team will be QRV on 1.8 through 50 MHz on CW, SSB and RTTY. Suggested frequencies (kHz) will be:

CW — 1826.5; 3504; 7004; 10,104; 14,024; 18,074; 21,024; 24,894; 28,024, and 50,115

SSB — 3799; 7057; 14,195; 18,145; 21,295; 24,945; 28,475, and 50,115

RTTY — 7040; 10,140; 14,080; 18,100; 21,080, and 28,080

Midway Island ranks number 24 worldwide on *The DX Magazine*'s most wanted list and number 13 in Europe. The team will make major efforts "to meet the demand to the most needed geographical areas, the low bands and RTTY."

Joining N4XP and WB4JTT will be AA4NN, EA1IR, DJ9ZB, KH7U, KI6TVS, KL2A, N1DG, N4PN, N4XP, N6GQ, N7CQQ, WB4JTT, W6KK, W6OSP, WA7NB, W8CAA, W8GEX, WA8NJR and OK1KT. Plans are for the team to charter a plane. Because of this their equipment will be shipped several months in advance. This will add to the cost of the DXpedition. With this in mind the team is looking for support.

The K4M team expects to be QRV starting around October 9 and continuing through the 19th. Their Web site (**www.midway2009.com**) will include a log search, photos, history and other details. The QSL route as of press time has not been decided. Watch your favorite DX newsletter for updates on this one.

6 METER DX

Hopefully, by the time you read this column 6 meter DXers in the northern hemisphere will have already begun to experience some 6 meter E-skip DX. For some this may be their first time on the band and for others an annual event. Either way, we need to be reminded of a few basics about 6 meter DX on the "Magic Band." And remember: Treat your fellow Amateur Radio operators like you would want to be treated! In other words use the Golden Rule.

Here in the US the DX window extends from 50.100 to 50.125 MHz. Yes, I know and most of the readers of this column know that 50.125 MHz is the US calling frequency. So let's first talk about the calling frequency. Many across the states keep the calling frequency in one of their memories in their 6 meter box and monitor this frequency for openings. If someone wishes to see if the band is open or try CQing, that is a good place to start, but not if you already know the band is open! If you know the band is open, try moving up in frequency from the calling frequency. But let's say for the sake of argument you are not sure. Give a CQ or call on 50.125 MHz, giving your call several times using proper phonetics. If the band is open to DX the DX station might have trouble deciphering a silly phonetic like "We Bought Three Green Lizards Yesterday" (WB3GLY).

Okay, but back to your call to establish if the band is open or not. After you call CQ and if someone answers you, acknowledge their call and tell them something like "W3UR thanks for the call, let's go up to 50.175 to clear the calling frequency. Okay?" Once the other station confirms the frequency change move up the band, clearing the calling frequency for the next guy. It is rude to carry on a QSO and monopolize the calling frequency. You don't want to tick off your fellow 6 meter operators or get the reputation of having a broken VFO or being a crystal control operator.

Returning to the US DX window, which is between 50.100 and 50.125 MHz. US stations should never work another US station in the DX window, as this completely defeats the whole purpose of a DX window. The DX calling frequency (50.110 MHz) is very similar to the US calling frequency. DX stations as well as US stations really should not carry on QSO after QSO on the calling frequency. Once you have established the band is open, the station calling CQ should move off the calling frequency to allow his fellow DXers to then do the same. Don't worry. The US guys will spot the DX station on the packet clusters and those who have an opening will soon be calling! Typically the 6 meter E-skip season runs from mid-May until mid-July with the peak usually sometime between the last week of June and the first week of July.

6 METER DX NEWS

4O — MONTENEGRO

Dutch operators PA3FPQ, PE1LWT and PA2CHR have plans to go to Ranko's 4O3A, contest station in Montenegro between May 26 and June 4. This might be a little early for North American QSOs, but one never knows. They will be active on 50.144 and 432 MHz on SSB, CW, FSK and JT65.

8R — GUYANA

Rumor has it that an American team will operate from 8R on 6 meters during the upcoming E-skip season. Watch your favorite DX outlet for more on this.

HKØ/S — SAN ANDRES and PROVIDENCIA

Dennis, K7BV, is heading back to San Andres for a 6 meter DXpedition. Look for him to be QRV again as 5JØM from June 17-28. He will have a breakable beacon running on 50,106.2 kHz. He will be operating both terrestrial, WSJT MS (50,260 kHz) and WSJT EME JT65A (50,198.5 kHz). Dennis

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

plans to use an FT-950 and FT-450AT along with an Acom HF and 6 meter amplifier. On HF he'll have a wire and vertical and on 6 meters an 8 element Yagi on a 42.5 foot long boom. Mick, W1JJ (**w1jj@aol.com**) will be his pilot station and Pat, W5OZI (**w5ozi1@verizon.net**) will handle the HF coordination up on 14.345 MHz. Dennis has a Web page set up for this operation at **www.qth.com/k7bv/caribe2009**. QSL 5JØM via W1JJ.

V2 — ANTIGUA and BARBUDA

Jimmy, W6JKV, will operate from Antigua June 23-July 3. He says he has a good location and will have a large 6 meter antenna and *power*. Jimmy will be QRV as V29JKV. He will spend most of his time on 6 meters, "but HF may also be possible," he says. QSL via W6JKV.

DX NEWS FROM AROUND THE GLOBE

5N — NIGERIA

Bodo, DL3OCH/HB9EHJ, is now in Abuja, Nigeria until July 24 and QRV as 5NØOCH. His equipment consists of a TS-450, IC-7000, IC-706, 50 A power supply, 5 band Spiderbeam, 10 meter mast and monoband verticals for 30, 40 and 80 meters. At the moment Bodo is not sure yet what kind of antenna will be used for 160 meters but he is planning to be active on Topband. Bodo plans to be on the air mostly in the evenings and on weekends on CW but he will also be on SSB and RTTY. EME antennas and amplifiers have also arrived safely in Nigeria. Bodo will team up with some other 5N operators for EME activities. He also has plans to activate IOTA AF-076, but no details at the moment. All QSLs (bureau or direct) go via DL3OCH. He will answer all cards after his return to Switzerland in August.

8Q — MALDIVES

Look for 8Q7TB from June 8-25, with Tom, PF4T, operating. He'll be on 40 and 20 meter SSB. For a quick card, send to Tom Braam, PF4T, Hondsrug 210, 8251 VB Dronten, The Netherlands. Send a self-addressed envelope, with one US dollar within Europe. If outside Europe, it takes two US dollars to cover postage.

PYØF — FERNANDO DE NORONHA

Alex, PY2WAS, tells us about a June 2009 Fernando de Noronha (SA-003) DXpedition. The team will include Alex as well as Anderson, PY2TNT; Bob, N6OX, and Fabio, PY2AAZ. Look for ZYØF to begin around 2300Z on June 10 continuing through around 1300Z on June 15. The guys will be operating on 10, 12, 15, 17, 20, 30, 40, 60, 80 and 160 meters on SSB and CW. 60 meters will be under a temporary license granted by the Brazilian Government. This DXpedition is being sponsored by Spiderbeam Antennas. QSL via PY2WAS either direct or via the bureau.

S9 — SÃO TOMÉ and PRINCIPE

DK7LX says his next destination will be Sao Tome and Principe, in June 2009. He expects to start up around June 13 and go for 2 weeks. He will be on 80-10 meter CW only and have an online log. The call sign will be S92LX. QSL via the bureau, direct or request a card via e-mail. He operated as TX7LX in Mayotte in 2008.

TT — CHAD

In last month's issue we mentioned that F4BOQ had been in Chad since the beginning of February. He is expected to stay and be QRV as TT8CF until July 1. QSL via F4BOQ.

DX GATHERINGS

Ham-Com 2009 (**www.hamcom.org**) will be held at Plano Centre in Plano, Texas on June 12 and 13. The Lone Star DX Association (**www.dxer.org**) will have several DX oriented programs. Starting off on Friday night LSDXA will sponsor the 2009 W5DXCC DX Dinner with K5D coleader Bob Allphin, K4UEE, presenting "what promises to be a very interesting program." Then on Saturday the LSDXA DX forum will have some (K4UEE, K5AC, K5AND and NA5U) of the K5D operators doing a round table Q and A on Desecheo. W5SL will talk about the March VK9LA DXpedition to Lord Howe Island. Propagation guru K9LA will be talking about Cycle 24 and more. A 6 meter DX talk will be presented by K5AND. These are just some of the plans.

WØ DXCC. Mark your calendars now for the second WØ DXCC and Contest Central convention, which is expected to take place on July 18, in Rochester, Minnesota. There will also be a "WØ DXCC Banquet that will feature the Desecheo DXpedition with many team members." Watch the Twin City DX Association Web site at **www.tcdxa.org**.

Maritime DX Forum. The Halifax Amateur Radio Club (HARC) invites DXers, contesters and HF enthusiasts to the 2009 Maritime DX Forum. On Friday, August 7, a reception and registration will begin at 7 PM. The MDF program on Saturday, August 8 will run from 8:30 AM-4:45 PM, followed by reception and the DX banquet at 6 PM.

The speakers — active and outstanding members of our ham radio community — include:

Martti Laine, OH2BH: Turning New Stones: Building Passion for Amateur Radio

Joe Taylor, K1JT: Advances in Weak Signal Communications

George Nicholson, N4GRN: 2009 Desecheo Island DXpedition

Doug Zwiebel, KR2Q: QRP Contesting from Home Stations

The MDF will be held in the Rosaria Centre of Mount St Vincent University in Halifax, Nova Scotia. Inexpensive accommodations are available at the university. This is a great opportunity to combine a top-notch ham radio event with a tourist visit to Canada's Maritime Provinces.

The cost of the Maritime DX Forum is $45 and the banquet is $35. Registration materials can be downloaded from the HARC Web site (**www.halifax-arc.org**) or requested directly from the MDF Chair, Scott Wood, VE1QD. Scott would like to know of your intention to attend and will gladly answer any questions. He can be contacted at **ve1qd@rac.ca** or at 902-823-2761.

PNWDXC. The 54th annual Pacific Northwest DX Convention (PNWDXC) will be hosted by the Spokane DX Association on August 7, 8 and 9. The event will be held at the Mirabeau Park Hotel and Convention Center (**www.MirabeauParkHotel.com**) in Spokane Valley, Washington. Registration and more information will soon be available on the Spokane DX Association Web site at **www.sdxa.org**. QST

VHF/UHF Century Club Awards

Compiled by Sharon Taratula
Administrative Manager

The ARRL VUCC numbered certificate is earned by amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceding call signs indicate total grid locators claimed. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from February 1, 2009 to March 20, 2009.

The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/awards/vucc**. An SASE to ARRL is required if you cannot download these forms. Send questions relating to VUCC to **vucc@arrl.org**.

50 MHz
100

1676	K7JIZ
1677	N1NK
1678	NØYO
WAØGUD	150
K8YC	175
KG4JSZ	175
NA2R	200
WA7PDC	300
KF8UN	425
W1OW	600
W4UDH	900

144 MHz
100

W4VC	150
K2BLA	325
N9LR	500

222 MHz
50

W4VC	60

432 MHz
50

W4VC	70

1296 MHz
25

153	W4VC
154	KT1J

3.4 GHz
5

WW2R	20

5.7 GHz
5

WW2R	10

10 GHz
5

187	KT1J (FN34BI)
KT1J	15

Satellite
100

172	N3YZ
W9DQ	125
WA4NVM	275
N5ZNL	500
XE2AT	900

QST

W3ZZ

THE WORLD ABOVE 50 MHz

Determining and Maintaining Frequency

Two of the more important questions in modern VHF+ operating are what frequency am I on and how far from this frequency will I be in the next five minutes if I don't touch the dial. Many forms of modern VHF+ communication such as EME and meteor scatter require reasonably close frequency accuracy. Particularly on microwave frequencies, stability has become a critical issue even to find a station and work it by troposcatter. These parameters determine what mode one can use for a contact, especially on the digital modes. For instance, the sensitivity of JT65a is greater than that of JT65b, which in turn is greater than JT65c. The ability to use the more sensitive versions is dependent in part on the frequency stability of your receiver and transmitter.

Back some years ago accurate frequency sources were difficult and expensive to obtain and frequency stability was insufficient for many of the modern communications modes on the higher VHF+ frequencies. Thus, digital EME on 23 cm was difficult to achieve, for example. In the past several years new technical developments have made these issues more tractable. Frequency readout can now approach the accuracy of multiply locked GPS (global positioning system) satellites. Thus, for a relatively high quality GPS disciplined source, the frequency accuracy can approach 1×10^{-9}. Frequency stability of this source can exceed that amount. In either case, that is more than enough for most amateur uses.

In general, stability and accuracy on the lower four V/UHF bands is sufficient for a modern transverter to supply adequate performance in this regard. In this column I wish to describe in general terms how these advances can be applied to your microwave station, although by suitable programming the same approach can be applied to the lower V/UHF bands. What you will see is an introduction or conceptual approach, not a detailed how-to discussion. There are many published articles on the Internet and in conference proceedings that address the details. Though you can build some of the required equipment yourself, the emphasis will be on integrating commercial or amateur equipment into a working system.

The Basic Approach

To improve your frequency reading and frequency stability, the approach is to replace your local oscillator (LO) with a phase locked loop (PLL) of some kind. The PLL is referenced to a highly accurate and stable source like either GPS or the precise electron transitions in atomic isotopes [Rubidium (Rb^{87}) and Cesium (Cs^{133}) are the ones used]. In the next paragraphs I will describe a few of these sources and a few of the PLL designs that can generate the frequencies needed to replace the current transverter LO.

In all cases the general process can be described by the schematic block diagram representing a 1296 MHz system in Figure 1. Now let's look at the definitions of some of the parameters and specifically at the reference sources and PLLs. You can use the list of references to obtain greater detail.

Some Definitions

Since the components of this system are oscillators they will have phase noise.

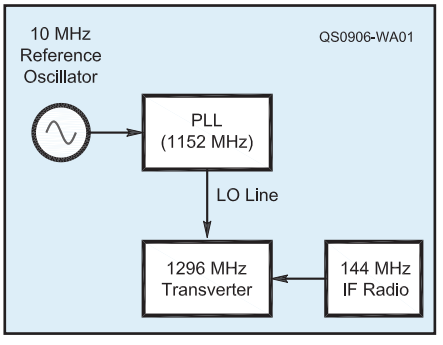


Figure 1 — A general schematic block diagram of a transverter system with an LO referenced to a stable source. Here the example is 1296 MHz.

This Month

June 13-15	ARRL June VHF QSO Party
June 20-21	2009 SMIRK QSO Party
June 27-28	ARRL Field Day
*June 28	Good EME conditions

*Moon data from W5LUU.

For an oscillator, phase noise is generally defined as the frequency domain of the minute variations in the phase of the waveform generated by the time domain instabilities of that oscillator. It is usually measured in dBc/Hz (decibels relative to carrier) at a specific frequency offset from the carrier. If the oscillator were a perfectly pure sine wave there would be no phase noise, but these being real world oscillators there is always some. For our purposes how much is too much? As is often the case, Steve Kostro of Downeast Microwave (DEMI) has a good discussion of this question complete with graphs of phase noise vs frequency for the Apollo 32 (A32) PLL designed by N5AC and sold by DEMI.

The bottom line is that phase noise of –70 dBc/Hz at 1 kHz is sufficiently good for a PLL in the 1 GHz region even when that figure is necessarily degraded by multiplying the PLL frequency ×9 to provide LO injection for a 144 MHz IF at, for example, 10 GHz. There are two issues here: Is there enough gain in the front end to overcome whatever phase noise there is, and how badly is a desired signal degraded by the phase noise. N2CEI has measured the effect of the phase noise by injecting a separate, strong signal nearby to a desired signal and finds that only quite strong signals produce any noticeable effect. Moreover if the gain of the preamplifier stage in the transverter is sufficient, and most in the microwave region have plenty of gain, most people would not notice any degradation. Of the two, the major problem is signal strength; the narrow-beamwidth antennas at the microwaves and the limited amount of activity make it unlikely that strong signals will be a problem.

Reference Oscillators

Although the reference oscillator can be for any convenient frequency, to avoid complexity we will consider initially only external GPS-linked 10 MHz reference oscillators. Look at Table 1. In case you are interested in external Rb or Cs references, these have been included but will not be otherwise discussed. Many use the standard HP3801A or its newer version the HP3816A (not listed). These are rugged, reliable sources that are

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 ♦ w3zz@arrl.org; (301-948-2594)

Table 1

Components of a Frequency Stabilized LO System

10 MHz Reference Oscillator	*Cost*	*Availability*	
HP Z3801 GPS	$500	eBay	
Trimble Thunderbolt GPS	$150	eBay	
Rockwell Jupiter Engine			
Rubidium	~ $200	eBay	
Cesium	n/a	???	
PLL Oscillator	*Cost*	*Availability*	*Phase Noise**
DEMi A32 (Apollo32)	$140	DEMI	–74 to –81
JWM Engineering 1152 - A	$269	JWM	–70
CT1DMK (VE1ALQ)	~ $120 Kit	VE1ALQ	—
10 MHz Distribution			
DEMI 10-4 (4 ports)	$75	DEMI	
JWM RDA-6 (6 port)	$264	JWM	
Homebrew (8 port)	$100		

*dBc/Hz@1 kHz
DEMI = Down East Microwave; JWM = JWM Engineering

readily integrated into a frequency control system. They are available from eBay but at a somewhat high price. The Thunderbolt is a Trimble GPS-linked oscillator that has currently become available and should provide reasonable performance at a considerably lower price than the HP units. Not mentioned here is the Rockwell Jupiter engine; it is of comparable performance to the HP units, but with the exception of a few units from VE1ALQ it no longer appears to be available and I saw none advertised on eBay.

At first glance it might be preferable to include an internal 10 MHz source. One that has found recent favor is the Fox 801BE offered by DEMI on their Apollo 32 board. Because these are TCXOs (temperature-compensated crystal oscillators), their frequency will not be as stable as the GPS-disciplined oscillators previously described. The frequency will vary up to a few hundred hertz as the transverter temperature rises during use.

PLLs

Three popular PLLs are listed in Table 1. Once sold by TAPR, the CT1DMK Reflock is widely used but is now available only in limited quantities from VE1ALQ. N1JEZ has an extensive discussion of its implementation that you must be sure to read if this is the direction you wish to go. Locally in the Washington, DC area we have had good success with a commercial PLL from JWM Engineering Group (**www.jwmeng.com**). It is a bit pricey but is an excellent performer suitable for remote use inside a tower mounted microwave box.

More recently, Steve Hicks, N5AC, has described two versions of a suitable PLL (the Apollo and the Apollo 32) at VHF+ conferences. The Apollo 32 is now available from DEMI as part of an easy-to-integrate system. I do not have phase noise numbers for the CT1DMK/VE1ALQ/N1JEZ Reflock, but both the JWM and the Apollo have more than adequate numbers exceeding –70 dBc/Hz at 1 kHz. The JWM and Apollo 32 also can be BCD (binary coded decimal) programmed to yield a variety of frequencies in the 1 GHz range that can be multiplied to yield LO inputs for transverters in the 1296 MHz to 10 GHz range.

Still another approach is the single and double loop PLL Direct Frequency Synthesizers described by Dave Powis, G4HUP/ND8P. These have excellent phase noise characteristics. While the single loop can only generate ± frequency pairs, the dual loop can use division and multiplication to generate all the needed LO frequencies to control microwave transverters.

Distribution Systems

The key to the versatile deployment of the above mentioned systems is the ability to generate suitable LO frequencies for a number of transverters from a single stable, accurate 10 MHz source and a single PLL. This requires a 10 MHz distribution amplifier and a programmable PLL, a means for programming it and a means for switching the programmed LO frequency to a series of transverters for different microwave frequencies.

Look again at Table 1. The 10 MHz oscillator distribution system is a project that you can build yourself using readily available video distribution amplifiers. JWM provides a commercial solution though at a cost. Recently, DEMI has provided an inexpensive four port filtered system that is quite suitable as is the system from G4HUP if filtered. The PLL distribution requires a BCD switch and an SMA coax relay to distribute the correct base frequency in the 1 GHz range to the

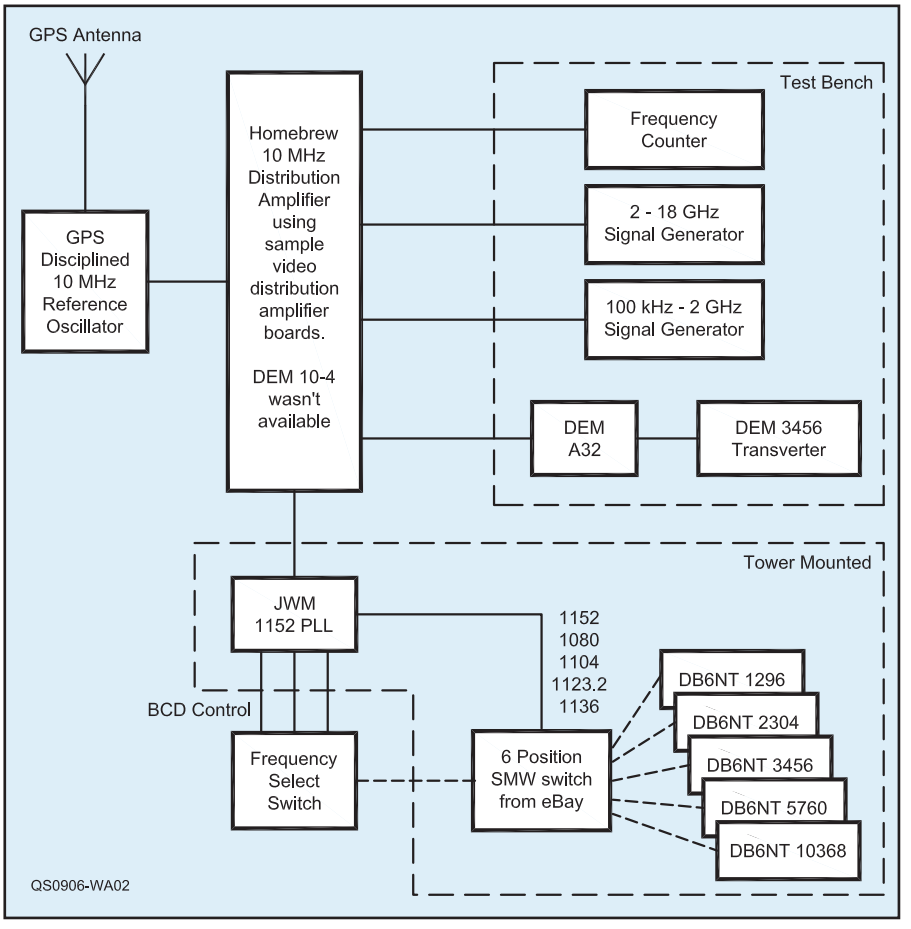


Figure 2 — GPS-locked microwave transverters and test equipment in use at W8ZN.

correct transverter. Inside the transverter multipliers are used to translate the PLL frequency — typically none on 1296, ×2 on 2304, ×3 on 3456, ×5 on 5760 and ×9 on 10 GHz.

A Typical GPS-Disciplined Oscillator LO System

We now have sufficient information to put all of this together in a working manner. Terry Price, W8ZN, has shared his microwave transverter system with me in Figure 2. It goes beyond just the transverters to supplying a stable reproducible frequency source for his test bench. An HP Z3801A GPS-disciplined oscillator feeds a homebrew distribution amplifier. Terry now says that had the DEMI 10-4 been available when he homebrewed the distribution amp, he clearly would have used the DEMI. Output from the Z3801A/10-4 goes to his frequency counter, two signal generators and to an Apollo 32 PLL driving a DEMI 3456 transverter for testing 3456 amplifiers, one of his current projects. The final output goes to his tower mounted microwave system. There it feeds a JWM 1152 PLL, which is BCD-programmed to provide suitable outputs for 1296 MHz to 10 GHz DB6NT transverters, each fed separately via a 6 position SMA relay. The base frequencies are noted in Figure 2.

In Summary

The foregoing has been a very basic description of the application of a highly stable and highly accurate oscillator system to replace the undisciplined LOs in microwave transverters. No longer will you have to guess what frequency you or the other guy is on, nor will you worry about how much you have drifted since you started your QSO. The same technology can be applied to transverters at lower and higher frequencies. This technology is not cheap but it comes at a cost not much more than a single new high quality transverter. At that it is a bargain.[1]

ON THE BANDS

March 2009 represents the least activity your conductor has seen in a single month since I started in December 2002.

6 meters. Only a single report of beacons in the US from NØJK: Jon heard K4MHZ/B FM25 and spotted a report of NØLL/B EM09 in EM86. Even the propagation reflectors are bereft of openings. But in South America Walt, LU3EX, found E_s to OA on the 15th and 24th; and PY on the 24th as well as TEP to KP4 on the 24th and 29th and XE on the 31st.

EME. After more than two years of trying, Dave, KJ9I, completed an unelevated one Yagi to one Yagi JT65a EME QSO with Joel, KG6DX, on Guam. These are difficult contacts at the margin of feasibility. Both use near legal limit power; Dave uses a C3I 13 element Yagi on a 51 foot boom and Joel uses a 6 element Yagi on a 34 foot boom. Dave also reports another such contact with UN8GC.

[1]For a Bibliography, see **www.arrl.org/files/qst-binaries**.

HERE AND THERE

June ARRL VHF QSO Party. Last year's June VHF contest yielded some record and near record scores. E-skip was everywhere! What will happen this year? You can find out and participate by joining the fun beginning at 1800Z June 13 to 0300Z June 15. Details are in May 2009 *QST* or at **www.arrl.org/contests/rules/2009/june-vhf.html**.

2008 SMIRK QSO Party. This popular 6 meter only contest runs from 0000Z June 20 to 2400Z June 21 and is sponsored by the Six Meter International Radio Klub (SMIRK). More information can be found at **www.smirk.org**. In 2008, the top five worldwide winners were K3NAM, K3FM, N4BP, W3XO and WA5LFD.

San Andres DXpedition. 5JØM will return. See How's DX? this issue.

New spotting service for 2 meter E_s. Frank, PA4EME, notes that the well-known European VHF DX portal Make More Miles on VHF (MMMonVHF) at **www.mmmonvhf.de** has now developed new tools that should allow them to plot E_s openings in North America as they do in Europe. Frank supplies the following information from Guy, DL8EBW: To send your log, go to the E_s section of MMMonVHF. If this is your first visit, you will need to register. After logging in, the page is self-explanatory.

Let's take advantage of this powerful new tool.

144 MHz Standings

Published 144 MHz standings include call area leaders as of April 1, 2009. For a complete listing, check the Standings Boxes on the "World Above 50 MHz" Web pages at **www.arrl.org/qst/worldabove/**. There are two requirements for inclusion in this list: US operators located east of the Mississippi River must have worked at least eight states. All operators must have submitted information within the previous 2 years. (You need not work additional stations to remain in the standings, but please confirm your continued interest.) Submit data by e-mail to **standings@arrl.org** or mail paper submissions to Steve Ford, WB8IMY, ARRL, 225 Main St, Newington, CT 06111. Listed by states worked.

Call Sign	State	States	DXCC	Grids	DX (km)
1					
K1MS*	MA	50	32	—	2,166
W1AIM*	VT	50	18	228	2,340
K1SIX*	NH	43	14	201	2,501
W3EP/1	CT	36	3	191	2,450
N1RR	MA	29	2	36	2,200
WA1FVJ	CT	26	2	51	2,200
2					
K1JT*	NJ	47	73	466	2,369
K1NY	NY	38	4	151	2,576
W2MPK*	NY	37	17	—	—
WB2CUT	NJ	37	2	158	—
K2OVS*	NY	36	6	165	2,812
3					
WA2FGK*	PA	47	46	302	—
W3ZZ	MD	38	6	241	2,526
AE3T	PA	37	3	—	2,350
AK3E	MD	36	4	168	2,293
4					
W8WN*	KY	50	73	522	2,273
WA4CQG*	AL	50	16	—	—
K4ETC	TN	40	8	295	1,289
K2BLA*	FL	39	58	373	—
K4QI	NC	38	6	229	—
AA4H	TN	38	3	168	2,007
K4RTS	VA	37	3	166	2,023
N4MM	VA	35	5	149	—
K4MM	FL	34	8	163	2,347
N4HN	NC	34	2	143	—
K4MSG	VA	31	2	107	1,656
K4YMQ	AL	26	2	77	1,320
K4EME*	VA	25	23	95	—
K0VXM	FL	25	5	138	1,974
N9HF*	FL	22	8	—	—

Call Sign	State	States	DXCC	Grids	DX (km)
5					
W5UWB*	TX	50	53	390	2,332
W5ZN*	AR	50	37	325	2,400
WD5AGO*	OK	50	32	220	2,050
WA5VJB*	TX	50	19	—	—
W5RCI*	MS	50	16	284	2,992
W5LUA*	TX	50	—	—	—
N5KDA*	MS	48	55	343	—
K5UR	AR	48	5	517	—
N5LJL	OK	48	3	219	2,472
K5SW	OK	47	5	298	2,378
K5QE*	TX	47	5	—	—
K5LLL	TX	39	3	208	2,089
AA5JG	OK	39	3	150	2,171
W5HNK	TX	37	3	—	2,442
W3UUM*	TX	36	23	237	2,547
K5AM	NM	31	9	157	—
AA5AM	TX	31	3	125	2,271
6					
K6AAW*	CA	50	58	406	3,831
KC6ZWT*	CA	31	38	260	3,934
K6QXY*	CA	24	8	—	3,794
KR7O*	CA	23	24	199	2,134
N6ZE*	CA	22	16	115	2,600
7					
W7GJ*	MT	50	110	—	—
W7MEM*	ID	50	70	442	—
WA7GSK	ID	30	2	215	3,635
WA7JTM	AZ	27	1	100	—
8					
K8BHZ*	MI	50	45	362	2,278
K8ROX	OH	40	2	151	1,915
K2YAZ	MI	38	2	165	2,167
WA8WV	WV	19	2	35	1,026
KB8O	OH	17	2	39	1,097

Call Sign	State	States	DXCC	Grids	DX (km)
9					
N9LR*	IL	50	50	511	2,274
AA9MY*	IL	49	69	417	2,045
KA9UVY	IL	43	2	161	2,373
K9SM	IL	40	36	237	1,752
W9RM*	IL	35	8	109	2,121
W9RPM	WI	32	6	155	2,670
WA9PWP	WI	32	2	144	1,940
Ø					
KØFF*	MO	50	35	267	2,185
WØRT*	KS	50	17	206	2,357
KØALL*	ND	50	15	—	—
WØSD*	SD	50	13	297	—
KØAWU*	MN	48	48	372	—
NØPB	MO	48	5	315	2,474
NØLL	KS	47	3	387	2,378
KWØA	MO	45	2	238	2,501
KØGU*	CO	42	40	350	2,400
KBØPE	MO	29	1	111	1,702
KØRZ*	CO	26	2	107	2,173
KØCS	CO	26	2	83	2,177
Canada					
VE3KH*	ON	50	63	400	1,985
VE2PIJ*	PQ	14	2	52	1,781
International					
DL8EBW*		39	99	826	—
XE2AT*		43	56	279	2,191
PA3CEE*		28	93	701	—
NP3CW	PR	2	9	18	6,390

*Includes EME contacts
— Not given

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Through Dec 31, 0100Z-2359Z, Republic of Macedonia. Macedonia Telegraphic Group, Z3ØMCWG. 15th Jubilee of MCWG. 28.080 24.900 21.020 18.080 14.020 10.120 7.020 3.520 1.820. QSL. Valdimir Kovaceski, Z35M, Sava Kovacevic 47 G/55, 1000 Skopje, Republic of Macedonia. *Special Event began February 20, 2009.* **www.qrz.com/z30mcwg**

May 16, 1300Z-2100Z, Williamsburg, VA. Williamsburg Area Amateur Radio Club, K4RC. 402nd anniversary of the founding of Jamestown. 14.260 7.260. Certificate. WAARC, PO Box 1470, Williamsburg, VA 23187. **www.k4rc.net**

May 16, 1500Z-2300Z, Fort Bliss/El Paso, TX. W5CSM, K5B. Armed Forces Day Honoring America's Fallen Heroes. 145.570 145.070 14.330 14.280 145.070 WinLink 2000 RMS and PacLink using K5CW-10. 145.570 D-Star local. QSL. Dave Null, W5CSM, 11209 Loma Seca Pl, El Paso, TX 79934.

May 16, 1600Z-2359Z, Seattle, WA. Boeing Amateur Radio Society, K7B. 50th Anniversary of Boeing Amateur Radio Society, K7NWS. 14.275 14.125 QSL. BEARS Trustee, 19221 Normandy Park Dr SW, Seattle, WA 98166. **n7rvf@aol.com**

May 16-May 17, 1901Z-0659Z, Astoria, OR. Sunset Empire Amateur Radio Club, N7Q. Marque Marriott Memorial Grid Square Day — CN76xf. 146.580 14.270 7.275 3.975. QSL. Sunset Empire Amateur Radio Club, PO Box 264, Astoria, OR 97103. **www.w7bu.org/mmm**

May 21-May 23, 1200Z-1700Z, Charlton, Portsmouth, Hampshire, UK. Radio Society of Great Britain, GB2CT. Over 200 years since Admiralty Shutter Telegraph Installed. 14.200 7.090. QSL. John Wakefield, Oakhurst, Lower Common Rd, West Wellow, Romsey SO51 6BT, UK. **www.qrz.com/gb2ct**

May 23, 1300Z-2100Z, Devens, MA. Members of US Army MARS, K1KBO. Army Security Agency and SP4 John T. Davis first KIA Vietnam. SSB 14.275 7.275 CW 7.025 3.5025. QSL. William C. Voedisch, W1UD, 240 Main St, Leominster, MA 01453-2933. **w1ud@juno.com**

May 25-May 26, 1500Z-0300Z, Sevierville, TN. Sevier County Emergency Radio Service, W4W. Remembering Memorial Day 2009. 7.253 7.150 3.845 3.750. QSL. Rick Sawaya, 2005 Spence Mountain Loop, Sevierville, TN 37876. *Club members will also be working with their own calls; please QSL the station contacted.* **n4jtq@live.com**

May 30-Jun 1, 1700Z-0100Z, San Mateo, CA. Blackberry REACT, K6M. MakerFaire, a festival of arts, crafts and engineering. 14.250. QSL. Phil Stripling, 301 S. Grant St, San Mateo, CA 94401. **makerfaire.com**

Jun 4-Jun 7, 0001Z-2359Z, Makedonia, Greece. SY2 D-DAY Team, SY2DDAY. 65th Anniversary of D-Day. All bands All modes. QSL. Archelaos Iakovidis, PO Box 26, PC 59100 Veria, Makedonia, Greece. **www.qrz.com/sy2dday**

Jun 5-Jun 7, 0000Z-2359Z, Weymouth, England. Wyke Regis Radio and Training Club, GB65FRW. 65th Anniversary of D-Day. For US 20 15 m For Europe 80 40 m. QSL. Bob Palmer, M3DPQ, 34 Ditmas Ave, Kempston Bedford, Bedfordshire MK42 7DP, England. **wykerradio.org**

Jun 5-Jun 7, 1500Z-0000Z, Mena, AR. Ouachita Amateur Radio Association Inc, W5HUM. Lum and Abner Radio Program. 28.373 14.273 7.273 3.973. Certificate. Don Thomas, 309 1st St, Mena, AR 71953. *Special certificate to the first 100 QSLs received.* **www.geocities.com/w5hum**

Jun 6, 1300Z-2000Z, Asheboro, NC. Randolph Amateur Radio Club, NC4ZO. North Carolina Aviation Museum Fly-In & War Bird Display. 21.350 14.260 7.250. QSL. Butch Simpson, WS4H, 6747 King Mtn Rd, Asheboro, NC 27205. **butch@atomic.net**

Jun 6, 1400Z-1900Z, Badin, NC. Montgomery Amateur Radio Society, NC4MC. 65th anniversary of the loss of *Badin Bomber* on June 8, 1944. 14.250 7.250 146.58. Certificate. Don Grady, KG4ZRH, 120 Woodline Dr, Troy, NC 27371. **nc4mc-ars@embarqmail.com**

Jun 6, 1400Z-2100Z, Oswego, NY. Fulton Amateur Radio Club, W2CXV. D-Day and Museum Ships Weekend from the *USAT LT-5*. 21.365 18.165 14.265 7.265. QSL. Redd Swindells, AI2N, 134 E Seneca St, Oswego, NY 13126. **www.fultonhamradioclub.org**

Jun 6, 1400Z-2100Z, Whiteman AFB, MO. Warrensburg Area Amateur Radio Club, Inc, WØW. Honoring Cold War veterans, from inactive missile site 15 years. 14.245 7.245. Certificate. WAARCI, PO Box 1364, Warrensburg, MO 64093. **www.waarci.org**

Jun 6-Jun 7, 0001Z-2359Z, Camden, NJ. Battleship *New Jersey* Amateur Radio Society, NJ2BB. Museum Ships Weekend Event. 21.330 18.150 14.270 7.250. QSL. Margaret Burgess, KB2BRR, 150 Schooner Ave, Barnegat, NJ 08005. *Contact 15 ships for a certificate*. **www.nj2bb.org**

Jun 6-Jun 7, 1200Z-0000Z, Mobile, AL. Battleship USS *Alabama*, W4A. Museum Ships on the Air. See URL for freqs. QSL. Brian Page, N4TRB, 1717 Tidewell Trace, Lawrenceville, GA 30043. **www.n4trb.com/AmateurRadio/MuseumShips/2009/BB60.htm**

Jun 6-Jun 7, 1400Z-2145Z, Baton Rouge, LA. Baton Rouge and USS *Kidd* Amateur Radio Clubs, W5KID. Museum Ships on the Air. SSB: 15 20 40 m Gen & above RTTY subband CW: QRP sub bands. QSL. W5KID, 305 S River Rd, Baton Rouge, LA 70802. *Primary freq 20 m.* **www.lsu.edu/brarc/uss_kidd.htm**

Jun 6-Jun 7, 1400Z-2000Z, Streetsville, Mississauga, ON, Canada. Mississauga Amateur Radio Club, VE3MIS. Annual Streetsville Bread & Honey Festival. 28.480 21.315 14.240 7.230. Certificate. Michael Brickell, VE3TKI, 2801 Bucklepost Cres, Mississauga, ON L5L 1M6, Canada. *Please include $2 for postage.* **www.marc.on.ca**

Jun 6-Jun 7, 1500Z-0300Z, La Junta, CO. Pueblo Ham Club, WØPHC. Bent's Old Fort National Historic Site. 14.260. QSL. Pueblo Ham Club, 4 Fireweed Ct, Pueblo, CO 81001. **bill@billnicoll.com**

Jun 6-Jun 7, 1600Z-2359Z, San Diego, CA. USS *Midway* (CV 41) Museum Radio Room, NI6IW. Annual International Museum Ships Radio Weekend. SSB 14.320 7.250 CW 14.060 7.055 PSK-31 7.070-7.080 RTTY 14.080 7.080 2m/70cm SOCAL rep. USS *Midway* (CV 41) Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **af6ha@yahoo.com**

Jun 6-Jun 7, 2000Z-2000Z, Eureka, CA. Humboldt Amateur Radio Club, W6ZZK. Normandy Invasion (D-Day) and Museum Ships Weekend. 14.260 14.039 7.260 7.039 3.860 3.539. QSL. Jim Falls, HARC, 2605 R St, Eureka, CA 95501-3135. *From the* USS LCI(L)-1091. *TCS-8 used on AM/CW top of the hour.* **www.navsource.org.archives/10/15/151091.htm** *or* **www.humboldt-arc.org**

Jun 6-Jun 14, 0000Z-2359Z, Monterey, CA. Naval Postgraduate School Amateur Radio Club, N6C. Centennial of Naval Postgraduate School. 14.255 7.255. QSL. NPS Amateur Radio Club K6LY, 833 Dyer Rd – Code EC/K6LY, Monterey, CA 93943. **www.k6ly.org**

Jun 7, 1300Z-2000Z, Cornwall-on-Hudson, NY. Orange County Amateur Radio Club, W2HO. NYS Hudson-Fulton-Champlain Quadricentennial. 146.520 7.280 3.920. QSL. A. J. Maroney, W2SON, 4 Barr Ave, Cornwall-on-Hudson, NY 12520. **www.ocarc-ny.org**

Jun 7, 1400Z-2200Z, Manitowoc, WI. USS *Cobia* Radio Club and ManCoRad Radio Club, NB9QV. WW II Submarine USS *Cobia* AGSS-245 on the air. 14.260 7.250 3.900. QSL. Fred Neuenfeldt, W6BSF, 4932 S 10th St, Manitowoc, WI 54220-9121. **www.qrz.com/nb9qv**

Jun 10, 1300Z-2300Z, Kearney, NE. Midway Amateur Radio Club, WØKY. Pony Express Re-ride Commemoration from Ft Kearny State Park. 14.275 7.280. Certificate. Midway Amateur Radio Club, PO Box 1231, Kearney, NE 68848. **w0ky.kearney.net**

Jun 12-Jun 13, 2300Z-2300Z, Bloomfield, MO. Bootheel and SE Missouri Amateur Radio Clubs, WØS. Commemorating 148 years of the Stars & Stripes Newspaper. 14.260 7.260 3.950. Certificate. Stars & Stripes, PO Box 98, Jackson, MO 63755.

Jun 12-Jun 15, 1600Z-0100Z, Fountain Valley, CA. Fountain Valley Amateur Communications Team, WA6FV. City of Fountain Valley Summerfest and Classic Car Show. 14.260 7.260. QSL. Fountain Valley Amateur Communication Team, 15849 Los Reyes St, Fountain Valley, CA 92708. **www.qsl.net/fvraces**

Jun 13, 1400Z-2100Z, West Palm Beach, FL. West Palm Beach Amateur Radio Club, K4PBC. 100th anniversary of the formation of Palm Beach County, FL. 14.270 7.270. Certificate. West Palm Beach ARC, 113 Dory Rd N, North Palm Beach, FL 33408. **jgrant2@earthlink.net** *or* **www.wpbarc.org**

Jun 13, 1500Z-2100Z, Dillon, MT. Area Amateurs, W7R. 100 Year Celebration of the Railroad Depot in Dillon, MT. 14.245 7.245 3.880. Certificate. Bill Kolar, 955 E Parkview, Dillon, MT 59725. **bicaboca@bmt.net**

Jun 13, 1500Z-2300Z, Jacksonville, TX. Cherokee County Amateur Radio Club, K5JVL. 25th Annual Tomato Fest. 14.250 7.250. Certificate. Brad Low, 840 Henderson St, Jacksonville, TX 75766. **www.k5jvl.net**

Jun 13-Jun 14, 0000Z-2359Z, Tucson, AZ. Saguaro National Park Operation, KE7DX. WFF Green Days. 14.244 14.044 7.244 7.044. QSL. Gary Keck, KE7DX, PO Box 18135, Tucson, AZ 85731. **wff44.com/en/contest/** *or* **www.marketemporium.com/joomla/ke7dx_menu**

Jun 13-Jun 14, 1400Z-1800Z, Colo, IA. Story County Amateur Radio Club, WØYL. 96 Years on the Transcontinental Lincoln Highway. 14.275 7.250 3.875. Certificate. Dave Lucas, 4263 Highway 13, Central City, IA 52214.

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

Operating from the Reed Niland Cafe in conjunction with KØKBX. **k0dlp@arrl.net** *or* **www.w0yl.com**

Jun 13-Jun 14, 1400Z-1800Z, Watkins, IA. Benton County Amateur Radio Club, KØKBX. 96 Years on the Transcontinental Lincoln Highway. 14.275 7.250 3.875. Certificate. David Lucas, 4263 Highway 13, Central City, IA 52214. *Operating from the Youngville Cafe (www.youngvillecafe.com) in conjunction with WØYL.* **k0dpl@arrl.net**

Jun 13-Jun 15, 1800Z-0300Z, Jefferson, OH. N8OFS, N8O. Caboose Portable for the AC&J Railroad's 25th Anniversary. FM 52.525 51.500 50.300 USB 50.200. QSL. N8OFS, PO Box 517, Jefferson, OH 44047.

Jun 13-Jun 20, 1700Z-2200Z, Greensburg, IN. Amateur Radio of Decatur County, Inc, W9G. Commemorating 150 years of Greensburg, Indiana — the Tree City. 14.330 7.200 7.050 3.978. QSL. W9G, 6014 S County Rd 600 W, Greensburg, IN 47240. **www.n9lqp.org/w9g**

Jun 18, 1400Z-2000Z, Irondale, MO. Zombie Squad Amateur Radio Club, KA3WSQ. 5th Annual ZombieCon Disaster Preparation Seminar. 14.265. QSL. T. Thompson, 1314 Mt Pleasant Rd, West Newton, PA 15089. **www.zombiehunters.org**

Jun 19-Jun 28, 0000Z-2359Z, Oklahoma City, OK. OKC DX Club, W5E. Peak of Sporadic E Season. 50.150 28.425. QSL. OKC DX Club, 2310 NW 35th St, Oklahoma City, OK 73112. **kx5t@cox.net**

Jun 20, 1200Z-2000Z, Newington, CT. Newington Amateur Radio League, NA1RL. Annual Hamfest. 28.450 21.225 18.150 14.250. QSL. Richard Lawrence, KB1DMX, 335 Lloyd St, Newington, CT 06111. **www.narl.net**

Jun 20, 1300Z-2000Z, Byesville-Cambridge, OH. Cambridge Amateur Radio Association, K8R. Relay For Life — a cele-bration of cancer survivors. 146.520 28.400 14.265 7.235. QSL. Mary Jane Rhodes-Ellis, KD8EIR, 5855 Sherrard Rd, Cambridge, OH 43725. **www.relayforlife.org**

Jun 20-Jun 21 and **Jun 27-Jun 28, 0000Z-2359Z**, Vergina, Greece. SX2MT Team, SX2MT. International Museums Weekend 2009 — Museums On-The-Air. All bands All modes EchoLink R-4 node 121496. QSL. Archelaos Iakovidis, SV2KBB, PO Box 26, PC 59100 Veria-Makedonia, Hellas, Greece. *Museum of Vergina — Royal Tombs. Museum number IMW 5178 EPC 3701.* **www.qrz.com/sx2mt**

Jun 26-Jun 28, 1700Z-2000Z, Sevierville, TN. Sevier County Emergency Radio Service, W4W. SCERS 1st Field Day. 28.450 7.260 14.260 3.860. QSL. SCERS – Rick Sawaya Sr, 2005 Spence Mountain Lp, Sevierville, TN 37876. *Please QSL direct to operator worked.* **scers2008@gmail.com**

Jun 26-Jun 28, 1800Z-1900Z, Simi Valley, CA. Ventura County Amateur Radio Society, N6R. Field Day and Commemorating Lives of President and Mrs Ronald Reagan. 28.369 21.289 14.289 7.289. QSL. Ventura County Amateur Radio Society, N6R c/o Peter S. Heins, 1559 Norwich Ave, Thousand Oaks, CA 91360. *VCARS will be joined by Simi Settlers Amateur Radio Club and Ventura County Amateur Radio Club in this event.* **www.vcars.org**

Jun 27, 1600Z-2359Z, San Diego, CA. USS *Midway* (CV 41) Museum Radio Room, NI6IW. Commemorating and participating in Armed Forces Field Day. SSB 14.320 7.250 CW 14.060 7.055 PSK-31 7.070-7.080 RTTY 14.080 7.080 2 m/70 cm SOCAL rep WIN. QSL. USS *Midway* (CV 41) Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **af6ha@yahoo.com**

Jun 27-Jun 28, 0800Z-2359Z, Salem, OR. Salem Multicultural Institute, W7B. Oregon's 150th Anniversary and Salem's Multicultural Background. 50.120 21.250 14.250 3.940. QSL. Simon Clowes, 3109 13th St SE, Salem, OR 97302. **n7aus@comcast.net**

Jun 27-Jun 28, 1800Z-1800Z, Lindenhurst, NY. Great South Bay Amateur Radio Club, W2GSB. Field Day. 14.260 7.250 3.895 14.070 PSK Gen bands CW SSB digital. QSL. W2GSB, PO Box 1356, West Babylon, NY 11704. **www.gsbarc.org**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9 ×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's Web site.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form, at **www.arrl.org/contests/spevform.html**. A plain text version of the form is also available at that site. You can also request a copy by e-mail or send a self-addressed stamped envelope (SASE) (Special Requests, ARRL, 225 Main St, Newington, CT 06111; write "Special Events Form" in the lower left-hand corner). Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Aug** *QST* would have to be received by **Jun 1**. In addition to being listed in *QST*, your event will be listed on the *ARRLWeb* Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through April 13. You can view all received Special Events at **www.arrl.org/contests/spev.html**.

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 25 Volunteer Examiners according to the total number of exam sessions they have participated in since their accreditations. Since each session requires an average time commitment of 2-4 hours or more, the thousands of hours these VEs have invested is extraordinary! Whether you are one of our VE Teams that test once a week, once a month or once a year, we want to express our warmest appreciation to all volunteers for their generous contributions to the ARRL VEC program.

If you are an ARRL VE, you can see your session stats online at **www.arrl.org/arrlvec/veparti.php**.

If you're not a VE, become one! See **www.arrl.org/arrlvec/become-a-ve.html**.

Examiner	*Sessions*	*Accreditation Date*	*Examiner*	*Sessions*	*Accreditation Date*
N5AF, Sammy Neal	481	20-Nov-1984	KK5NU, John Moore III	278	21-May-1995
K6VIP, Royal Metzger	368	29-Apr-1985	KØIH, John Hauner	268	11-Jan-1985
ABØSX, Harry Nordman	358	9-Jan-2002	AA2HX, Daniel Calabrese	264	1-Nov-1991
K6RQ, Frank Glass	353	29-Apr-1985	N6NAD, Ralph Schutte	260	22-Aug-1997
KAØCDN, Karen Schultz	337	6-Sep-1984	KB5PGY, David Fanelli	260	1-Oct-1991
WØIJR, Glenn Schultz	327	28-Sep-1984	WB5R, Gerald Grant	260	4-Jan-1985
K3FL, Franz Laugermann	304	1-Dec-1991	ABØTO, David Bartholomew	259	22-Mar-2002
AC2T, Paul Maytan	299	6-Sep-1984	K6PYP, Scott Swanson	258	1-Dec-1992
KSØF, John Mackey, Jr	291	1-Oct-1990	W7QGP, Mary Lewis	255	12-Aug-1985
KA6RHF, David Laurel	287	22-Apr-1985	NI5S, Leslie Dale	255	6-Sep-1984
NØWDG, Kevin Naumann	286	17-Nov-2002	N5KBW, Michael Faucheaux	254	15-Jul-1996
W6IO, Leonard Scarpelli	285	1-Nov-1992	N8MPC, James Henderson	252	1-Nov-1991
KP4PQ, Victor Madera	283	1-Mar-1992			

WB8IMY

ECLECTIC TECHNOLOGY

High Speed Multimedia at 3.5 GHz

For several years hams have been experimenting with high-speed multimedia (HSMM) communication, primarily at 2.4 GHz using wireless network routers. Yes, the same wireless Internet routers you may have in your home right now. HSMM enthusiasts are turning these routers into ham transceivers by adding gain antennas, external RF power amplifiers and new operating firmware.

What makes this activity legal is the fact that consumer-grade wireless routers use channel frequencies that overlap the Amateur Radio allocation at 2.4 GHz. So long as they operate on frequency channels within our band, hams can use these modified router systems for applications the original manufacturers probably never imagined. As a result, the HSMM folks have been setting up sophisticated networks all over the country, swapping voice, image and other data over substantial distances at Internet speeds. There is an entire chapter devoted to this topic by John Champa, K8OCL, in the *ARRL VHF Digital Handbook*.

The shared frequency allocation that makes all this possible has a downside, as you've probably guessed. The wonders of spread spectrum notwithstanding, there are plenty of opportunities for mutual interference. John Doe down the street just wants to stream Internet video over his home network. He is oblivious to the ham on the next block who is trying to do HSMM on the same channel. The two gentlemen's activities are bound to clash, and sometimes do.

Hams have been looking to other bands for HSMM, bands where we are virtually alone. The problem has been finding affordable equipment. (Appropriating a $75 wireless router as your 2.4 GHz transceiver has a certain budget appeal.)

Change appears to be on the wind. Steve Lampereur, KB9MWR, passed along a tip concerning a possible solution at 3.5 GHz — another Amateur Radio band at a shared, but much less crowded, allocation. Ubiquiti Corporation (**www.ubnt.com**) has just announced the NanoStation3, a 3.5 GHz wireless transceiver module that retails for only $80. You can read the data sheet at **www.ubnt.com/downloads/ns3_ds.pdf**.

The Ubiquiti NanoStation transceiver in this photo is the white module just above the parabolic dish antenna. At 3.5 GHz, these inexpensive units have potential for amateur HSMM applications.

An Indian ATS-1 transceiver kit.

Considering the portable size, easy firmware updating and low price, the NanoStation3 units have strong potential. It will be interesting to see what the HSMM hams can do with these.

Homebrewing a 20 Meter SSB Transceiver in India

The Amateur Radio homebrew spirit is very much alive and well in India — and they are using the Web to keep it going. The object of all the enthusiasm is a 20 meter SSB transceiver known as the ATS-1. Designed by Rajani, VU3CAV, and Gaurav, VU2GTI, the ATS-1 is a communal effort coordinated through VU2GTI's Web site at **www.vu2.in**. Hams who register on the site (create an account) have access to all the design documents, circuit board layouts and so forth. Apparently the ATS-1 is being made available in kit form, although the price wasn't available at press time.

The Sounds of Space

Here is an educational way to waste time at the home or office. The folks at Space Weather have inaugurated a live audio stream from the Air Force Space Surveillance Radar in Texas. Whenever an object (such as a meteor) generates a radar echo, you hear the resulting ping. In the near future they plan to add broadcasts of solar radio bursts and VLF signals from the ionosphere. The streams are punctuated by Daily Space Weather Updates from Dr Tony Phillips. Go to **http://spaceweatherradio.com/**, scroll down to "Space Surveillance Radar" and click the LISTEN! button.

Reversible Diodes?

No kidding! Scientists at Rutgers University have discovered that a crystal made of bismuth, iron and oxygen can function as a reversible diode. They published their findings in the journal *Science* and the results are intriguing.

They also discovered that diodes made from this material generate current when light falls on them, making the material a potential candidate for future solar cells.

The crystal is a *ferroelectric* material, meaning that it exhibits electrical polarization, or alignment. By applying an external voltage to the ferroelectric crystal, the polarization reverses, along with the direction that the diode allows electricity to flow.

The material belongs to a class of crystalline materials known as *perovskites*, which have two positive ions of different atomic sizes (in this case, bismuth and iron) bound to negative ions (oxygen). It has three oxygen atoms for each bismuth and iron atom.

Don't look for these in your favorite parts catalog any time soon. According to the report, the first applications are likely to be in microprocessors. QST

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

K2TQN

VINTAGE RADIO

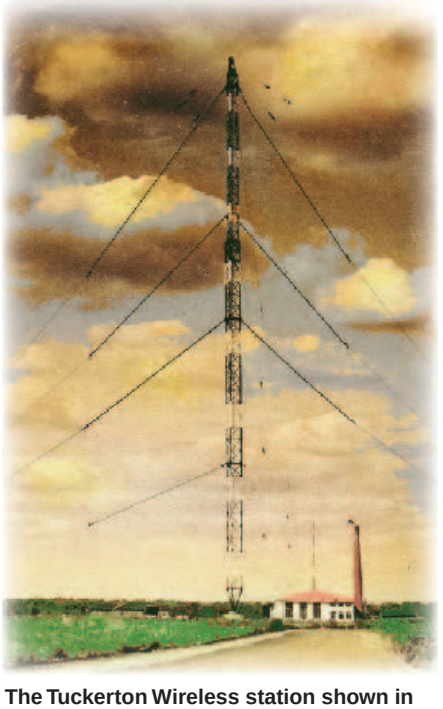
Tuckerton Wireless

Recently I was asked to give a 15 minute talk about the Tuckerton Wireless station by a neighbor who holds officer positions in several historical organizations around New Jersey. Her meeting was being held on a Saturday at the Tuckerton Seaport, once known as the Barnegat Bay Decoy and Baymen's Museum. The Tuckerton Seaport (**www.tuckertonseaport.org**) has evolved into a maritime village located along historic Tuckerton Creek in Tuckerton, New Jersey, about 15 miles north of Atlantic City. Since it is nearby, I said okay.

As I was researching the project, memories flooded my mind. Good memories of a trip with my dad when I was about 10 years old to see the huge tower there. It was no longer operating then but the enormity of the site took your breath away. Dad pointed out that men climbed the tower to build it and to maintain it. This was hard to imagine for a 10 year old. I had climbed my share of trees, but 15 feet was always high enough for me and way too high for my mother.

On the way back home, dad told me about the legend that the Germans who built it radioed the signal "Get Lucy" from there to a submarine in 1915, instructing them to sink the ocean liner RMS *Lusitania*. A few years later I remember hearing news broadcasts that the tower had been demolished. Since that time the property was sold, lagoons were dug to the river and reasonably priced waterfront homes were built there. Remnants of the tower are still in existence. The huge guy anchors were too large to be removed, so they are now next to the road where it bends around them. One is next to a home owned by a local ham. The main building is also there, sitting next to one of the roads.

JOHN DILKS, K2TQN

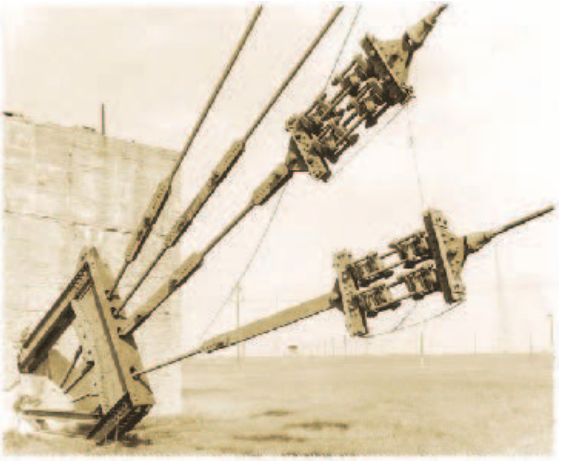


The Tuckerton Wireless station shown in an old souvenir photo.

BRUCE KELLEY, W2ICE

The base of the tower. The inset shows a magnified photo of a man on the tower base.

BRUCE KELLEY, W2ICE



One of the giant anchor blocks showing the 7 foot long glass insulators.

While researching this project, I found many online and printed sources with a lot of information, much of it conflicting. For instance, the height of the tower was reported to be from a low of 500 feet to well over 900 feet. I ended up using information provided by sources that I felt were most reliable: Ed Raser, W2ZI; Bruce Kelley, W2ICE, a founder of the Antique Wireless Association (AWA) and Thorn Mayes, W6AX, all silent keys. These men researched, visited and photographed the station and interviewed as many individuals still alive as they could. I also used newspaper interviews of Dan Flomerfelt, W2BFV, who worked at the station. They were all members of the AWA.

Building the Station

The project began in 1911 when the Germans determined they wanted to have a worldwide radio system of communications. The German government purchased 200 acres on Hickory Island to build this mammoth radio site. A sister station was also built in Germany at the same time. Plans were made to build additional stations around the world.

Local men were hired to build the antenna and tower, and they completed the task before the professional builders and engineers completed theirs in Germany. The steel tower's official height was 825 feet high. The lower end of the tower terminated in a large steel ball resting on glass insulators to insulate it from ground. Attached to the top was a 60 foot wooden pole 16 inches in diameter, which supported the antenna at a height of 865 feet. Thirty six copper cables connected to this pole extended down 600 feet to large insulators and from there, steel cables continued to the tops of 36 poles, 40 feet high, mounted around the base of the tower at a radius of 1500 feet. Leads from the antenna wires went to the transmitter house. The natural frequency of the antenna was 107 kHz or 2800 meters.

Inside the building was a steam power plant generating 120 kW of 220 V dc. A

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special 250 horsepower 4000 r/min motor was directly connected to the [Dr Rudolph] Goldschmidt 100 kW alternator, the most powerful transmitter at the time (1914). One terminal of the alternator was connected to ground, the other directly to the antenna through a large loading coil lowering the resonant frequency of the antenna to 40 kHz, 7400 meters, the frequency of the alternator. Communication was accomplished by keying the dc exciting current to the alternator. The Tuckerton Wireless signal, the first that could continuously reach Europe, was the most powerful one in the world.

War and politics changed the ownership of the station. The US Navy took over the station for the duration of the war. Legislation was later passed preventing foreign ownership of radio stations in the US and in 1920 the station was sold to RCA, a new company formed by General Electric and Westinghouse. Local papers reported the price paid was $1 million.

RCA improved the station and replaced the Goldschmidt equipment with two new 200 kW transmitters, Alexanderson alternators made by GE.

TUCKERTON HISTORICAL MUSEUM

Charles Buelow looks at glass base insulator at the Tuckerton Historical Society Museum.

In 1924 RCA relocated their marine station, WSC, from Siasconset, Massachusetts to Tuckerton. Later, before 1955, WSC was relocated up the road from Tuckerton, to West Creek, New Jersey.

The end came in 1955, about 2 years after the last transmission from the big alternators. On December 27, 1955, the day before the tower would come down, longtime employee Charles Buelow climbed to the top of the tower for the last time. He was 61. As a local boy of 17, he had started in 1912 as a helper assembling the tower. Over the years he rose to the level of engineer, retiring from RCA in 1960.

Conclusion

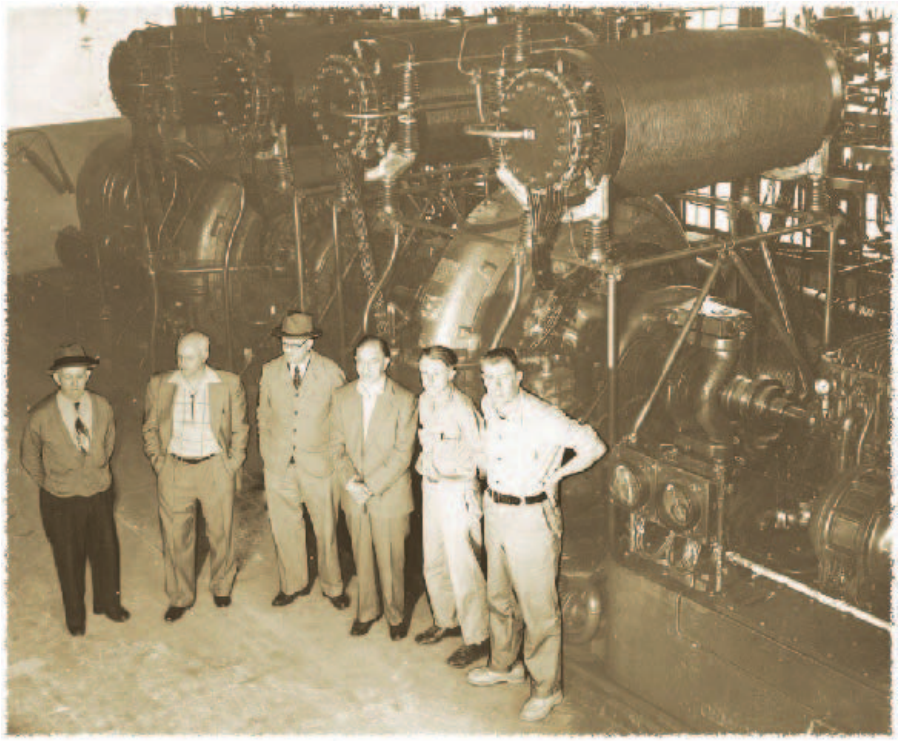
My thanks to Bruce Kelley and Ed Raser who had planned their visit to the Tuckerton Wireless station for some time. They arranged to meet up with Dan Flomerfelt who was the former Supervisor in Charge of the station for a personal tour. Dan worked there over 31 years and was the last employee of record. On May 13, 1955 Kelley brought his trusty camera and took many photos of the station.

Thorn Mayes researched this station and many others and wrote a fabulous book, which I recommend. Many of the facts I used came from his notes and book: *Wireless Communication in the United States, The Early Development of American Radio Operating Companies*.

BRUCE KELLEY, W2ICE

Dan Flomerfelt, W2BFV, standing before the station's commemorative plaque.

BRUCE KELLEY, W2ICE



AWA members from left: Dan Flomerfelt, W2BFV; George Batterson, W2GB; Ed Raser, W2ZI; Luther Anderson, W2LF; Lincoln Cundall, W2QY, and Bruce Kelley, W2ICE.

Thorn L. Mayes, W6AX, was an electrical engineer who grew up in the time he wrote about. He knew wireless and many of the people who developed it. The book is a factual account of alternators, arcs and sparks, and coherers, barretters and tickers! [Barretter is a resistor inserted into a circuit to compensate for changes (as those arising from temperature fluctuations.) — *Ed.*] It tells of great engineering achievements. It describes unscrupulous stock promotions that by chance yielded some technical breakthroughs.

This book covers the glory days of high powered wireless, 300,000 W spark transmitters, 1 million W arc transmitters and the mighty Alexanderson alternators with antennas as long as 9 miles. These systems delivered dependable worldwide radio communication over 80 years ago. It also includes interesting tales from the business history of early radio. The appendix includes fresh opinions from excerpts of unpublished letters of pioneers and early drawings of well-designed quenched gap spark transmitters.

The book is available from The New England Wireless and Steam Museum Inc, 697 Tillinghast Rd, East Greenwich, RI 02818, **www.newsm.org**.

There is a lot of Web information available. For more early photos and those of the site today with all the houses, please visit **www.k2tqn.com**.

Oh, by the way, I titled my talk "Tuckerton Wireless, 44 Years of Radio History Condensed into 15 Minutes." QST

OP-ED

Phonetics — Am I Being Understood?

Gary Sawyer, WØGDS
w0gds@arrl.net

Through my years of involvement in various types of communication in this great hobby of ham radio, I have always been attuned to the pronunciation of words and how we try to clarify what we are saying to another operator. Sometimes an uncontrollable laugh results from the poorest of poor words some people come up with when faced with trying to spell their intended words phonetically.

Most professionals (not so much actual radio professionals, just those whose job involves communication) have been taught either the military or law enforcement phonetics styles. In Amateur Radio the information on phonetics can be found in *The ARRL Operating Manual*, which includes a listing of letters and their phonetic mate, along with the Q signals and the chart for RST meanings.[1] They also appear on the ARRL Web site, **www.arrl.org**. Search for PHONETICS and click on FSD-220.

Having been trained in both the military and law enforcement styles of phonetic usage, it hasn't been difficult for me to cross train and learn the ham style. There may be times that I hesitate before recalling the correct mate word to use but it has never been lost.

Phonetics is not only for brevity, but also for clarity. Its purpose is to reduce the possibility of error in sending a message to another operator. Each service has a standard set of phonetics. By using the standard phonetics of that particular service, there will be less chance of confusion between operators.

Today when I listen in on public safety or Amateur Radio frequencies, I still hear operators ad-libbing with the most atrocious mate words. In public safety operations, instead of using "John" for the letter "J" I hear officers say "Jack" or even "Jill," not sounding very professional at all. Of course it keeps the airwaves hopping with funny sounding words, but it would not be considered professional by someone who is familiar with the proper procedures.

On the Amateur Radio bands I will often hear operators using "Kilowatt" for "K" when the proper mate word is "Kilo." Kilowatt is a measurement of power and not a word for phonetics. This substitution creates ambiguity for the receiving operator who expects the standard phonetic: Does kilowatt mean "K" or "KW"? There are many other substitute words being used in Amateur Radio and it makes us sound amateurish. Frequently I will hear DX operators using better phonetics than those in the USA. One would expect more professional behavior from hams in the country with one of the largest number of licensed Amateur Radio operators.

So in closing I would offer this to all my fellow operators in Amateur Radio and other professional operations: become very familiar with the proper phonetic words to be used to verify the letters that are being transmitted, instead of substituting local colloquialisms and "funny" words that do not sound professional on the air. You will feel better about yourself and others will be able to understand you more clearly as well.

[1]Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order no. 8217. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Gary Sawyer, WØGDS, an Extra class licensee and ARRL member, was a member of the US Naval Security Group for Communications Intelligence. His amateur interest is Emergency Communications and he is a member of ARES®, RACES and Army MARS. He is a VE and enjoys teaching new hams about the hobby. Gary also enjoys DXing and hopes to go on a DXpedition someday. You may contact him at 3110 Pecan Meadow Dr, Garland, TX 75040-2853.

Op-Ed Policy

The purpose of Op-Ed is to air member viewpoints that may or may not be consistent with current ARRL policy.

1) Contributions may be up to 900 words in length.

2) No payment will be made to contributors.

3) Any factual assertions must be supported by references, which do not necessarily have to be included in the body of the article to be published.

4) Articles containing statements that could be construed as libel or slander will not be accepted.

5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

7) No guarantee can be made that an accepted article will be published by a certain date, or indeed, that it will be published at all; however, only articles that we intend to publish will be accepted, and any article we have decided against publishing will be returned promptly.

8) Send your contributions to ARRL Op-Ed, 225 Main St, Newington, CT 06111 or via e-mail to **qst@arrl.org** (subject line Op-Ed). QST

Strays

BACK TO SCHOOL

◊ I recently had the chance to give a talk on Amateur Radio to my son Riley's 2nd grade class in Grant Park, Illinois. One of their reading books had a small section on Morse code and ham radio. When my son saw this he got really excited and asked me if I could come to his class and talk about it. How could I resist!

During my visit I passed around some QSL cards from around the world and showed them a simple dipole antenna constructed of basic supplies you can find at the hardware store. The kids could not believe that my first contact was with a ham in Norway! I also gave them a demonstration of both Morse code and ham radio in action using my UHF handheld and the WaldoFar Repeater System (**www.waldofar.net**).

The next day I got a great thank-you poster with signatures from all the second-graders at Grant Park Elementary School. I am currently working on building my new shack, so that will be one of the first wall decorations for sure! — *Tom Gunderson, W9SRV*

COURTESY TOM GUNDERSON, W9SRV

Second grade demo: **Tom Gunderson, W9SRV, impressed the pupils in his son's class as well as their teacher with his recent Amateur Radio demonstration.**

AT THE FOUNDATION

California Teen Is 2009 Goldfarb Scholarship Recipient

In April 2009, the ARRL Foundation Board of Directors voted unanimously to award the prestigious William R. Goldfarb Memorial Scholarship to Dean LaBarba, KI6CUX, of Long Beach, California. LaBarba will graduate from Woodrow Wilson High School this year with a GPA of 4.0. Upon graduation, LaBarba will more than meet the course requirements with 50 hours of honors and Advanced Placement credits.

Goldfarb Scholarship winner Dean LaBarba, KI6CUX.

LaBarba holds a Technician class license that in 2005 led him to participation in the Amateur Radio Emergency Communication (AREC) team at his high school; since 2007, he has served as president. The mobile Amateur Radio station at Wilson High School is the only high school emergency team in Long Beach. LaBarba took the "extra initiative" to display and demonstrate the mobile radio station at the district science fair, explaining to the public the role that Amateur Radio plays in community safety. LaBarba also spends considerable time coordinating Amateur Radio activities, including Field Day, with the local community

In addition to his Amateur Radio activities, LaBarba is active in the Symphony and Symphonic Orchestra where he is seated as principal trombone. He also participates in the school speech and debate team. From an early age, LaBarba has had a keen interest in medicine and intends to pursue a career in neurology.

The Goldfarb Scholarship is the result of a generous endowment from the late William Goldfarb, N2ITP. Before his death in 1997, Goldfarb set up a scholarship endowment of close to $1 million in memory of his parents, Albert and Dorothy Goldfarb. Awarded to one high school senior each year, the Goldfarb Scholarship assists the recipient to receive a four-year undergraduate degree in engineering or science or in the medical or business-related fields. The terms of reference of the generous Goldfarb scholarship award require that recipients demonstrate financial need and significant involvement with Amateur Radio, in addition to high academic performance. The seventh Goldfarb Scholarship winner, LaBarba continues the tradition of prior recipients, demonstrating superior academic performance, outstanding leadership and extraordinary Amateur Radio and community service.

More information on the Goldfarb Scholarship is available on the ARRL Foundation Web site, **www.arrlf.org**. Applications for the Goldfarb Scholarship and other ARRL Foundation Scholarships are accepted each year beginning October 1 and ending February 1 for the academic year that starts the following August/September.

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

Feedback

♢In "Tuning Switch with Limit Indicator for Screwdriver Antennas" [December 2005, p 52], the value of R2 is correct in the schematic, as is the Mouser part number.

♢In "Getting on the Air — Learning to Live with RF Safety" [March 2009, pp 70-71], the URL for the FCC bulletins is now **www.fcc.gov/oet/info/documents/bulletins/#65**.

♢In the 2008 November CW Sweepstakes Results [May 2009, pp 81-83], the Southeastern Division winner in the Single Operator, QRP category was listed as W5JBI. The correct call should be W5JBV. Also, K1RX was not listed as the new New England Division record holder in the Multi-operator category.

♢In "This Just In" [May 2009, p 12], ARRL Pacific Division Vice Director Andy Oppel, N6AJO, was incorrectly identified in a photo caption as a Section Manager, a position he held some years ago.

Strays

YOUR CALL HERE!

♢Have you ever wanted to see your name in print? Ever have a member of your club come up and ask you how you did that or tell you "That was a great talk you gave"? Ever had an article published in your club newsletter?

Well, fire up the PC and start writing!

If you have experience in a particular area of ham radio and can explain your ideas in a simple, straightforward way, we'd like to see your work. In the "News and Features" section, we typically publish practical articles that provide *QST* readers with useful information on how they get more from their favorite pastime. If you're involved in DXing, an unusual type of portable operating or virtually any other type of Amateur Radio-related pursuit, help your fellow hams enjoy their time on the air and earn $65 per published page by putting your experiences into words.

Articles should be between 900 and 2500 words in length (more or less). You don't have to be a professional writer to write for *QST*… in fact, very few *QST* authors fit that category. E-mail your manuscript and graphics to **qst@arrl.org** or send them to *QST*, 225 Main St, Newington, CT 06111. Before you get started, have a look at our Authors Guide at **www.arrl.org/qst/aguide**. We can mail you a copy if you send a self-addressed, stamped envelope to *QST* Authors Guide, c/o ARRL HQ. — *Steve Sant Andrea, AG1YK*

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

Alabama (Fort Payne) — Jun 13 D F R T V
8 AM-1 PM. *Spr:* DeKalb County ARC. VFW Fairgrounds, 18th St NW. 9th Annual Hamfest/Tailgate. *TI:* 147.27 (100 Hz). *Adm:* $5. Tables: Free tailgate space. Ralph Wiseman, KU4WR, 305 County Rd 589, Fort Payne, AL 35968; 256-657-5454; **ku4wr@arrl.net**; **w4gbr.org**.

Arizona (Show Low) — Jun 6 F T V
6 AM-noon. *Spr:* Kachina ARC. Show Low Intermediate School, 500 W Old Linden Rd. *TI:* 146.61 (162.2 Hz), 146.52. *Adm:* $1. Tables: $5. Richard Gurk, KE7EDP, 1020 N 22nd Ave, Show Low, AZ 85901; 928-242-1178; **ke7edp@cableone.net**; **www.whitemountainhamfest.com**.

California (Santa Maria) — Jun 20 F R
7 AM-4 PM. *Spr:* Satellite ARC. Santa Maria Elks Lodge, 1309 N Bradley Rd. *TI:* 145.14 (131.8 Hz). *Adm:* Free. Tables: $15. Eric Lemmon, WB6FLY, 4416 Titan Ave, Lompoc, CA 93436-1027; 805-733-4416; fax 805-733-4418; **wb6fly@verizon.net**; **www.satelliteARC.com**.

Connecticut (Newington) — Jun 20
D F H R S T V
8 AM-2 PM. *Spr:* Newington AR League. St Mary School, 625 Willard Ave. NARLFEST 2009. *TI:* 145.45 (127.3 Hz). *Adm:* $5. Tables: $10. Mary Hobart, K1MMH, 259 Prospect St, Wethersfield, CT 06109; 860-594-0397; fax 860-594-0259; **mmhobart2@cox.net**; **www.narlhamfest.org**.

Idaho (Post Falls) — Jun 13 D F H R V
6:30 AM-2:30 PM. *Spr:* Kootenai ARS. American Legion Hall, 1138 E Poleline Ave. *TI:* 146.98 (100 Hz), 146.5. *Adm:* $3. Tables: $5. Jim Monroe, N7ESU, 14375 Rockwood Ct, Rathdrum, ID 83858; 208-755-2100 (phone and fax); **n7esu@arrl.net**; **www.k7id.org**.

Illinois (Granite City) — Jun 14 F S V
7 AM-1 PM. *Sprs:* Egyptian RC and SWIC College. Southwestern Illinois College, Sam Wolf Granite City Campus, 4950 Maryville Rd. 80th Year Hamfest, guest speakers Riley Hollingsworth and Bob Heil. *TI:* 146.79 (127.3 Hz), 146.76 (141.3 Hz). *Adm:* advance $5, door $6. Tables: $10. Frank Shears, K7RMJ, Box 562, Granite City, IL 62040; 615-796-0314; **cuban9@charter.net**; **www.w9aiu.org**.

Illinois (Wheaton) — Jun 21 D F R V
7 AM-2 PM. *Spr:* Six Meter Club of Chicago. DuPage County Fairgrounds, 2015 Manchester Rd. 52nd Annual Hamfest, antique and vintage radios, donation auction (11 AM), overnight RV parking (must register in advance). *TI:* 146.97 (107.2 Hz), 146.52. *Adm:* advance $6, door $8. Tables: flea market $12, commercial $15. Michael Huedepohl, WD9GJK, 3532 Raymond Ave, Brookfield, IL 60513; 708-485-5481 or 708-442-4961 (24-hour InfoLine); **mhuedepohl@comcast.net**; **www.k9ona.com**.

Massachusetts (Cambridge) — Jun 21. Nick Altenbernd, KA1MQX, 617-253-3776 (9 AM-5 PM); **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Midland) — Jun 20 V
8 AM-noon. *Spr:* Midland ARC. Salvation Army Building, 330 Waldo Rd. *TI:* 147.0 *Adm:* $5. Tables: $5. Pat Mullet, KC8RTW, 171 E Orchard Ave, Shepherd, MI 48883; 989-828-6657; **pat_mullet@yahoo.com**; **www.qsl.net/w8kea**.

Michigan (Monroe) — Jun 21 F T
7:30 AM-1 PM. *Spr:* Monroe County Radio Communications Assn. Monroe County Fairgrounds, 3775 S Custer Rd. *TI:* 146.72. *Adm:* $6. Tables: $12. Fred VanDaele, KA8EBI, 4 Carl Dr, Monroe, MI 48162; 734-242-9487; fax 734-587-2250; **ka8ebi@yahoo.com**; **www.mcrca.org/hamfest.htm**.

Minnesota (Maplewood) — Jun 6 F T
7 AM-1 PM. *Spr:* TwinsLAN ARC. 3M Center Building 208, Conway Ave and 5th St. *TI:* 147.12. *Adm:* buyers $7, sellers $15. Tables: Not provided. Anders Johansson, KBØPJV, 8201 32nd Ave N, Crystal, MN 55427; 763-208-7493; **kb0pjv@arrl.net**; **www.twinslan.org**.

New Jersey (Piscataway) — Jun 20 S
7 AM-2 PM. *Spr:* Raritan Valley RC. Piscataway High School, 100 Behmer Rd. *TI:* 146.625 (141.3 Hz). *Adm:* $6. Tables: $6. Eric Lund, NW2P, 112 Rock Rd W, Green Brook, NJ 08812; 908-251-3938; fax 908-753-6153 (voice first); **nw2p@w2qw.net**; **www.w2qw.org**.

New Jersey (Township of Washington) — May 23 D F Q R V
8 AM-3 PM. *Spr:* Bergen ARA. Westwood Regional Jr/Sr High School, 701 Ridgewood Rd. *TI:* 146.79 (141.3 Hz). *Adm:* $2. Tables: $15. Jim Joyce, K2ZO, 286 Ridgewood Blvd N, Township of Washington, NJ 07676; 201-664-6725; fax 201-265-1366; **k2zo@arrl.net**; **www.bara.org**.

New York (Bethpage) — Jun 14 D F R
Set up 7:30 AM; public 8:30 AM. *Spr:* Long Island Mobile ARC. Briarcliffe College, 1055 Stewart Ave. Outdoor Hamfest, tune-up clinic. *TI:* 146.85 (136.5 Hz). *Adm:* $6. Tables: $10. Richard Cetron, K2KNB, 198 Haypath Rd, Old Bethpage, NY 11804; 516-694-4937; fax 631-574-4851; **k2knb@limarc.org**; **www.limarc.org**.

New York (Chaffee) — Jun 13 D F
Set up 7 AM; public 8 AM-noon. *Spr:* Pioneer Radio Operators Society. Manion Park, Grove St. *TI:* 145.39. *Adm:* $5. Tables available; vendors bring your own. Gary Tillinghast, KB2YAA, 180 Elm St, Springville, NY 14141; 716-592-9554; **tillfam180@verizon.net**.

New York (Cortland) — Jun 13 D F R V
7 AM-1 PM. *Spr:* Skyline ARC. Cortland County Jr Fairgrounds, Carroll St Ext. *TI:* 147.18. *Adm:* advance $4, door $5. Tables: $10. Andrew Slaugh, KB2LUV, Box 5241, Cortland, NY 13045; 315-677-5242; **k2iwr@arrl.net**; **www.skylineradioclub.org**.

New York (Queens) — Jun 7 D F H Q R T V
Set up 7:30 AM; public 9 AM-2 PM. *Spr:* Hall of Science ARC. New York Hall of Science Parking Lot, 47-01 111th St (Flushing Meadow Corona Park). Drop and Shop, free admission to museum from 10-11 AM or $6 after 11 AM with hamfest ticket, free tune-up clinic. *TI:* 444.2, 145.27 (both 136.5 Hz). *Adm:* buyers $5, sellers $10 per space. Stephen Greenbaum, WB2KDG, 85-10 34th Ave, Apt 323, Jackson Heights, NY 11372; 718-898-5599; **wb2kdg@arrl.net**; **www.hosarc.org**.

North Carolina (Winston-Salem) — Jun 13
F R T V
8 AM-noon. *Spr:* Forsyth ARC. Dixie Classic Fairgrounds (Home and Garden Building), 421 W 27th St. *TI:* 146.64 (100 Hz). *Adm:* $5. Tables: $15. Henry Heidtmann, W2DZO, Box 11361, Winston-Salem, NC 27116-1361; 336-245-5740; **info@w4nc.org**; **w4nc.com**.

Ohio (Milford) — Jun 20 D F T V
Set up 6 AM; public 8 AM-2 PM. *Spr:* Milford ARC. Eastside Christian Church, 5874 Montclair Blvd. 19th Annual Hamfest. *TI:* 147.345. *Adm:* $5. Tables: $5. Jim Linn, WB8RRR, 5110 Romohr Rd, Cincinnati, OH 45244; 513-831-6255; fax 513-528-7270; **wb8rrr@arrl.net**; **www.w8mrc.com**.

Coming ARRL Conventions

May 15-17
ARRL National, Dayton, OH*

May 22-24
Wyoming State, Casper*

May 29-31
Rocky Mountain Division, Estes Park, CO*

May 30
Atlantic Division, Rochester, NY*

June 5-7
Northwestern Division, Seaside, OR*

June 6
Georgia State, Marietta*

July 17-18
Arizona State, Williams

July 17-19
Montana State, Essex

July 18
WØ DXCC and Contest Central, Rochester, MN

July 23-25
Central States VHF, Elk Grove Village, IL

July 24-25
Oklahoma Section, Oklahoma City

August 7-8
Texas State, Austin

August 7-9
Pacific Northwest DX, Spokane, WA

*See May *QST* for details.

Eastern Pennsylvania Section Convention

July 4, Bressler
D F H Q R S T

The Eastern Pennsylvania Section Convention ("Firecracker Hamfest"), sponsored by the Harrisburg Radio Amateur Club, will be held at the Emerick Cibort Park, intersection of Penn and Center Sts. Doors are open for setup Friday (Jul 3) 6-9 PM, Saturday 6 AM; public 8 AM-1 PM. Features include 37th Annual Event, largest tailgate ($5 per space) and electronics flea market in central PA,

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

80 covered commercial tables, new and refurbished equipment dealers, seminars all morning, DXCC and WAS card checking, special event station W3W in operation, breakfast and lunch, handicapped parking. Talk-in on 146.76 (100 Hz). Admission is $5 (nonham spouses and kids free). Tables are $12 (before Jun 1), $15 (after Jun 1). Contact Terry Snyder, WB3BKN, Box 355, Halifax, PA 17032-0355; 717-979-9515; fax 717-303-0565; **hracw3uu@gmail.com**; **hrac.tripod.com**.

Pennsylvania (Lehman) — Jul 5 D F T V
8 AM-3 PM. *Spr:* Murgas ARC. Luzerne County Fairgrounds, Rte 118. 30th Annual Hamfest and Computerfest. *Tl:* 146.61 (82.5 Hz). *Adm:* $6. Tables: $15 (until Jun 22), $20 (after Jun 22). Carol Nygren, KA3EEO, 2081 State Rte 118, Sweet Valley, PA 18656; 570-477-2294; **cnygren@epix.net**; **www.qsl.net/k3ytl.**

Pennsylvania (Lime Ridge/Bloomsburg) — Jun 13 F R T V
7 AM-1 PM. *Spr:* Columbia-Montour ARC. Lime Ridge Community Center, 6405 4th St. 19th Annual Hamfest, estate sale items. *Tl:* 147.225 (203.5 Hz). *Adm:* $5. Tables: $10. Dave Schack, WC3A, 6020 Fort Jenkins Ln, Bloomsburg, PA 17815; 570-752-6851; **drs352478@verizon.net**; **www.qsl.net/cm-arc/hamfest.htm**.

Tennessee State Convention

June 13, Knoxville

D F H R S T V

The Tennessee State Convention, sponsored by the Radio Amateur Club of Knoxville, will be held at the Kerbela Temple, 315 Mimosa St. Doors are open for setup 7 AM; public 9 AM-4 PM. Features include 43rd Annual Knoxville Hamfest and Electronics Exposition, outside flea market ($5 per space plus admission), inside dealers, forums, exhibits, demonstrations, VE sessions, handicapped accessible, free parking, breakfast and lunch. Talk-in on 147.3, 224.5, 444.575. Admission is $7 (under 13 free). Tables are $20 (8-ft) before Jun 3; $25 after Jun 3. Contact David Bower, K4PZT, 512 Elkmont Rd, Knoxville, TN 37922; 865-363-7388; fax 865-690-8360; **d.bower@ieee.org**; **www.w4bbb.org**.

West Gulf Division Convention

June 12-13, Plano, TX

D F H R S T V

The West Gulf Division Convention (Ham-Com 2009), co-sponsored by Ham-Com, Inc, the North Texas Microwave Society, the McKinney ARC, et al, will be held at the Plano Centre, 2000 E Spring Creek Pkwy. Doors are open Friday and Saturday 9 AM-6 PM. Features include indoor and outdoor flea markets; tailgate market; commercial exhibitors; vendors; workshops, programs, and forums; SIG meeting; VE sessions (Friday and Saturday); Lone Star DX Dinner (Friday, Jun 12, 6:30 PM at the Plano Centre Windhaven Room, $40); special guests including ARRL CEO David Sumner, K1ZZ; Gordon West, WB6NOA; and Bob Allphin K4UEE; handicapped accessible. Talk-in on 147.18 (107.2 Hz). Admission is $8 in advance, $10 at the door. Tables are $38. Contact Barry Goldblatt, WA5KXX, 3212 Jeremes Landing, Plano, TX 75075; 972-596-4669; fax 972-596-5078; **wa5kxx@verizon.net**; **www.hamcom.org/**.

Texas (Smithville) — May 16 F
Sun-up to mid-day. *Spr:* Bastrop County ARC. Vernon Richards Riverbend Park, intersection of Highway 71 and Colorado River. Johnny Pittman Memorial Swapfest. *Tl:* 145.35, 443.75 (both 114.8 Hz). *Adm:* Free. Tables: $10. Lynn Fisk, K5LYN, 167 Hudson Rd, Smithville, TX 78957; 512-360-4809; **k5lyn@arrl.net**; **bcarc-hams.org**.

Virginia (Manassas) — Jun 14 D F H T V
7 AM-4 PM. *Spr:* Ole Virginia Hams ARC. Prince William County Fairgrounds, 10624 Dumfries Rd. 35th Annual Hamfest. *Tl:* 146.97, 224.66, 442.2. *Adm:* $6. Tables: $20. Chris Allen, KI4POT, 9160 Pristine Ct, Manassas, VA 20110; 703-361-3257; **ki4pot@gmail.com**; **www.w4ovh.net**.

Washington (Dryden) — Jun 12-14 F V
Friday noon-Sunday late morning. *Spr:* Apple City ARC. Dryden Gun Club, 7653 Saunders Rd. Wenatchee Hamfest. *Tl:* 146.68 (156.7 Hz). *Adm:* $7. Tables: Free. Judy Chrisco, KA7ZNA, 1812 SE Soden St, E Wenatchee, WA 98802; 509-884-1251; **ka7zna@msn.com**; **www.qsl.net/w7td**.

YLISSB Convention

June 18-21, Spokane Valley, WA

R S

The YLISSB Convention, sponsored by the YL International Single Sideband, will be held at the Mirabeau Park Hotel, 1100 N Sullivan Rd. Doors are open 8 AM-10 PM. Features include workshops, business meeting, tour of Silver Valley in Idaho (Thursday, Jun 18; $70 per person, includes lunch, must be booked prior to Jun 1), hospitality suite, banquet (Saturday, Jun 20, 6 PM; $45), Sunday brunch ($20), RV parking. Admission is $15 in advance (by Jun 1), $25 (after Jun 1). Contact Rose Rybachek, KL7FQQ, Box 954, Newman Lake, WA 99025; 509-226-5239; **kl7fqq@yahoo.com; ylsystem.org**. QST

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests.html**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/FandES/field/hamfests/regform.html** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online, donated ARRL publications and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **June 1** to be listed in the **August** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's Web site for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and *ARRLWeb* banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

Strays

CANCELING A HAM RADIO LICENSE

◊ When a ham becomes a Silent Key, it's expected that his or her license will expire at the normal license expiration date — and after two years (the grace period for renewal) that it will be canceled.

Before canceling a license of a deceased holder, the FCC must receive a signed written request indicating that the current licensee is now deceased (include the deceased licensee's name and call sign in the letter). The FCC also requires that some type of evidence of death accompany the request — something that verifies that the licensee is deceased — such as a dated newspaper obituary, a death certificate or [SSDI] social-security/death-benefits documentation.

Use postal mail or send by courier to the FCC, Attn: Amateur Cancelation, 1270 Fairfield Rd, Gettysburg, PA 17325-7245. Faxed documents are not accepted.

Allow the FCC one to two weeks to cancel the license. You can verify that the FCC has canceled the license by looking up the FCC license call sign data at **wireless.fcc.gov/uls**. If the license has been canceled, FCC will show the license STATUS as "CANCELLED."

Please note that the effective date of the cancelation will be the day of the former license holder's death. Also, no one is under any obligation to cancel a call sign, as it will expire and be canceled automatically. — *Perry Green, WY1O, ARRL VEC*

QST congratulates…

◊ ARRL Life Member, Danny Goodman, AE9F, whose iPhone and iPod Touch application, *BeaconAid HF*, has been released. The program helps HF operators and SWLs take full advantage of the NCDXF/IARU global beacon network to determine actual propagation conditions.

I would like to get in touch with…

◊ anyone who knew Dudley A. Buck as a ham or broadcast engineer. He worked at KTMS in Santa Barbara, California in 1944, ROTC radio club at the University of Washington 1944-1948, Navy CSAW 1948-1950 and MIT 1950-1959. — *Alan Dewey, WB9JTK,* **alan@alandewey.com**

◊ any hams who attended the Missouri Institute of Technology in 1978, 1979 or 1980. Also anyone involved with the Amateur Radio Club there during those years. — *Martin Campbell, KBØHAE,* **kb0hae@arrl.net**

75, 50 AND 25 YEARS AGO

June 1934

■ The cover photo shows two hams enjoying Field Day, operating from their convertible coupe, with its rumble seat folded open.
■ The editorial beats the drums for the ultra-high frequencies, and notes that the League has petitioned the Federal Radio Commission to extend amateur allocations into "the really ultra-high-frequency region."
■ George Grammer, W1DF, asks, "What about the Simple Receiver?" and answers his own question by presenting a nifty two-tube design.
■ Technical Editor James Lamb discusses "Practical Transmitting Circuits for Suppressor-Type Screen-Grid Tubes."
■ Durwood Tucker, W5VU, tells about using "Low-Cost Crystal Control for High Power," by applying "the crystal-lock system in a 250-watt outfit."
■ Frank Jacobs, W2BSL, describes his design of "A Medium-Power 56-Mc. Transceiver."
■ Philip Ennis, K7BWZ, went to Alaska to find a job during the Great Depression, then built a low-power transmitter "from junk" to get on the air, using "Flea Power in the Arctic" with a type '10 tube in a self-controlled oscillator circuit. He reports that he used copper tubing for his inductors, winding them "around the peg-leg of a dock watchman." You can't make up stuff like Phil's descriptions of borrowing, scrounging, improvising, and winding coils!
■ Philip Rosenblatt, W2AKF, and Henry Miller, W2AIS, tell about building a tiny 10-watt transmitter they call "The Ultra-Midget."
■ Wolcott Smith discusses "Automatic Gain Control with Diode Detection," and describes how he used a type B7 tube as a combined I.F. stage and second detector in a S.W. superhet.

June 1959

■ The cover notes that "Field Day Is Coming," with a photo of a past K6CLZ FD setup.
■ The editorial discusses "Field Day" and "Citizens Band."
■ Ben Vester, W3TLN, tells us about getting on 15 meters with his "Mobile S.S.B. Transceiver."
■ Arthur Blave, ON4BX, describes his use of a "Feeder Matching System for the G4ZU Beam."
■ "Simplified Break-In Control," by Jerome Horwitz, W4HBO, details his simple circuit that doesn't use relays.
■ Robert McGraw, W2LYH, tells about building "Three Crystal-Controlled Converters" for 20, 15 and 10 meters.
■ Don Sutherland, K6JKK, reminds us that the old 1930s technique of building wooden towers still works well, in "Sixty Cents per Foot."
■ Tom Beckage, W3LCK, tells about "A V.F.O. for 6 Meters" that uses a single 6AU6 (the tube used in Johnson Viking and Heathkit VFOs, among others).

June 1984

■ The cover photo shows K1WJ on the W1AW tower, working on the new upgraded 40 meter beam that he and AA2Z installed.
■ The editorial discusses "Our Next Great Challenge," that of full-time, reliable communication, and takes a look at packet radio as the answer.
■ Dick Jansson, WD4FAB, tells us about "Keeping Cool: A Thermal Design Primer" for solid-state amplifiers.
■ In "A Second Look at Magnetic Cores," Doug DeMaw, W1FB, looks at the practical aspects of toroids and other magnetic cores.
■ W1FB also introduces us to "The World of Switches and Relays," Part 6 of "First Steps in Radio."
■ Roy Lewallen, W7EL, urges us to "Try the 'FD Special' Antenna." It's simple, inexpensive, lightweight and easy to install.
■ Part 3 of "The Effect of Real Ground on Antennas," by James Rautio, WJ3K, is a valuable in-depth discussion of sloping dipoles (slopers).
■ *QST* sadly reports the death of "George Grammer, W1DF," former long-time *QST* Technical Editor who joined the HQ staff in 1929.
■ Astronaut Owen Garriott, W5LFL, reports on his operation "… From the Spacecraft *Columbia*."
■ Tom Frenaye, K1KI, tells about "The KI Edge," which helps the DXer via great-circle maps.

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

March 2009

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program are at this Web page: **www.arrl.org/FandES/field/pshr/.**

735
W7TVA
705
KØIBS
690
AC8AR
445
W2MTA
420
WD8USA
402
W4CAC
350
W5DY
337
KI4KWR
335
N2LTC
324
KT5SR
310
AK2Z
305
KA2ZNZ
300
WA2WMJ
KB2RTZ
298
WB7WOW
W7JSW
290
K4DND
276
N2YJZ
254
KI4HGO
249
KB3KKY
243
NC4VA
227
KB2ETO
220
N7CM
217
AD4BL
215
K7EAJ
214
WB8RCR
205
K2HJ
201
KØLQB
200
KB2BAA
195
WD9FLJ
N1UMJ

192
KC8NTE
189
WA2BSS
185
K2ABX
W2DWR
175
KB5PGY
174
K7OAH
168
K2BRG
165
KE5HYW
160
KGØGG
156
WB2KNS
155
N2RDB
KD1SM
154
W2LIE
KA8ZGY
153
W2KFV
152
NY3H
151
N4HUB
150
W2SFD
WB5ZED
K8RDN
145
KI4PRX
140
K7BFL
N2JBA
WØLAW
KK3F
K4GK
W4DNA
K8MFK
138
WA4UJC
135
K9LGU
N2GJ
W3YVQ
N4EJF
KI4ZJI
131
WB2WAK
130
WB2FTX
W4ZJY
W4FAL
KJ4G
KB5KKT

125
NN7H
W7EKB
KB5KEG
N3RB
124
K7BC
123
W3CB
K4JTD
122
K2GW
120
N7BEC
K6JT
K2UL
W8UL
KA4FZI
KW1U
W1GMF
K1YCQ
N1LKJ
K4IWW
W4NBF
119
K8AMR
117
K5SFM
WB2HPI
116
K6RAU
N2VC
115
WM2C
N7IE
112
W3ZQN
110
W7GB
W7QM
N4ABM
K2VX
KC5OZT
W6DOB
N8IO
N1IQI
K1HEJ
KB1NMO
N7XG
N7YSS
KF7CG
KM1N
W2EAG
KB2EV
WB4GHU
KK5GY
WB9JSR
108
K2YYD
105
WA2DNA
N8OD
KE4CB

K2TV
KD1LE
103
KK1X
102
W5GKH
101
KD8FNN
100
W7GHT
K4SCL
KE4PAP
W5ESE
K2AN
N1JX
N2GS
WB8SIQ
KB2KLH
NX1Q
W7ELI
KB3MXM
WB4FDT
AA3SB
NN7D
WA1JVV
W3TWV
KI4YV
W4TTO
N9MN
NR2F
NØMEA
99
W2DSX
KK7DEB
N7JCO
98
KJ7NO
96
N2VGA
95
KE7DVV
N2DW
WB6UZX
WG8Z
KA2EJD
94
KS3Z
N8NMA
90
WA2CUW
N8DD
WD8Q
NG1A
KA1RMV
KA1GWE
KK1A
N3ZOC
K3IN
WB8OIF
WD8DHC
KB8NDS
K4BG
WB4BIK

KBØDTI
K1JPG
W8IM
NIØI
89
W8CPG
88
W2CC
W5CU
87
N7EIE
84
N1CKM
83
KI4GND
82
W7VSE
NA7G
W1PLW
KC4PZA
81
KI4JQB
WDØGUF
80
K7MQF
KA3NZR
KK5NU
NS7K
WA9WNE
W1SGC
W3GQJ
WØCLS
AB8SY
KB8GT
76
W5XX
75
W6SX
K4DLF
73
KE5DKV
71
KB3LFG
70
NM1K
N3SW
NØZIZ
WØADZ
NØDUW
NØDUX
NUØF
KAØFUI
KBØJKO
NØMHJ
KØPTK
KØOR
KØRXC
NØUKO
WAØVKC
KD7ZUP

The following stations qualified for PSHR in previous months but were not recognized in this column: (Feb) N2YJZ 540, KT2D 455, W2LTB 365, WA2WMJ 325, WA2BSS 177, W2SFD 161, N2JBA 134, WM2C 115, N2VC 106, WB4FDT 100, KO4OL 99, N7JCO 71. (Jan) W2CC 101.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, EMA, ENY, EPA, EWA, GA, ID, IL, IN, KS, MDC, ME, MI, MN, NC, NFL, NLI, NNJ, NNY, NTX, OH, OK, OR, SFL, SJV, SNJ, STX, TN, UT, VA, WCF, WI, WMA, WNY, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AK, AZ, EWA, GA, IN, KS, LA, MDC, ME, MI, MO, MT, NC, NH, NLI, NM, NTX, NV, OH, OK, SD, SFL, SNJ, SV, VA, WPA, WTX, WV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

KK3F 3416, WB5ZED 2741, N2IQI 1699, KA9EKG 1352, W1GMF 1295, WB5NKD 1144, N1UMJ 1100, WB5NKC 850, W8UL 797, KW1U 774, KT2D 720, WB9JSR 695, N8IXF 523, K8LJG 310, K9LGU 102.BPL by originations plus deliveries: KK5GY 185, K8LJG 141, NM1K 136.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

♦W1CCX **Reid**, Plez Z. Jr, Trumbull, CT
W1GLD **Melanson**, Alderic J., Millbury, MA
NW1G **Chandra**, Huguette M., Windham, NH
WA1MCJ **Sanroma**, Edna, Bristol, RI
WA1MZK **Lempke**, Earl W., North Port, FL
K1OLV **Colbath**, Henry J. Jr, Wolfeboro, NH
W1TTQ **Moore**, John J., Salem, MA
W1TTU **Preston**, Edgar H., Concord, NH
W1VDI **DeQuattro**, Peter, Providence, RI
K1WL **Lovell**, Warren P. Jr, Danvers, MA
K2EHS **Meiklejohn**, William H., Schenectady, NY
KB2FTM **Fiorino**, Louis J., Albany, NY
WA2GYF **Ortman**, Leonard J., Cape May, NJ
N2HLT **Ingerick**, Leon Jr, Branchport, NY
WB2KWN **Beutel**, George A., Rockledge, FL
W2OTB **Risley**, William H., Egg Harbor Township, NJ
KE2P **Ertsgaard**, E. Paul, Rochester, NY
♦ KB2PR **Cahan**, Dr Herbert N., Margate City, NJ
W2QHS **Hill**, Alexander L. Jr, Tinton Falls, NJ
N2RAM **Glass**, Edward F., Hamburg, NY
KA2RZD **Zampini**, Joseph J., Cicero, NY
WB2UVC **Chissom**, William H., Cleveland, NY
K2ZFV **Van Voorhis**, Charles S., Himrod, NY
W3ABX **West**, Harold R., Annapolis, MD
N3AIW **Wagner**, Frank F., Furlong, PA
KA3CVE **Church**, Dorothea B., Pittsboro, NC
KB3FNM **Marzina**, Henry III, Bethel Park, PA
KB3GOZ **Sells**, Elmer C., Galena, MD
K3HTN **Bochnak**, Michael A., Riverdale, MD
WA3KLH **Stickley**, Vernon B. Jr, Frederick, MD
KA3LNG **Schreiber**, Kurt W., Coraopolis, PA
KA3MTU **Ciufo**, Anthony C., New Brighton, PA
KF4AO **Goldstein**, Sidney, Coconut Creek, FL
AJ4AW **Pond**, Edna L., Warrior, AL
WB4BAH **Kemp**, Timothy D., Fuquay-Varina, NC
W4BTP **Howell**, Mildred L., Folly Beach, SC
N4CBN **Switzer**, Betty T., Shelby, NC
WA4CVP **Christian**, James R., Satsuma, AL
N4CZY **Kennedy**, Donald L., Canfield, OH
exW4DBT **Elias**, Lewis W. Jr, Winston-Salem, NC
N4DJR **Hudson**, Lionel "Butch" L. Jr, Birmingham, AL
♦ K4DWK **Prather**, Thomas Timothy, Lexington, KY
W4EMA **Williams**, Ruby Mae E., Jasper, AL
KB4EVK **Culp**, William M., Atlanta, GA
KN4GKR **Cleveland**, Don E., Charlotte, NC
WO4I **Strickland**, Frank A., Columbus, GA
K4JJF **Smith**, Dan L., Las Vegas, NV
WD4JNV **Griffin**, Evert Ross, Newport News, VA
WB4KDL **Doss**, Frances M., Piedmont, AL
WB4LJC **Chitty**, Charles D. Jr, Albany, GA
NC4LM **Meoli**, Lawrence, Raleigh, NC
WB4LRD **Farris**, Ronald A., Hixson, TN
NW4M **Forbis**, Ronald M., McCalla, AL
KD4MOG **Allen**, Charles M. III, Havanna, FL
K4OIL **Newell**, Charles "Chuck" P., Birmingham, AL
K4QKS **Patton**, Carl C., London, KY
WB4QVZ **Odette**, John, Clearwater Beach, FL
W4RHE **Watters**, Charles H., Orlando, FL
KA4RLW **Wallace**, Robert L., Davenport, FL
KF4RXN **Lesko**, Mark E., Chester, VA
N4TLT **Martin**, Teddy E., Jeffersonville, KY
KD4VKW **Surrett**, Clark L. Sr, Morristown, TN
W4YGE **Bishop**, Chalmer, Elizabethton, TN
K4YNM **Harvey**, Edwin W., Jacksonville, FL
AB4YO **Singletary**, James C. Jr, Bladenboro, NC
W5DW **Crumbaker**, Wilbur H., Longview, TX
WD5DXK **Seamans**, Celia L., Ponca City, OK
WB5EMT **Harper**, Thomas L., Dayton, OH
AD5IZ **Norris**, Robert L., Ash Flat, AR
K5JMD **Martin**, Clinton W. Sr, Wesson, MS
N5MDR **Bates**, Franklin L., Hoover, AL
KB5RR **Dollmeyer**, Clarence H., Denver, CO
N5SDB **Richburg**, Dr Paul L., Austin, TX
K5SUB **Aaron**, James R., Orange, TX
♦ N5TLK **Vasquez**, Gary R., Kilgore, TX
WD5TL **Leggett**, Thomas C., West Monroe, LA
K5WWR **MacFarlane**, John S., Shreveport, LA
AA5XH **Mathis**, Gilbert R., San Antonio, TX
KB5YJV **Robertson**, Sammy Ray, Round Rock, TX
WA6DBT **Brooks**, Jack L., Grass Valley, CA
KH6FMD **Roberts**, Lonnie D., Chunky, MS
W6FNU **Blankenship**, Thomas H., Redding, CA
W6FRM **Harris**, Harry, Los Angeles, CA
KH6GI **Chernin**, Ted, Aiea, HI
KE6IVA **Wood**, James F., Fremont, CA
♦K6JLZ **McMillan**, Jack A., Inyokern, CA
K6PRU **Younger**, Donald E., Placentia, CA
WA6QFD **Pierce**, Charles C., Inyokern, CA
KM6Q **Brock**, George F. Jr, Camarillo, CA
N6SIA **Anthony**, Donald L., Walnut Creek, CA
N6SN **Snuffer**, Garland W., Bonaparte, IA
N6UE **Isenson**, Col Raymond S., Santa Maria, CA
WB6YUT **Wing**, Frank, San Francisco, CA
WO7A **Landis**, Ned, Roseburg, OR
W7BNK **Pratt**, Lowell "Lee" E., Lewiston, ID
K7BZS **Underwood**, Stanley Ralph, Portland, OR
W7CHI **Korfhage**, Robert S., Walla Walla, WA
♦W7EA **West**, Charles P., Fife, WA
W7GMH **Miller**, Edwin James, Keaau, HI
W7ISW **Bohman**, Donald R., Silverdale, WA
W7ITN **Rhodes**, J. W., Nampa, ID
WA7KUM **Radicke**, Ingo, Globe, AZ
W7MUM **Kelly**, Sam R., Great Falls, MT
W7PBV **Norman**, Leonard M., Boulder City, NV
KB7PGV **Freeman**, Royce L., Gresham, OR
WA8AIZ **Wise**, Edwin J., North Ridgeville, OH
WD8AJK **Churley**, Bob, East China, MI
KB8AU **Medlock**, C. W. "Chuck," Centerville, OH
KA8JPG **Washburn**, Harold, Harrisville, WV
K8MBV **Barbour**, David C., Dewey, AZ
AB8ML **Cramer**, Chester W., Fenton, MI
KA8NRU **Spiegelberg**, Violet, Oberlin, OH
WA8PVK **Woodside**, Ralph E., Pontiac, MI
N8QOQ **Ferrell**, James Thomas III, Shelby Township, MI
♦WD8RJI **Hanschu**, Norman W., Canton, MI
W8RLE **Edwards**, Robert L., Troy, OH
KI8SS **Stoddard**, Donald L., North Jackson, OH
KC8TES **Connelly**, Jerry D., Bluefield, WV
K8TQN **Hales**, John "Jack" B., East Liverpool, OH
W8WNO **Burroughs**, Gary A., Buckhannon, WV
KF8WQ **Willingham**, William, Cincinnati, OH
W8ZCG **Kennedy**, Lorne V. Jr, Ypsilanti, MI
W8ZOJ **Hager**, James C., Princeton, WV
N9AFA **Johnson**, Clifford P. Jr, Prairie Du Sac, WI
N9BOP **Wolhowe**, Miles V., Platteville, WI
W9CSY **Newlin**, Charles L., Matthews, IN
N9DFQ **Dayhuff**, Wilma J., Spencer, IN
W9FEM **Lecocq**, Paul F., Murphysboro, IL
W9KKL **Pearson**, Robert E., Schererville, IN
W9LWC **Hollinger**, Wallace E., Cumberland, WI
W9MEV **Sandstrom**, Herbert E. Jr, East Peoria, IL
WB9NFZ **Jorae**, Anthony E., River Grove, IL
WA9PFB **Clink**, Edward F., New Berlin, IL
W9PNE **Anderson**, Brice, Mt Carmel, IL
KX9U **Keenan**, Eugene R., Chicago, IL
N9XHJ **Tarvin**, Gregory A., Loveland, CO
W9ZF **Bundy**, Robert L., Morton, IL
WØCQQ **Welch**, William C., Pawnee City, NE
WØDEN **Gassman**, George, Iowa City, IA
WDØEYF **Britton**, David W., North Platte, NE
WØFTD **Resch**, Clarence A. "Bud" Jr, Independence, MO
AAØIT **Thornton**, James A., Independence, KS
KDØJL **Tull**, John E. Jr, Kansas City, MO
NØJMF **Doucey**, Mary V., Springfield, MO
♦ NØKLT **Mills**, Gary D., Lincoln, NE
NØPV **Beebe**, Richard L. III, Sioux Falls, SD
WAØQMV **Gulbrandson**, Floyd B., Lennox, SD
WØUHP **Huiatt**, William F., Mound City, MO
WØVSF **Glischinski**, Robert, Saint Paul, MN
♦ VE3HIR **Hardie**, Laetitia C., Kincardine, ON, Canada
VE4TL **Loftus**, William T., Winnipeg, MB, Canada
VE7PG **Walsh**, James H., Kamloops, BC, Canada
DL1BO **Flick**, Theodor, Karlsruhe, Germany

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Gail Iannone ♦ Silent Keys Administrator ♦ sk@arrl.org

Strays

***QST* congratulates…**

◊ the Institute of Electrical and Electronics Engineers (IEEE), which celebrated its 125th anniversary May 12 (see **www.ieee125.org/**).

◊ ARRL life member Danny Goodman, AE9F, of El Granada, California, whose iPhone app, iFeltThat, is available from Apple. The program provides iPhone and iPod touch users with up-to-the-second details and integrated maps of earthquake activity in 16 regions around the world from several sources.

TOMMY TERRY, W5JTT

Among the many events taking place this past Veterans Day at La Vernia (TX) Elementary School were classroom visits by veterans. Pat Duncan, W5RHU, a Pearl Harbor survivor, is at the front. Rear, from the left: Lt Cmdr Tim Padelford (USN, Ret), Chief Petty Officer Jackie Padelford (USN, Ret) and Don Hooper (USAF, Ret). The students were also visited, via radio, by Lt Col Bob Dunn, KIØKS, USAAF/USAF (Ret), who also related his experiences during the attack on Pearl Harbor.

HAMSPEAK

The following are brief descriptions of Amateur Radio related terms found in this month's issue of *QST*. More information on most can be found in *The ARRL Handbook*, or other specialized ARRL publications.[1] See also **www.arrl.org/qst/glossary.html**.

The Doctor is IN

Beverage — Long (typically multiple wavelengths) horizontal receiving antenna, typically used on MF and the low end of HF, situated around 6 feet above the ground. Named after the inventor, this antenna is directive, receiving vertically polarized signals that travel along the length of the antenna. Signals are weak, but the noise is even weaker, resulting in an improved signal to noise ratio compared to most more efficient antennas.

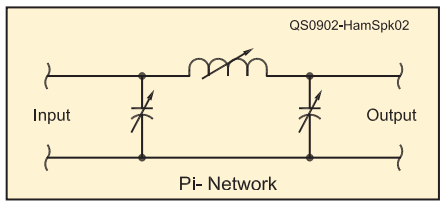
Dummy load — Sometimes called dummy antenna. Device designed to provide a matched load (often 50 Ω) to a transmitter. Accepts and dissipates the power from a transmitter without radiating it. Generally used for transmitter testing to avoid interfering with other spectrum users.

Ewe antenna — Two element array of short vertical monopoles driven and phased to provide directivity. Typically used on 160 through 40 meters as a receive antenna to provide the benefits of a Beverage in a smaller area.

Packet radio — A computer-to-computer radio communication mode in which information is broken into short bursts. The bursts (packets) contain addressing and error-detection information.

Pi-network — Generally wide range adjustable three element matching network in which a shunt input capacitor was followed by a series inductor, then by a shunt output capacitor. Used as an output tuning device in vacuum tube transmitters and amplifiers to match the high plate impedance to a nominal 50 Ω load, it could tune loads quite removed from that value. Also used as an antenna or interstage tuner.

RTTY — Radioteletype. Originally a communications system in which keyboard initiated data was sent to a mechanical key printer, similar to a typewriter. A five unit code is used to represent the 32 possible keys, including one to toggle between letters and figures (including punctuation). Often now synthesized using a computer or video terminal. See **www.arrl.org/tis/info/digital.html**.



Vertical antennas — Antennas in which the electric field is vertical. Referred to as vertically *polarized* and generally physically oriented perpendicular to the Earth's surface.

Vertical monopole — Single vertical antenna element, typically a quarter or more wavelengths long. Often used as a transmit and receive antenna, singly or in combination with other similar antennas.

Hints & Kinks

Exalted carrier reception — Reception of a full carrier or reduced carrier AM signal through the use of a locally generated carrier signal in the receiver. This tends to make fading of the signal less noticeable. In a reduced carrier system, the receiver carrier oscillator is generally phase locked to the low level received pilot carrier. In a full carrier system, the carrier is partially notched out to simulate a reduced received carrier. A modern SSB receiver may also be used by selecting whichever sideband has the least interference and rejecting the carrier and alternate sideband by the SSB filter. The receiver is then usually manually tuned for proper audio response.

A Homebrew Radio Telescope

Beamwidth — Angular range over which a receiving antenna will accept signals, or a transmitting antenna will transmit signals. Typically stated as the angular range over which power is no less than 0.5 (–3 dB) from the maximum value within the beam.

Clarke belt — Geostationary orbital positions were hypothesized as a location for future communication satellites by Arthur C. Clarke in 1945.

Downconverter — Typically part of a receiving system containing a mixer and heterodyne oscillator that translates a band of high frequencies down to a lower frequency range for subsequent processing.

Dummy load — Sometimes called dummy antenna. Device designed to accept and dissipate the power from a transmitter without radiating it. This is generally used for transmitter testing to avoid interfering with other spectrum users.

F type connector — Type of coaxial cable connector designed for use in small (RG-6 type) 75 Ω TV connections between a utility pole and an end user, as well as within the end user location. Generally assembled by crimping onto the cable shield and using the extended coax cable center conductor as the center pin.

Geosynchronous orbit — Orbit located 22,236 miles above the earth's equator, in which satellites will stay above a fixed point on the ground and appear stationary. These geostationary orbital positions were hypothesized as a location for future communication satellites by Arthur C. Clarke in 1945.

Sound card — Generic name for an audio to computer processing interface device. Originally available as an internal plug-in accessory card for a PC, the functionality is now generally available in the PC itself. Advanced models are often configured as an external device from the connected PC. See a *QST* Product Review of samples of various configurations at **www.arrl.org/members-only/prodrev/pdf/pr0705.pdf**.

Strip chart — Media used in an electromechanical recording instrument (strip chart recorder). A typically paper strip is pulled past an electrically actuated pen that marks the paper indicating a change in one or more parameters over time.

Twin-T audio oscillator — Traditional oscillator in which a pair of T configuration R-C phase shift networks are used in cascade to provide the required 180° phase shift needed to result in an oscillation.

Low Cost QSK Conversion of the Ameritron ALS-600 HF Amplifier

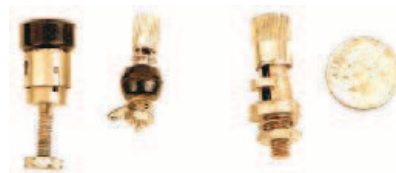
DPDT — Abbreviation for double pole double throw. Contact configuration of a switch or relay in which two separate circuits are each switched at the same time between two separate outputs.

Full break-in (QSK) — Radiotelegraph operation in which the sending operator can listen to the channel in between transmitted dots and dashes. This enables the other operator to "break in" to ask for a repeat or a clarification. It also allows the sending operator to adjust speed or suspend operation in the presence of noise or interference.

The *No Excuses* 160 Meter Vertical

Big guns — Characterization applied to amateur stations, typically competitive contest or DX chasing stations, that make use of maximum allowed power and large or high gain antenna systems.

Binding post — Mechanical connector arrangement designed for temporary connection of wires. Often found on power supplies for attachment of loads, on test equipment for connecting test subjects and sometimes on radios as antenna and ground connection.



Guying — Use of supplemental wires (*guy wires*) or rope supports to secure a vertical object such as a tower or antenna mast.

Helical winding — The application of wire to a core or other support in a way that avoids turns crossing each other and often contains a spacing between turns. The resulting wire takes the shape of a geometric helix.

Loading coil — An inductor inserted into an antenna to make it electrically longer. QST

[1] *The ARRL Handbook for Radio Communications*, 2009 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0261 (Hardcover 0292). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

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newcastle@hamradio.com

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(800) 854-6046
Leon, W7AD, Mgr.
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John, WØIG, Mgr.
denver@hamradio.com

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Gary, N7GJ, Mgr.
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phoenix@hamradio.com

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Twice the tensile and flexural strength of nylon insulators!

Stainless steel tilt and mount, strongest fiberglass base insulator—standard equipment

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43 Foot Multi-Band 10 to 160 Meter Vertical

- 6063 T832 corrosion-resistant aircraft aluminum tubing and stainless steel hardware
- 43 ft. optimal length vertical radiator for multi-band operation
- Easy tuning design—correct length and taper
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- Freestanding—just like the other guy's
- Requires DXE-UN-43 UNUN Balun for multi-band use with your wide range tuner

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Special Multi-Band UNUN Vertical Matching Network

- Superior to other multi-band vertical UNUNs
- Higher efficiency design especially for multi-band/tuner verticals
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- Better impedance matching allows your tuner to provide higher system performance
- Use it to improve performance of competitive 43 foot multi-band verticals
- Direct replacement for other multi-band UNUNs—fits existing mounting hole pattern
- Optional mounting bracket fastens directly to antenna element

Multi-Band Vertical UNUN

DXE-UN-43 ..... **$74.95**

DXE-UN-BRKT UNUN mounting bracket assembly; **$16.95**

Accessories

DXE-RADP-1P Radial Plate with 20 stainless steel bolt sets **$54.50**

DXE-363-SST Bulkhead Grounded Cable Connector; **$6.95**

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4BTV	(10, 15, 20, 40m)	**$114.95**
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Feedline Current Chokes

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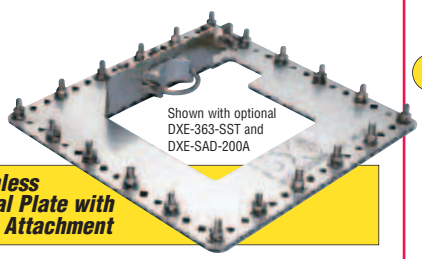

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Makes radial attachment a snap!

- Fits 2" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

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DXE-RADP-1HWK	20 sets of 1/4" stainless hardware	**$7.50**
DXE-CAVS-2P	Stainless Saddle Clamp for attachment to round tube 1.0" to 2.0" O.D.	**$10.95**
DXE-363-SST	Silver/Teflon® bulkhead connector	**$6.95**
DXE-VFCC-H05-A	Vertical Feedline Current Choke	**$94.95**
DXE-RADW-500K	Radial Wire Kit, 500 feet of wire, 20 lugs, 100 steel anchor pins	**$61.90**
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DXE-STPL-100P	Steel Radial Wire Anchor Pins, 100 pack	**$16.00**
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Biodegradable Anchor Pins Also Available

FAMOUS HIGH PERFORMANCE VERTICAL ANTENNA SYSTEM

Hy-Gain Hy-Tower 5-Band 50 Foot Vertical

New!

The Hy-Tower is an omnidirectional, self-supporting vertical radiator that operates on 10 through 80 meters. Add a loading coil and 160 meter operation is possible. The use of stub decoupling systems allows band switching on 10, 15, 20, 40, and 80 meters. The stubs isolate various sections of the vertical antenna so that an electrical 1/4 wavelength (or odd multiple of 1/4 wavelength) exists on all bands. On 20 meters, the 80 meter section acts as a 3/4 wave radiator.

- Tilt base allows easy assembly before raising antenna into position
- Stainless steel hardware
- Maximum Power: 1 kW AM, 2 kW PEP
- Overall Height: 53 feet

The Hy-Tower is drop-shipped directly from Hy-Gain. DX Engineering will e-mail you a shipping quote when you place your order.

HYG-AV-18HT **$899.95**

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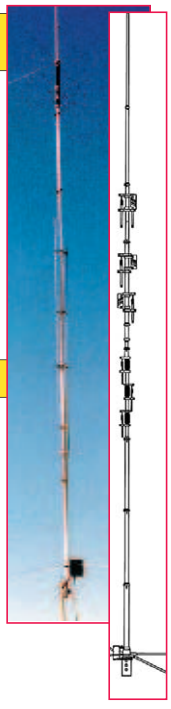
MULTI-BAND, NO-RADIALS VERTICAL ANTENNAS

Patriot HF 8-Band No-Radials Vertical

- Quarter wave stubs on 6, 10, 12, and 17 meters
- Efficient end loading coil and capacity hats on 15, 20, 30, and 40 meters
- Effective counterpoise system replaces radials and grounding
- No lossy can traps
- End loading of the lower HF bands allows efficient operation
- Maximum Power: 1,500W
- Overall Height: 25.5 feet

HYG-AV-640 ..... **$379.95**



7-Band, No-Radials Vertical

- Operates on 10, 12, 15, 17, 20, 30, and 40 meters
- No ground radials required
- Off-center feed design
- High efficiency high-power traps
- Heavy-duty tiltable mast clamp for tubing up to 2 1/8" O.D.
- Easily raised and lowered
- Exceptional bandwidth on 40 and 20 meters
- Maximum Power: 750W average, 1,500W PEP
- Overall Height: 29 feet

HYG-DX-77A **$439.95**

Receiving System Components

DXE-F6-1000	75 Ω, F6 style direct bury flooded cable, 1,000 ft.	**$149.95**
DXE-F6-CTL	75 Ω F6 cable by the foot	**$0.19/ft.**
DXE-SNS6-25	Watertight F6 Connectors, 25 pack	**$25.50**
DXE-SNS-CT1	F6 Connector Installation Tool	**$52.00**

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6063 Aluminum Tubing

- High strength Type 6063-T832 drawn aluminum tubing
- Sections with 0.058 inch wall thickness are perfect for telescoping antenna elements
- Most sizes are pre-slit on one end for element clamps
- Available in 3 and 6 foot lengths

Aluminum Tubing, 0.058" Wall, 3 Foot Length

Part Number	Diameter/End Type	Price	Cost/Foot
DXE-AT1240	0.375", no slit	$2.70	$0.90
DXE-AT1241	0.500", one end slit	$3.30	$1.10
DXE-AT1242	0.625", one end slit	$3.60	$1.20
DXE-AT1243	0.750", one end slit	$3.90	$1.30
DXE-AT1244	0.875", one end slit	$4.20	$1.40
DXE-AT1245	1.000", one end slit	$4.50	$1.50
DXE-AT1246	1.125", one end slit	$4.95	$1.65
DXE-AT1247	1.250", one end slit	$5.55	$1.85
DXE-AT1248	1.375", one end slit	$6.15	$2.05
DXE-AT1249	1.500", one end slit	$6.75	$2.25
DXE-AT1250	1.625", one end slit	$7.65	$2.55
DXE-AT1251	1.750", one end slit	$8.40	$2.80
DXE-AT1252	1.875", one end slit	$9.15	$3.05
DXE-AT1253	2.000", one end slit	$9.90	$3.30
DXE-AT1254	2.125", one end slit	$11.40	$3.80

Aluminum Tubing, 0.058" Wall, 6 Foot Length

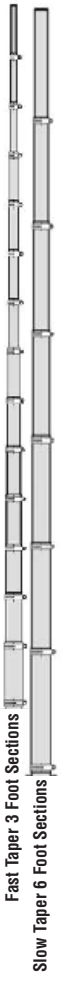
Part Number	Diameter/End Type	Price	Cost/Foot
DXE-AT1189	0.375", no slit	$5.40	$0.90
DXE-AT1205	0.500", one end slit	$6.60	$1.10
DXE-AT1206	0.625", one end slit	$7.20	$1.20
DXE-AT1207	0.750", one end slit	$7.80	$1.30
DXE-AT1208	0.875", one end slit	$8.40	$1.40
DXE-AT1209	1.000", one end slit	$9.00	$1.50
DXE-AT1210	1.125", one end slit	$9.90	$1.65
DXE-AT1211	1.250", one end slit	$11.10	$1.85
DXE-AT1212	1.375", one end slit	$12.30	$2.05
DXE-AT1213	1.500", one end slit	$13.50	$2.25
DXE-AT1214	1.625", one end slit	$15.30	$2.55
DXE-AT1215	1.750", one end slit	$16.80	$2.80
DXE-AT1216	1.875", one end slit	$18.30	$3.05
DXE-AT1217	2.000", one end slit	$19.80	$3.30
DXE-AT1218	2.125", one end slit	$22.80	$3.80

Aluminum Tubing, 2.000" Diameter, 0.125" Heavy Wall

Part Number	Length/End Type	Price	Cost/Foot
DXE-AT1255	3', no slit	$14.85	$4.95
DXE-AT1204	6', no slit	$29.70	$4.95

All Stainless Steel Element Clamps

DXE-ECL-020	1/2" and smaller tubing	$1.90
DXE-ECL-040	5/8" tubing	$1.90
DXE-ECL-060	3/4" and 7/8" tubing	$1.90
DXE-ECL-10SS	1" and 1 1/8" tubing	$1.90
DXE-ECL-12SS	1 1/4" tubing	$1.90
DXE-ECL-16SS	1 3/8" and 1 1/2" tubing	$1.90
DXE-ECL-20SS	1 5/8" and 1 3/4" tubing	$1.90
DXE-ECL-24SS	1 7/8" and 2" tubing	$1.90
DXE-ECL-28SS	2 1/8" and 2 1/4" tubing	$1.90
DXE-ECL-32SS	2 3/8" and 2 1/2" tubing	$1.90
DXE-ECL-36SS	2 5/8" and 2 3/4" tubing	$1.90
DXE-ECL-40SS	2 7/8" and 3" tubing	$1.90
DXE-ECL-44SS	3 1/4" maximum tubing	$1.95



65 ft. Telescopic Aluminum Tubing Kit

- 65 ft. slow taper from HD 2" O.D. base to 7/8" O.D. top
- Build your own vertical antennas or arrays
- Use with DXE Insulated Base Assemblies

DXE-ATK65 ..... $194.50

Insulated Vertical Base Assemblies for 2" O.D. Antenna Masts

Standard Base

- Tilt Base optional
- Two DXE-CAVS-1P mounting clamps required to attach base to mounting post

DXE-VE-BASE ..... Only $99.50

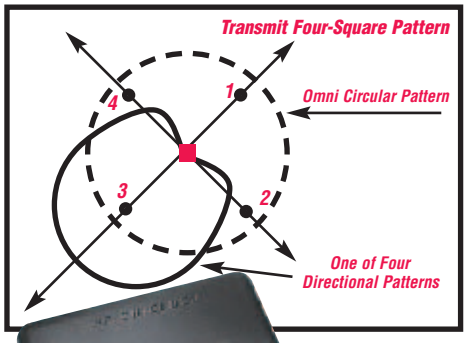
DXE-CAVS-1P	V-Saddle Clamp	$8.95
DXE-TB-3P	Tilt Base Assembly	$62.50

Heavy Duty Base

- Tilt Base included
- Two DXE-CAVS-2P mounting clamps required to attach base to mounting post

DXE-VA-BASE		$149.50
DXE-CAVS-2P	V-Saddle Clamp	$10.95

FOUR-SQUARE TRANSMIT CONTROLLER!



NOW SHIPPING 40 AND 80 METERS!

New!

Transmit Four-Square Hybrid Controller—4 Directions plus Omni

- Classic Hybrid design—easy to install
- 5 kW CW power rating—high reliability
- Hot switching lock-out—disables amplifier while switching
- Drop-in replacement for Comtek—easy upgrade
- Proven DX Engineering RF relays—high performance
- RF Shielded weatherproof housing—unique protection

DXE-TFS4-160	160 Meter Four-Square Controller with Control Console	$499.00
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DXE-TFS4-40	40 Meter Four-Square Controller with Control Console	$499.00

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- Preassembled with lugs for both #10 and 1/4" bolt sizes
- Call to order custom cable/connector assemblies

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- Highest quality Belden coaxial cable is used
- All cable assemblies are high voltage tested to handle full rated power
- Watertight seal between connectors and coax
- Call to order custom cable/connector assemblies

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New!

- Precision, two-step operation
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DXE-UT-8213	Cable Stripper for RG-8, RG-213, etc	$39.95
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PSK-31 SSTV WSJT

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TIG-SL-CABRJ1	RJ-11 mic connector	$14.95
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TIG-SL-CAB5PD	5-pin DIN	$14.95
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Many new HF radios, including the IC-7000, FT-450, and TS-480, are using a new 4-pin plug for DC Power. If your shack is already wired up with the "standard" 6-pin plug, this is the adapter you need. Other configurations are also available.

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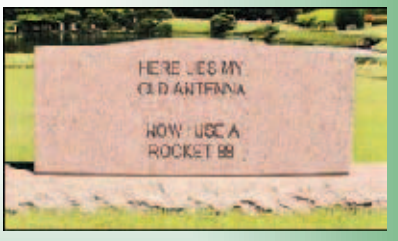
Is Your HF Antenna "Shovel-Ready"?



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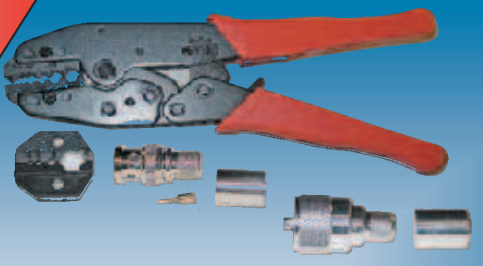
See Them At Dayton!



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NEW! YT-100

An autotuner for several popular Yaesu Radios. An included cable interfaces with your FT-857, FT-897 and FT-100 (and all D models) making it an integrated tuner, powered by the interface. Just press the tune button on the tuner, and everything else happens automatically: mode and power are set, a tune cycle runs, and the radio is returned to its original settings. It's the perfect complement to your Yaesu radio.

Suggested Price $199.99

NEW! Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple; one button push on the tuner is all that is needed - the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the tune button on the tuner. Powered by four AA internal Alkaline batteries (not included), so there are no additional cables required. A coax jumper cable is also induced for fast hook up. ***Suggested Price $129.99.***

AT-200Pro

The AT-200 features LDG's new "3-D memory system" allowing up to eight antenna settings to be stored for each frequency. Handles up to 250 watts SSB or CW on 1.8 – 30 MHz, and 100 watts on 54 MHz (including 6 meters). Rugged and easy-to-read LED bar graphs show power and SWR, and a function key on the front panel allows you to access data such as mode and status. All cables included. ***Suggested Price $249***

NEW! KT-100

LDG's first dedicated autotuner for Kenwood Amateur transceivers. Easy to use - just right for an AT-300 compatible Kenwood transceiver. The KT-100 actually allows you to use the Tune button on the radio. The LEDs on the front panel indicate tuning status, and will show a match in seconds, or even less of you've tuned on or near that frequency before. Has 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies. If you have an AT-300 compatible Kenwood radio, you can simply plug the KT-100 into your transceiver with the provided cable; the interface powers the tuner, and the Tune button on the radio begins a tuning cycle. The supplied interface cable makes the KT-100 a dedicated tuner for most modern Kenwood transceivers. ***Suggested Price $199.99***

See AT-1000Pro Review in Nov. '08 CQ

AT-1000Pro

Building on the success of the AT-1000, LDG Electronics has refined and expanded its 1KW tuner. The AT-1000Pro has an Automode that automatically starts a tuning cycle when the SWR exceeds a limit you set. Operates at any power level between 5 and 1,000 watts peak. RF Relay protection software prevents tuning at greater than 125 watts. Tunes from 1.8 to 54.0 MHz (inc. 6 meters), with tuning time usually under 4 seconds, transmitting near a frequency with stored tuning parameters, under 0.2 seconds. 2000 memories. 2 Antenna connections. All cables included. ***Suggested Price $599***

The #1 Line of Autotuners - Now With 2 Year Transferable Warranty!

A warranty is a promise, a promise of quality and service life. The #1 line of autotuners in the industry now comes standard with a no-questions-asked 2-Year Transferable Warranty.

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Now With 2 Year Transferable Warranty!

AT-100Pro

This desktop tuner covers all frequencies from 1.8 – 54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch, allowing you to switch instantly between two antennas. The AT-100Pro requires just 1 watt for operation, but will handle up to 125 watts. All cables included. ***Suggested Price $219***

radio not included

AT-897 for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897 Autotuner mounts on the side of your FT-897 just like the original equipment and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price$199***

radio not included

FT Meter

LDG's new version of its popular FT-Meter presents a lush, highly readable 2.5" meter face with calibrated scales for signal strength and discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit. Each function is selectable from the radio's menu. On/Off switch for the light. ***Still Only $49***

NEW! FTL Meter For Yaesu's popular FT-857(D) and FT-897(D) transceivers, our FTL-Meter presents a lush, highly readable 4.5 inch meter face with calibrated scales for signal strength and discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit. Each function is selectable from the radio's menu. Best of all, it plugs into the meter jack on the bottom of the front panel. ***Suggested Price $79.99***

NEW! M-7700 The LDG M-7700 provides a lavish 4.5" meter for IC-7700. It will display S-meter on receive, or power out, SWR, ALC level or supply voltages, all selectable from the rig's setup menu. What's more, the M-7700 and the virtual meter on your radio can work together; for example, you can display SWR on the radio's meter and power output on the M-7700. ***Suggested Price $79.99***

Z-11Pro

Meet the Z-11Pro, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. The Z-11Pro uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. All cables included. ***Suggested Price $179***

NEW! IT-100

Matched in size to the IC-7000 and IC-706, the new IT-100 sports a front panel push-button for either manual or automatic tunes, and status LEDs so you'll know what's going on inside. You can control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. It's the perfect complement to your Icom radio that is AH3 or AH-4 compatible. ***Suggested Price $179.99***

NEW! Z-100Plus

LDG's popular Z-100 economy tuner is now the Z-100Plus. Still small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. ***Suggested Price $159.99***

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HL-1.1KFX
Lightweight HF Linear

This world-class compact HF amplifier has built-in switch mode power supply to save the weight. It is compatible with wide AC line of 100 to 250V, and is best suited for DX-peditioners. 22.5 lbs.

HL-1.5KFX
HF/50MHz Linear

The amp utilizes an advanced 16 bit MPU (microprocessor) to run the various high speed protection circuits such as overdrive, high antenna SWR, DC overvoltage, band miss-set etc.

HL-2.5KFX
HF Linear Amplifier

The HL-2.5KFX is the lightest and most compact self-contained 1.5kW output HF LINEAR amplifier in its class. The amplifier's decoder changes bands automatically with most modern HF transceivers.

HL-1.2KFX
750W PEP HF Desktop Linear

This Solid State, world-class compact 750W HF amplifier is the easiest to handle and operate. The amplifier's broadband characteristics require no further tuning once the operating band is selected.

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HC-200AT
HF/6m 200W Auto Tuner

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The CG-3000 is a further development based on the CG-2000 model. This new addition to the range has an even more professional and versatile case made from ABS and includes an "o" ring seal between the two halves of the body.

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VX-150


VX-8R

VX-150 2M FM HT
• TX: 144-148 • RX: 140-174
• Power: 5/2/0.5W • Memories: 209

VX-8R Quad-band HT
• TX: 50-54, 144-148, 222-225, 430-450 MHz
• RX: 0.5-999 MHz (cell blkd) • Memories: 1200+
• Power: 5/2.5/1/0.05W (1.5W on 220)
• Optional GPS Antenna Unit FGPS-2 provides you with real time APRS® data.

FT-817ND
HF/VHF/UHF Backpack QRP
• TX: HF/VHF/UHF • RX: 0.1-56, 76-154, 420-470 MHz
• Power: 0.7-5W • Memories: 200
• Field operation with AA batteries or Ni-MH pack

FT-1802M 2M FM Mobile
• TX: 144-148 • RX: 136-174
• Power: 50/25/10/5W • Memories: 221

FT-857D 100W HF/VHF/UHF Mobile
• TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200 • YSK-857 included!

FT-7800R 2M/440 FM Mobile
• TX: 144-148, 430-450 MHz
• RX: 108-520, 700-999 MHz (cell blkd)
• Power: 50/20/10/5W (2M), 40/20/10/5W (440 MHz)
• Memories: 1055 • YSK-7800 included!

FT-897D 100W HF/VHF/UHF Portable
• TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200

FT-8800R 2M/440 FM Mobile
• TX: 144-148, 430-450 MHz
• RX: 108-520, 700-999 MHz (cell blkd)
• Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz)
• Memories: 1000 • Crossband repeat
• YSK-8900 included!

FT-8900R Quad-Band FM Mobile
• Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd • YSK-8900 included!

FT-950 100W HF/6M Base
• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 100 • Auto Antenna Tuner
• 32-bit Floating Point DSP • Requires 12VDC PS
• Built-in high stability TCXO • Optional DMU-2000 Data Management Unit displays various operational conditions
• Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

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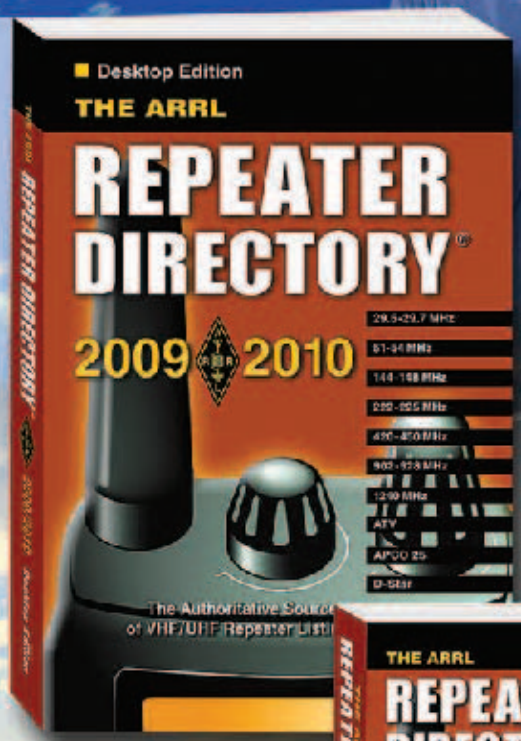

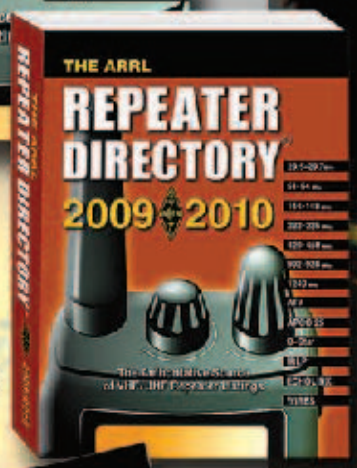

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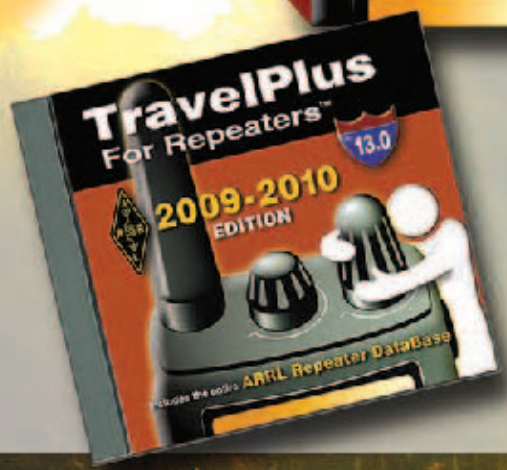

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IC-92AD

IC-V8 Sport 2M FM HT
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• AA Battery Case • Memories: 107

IC-92AD 2M/440 D-Star & FM HT
• TX: 144-148, 420-450 MHz
• RX: 0.495-999 MHz (cell blkd)
• Power: 5/2.5/0.5/0.1W
• Optional HM-175GPS Speaker microphone adds GPS capabilities

IC-V8000 2M FM Mobile
• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 75/25/10/5W • Memories: 207

ID-800 2M/440 FM Analog & D-Star Digital Dual Bander
• TX: 144-148, 440-450 • RX: 118-173, 230-549, 810-999 MHz (cell blkd) • Power: 55/15/5W (2M), 50/15/5W (440 MHz) • Memories: 512 • D-Star Digital Ready

IC-718 All Band HF Transceiver
• TX: HF • RX: 0.03-30 MHz • Power: 5-100W
• Memories: 101 • DSP built-in
• SSB, CW, RTTY and AM (40W)

IC-756PROIII HF/6M Base
• TX: HF/6M • RX: 0.03-60 MHz • Power: 5-100W
• Memories: 101 • 5 inch color screen • 32-bit floating DSP
• Real time spectrum scope • Automatic antenna tuner
• Improved 3rd order intercept point

IC-7000 Multiband Multimode Mobile
• TX: HF/6M/2M/440 MHz • RX: 0.03-199, 400-470 MHz
• Power: 100W (HF/6M), 50W (2M), 35W (440 MHz)
• Memories: 503 • 41 band-widths with sharp or soft filter shape • RMK-7000 included!

PW-1 HF/6M 1KW Linear Amplifier
• TX: 160-15M/6M • Power: 1000W (180-264 VAC), 500W (90-132 VAC) • Automatic band change & antenna tuner • Easily connects to any current Icom HF transceiver • Two input & Four output connectors

IC-7800 Multimode HF/6M Base
• TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
• Memories: 101 • 7" color screen • Four 32-bit floating DSPs
• Two identical receivers • Three roofing filters
• External VGA connector • Automatic antenna tuner

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DMU2000 Data Management Unit **889.95**
FH2 Remote Keypad **84.95**
SP2000 External Speaker **175.95**
UTUNINGKIT A, B, or C model..... **479.95**
YF122C 500 hz CW filter **159.95**
YF122CN 300 hz CW filter **164.95**

FT950

The FT-950 has been developed to fit the needs of both the casual and serious DX enthusiasts as well as new licensees desiring a top notch first radio to discover the magic of the HF and 50MHz bands. This superb radio features DSP filtering, 100 Watts of power output, factory installed antenna tuner and many of the outstanding ergonomic and performance features first introduced in our FTdx-9000 and FT-2000 flagship radios.

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FH2 Remote Keypad **84.95**
MD100A8X Desk top mic.....**139.95**
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SP2000 External Speaker.....**175.95**
UTUNINGKIT A, B, or C model.....**479.95**

FT450/AT

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ATAS120 Auto tuning antenna **289.95**
ATU450 Auto antenna tuner **149.95**
FC40 Auto antenna tuner **249.95**
MD100A8X Desk top mic.....**139.95**
MMB90 Mobile mount.....**33.95**

FT897D

The FT-897D is a rugged, innovative, multiband, multimode portable transceiver for the amateur radio MF/HF/VHF/UHF bands. Providing coverage of the 160-10 meter bands plus the 6 m, 2 m, and 70 cm bands and it's capable of 20-Watt portable operation using internal batteries, or up to 100 Watts when using an external 13.8-volt DC power source.

ADMS4B Programming software/cable **51.95**
ATAS120 Auto tuning antenna **289.95**
CT39 Packet Cable **9.95**
CT62 Computer Interface Cable.....**32.95**
FC30 Bolt on auto antenna tuner **189.95**
FNB78 NiMH Internal Battery **115.95**
FP30 Internal Power Supply.....**209.95**
MD100A8X Desk top mic **139.95**
MH59A8J Remote Control Mic.....**64.95**
YF122S 2.3 kHz SSB Filter.....**164.95**

FT857D

The FT-857D, the world's smallest HF/VHF/UHF mobile transceiver, provides base station-type performance from an ultra-compact package that's ideal for mobile or external battery portable work. Wide frequency coverage, outstanding receiver performance, and the convenience of optional remote-head operation make the FT-857D the expert's choice for high-performance mobile operation!

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ATAS120 Auto tuning antenna **289.95**
CT39 Packet Cable **9.95**
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CSC83 Soft Case..... **23.95**
CT39 Packet Cable **9.95**
CT62 Computer Interface Cable..... **32.95**
EDC5B Lighter Cable..... **23.95**
FNB72 Ni-Cd Battery Pack **59.95**
MH36E8J DTMF Mic..... **56.95**
YF122S 2.3 kHz SSB Filter..... **164.95**

FT2800M

Heavy-Duty 144Mhz FM Xcvr, High power output, a huge, easy-to-read display, WIRES™ Internet Linking Access capability are yours with the rugged new FT-2800M!

ADMS2J Cloning Software + Cable **38.95**
JTPS14M Jetstream Power Supply **49.95**
MLS100 External Speaker **46.95**
MX2 Hustler 2m Mag Mount **32.95**

FT1802M

The FT-1802M is a ruggedly-built, high-performance 50-Watt 2-meter mobile FM transceiver with outstanding receiver performance and crisp, clean audio. Optimized for ease of operation day or night, the FT-1802M is one tough radio for operating in a tough world!

JTPS14M Jetstream Power Supply **49.95**
MLS100 External Speaker..... **46.95**
MX2 Hustler 2m Mag Mount **32.95**

VX150

Compact yet incredibly rugged, the VX-150 2-meter handheld is derived from our Vertex commercial transceiver line, providing exceptional receiver performance along with clean, clear transmit audio. Built to withstand the rigors of outdoor use. The illuminated keypad provides easy viewing during nighttime operation.

SMAUHF SMA-UHF Adapter **3.50**
SMABNC SMA-BNC Adapter **3.50**
ADMS1F Software and cable..... **38.95**
EDC5B Cigarette Lighter Cable..... **23.95**
FBA25A AA Battery case **21.95**
MH34B4B Speaker Mic **33.95**
VC25 Vox Headset **62.95**

VX170

The VX-170 is a compact, high-performance FM hand-held providing up to five Watts of RF power, along with big audio output (700 mW) and unmatched protection against the elements! Protected against water ingress to IPX7 specifications (submersion for up to 30 minutes at a depth of 3 feet), the VX-170 features long operating time, thanks to the supplied 1400 mAh NiMH Battery Pack.

ADMSVX170 Software and cable..... **43.95**
EDC5B Cigarette Lighter Cable **23.95**
FBA25A AA Battery case..... **21.95**
MH57A4B Speaker Mic **27.95**
VC27 Earpiece Microphone..... **27.95**

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Model	Center Conductor	Shield	Center Indulator	Loss 100ft 50 Mhz	Loss 100ft 100 Mhz	Loss 100ft 200 Mhz	Loss 100ft 400 Mhz	Price	Spool
JT400 LMR400	Solid 10 gauge	Foil & Braid	Foam	.9db	1.2db	1.7db	2.5db	**.59/ft**	**$285 500ft**
JT2015F RG8/U	Stranded 9.5 gauge	Foil & Braid	Foam	1.1db	1.5db	2.0db	3.0db	**.64/ft**	**$310 500ft**
JT2015 RG8/U	Stranded 9.5 gauge	Foil & Braid	Poly Semi-solid	1.1db	1.5db	2.0db	3.0db	**.59/ft**	**$285 500ft**
JT2013 RG8/U	Solid 9.5 gauge	Foil & Braid	Poly Semi-solid	.9db	1.4db	1.8db	2.6db	**.59/ft**	**$285 500ft**
JT2213 RG213/U	Stranded 13 gauge	Braid	Solid Polyethylene	1.23db	1.81db	2.68	4.07db	**.59/ft**	**$285 500ft**
JT2008 RG8/U	Stranded 11 gauge	Foil	Foam	1.2db	1.8db	2.6db	3.8db	**.55/ft**	**$265 500ft**
JT1908 Mini 8/U	Stranded 16 gauge	Braid	Foam	2.5db	3.7db	5.4db	8.0db	**.29/ft**	**$270 1000ft**
JT1958 RG58/U	Stranded 20 gauge	Braid	Solid Polyethylene	4.1db	5.3db	8.2db	12.6db	**.20/ft**	**$180 1000ft**

VX8R

Bluetooth Hands-Free Operation with GPS/APRS and Real RF-Dual Wideband Receive… The next generation Amateur Handheld transceiver from Yaesu, who has been introducing Leading-Edge Transceiver Technology for years.

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BH2 Bluetooth Headset Mono **82.95**
BU1 Bluetooth Unit **71.95**
CD40 Charger Cradle BH1 & BH2 ..... **25.95**
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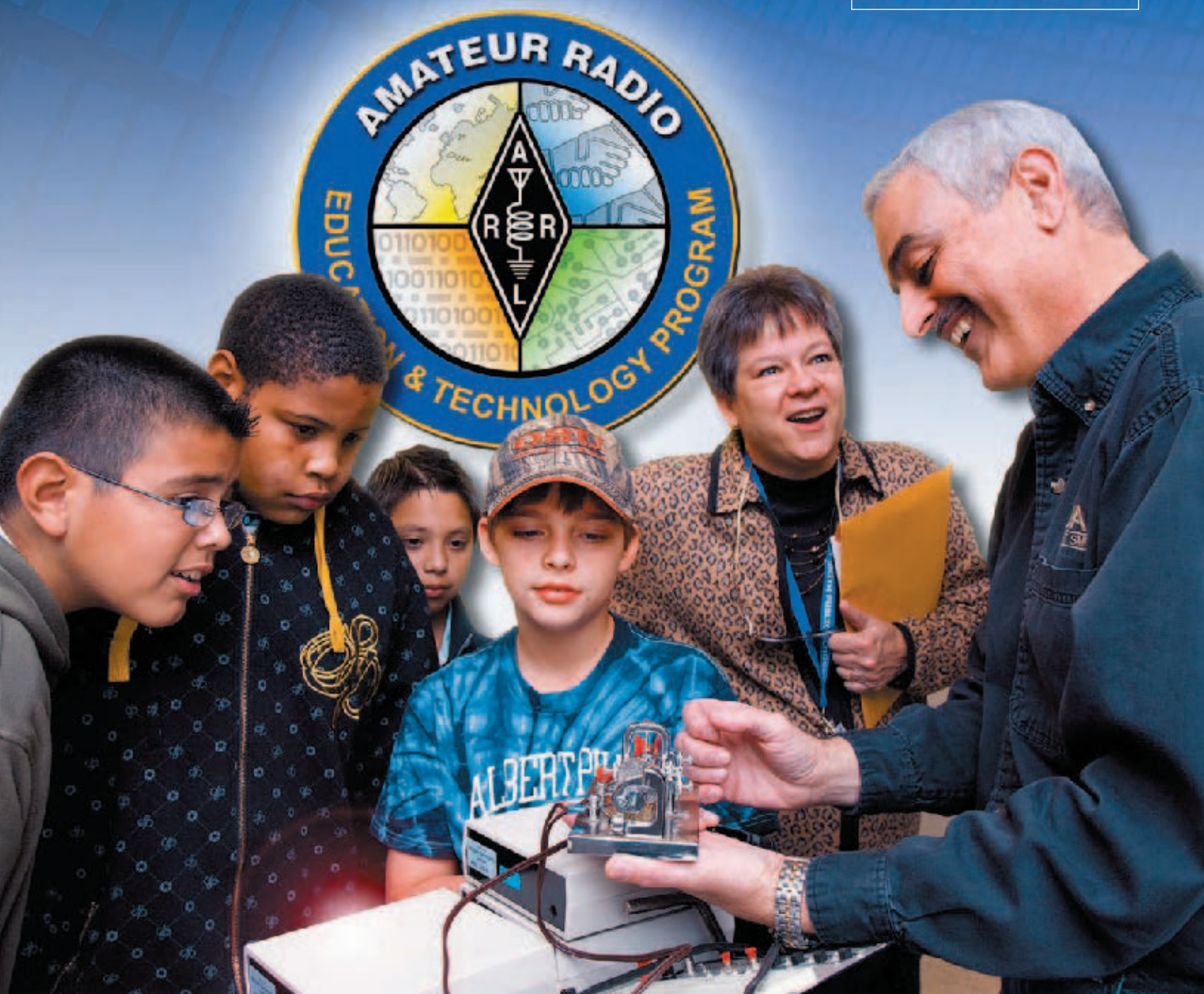

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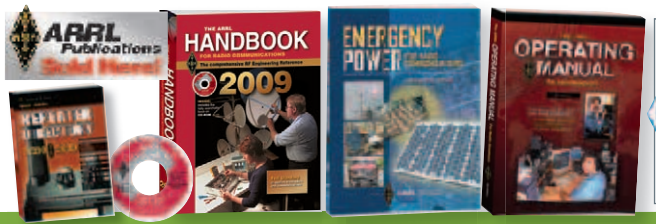

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200 watts, large TFT, built-in memory board, main & sub receiver VRF, full dual rx, internal power supply.

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200 watts, dual meters & LCD, VRF installed in main receiver, extra key & headphone jacks, internal power supply.

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High performance linear amplifier covers 160 to 15 and the 6 meter amateur bands

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144-146 MHz, Submersible, 200 Memory Channels, 700 mW of audio

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8 position antenna switch, 50 Ohm dummy load, peak reading backlit Cross-Needle SWR Power meter, 4:1 balun for balanced lines. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. 3.4 pounds.

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$89.95
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Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front panel. Lamp switch. SO-239 connectors. 5.3x5.75x3.5 in.
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1.5 kW *dry* Dummy Load

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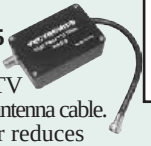

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B-5018-G
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B-1018-G, $409. MIRAGE's most popular *dual purpose* HT/mobile/base amp. 160 Watts out/10W in. For 0.25-10W rigs.

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RC-2, $49. Remote Control. On/Off, preamp On/Off, selects SSB/FM. 25 ft. cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

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6 Meter Amplifier

A-1015-G, $389, *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out/10W in. For 1-15 W transceivers. 20 dB GaAsFET preamp.

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430-450	KP-1/440	KP-2/440

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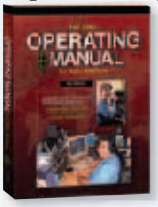

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Continued on page 136

MFJ 160-6 Meter Antenna

Self-supporting 43 foot vertical -- no guy wires required . . . 1500 Watts . . . exceptional performance . . . low-profile . . . includes base mount and legal limit balun . . . assembles in an hour . . .

MFJ-2990
$359.95

New!

Operate all bands 160 through 6 Meters at full 1500 Watt with this self-supporting, 43 feet high performance vertical! It assembles in less than an hour and its low-profile blends in with the sky and trees -- you can barely see it from across the street.

Exceptional Performance

The entire length radiates to provide exceptional low angle DX performance on 160 through 20 meters and very good performance on 17 through 6 Meters. You can shorten it by telescoping it down for more effective low angle radiation on higher bands if desired.

With an automatic antenna tuner there's no fuss -- just talk!

A wide-range automatic or manual antenna tuner *at your rig* easily matches this antenna for all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you simply put it up!

An optimized balun design allows *direct coax feed* with negligible coax loss (typically less than ½ dB 60-6 Meters and less than 1 dB 160-80 M with good quality, low-loss coax).

Fully self-supporting, Extremely low wind loading, Very low visibility . . .

With just 2 square feet wind load, the fully self-supporting MFJ-2990 -- *no guy wires needed* -- has the lowest wind-loading and lowest visibility of any vertical antenna! The key is a six foot section of tapering diameter *stainless steel* whip that flexes in strong wind instead of stressing the bottom sections. Its 2-inch O.D. and .120 inch thick walled tubing bottom section makes it incredibly strong -- it'll stay up!

Weighs just 20 pounds -- you can easily put it up by yourself because its corrosion resistant *6063 aircraft aluminum* tubing and stainless steel construction make it light *and* super-strong.

Assembles in an hour

You can easily assemble it in an hour! Ground mounting lets you completely hide its antenna base in shrubbery. Includes ATB-65 high-strength antenna mount. Requires ground system -- at least one radial. More extensive ground system will give much better performance.

Great for Stealth Operation in antenna restricted areas

This very low-profile antenna is perfect for stealth operation in antenna restricted areas. Hide it behind trees, fences, buildings, bushes. Use it as a flagpole. Telescope it down during the day. Put it up at night and take it down in the morning before the neighbors even notice!

Quick and easy installation makes it great for DXpeditions, field day and other portable and temporary operations.

MFJ *Automatic* Tuners

MFJ-998
$699.95

For legal limit 1500 Watt SSB/CW amplifiers. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, amp bypass, matches 12-1600 Ohms, 1.8-30 MHz.

MFJ-993B
$259.95

Dual power range -- 300 Watt range matches 6-1600 Ohms. 150 Watt/6-3200 Ohms. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, 1.8-30 MHz.

MFJ *Manual* Tuners

MFJ-989D
$389.95

1500 Watts SSB/CW, 1.8-30 MHz. Active peak-reading Cross-Needle SWR/Wattmeter, balun, dummy load, antenna switch, aircore roller inductor.

MFJ-949E
$179.95

World's most popular tuner! 300 Watts, 1.8-30 MHz. Peak/Average Cross-Needle SWR/Wattmeter, 8 pos. antenna switch, dummy load, 1kV capacitors.

Window Feedthru

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$69.95

Bring 3 coaxes, balanced line, random wire, ground thru window. Connectors mounted on *stainless steel* panel. ¾" thick *pressure-treated* weather-proof wood.

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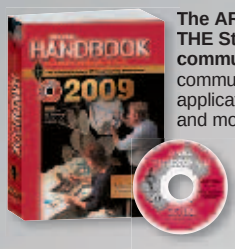

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Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

MFJ-1778
$44.95

***The** famous G5RV antenna is the most popular ham radio antenna in the world!* You hear strong signals from G5RVs day and night, 24/7.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

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MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

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160M, 265 ft.

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True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*® coax and *Teflon*® coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

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$29.95

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz.

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MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

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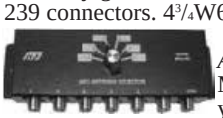
MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.



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33 ft. Telescoping fiberglass Mast

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MFJ Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3½ inch high, ¾ inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603
$89.95

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

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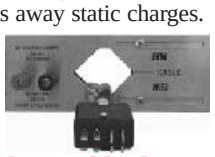
MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1¼X1⅝ in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.



3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602
$69.95

6 Coax

6 high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601
$59.95
New!

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

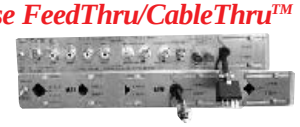
New!
MFJ-4600
$79.95

5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1¼x1⅝ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

MFJ-4604
$99.95
New!

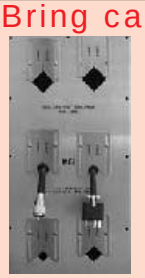
All-Purpose FeedThru/CableThru™

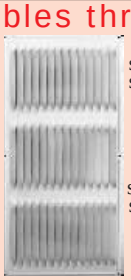


***Stacks** MFJ-4603 **and** MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

MFJ-4605
$159.95
New!

Bring cables thru eave of your house





MFJ-4616
shown with standard full-size vent (not included) it replaces. For *6 Cables*
$26.95
New!

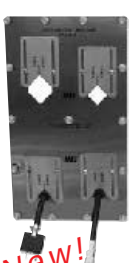
MFJ-4613
shown with standard half-size vent (not included) it replaces. For *3 Cables*
$14.95

Replace your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and…

Bring in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1¼x1⅝ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ *Wall Plates*



New!

MFJ-4612
For 2 Cables
$24.95

MFJ-4611
For 1 Cable
$14.95

MFJ-4614
For 4 Cables
$34.95

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1¼x1⅝ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

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MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-993B 300 Watt *IntelliTuner*™

The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B $259.95

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B $359.95

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

1500 Watt *Legal Limit*

for Ameritron AL-1500/1200/82 amps

Roam the entire HF spectrum 1.8-30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

MFJ-998 $699.95

300 Watt *Extra*...Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B $219.95

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 $219.95

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

MFJ-928 $199.95

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

MFJ-925 $179.95

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

G5RV Antenna

MFJ-1778 $44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feed-point insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

MFJ-926 $399.95

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

MFJ-927 $259.95

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

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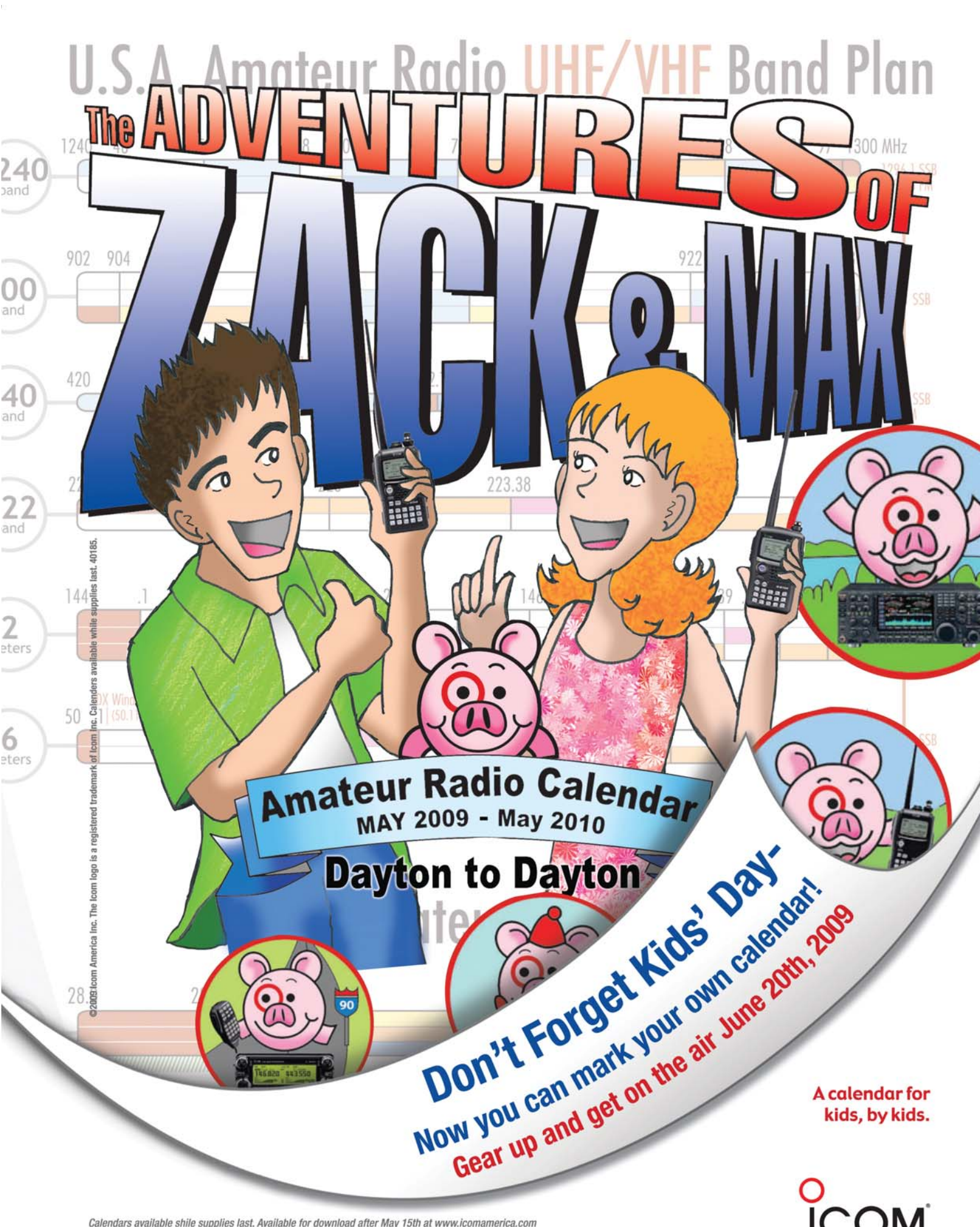
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Dayton to Dayton
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MFJ TUNERS

Ham Radio's ***Most Popular*** 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*(R) insulating washers and proper L/C ratio gives you *arc-free* no worries operation up to 300 Watts PEP transceiver input power.

MFJ-949E $179.95

The MFJ-949E inductor switch was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full *size* 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, *peak* or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune™* lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

Full *size* built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^{5}/_{8}$x$3^{1}/_{2}$x7 inches. Superior cabinet construction and more!

MFJ-948, $159.95. Econo version MFJ-949E. Has all features except for dummy load.

***No Matter What™* Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D ***Legal Limit*** Tuner

MFJ-989D $389.95

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. Easily handles *full* 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. *New* 500 pF air variable capacitors. *New* improved *AirCore™* Roller Inductor. *New* high voltage current balun. *New* crank knob. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D".

MFJ-986 Two knob ***Differential-T™***

MFJ-986 $349.95

Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D ***compact*** kW Tuner

MFJ-962D $299.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore™* roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$ x$10^{7}/_{8}$ in.

MFJ-969 300W ***Roller Inductor*** Tuner

MFJ-969 $219.95

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-941E ***super value*** Tuner

MFJ-941E $139.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M ***mobile*** Tuner

MFJ-945E $129.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 ***portable/QRP*** Tuner

MFJ-971 $119.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B ***smallest*** Versa Tuner

MFJ-901B $99.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 ***Tiny Travel*** Tuner

MFJ-902 $99.95

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 ***random wire*** Tuner

MFJ-16010 $69.95

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 ***6 Meter*** Tuners

MFJ-906 $99.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 ***VHF/UHF*** Tuners

MFJ-921/924 $89.95

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 ***artificial*** RF Ground

MFJ-931 $109.95

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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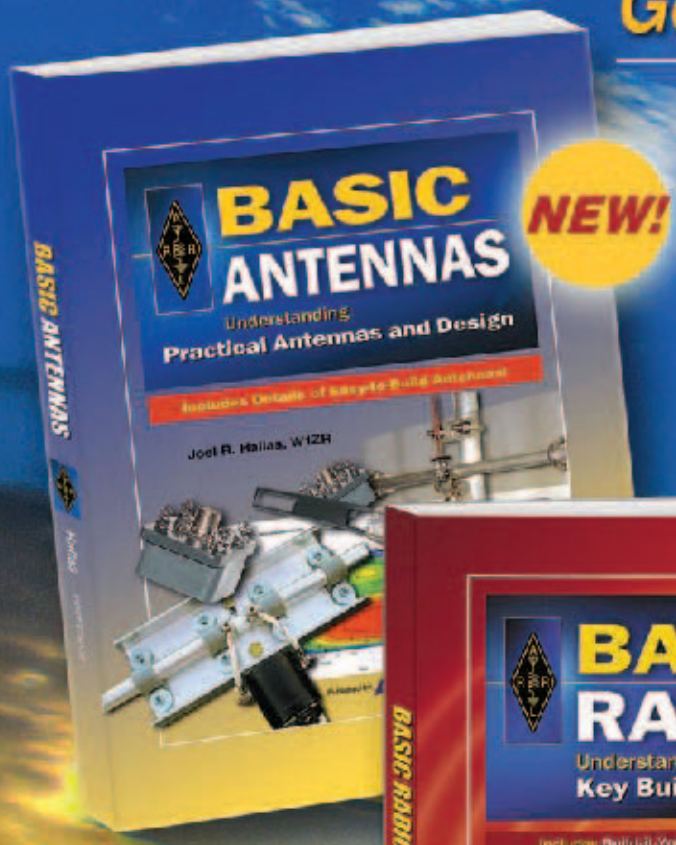

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Basic Antennas

Understanding Practical Antennas and Design

For something that is often so simple to make, an antenna is remarkably difficult for many people to understand. That's unfortunate, because for many radio systems the antenna is one of the most important elements, one that can make the difference between a successful and an unsuccessful system.

Basic Antennas is a comprehensive introduction to antennas—basic concepts, practical designs, and details of easy-to-build antennas. You'll learn how to make antennas that *really* work! This book will provide a foundation in antenna theory and design necessary for anyone undertaking more advanced topics.

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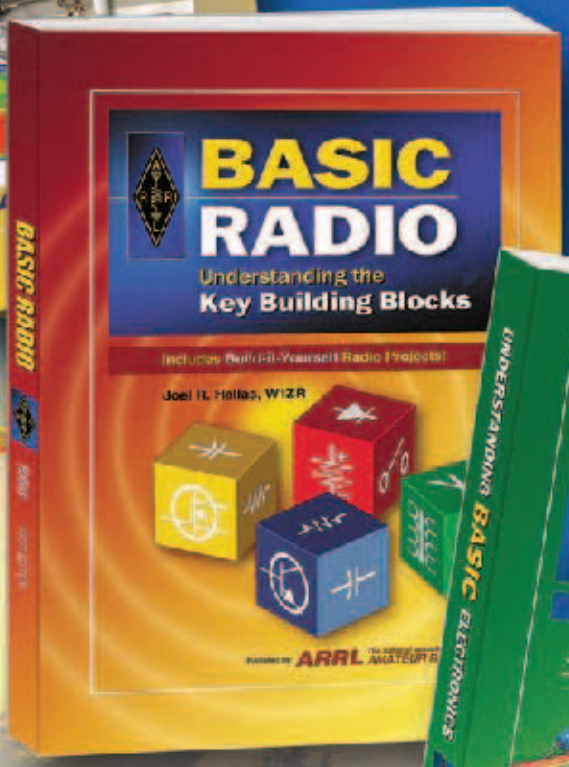

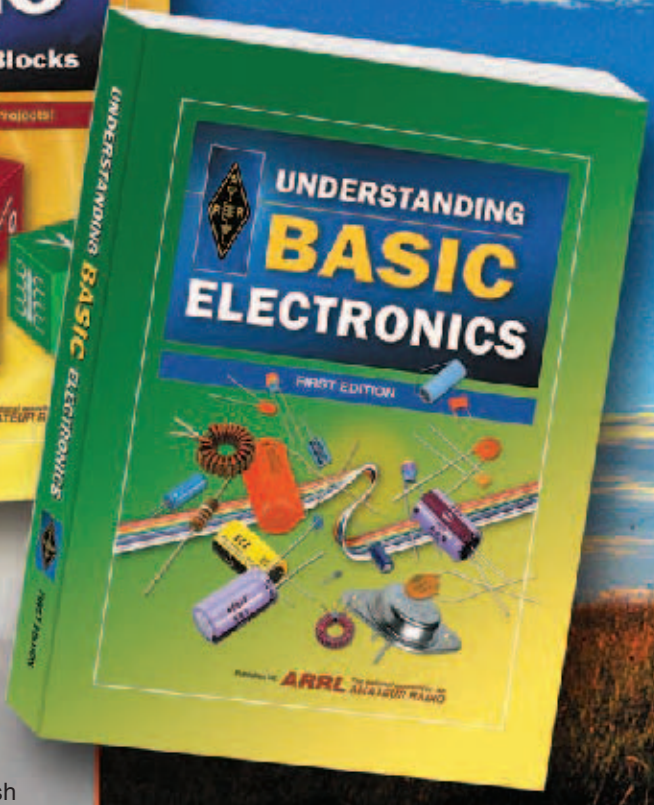

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Understanding the Key Building Blocks

An introduction to radio FOR EVERYONE!—what it does and how it does it. ***Basic Radio*** reveals the key building blocks of radio: receivers; transmitters; antennas; propagation and their applications to telecommunications; radionavigation; and radiolocation. It includes simple, build-it-yourself projects to turn theory into practice.

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Written in an easy-to-understand style for electronics beginners, ***Understanding Basic Electronics*** is for those who want to brush up on electronics principles. With the foundation it helps you create, you'll be ready to learn more advanced concepts.

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QS6/2009

MFJ tiny Travel Tuner

Tiny 4½x2¼x3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything!

MFJ brings you the *world's smallest* full power 150 Watt 80-10 Meter Antenna Tuner. Extra wide matching range lets you tune nearly any antenna.

It's no toy, its got guts! Built with real *air* variable capacitors (600 Volt, 322 pF) and *three* stacked powder iron toroids to handle real power -- not just QRP. Bypass switch lets you bypass tuner when you don't need it.

You can use nearly any transceiver at full power with nearly any coax fed or random wire antenna for portable, home or mobile operation.

It's perfect for compact rigs like Icom IC-706MKIIG, Yaesu FT-100D, Kenwood TS-50, QRP rigs and others with a built-in SWR meter.

Operate anywhere, anytime with a quick easy set-up! Tune out SWR on your mobile whip from inside your car. Operate in your apartment with a wall-to-wall antenna or from a motel room with a wire dropped from a window or from a mountain top with a wire over a tree limb. Great for DXpeditions or field day. Be prepared for emergencies.

MFJ-902 is so small and handy, you'll rely on it wherever you go! It's easy to pack away in your briefcase, suitcase, backpack, glove compartment or desk drawer. It's tiny enough to slide in your back hip pocket! 4½Wx2¼Hx3D inches.

MFJ-902
$99.95

Tiny Travel Tuner with 4:1 Balun

MFJ-902H
$119.95

MFJ-902H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun* for balanced lines and 5-way binding posts for balanced lines and random wire. 5¾Wx2¼Hx 2¾D in.

Tiny Travel Tuner with Cross-Needle SWR/Wattmeter

MFJ-904
$129.95

MFJ-904, same as MFJ-902 *Tiny Travel Tuner* but has *Cross-Needle SWR/Wattmeter.* Read SWR, forward and re-flected power all at a glance in 300/60 and 30/6 Watt ranges. 7¼Hx2¼Hx2¾D inches.

ALL-in-one *Tiny Travel Tuner* with 4:1 Balun *and* SWR/Wattmeter

MFJ-904H
$149.95

ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

Long 10/12 foot Telescoping Whips

MFJ-1954
$29.95
10 Feet

MFJ-1956
$34.95
12 Feet

10 foot extended, 19 inches collapsed, MFJ-1954, $22.95. 12 foot extended, 22.5 inches collapsed. MFJ-1956, $29.95. Standard 3/8 inch by 24 threaded stud for use with all standard mounts. Durable 1/2 inch diameter plated brass. Telescopes for full 1/4 wave operation 2 to 12/15 Meters. Cover 17, 20, 30, 40, 60, 80, 160 Meters with loading coil. Use two for multi-band dipoles. Replace screwdriver antenna whip for highly efficient *fixed* mobile operation.

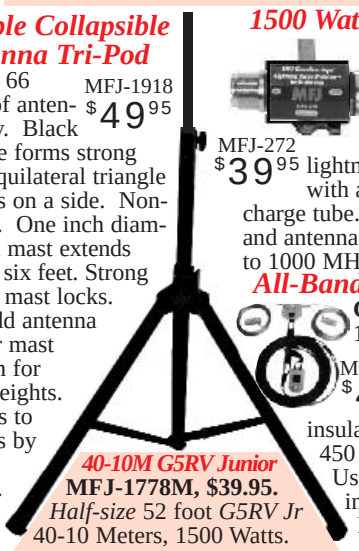
MFJ RF Isolator

MFJ-915 *RF Isolator*

MFJ-915
$29.95

prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. *Don't operate without one!* 5x1½ inches. For 1.8 to 30 MHz.

Portable Collapsible Antenna Tri-Pod



MFJ-1918
$49.95

Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.

40-10M G5RV Junior
MFJ-1778M, $39.95.
Half-size 52 foot *G5RV Jr* 40-10 Meters, 1500 Watts.

1500 Watt Lightning Surge Protector

MFJ-272
$39.95

Protect your expensive transceiver from static electricity and lightning induced surges with an ultra-fast gas discharge tube. Plug between rig and antenna, attach ground. DC to 1000 MHz. SO-239s.

All-Band G5RV Antenna

MFJ-1778
$44.95

Cover all bands, 160-10M with tuner. 102 ft. long, 1.5kW. Custom fiberglass insulator stress relieves 450 Ohm ladder line. Use horizontally, as inverted vee or sloper. Marconi on 160M.

Glazed Ceramic Antenna Insulator

MFJ-16C06
6-Pack
$4.56
(79 cents each)

Authentic *glazed ceramic* antenna insulator. Extra-strong -- will not break with long antennas and will not arc over or melt even under full legal power. Molded ridges give extra-long high voltage path to prevent high-voltage breakdown. Smooth wire holes prevent wire damage. Use as center or end insulator for dipoles, doublets, G5RVs, guy wires and others.

Current Balun/Center Insulator

MFJ-918
$24.95

True *1:1 Current Balun/Center Insulator* forces equal currents into dipole halves to reduce coax feedline radiation and field pattern distortion. Reduces TVI, RFI and RF hot spots in your shack. 50 ferrite beads on *Teflon*(R) coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

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MFJ . . . the world leader in ham radio accessories!

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™ warranty . . .

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 hand-held 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.

MFJ-269 $389.95

Digital and Analog displays

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz

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™ 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.

Range features

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

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

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

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

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

Super Easy-to-Use

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

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.
Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors.

MFJ-66, $24.95.
Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer™* and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer™*.

MFJ-99C, $40.90.
SWR** Analyzer Power Pack.* 10 Pack MFJ *SuperCell™* Ni-MH batteries, and power supply for SWR analyzers. ***Save $5!

MFJ-98, $60.85.
MFJ-269** Accessory Pack.* MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coils, power supply for MFJ-269. ***Save $5!

MFJ-98B, $88.90.
MFJ-269** Deluxe Accessory Pack.* Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. ***Save $7!

MFJ-269*PRO™* Analyzer

MFJ-269*PRO* $419.95 ***NEW!***

Like MFJ-269, but has extended coverage in UHF range ***(430 to 520 MHz)*** and ruggedized cabinet that protects LCD display, knobs, meters and connectors from damage.

MFJ-259B HF/VHF Antenna *SWRAnalyzer™*

The world's most popular antenna analyzer gives you a complete picture of your antenna performance 1.8 to 170 MHz.

It's Super easy-to-use -- makes tuning your antenna quick and easy.

Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet. Read inductance in uH and capacitance in pF at RF frequencies.

MFJ-259B $289.95

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

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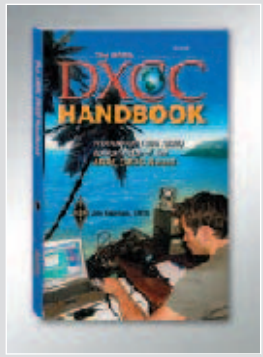
The Thrill of Worldwide Operating!

The ARRL DXCC Handbook

by Jim Kearman, KR1S
ARRL Order No. 9884
$19.95



Many radio amateurs enjoy the lure of DXing—seeing how far away we can communicate with other Amateur Radio operators. It's a way of determining how well our stations—and we, the operators— perform. DXing is a full-time goal for some hams and a just-for-fun challenge for others. We hope this book will inspire you to try DXing, and that you'll use it as a guide to beginning your own DX journey.

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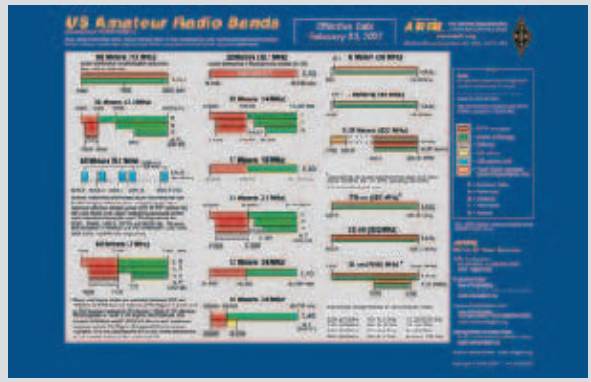

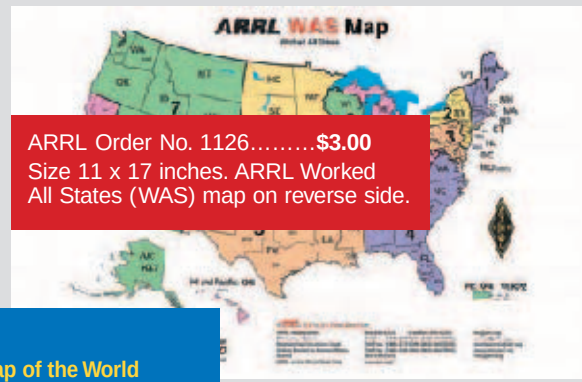

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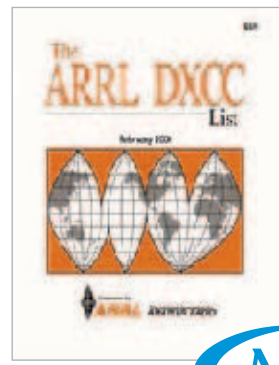

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40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. 7½Wx 4¾Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

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75 Amps continuous. Adjustable 13.8-14.2 VDC output. Reverse polarity, over-current/temperature, brown-out input protection, 7.8 lbs. 6½Wx3½Hx10D in. 108-132 VAC. Great for Ameritron's ALS-500M mobile amplifier!

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MFJ-1118, $84.95. Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. 12½x2¾x2½ in.

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MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

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MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

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MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

All PowerPoles™

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MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. Extra contacts, fuses. 12Wx1¼Hx2¾D".

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MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®, extra* fuses -- *no extra cost*. 9Wx1¼Hx2¾ inches.

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MFJ-1124 $64.95

MFJ-1124, $64.95. 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost.*

15 Amp Continuous

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MFJ-4115 $79.95

30 Amps Continuous

Linear with 19.2 lb.Transformer

No RF Hash!

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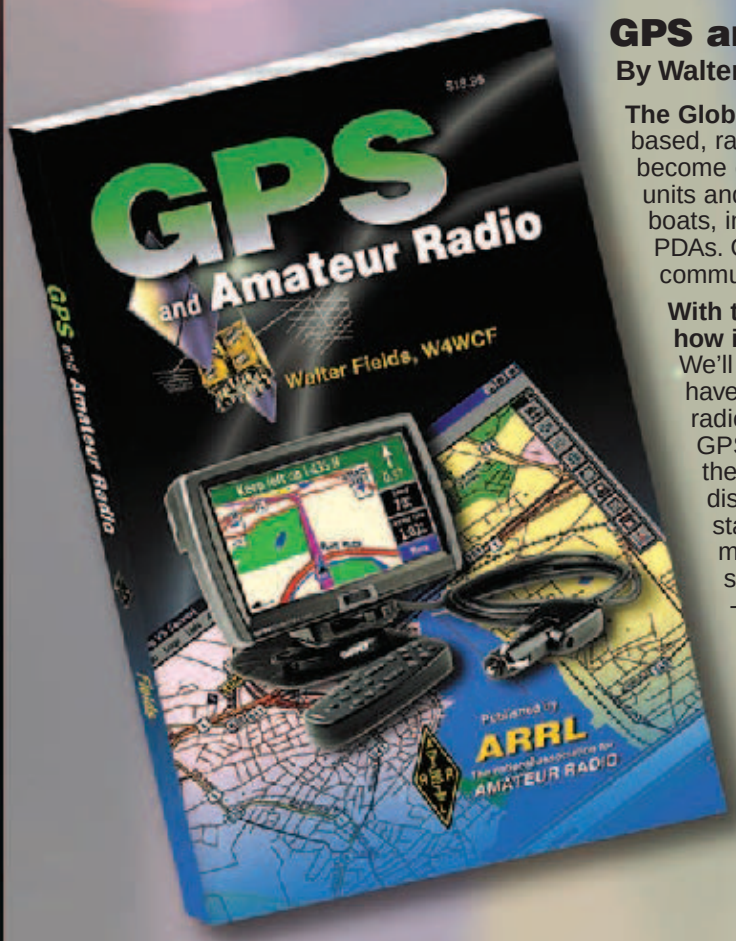

GPS and Amateur Radio

By Walter Fields, W4WCF

The Global Positioning System (GPS) is a satellite-based, radio navigation system. GPS devices have become commonplace in consumer electronics. GPS units and GPS technology is used in our cars, on our boats, in cell phones, in our personal computers and PDAs. GPS has improved the way we navigate, communicate, and move about the planet.

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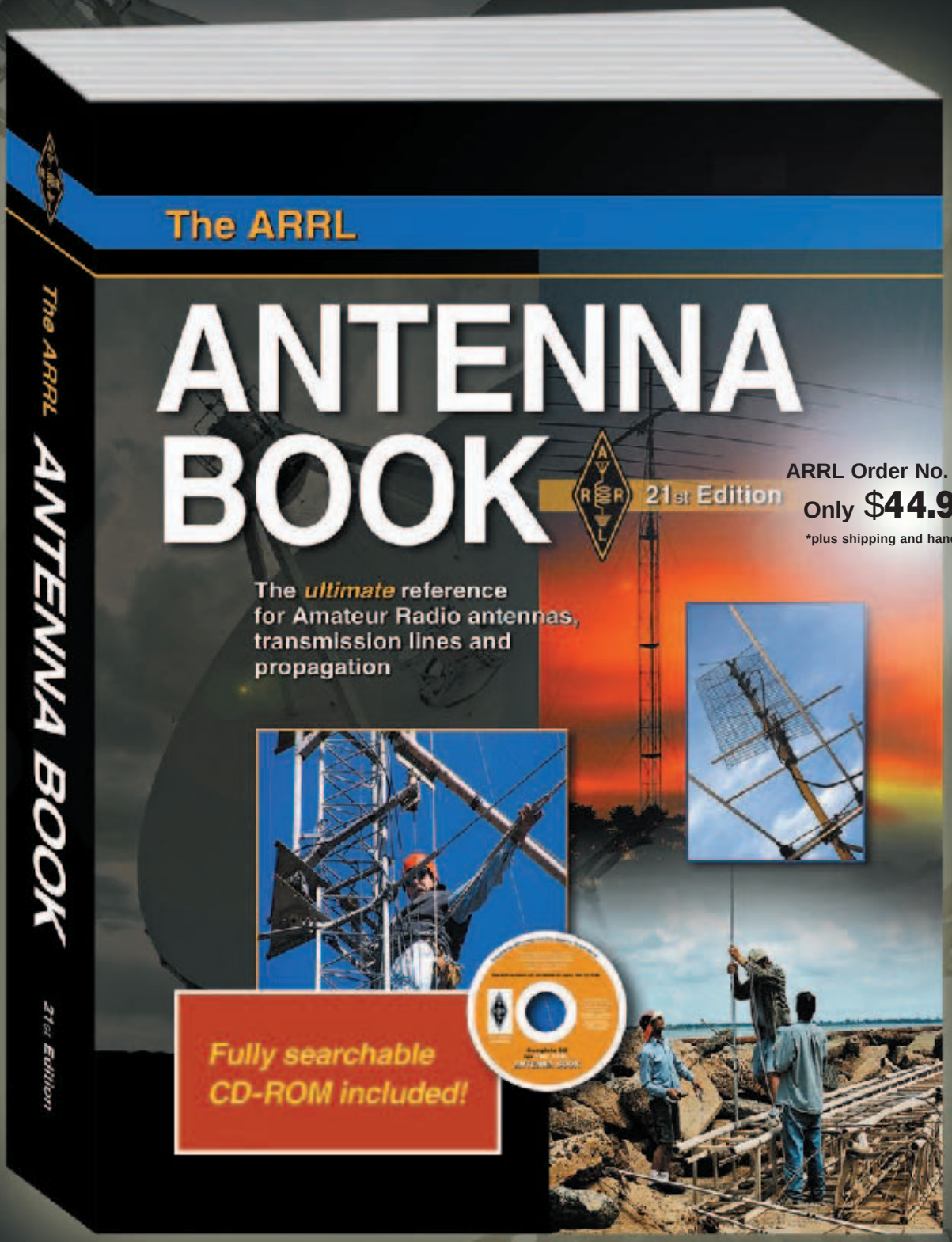

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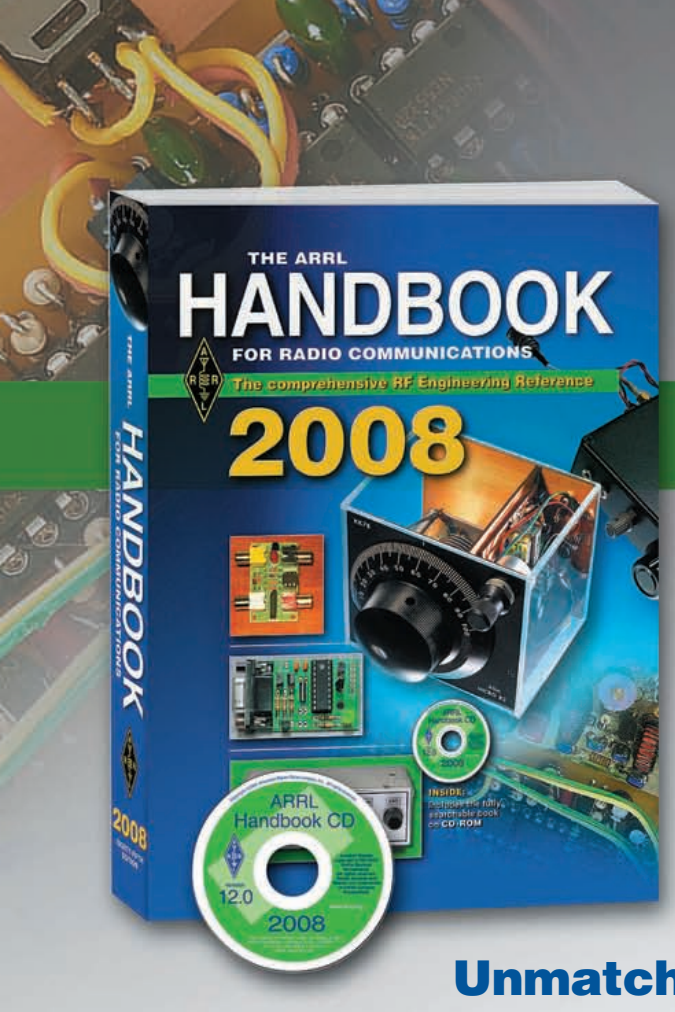

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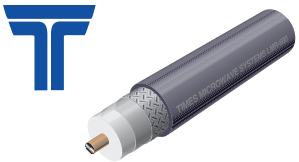

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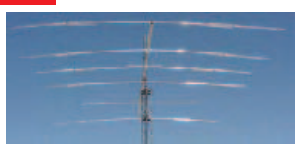

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