QST

Official Journal of ARRL The national association for AMATEUR RADIO

Devoted entirely to **Amateur Radio**

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January 2007

QST reviews:

- **ICOM IC-R2500** Communications Receiver
- **ElmerRadio** Crystal Radio Receiver Kit
- **MFJ-1164** AC Line Filter

Inside:

How to Restore Vintage Amplifiers

A History of the Collins KWM-1

The "Wonder Bar" Beam for 17 Meters

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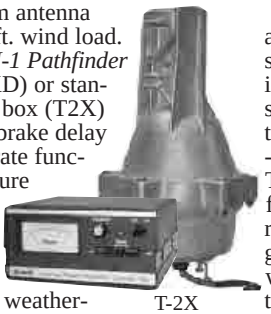
HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel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

TAILTWISTER SERIES II



T-2X
$649.95

T-2XD
$1029.95
with DCU-1

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.

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
$389.95

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
$949.95
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!*

AR-40

AR-40
$289.95

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
$1379.95

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.**

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.

Digital Automatic Controller

DCU-1
$649.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1 degree 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
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For UHF, VHF, 6-Meter, TV/FM antennas. Includes automatic controller, rotator, mounting clamps, mounting hardware. 110 VAC. One Year Warranty.

RBD-5
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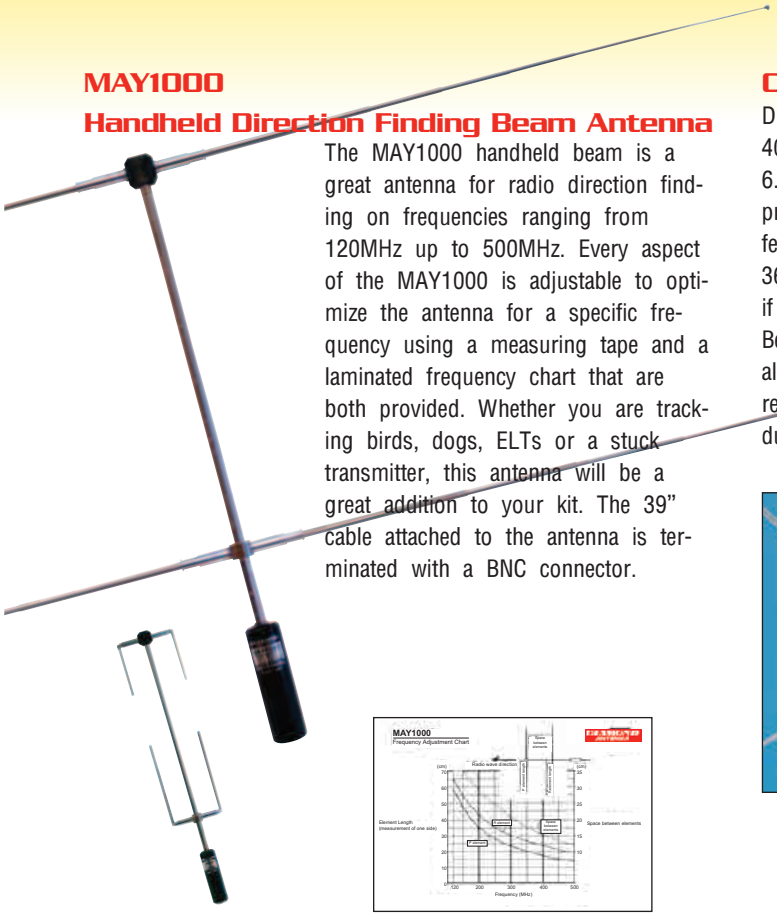
NEW PRODUCTS FROM THE INNOVATORS AT DIAMOND

MAY1000
Handheld Direction Finding Beam Antenna



The MAY1000 handheld beam is a great antenna for radio direction finding on frequencies ranging from 120MHz up to 500MHz. Every aspect of the MAY1000 is adjustable to optimize the antenna for a specific frequency using a measuring tape and a laminated frequency chart that are both provided. Whether you are tracking birds, dogs, ELTs or a stuck transmitter, this antenna will be a great addition to your kit. The 39" cable attached to the antenna is terminated with a BNC connector.

K9000 Motorized Mount

Diamond's K9000 motorized antenna mount is a tried and true product for light weight VHF/UHF antennas. I like to think of it as a garage door opener. My garage door opener malfunctioned last year. It wasn't 24 hours before it was at the top of all the honey-do lists to get replaced. Neither my wife or I wanted to leave the car to open that door.

Well, we don't want to get out of the car to lower the antenna either. With the K9000, every time we park in the garage, go into a parking structure or drive through a fast food establishment it's a simple matter of pushing the button and the antenna is safely lowered and out of harm's way. My garage door opener isn't a luxury, it is a necessity. I think of my K9000 motorized antenna mount in the same way.

CP725H

Diamond's new CP725H is a four band (6M, 10M, 15M and 40M) trap vertical antenna with trap radials. Its light weight, 6.6 pounds, makes it very manageable during the installation process and will allow for a simple mast solution. It is 11.8 feet tall and the radials are 71" long and can be mounted 360 degrees around the antenna or concentrated on one side if you need to mount it close to a structure.

Because of its light weight and the ability to concentrate radials on one side, the CP725H could be used in an antenna restricted situation where the mast was lowered on its side during daylight and raised while operating during the evening.

Bandwidth: 6 Meters 500KC, 10 Meters 600KC, 15 Meters 300KC, 40 Meters 45 KC.

Power handling: 500W P.E.P. @28/50MHz, 400W P.E.P. @21MHZ and 200W P.E.P. @7MHz.

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This Month in QST

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Technical

News and Features

US & Possessions: Membership in the ARRL, including a one year subscription to *QST*, is available to individuals at $39. Age 65 and over, with proof of age, $36. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of $20. Life Membership, including a subscription to *QST* is available at $975.* Age 65 and over, $900.* Membership and *QST* cannot be separated. Libraries and institutions, $39 per year. Single copies $5.

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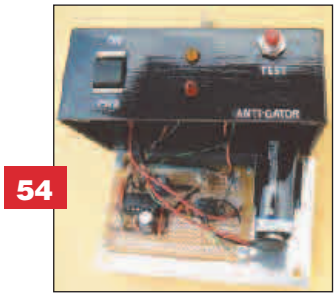
QST Workbench

Operating



OUR COVER
From the bottom: A Harvey Wells Bandmaster TBS-50C Senior Transmitter, a Globe Matcher WRL Electronics Model AT4 Antenna Tuner and a Hallicrafters Skyrider SX-12 Commercial Receiver grace the cover of our annual Vintage Issue. Bidders took home these three items, and many others, in the ARRL's first-ever Online Auction. Read more about the Auction on page 49. Photos by Jon Bloom, KE3Z.

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50 V/12 A Internal Switching Regulator Power Supply

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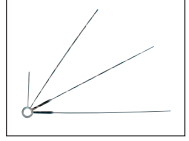

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We Go to Court

"Let's get right to the point: The ARRL is suing the Federal Communications Commission. Here is what led to this decision, why it is the right thing to do, and how you can help."

As regular readers of this page already know, under former Chairman Michael Powell the FCC cast itself in the role of cheerleader for an over-hyped technology known as Broadband over Power Line, or BPL. BPL deliberately puts radio frequency (RF) energy on unshielded power lines. As anyone knows who understands RF, this is likely to interfere with nearby radio receivers using the same frequencies.

The radio spectrum is a priceless asset. BPL, on the other hand, is an unintentional emitter. Any RF energy that a BPL system radiates is simply spectrum pollution.

Through careful frequency selection and design, BPL systems can avoid interfering with radio services. Unfortunately, rules for BPL adopted by the Powell FCC in 2004 allow poorly designed BPL systems operating on inappropriate frequencies — including amateur bands — to be deployed. The ARRL and others petitioned the FCC to reconsider these rules and to give better protection against BPL interference to licensed radio services.

With Powell's departure and the appointment of Kevin Martin as Chairman, we thought that technical evidence once again would trump wishful thinking at the FCC. But it was not to be. The FCC's reconsideration decisions, adopted on August 3, did not improve things. When the Memorandum Opinion and Order (MO&O) was released a few days later, we couldn't believe it — they had made matters worse!

A new FCC rule is aimed directly against mobile stations — in *all* services, not just amateur. The new rule, §15.611(c)(1)(iii), exempts BPL operators from having to do anything to correct interference to mobile operations other than to notch emissions to a level 20 dB (below 30 MHz) or 10 dB (above 30 MHz) below the absolute limit specified elsewhere in the rules. Here's a *direct quote* from the FCC (emphasis added):

> Where an Access BPL operator implements such notching, **we will not provide further protection** to mobile operations, **nor will we require the operator to resolve complaints of harmful interference** to mobile operations by taking steps over and above implementing the "notch."

Consider what this means. If a BPL system blankets an area with interference, the FCC will require *nothing* of the BPL system operator beyond putting a 10 or 20 dB notch on the frequency used by a complaining mobile operator.

ARRL measurements and studies show that this leaves the interference 25 dB higher than the *median* values for man-made noise in residential areas and up to 40 dB higher than the minimum values that amateurs routinely use for reliable communication. And as for other services, if a BPL system prevents a dispatcher from reaching a fire truck or ambulance — well, that's just too bad.

This isn't just a proposal. It's a rule that is **now in effect**. With one stroke, the rights of FCC licensees have been subordinated to those of spectrum polluters! **Never before** has an unintentional emitter been given a **free pass to interfere with licensed radio services**.

Some well-meaning people tell us, "Why worry? As a means of delivering broadband services to consumers, BPL is an inferior technology. According to the FCC's own figures, the BPL industry has managed to reach fewer than 5000 customers nationwide. BPL is failing in the marketplace, as well it should."

Here's the problem. Even if BPL disappears from the scene tomorrow, the FCC's preference for unlicensed, unintentional emitters over the interests of its licensees will remain on the books. **Bad rules left unchallenged will lead to even worse rules later**.

The FCC was heading in the wrong direction under Michael Powell. It's continuing in the wrong direction under Kevin Martin. Reasoned technical arguments backed up by overwhelming evidence have not altered the FCC's errant course. There was only one thing left that we could do: **appeal in federal court**. After carefully considering the costs and consequences, the ARRL Board of Directors concluded that was **what we must do**.

So, on October 10, 2006 the law firm of Wilmer Cutler Pickering Hale and Dorr LLP (WilmerHale) joined ARRL General Counsel Chris Imlay in filing a Petition for Review on behalf of the ARRL in the United States Court of Appeals for the District of Columbia Circuit.

We are not alone. The Association of Maximum Service Television (MSTV) and the National Association of Broadcasters (NAB) have decided to intervene in support of the ARRL. Their joint motion states, "MSTV and NAB believe that the regulations under review are arbitrary, capricious, and contrary to law, and will adversely impact their members by, among other things, permitting unlicensed users of radio spectrum to interfere with licensed uses of the spectrum."

The Court of Appeals will not substitute its judgment for the reasoned decision-making of an expert agency. But this long-established principle does not give agencies such as the FCC *carte blanche*. In another recent case, a panel of this Court had this to say about another federal agency: "We therefore owe no deference to [the agency's] purported expertise because we cannot discern it." When it reviews the FCC's BPL decisions we expect the Court to reach a similar conclusion.

Mounting a serious challenge to a federal agency is expensive. Attorneys who specialize in this work must be retained — and the attorneys at WilmerHale are the best in the business. A careful review of the FCC's records must be performed. Complex technical issues must be made understandable to a panel of judges who are not telecommunications experts. Exhibits must be prepared. Arguments must be selected and fine-tuned.

Your Board of Directors has decided to take these steps to protect you and your ability to use Amateur Radio frequencies. Your financial support of the Spectrum Defense Fund is vital to help fund this appeal. If you share our sense of outrage at the FCC's bending its rules to accommodate a polluter of the radio spectrum at the expense of the licensees it is supposed to protect, please express your support of the ARRL Board's decision with a generous contribution. Visit **www.arrl.org/forms/fdefense** for more information and a donation form.

David Sumner, K1ZZ
ARRL Chief Executive Officer

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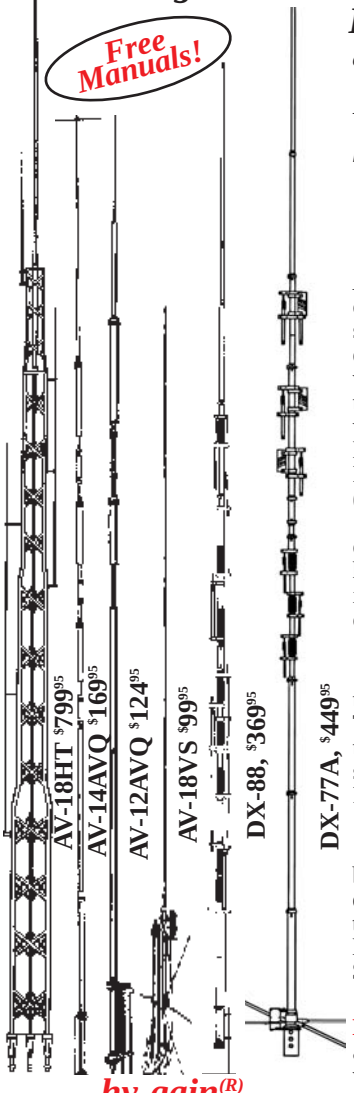

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They offer remarkable DX performance with their extremely low angle of radiation and omnidirectional pattern.

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

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Includes all stainless steel hardware. Recessed SO-239 prevents moisture damage.

Hy-gain verticals go up easily with just hand tools and their cost is surprisingly low.

Two year limited warranty.

AV-18HT, $849.95. (10,12,15,20,40,80 M, 160, 17 Meters optional). 53 ft., 114 lbs.

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

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

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

AV-18VS, $99.95. (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. **High** quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

DX-88, $369.95. (10, 12, 15,17,20,30,40,80 Meters, 160 Meters optional). 25 ft., 18 lbs.

All bands are *easily* tuned with the DX-88's *exclusive* adjustable capacitors. 80 and 40 Meters can even be tuned from the ground without having to lower the antenna. Super heavy-duty construction. DX-88 OPTIONS: 160 Meter add-on kit, KIT-160-88, $189.95. Ground Radial System, GRK-88, $99.95. Roof Radial System, RRK-88, $99.95.

DX-77A, $449.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs.

No ground radials required! Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Heavy-duty tiltable base. Each band independently tunable.

Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$849.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$134.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$99.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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

No ground or radials needed

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

Sleek and low-profile

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

Full legal limit

Handles 1500 Watts key down continuous for two minutes.

Built-to-last

High wind survival of 80 mph. Broadband matching unit made from all *Teflon*® insulated wire. Aircraft quality aluminum tubing, stainless steel hardware.

hy-gain® warranty

Two year limited warranty. All replacement parts in stock.

AV-640, $399.95. (6,10,12, 15,17,20,30,40 Meters). 25.5 ft., 17.5 lbs. The AV-640 uses quarter wave stubs on 6, 10, 12 and 17 meters and efficient end loading coil and capacity hats on 15, 20, 30 and 40 meters -- no traps. Resonators are placed in parallel not in series. End loading of the lower HF bands allows efficient operation with a manageable antenna height.

AV-620, $299.95. (6,10,12,15,17,20 Meters). 22.5 ft., 10.5 lbs. The AV-620 covers all bands 6 through 20 Meters with no traps, no coils, no radials yielding an uncompromised signal across all bands.

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Dual Band Dynamos for your pocket or your car!

DR-635T 2M/440MHZ Mobile/Base Transceiver

Dual Band Transceiver with Full Duplex Capability

Alinco's new DR-635T is an easy-to-use, high-quality transceiver for simplex and repeater operations on the VHF and UHF bands. With cross-band repeat, full duplex capability and a remote mountable control head, the DR-635T features newly designed RF circuitry that delivers increased resistance to interference from adjacent signals. Plus, a new protection circuit automatically lowers the power setting whenever the internal temperature rises. This protects the radio when used as a cross-band repeater. But, that's just the beginning:

- Large, 6 character alphanumeric display with freely and separately selectable three color display illumination in blue, violet or orange for TX/RX/stand-by
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- Power supply voltage display
- Ignition key on/off feature & theft alarm feature
- CTCSS, DCS encode/decode and DTMF encode functions plus European Tone Bursts
- Multiple scan modes and extended receive capabilities including broadcast FM
- Backlit DTMF microphone allows direct frequency entry and more
- VHF: 50/20/5, UHF: 35/20/5 watt power output settings
- 200 Memory channels that can operate in splits of 80ch/VHF, 80ch/UHF and 40ch freely programmable with 1 call channel each for VHF and UHF operation
- Extended receive from 108.000 ~173.995MHz / 335.000 ~ 479.995MHz / 87.5 ~ 107.995MHz, transmits from 144.000 ~ 147.995MHz / 430.000 ~ 449.995MHz, plus reception on AM aircraft band and the ability to operate on MARS frequencies
- Can also operate with Alinco's optional EJ-50U digital data packet board that fits inside or the EJ-47U digital voice board

Thanks to Alinco, you can have a dual band dynamo in your pocket AND in your car!

DJ-C7T 2M/440MHZ "Pocket-size" HT

Hams are packing some serious radio power in their pockets with the DJ-C7T, the new dual band mini HT. Alinco led the way in breakthrough miniature electronics technology with its revolutionary "credit card" size transceivers. Now, the DJ-C7T offers a "pocket size" HT that's small in size but BIG in added memories and modes.

Check out the features of this "new generation" DJ-C7T

- Internal speaker with great audio!
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- SMA antenna port
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- Cloning feature
- Lithium-ion battery
- Wide-band receive; includes FM broadcast and AM aircraft bands
- Auto repeater setting

The DJ-C7T can fit in a pocket or purse, but it's a versatile dual band HT with an enhanced receiver. So, you can enjoy twice the operating fun in half the size.

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This Just In

By Joel P. Kleinman, N1BKE; jkleinman@arrl.org

In Brief

- With publication in the *Federal Register* November 15, the rules changes included in the FCC's "Onmibus" Report & Order will take effect December 15. See Happenings, elsewhere in this issue, for details.
- Patricia Hensley, N4ROS, has been elected Roanoke Division Vice Director. Ballots were counted at ARRL Headquarters November 17.
- The Association for Maximum Service Television (MSTV) and the National Association of Broadcasters (NAB) have filed a joint *Motion For Leave To Intervene* in support of the ARRL in its court appeal of the FCC's Broadband over Power Line (BPL) rules.
- The winner of the *QST* Cover Plaque Award for October was Randy Koehn, KC5TIL, for his article "A Remote Reporting Solar Powered Weather Station."
- Registration opened for these ARRL Certification and Continuing Education (*CCE*) program online courses: Amateur Radio Emergency Communications Levels 2 and 3, Antenna Modeling, HF Digital Communications, VHF/UHF — Life Beyond the Repeater, and Radio Frequency Propagation.
- The ARRL has requested that the FCC to support a Draft Proposal seeking to have World Radiocommunication Conference 2007 (WRC-07) delegates consider a 150 kHz worldwide, secondary Amateur Radio allocation in the 60 meter band.
- Member states of the International Telecommunication Union attending the 17th ITU Plenipotentiary Conference in Antalya, Turkey, elected *Hamadoun I. Touré* of Mali as Secretary-General of ITU for a four-year term.
- The American Red Cross has clarified its policy to require background checks of its employees and volunteers, at least as far as the policy applies to possible credit checks. See Happenings, elsewhere in this issue, for details.
- Participants in the 500 KC Experimental Group for Amateur Radio, which is researching the radio spectrum in the vicinity of that frequency, have been heard across both the Atlantic and Pacific Oceans, as well as around the US.
- Plans for launching the second SuitSat, a surplus Russian space suit fitted with an Amateur Radio transmitter, were discussed at the recent AMSAT Space Symposium in the San Francisco area.
- The ARRL *Legislative Action Program* is looking for ARRL members who want to help promote and protect Amateur Radio through political action at the "grassroots level."
- The Temple Amateur Radio Club (TARC) in Texas has donated $1000 to the 2007 ARRL Spectrum Defense Fund.
- On November 6, a solar flare from an emerging sunspot produced a C8.8 solar X-ray flare that caused a moderate-to-strong Type II radio burst event.
- ARES and RACES volunteers assisted the American Red Cross response to the Esperanza Fire east of Los Angeles that claimed the lives of five firefighters.

Media Hits

Allen Pitts, W1AGP

Whenever someone asks, I am happy to tell them I really love working at ARRL HQ. But there *is* one monthly task I dread — trying to pick Media Hits. This month is especially hard because there are so many really good articles that came out recently.

- Bob Josuweit, WA3PZO, highlighted the *Hello* campaign and the continuing role of hams in the history of voices over the airwaves. *Conformity Magazine's* "Hello! Hello! Can Anyone Hear Me?" published in November, was a major hit indeed.
- The heartwarming tale of one incredible CQ call was the story of a blind 8 year old Chinese girl calling out for help on her brother's radio in 1945. She luckily contacted an American doctor in Manila and the ham-doctor helped her get an education. Lucy Ching has since become an author, social worker, won international awards and is the subject of a major movie. This story, mostly unknown in the USA, was reported in the *San Gabriel Valley Tribune* (West Covina, CA) on November 2.
- Other articles promoting Amateur Radio included "CQ…standing by…" by Joey Borson in the *Brown Daily Herald* (Brown University) on November 7; "Ham radio beckons those who like to be tuned in" by Jeff Farance in the *Daytona Beach (FL) News Journal* on October 12, and *Inside the Bay Area* (Oakland, CA) publishing "Amateur radio still airworthy" by Rachel Cohen on October 17.
- Youth activities and JOTA were far from forgotten and media hits included a *Herald Times* (Bloomington, IN) major article "South students ride the radio waves" by Nicole Kauffman on November 6. JOTA activities were reported in the *Joliet (IL) Herald News* "Making connections," *The Daily Independent* (Ridgecrest, CA) ran "Jamboree-On-The-Air Scouting Event" and the *News-Journal* (Longview, TX) had an article "Scouts make own waves."
- EmComm work was not forgotten with articles such as "Volunteers track storms" in *Madison.com* (Madison, WI) October 26, "Ham operators important in emergency situations" in *The Monitor* (McAllen, TX) October 11, "Hams keep connections in disasters" in the *State Journal Register* (Springfield, IL) October 12 and a major article in the *Arkansas Democrat-Gazette* (Little Rock) titled "Hams Stay Tuned" on October 19.
- Finally, the ingenuity of one ham was the subject of two articles in northern New Jersey. Both *NorthJersey.com* and *Herald News* covered Gary Swangin as he ran the New York Marathon. Gary was the runner wearing a headset and mike and making contacts as K2ITT as he ran the race.

Field Day Life Saver

At Field Day 2006, Mike Brown, KG4FGF, not only celebrated life, he saved the life of fellow Thomasville (GA) ARC member Bobby Cooper, N4KXL. Unable to breathe, Bobby slipped into unconsciousness and was quickly slipping away when Mike, with a cool head and quick action, performed the Heimlich maneuver on his favorite fishing buddy.

For this, and for all that he is, it was my pleasure to present Mike with an ARRL Certificate of Merit at the Thomasville ARC's November fish fry meeting. Used to recognizing others, Mike was a bit overwhelmed at having the tables turned on him. As always, the two fishing buddies were once again sharing fish frying duties at this year's event. And celebrating life. — *Susan Swiderski, AF4FO*

DAN MONIZ, KI4HGO

At the recent club meeting where he was recognized for saving his fishing buddy's life, Mike Brown, KE4FGF, standing, with Bobby Cooper, N4KXL, seated, and GA Section Manager Susan Swiderski, AF4FO.

COURTESY MIKE ANDERSON, WV7T

Members of the Rocky Mountain Navy ARC, KØUSN, operated a Veterans Day Special Event Station to remember our veterans. Club president Mike Anderson, WV7T, a retired Navy Chief Petty Officer and Desert Storm veteran, was born on the first Veterans Day, November 11, 1954.

Inside HQ

Ongoing Improvements to *QST*

Thanks to all of you for the positive feedback on the changes that we have been making to improve the look, readability and usability of *QST* during the last year or so. *QST*'s Editorial and Design Team headed by Steve Ford, WB8IMY, Joel Kleinman, N1BKE, and Sue Fagan; the Production Team led by Shelly Bloom, WB1ENT; the Advertising Department managed by Deb Jahnke, K1DAJ, and the Circulation Department led by Amy Hurtado, KB1NXO, have all worked hard to make this happen.

Continuing in that direction, we will be making more changes to *QST* during the next few months. These include:

- We are adding a glossary based on words used in articles that appear in the issue. This will help newer amateurs who say that they do not understand some of our "hamspeak" vocabulary. (Is the SWR low enough on your G5RV since you added your 1.5 kW solid-state, no-tune linear?)
- We are modernizing the design of the Workbench section. This section, which includes "The Doctor is In" and "Hints and Kinks," continues to be one of the most popular parts of *QST*. Among other visual improvements, each Workbench article or column will have a distinctive new icon in the title area. We will also print a photo of our elusive "Doctor" at the top of his column. His office hours, however, remain unchanged!
- We are improving the look of the Coming Conventions/Hamfest Calendar section by adding colorful letters to illustrate some of the activities that occur at each event.
- You may have noticed that we changed the look of the *75, 50, 25 Years Ago* column in the last issue. We made it easier to read and improved the graphics.
- There will be two 1-page articles in most issues stressing the practical aspects of ham radio. We plan for one of these to be technically oriented and the other operating oriented.
- *QST* is still printed by RR Donnelley. However, we are now printing *QST* in a different printing plant that focuses on printing specialized magazines like *QST*. This change will significantly upgrade our print production quality and allow us to experiment with additional print formats and enhancements. Stay tuned!
- We will be publishing some special issues, like this, the Vintage Issue. Later in the year there will also be an Antenna Issue and a new Emergency Communications Issue.

Here, inside HQ, almost every employee is involved with *QST* in one way or another. We are proud of *QST* and we are keenly aware of its heritage and its importance to Amateur Radio. We are all working hard to make *QST* the finest Amateur Radio periodical for you, our members.

73,

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

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

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

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

Membership inquiries and general correspondence should be addressed to the administrative headquarters:
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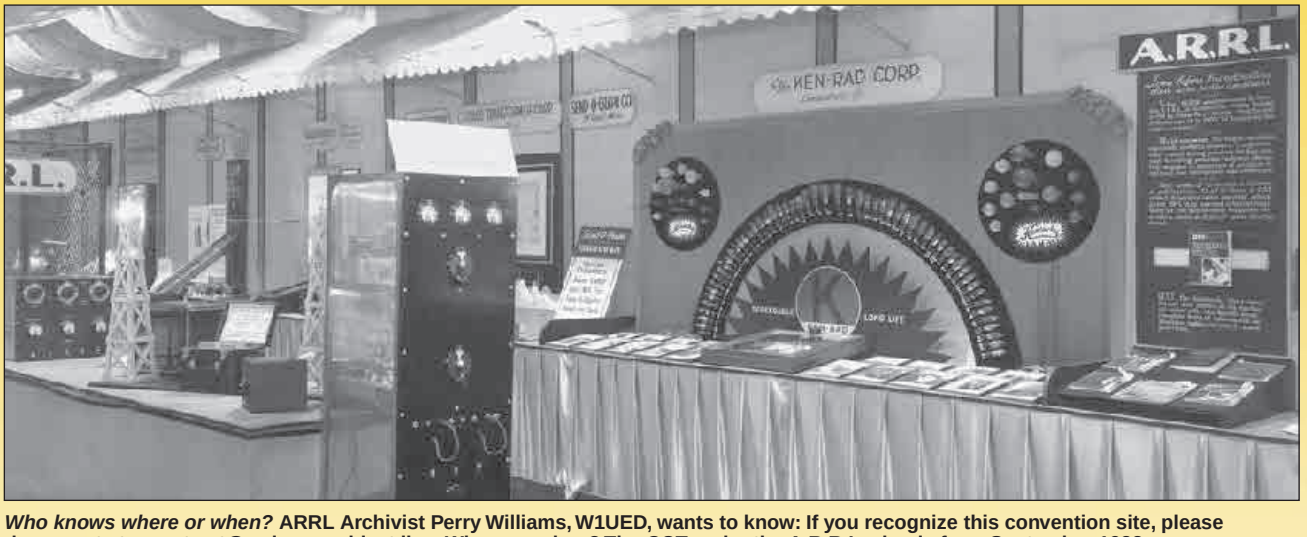
Up Front in QST

LOUIS HODGES, W9IL

She lost: **This photo was taken in Ironton, Missouri, during the 2006 election season. Alas, Veronica Hambacker, a Democrat, was not successful in her bid to represent the 8th congressional district of Missouri in the US House of Representatives.**

HANNO VOGELS, DK3HV

A ham's home is his castle: **While on vacation on the Spanish island of Mallorca, EA6, Hanno Vogels, DK3HV, of Munich, Germany, found a place we radio amateurs would find comfortable.**



Who knows where or when? **ARRL Archivist Perry Williams, W1UED, wants to know: If you recognize this convention site, please drop a note to us at qst@arrl.org, subject line: Where or when? The *QST* under the A.R.R.L. sign is from September 1933.**

T. J. LALLY, W1NSS

Ah, the warm glow of the license plate: **Guess what type of tubes W1NSS uses in his retro-design final amplifier?**

COURTESY KIRK SANDERSON, W8WNA

15 W QRP in 1929: **This QSL card, from NQ5CX in Colon, Cuba, is part of the collection of Carl J. Theis, W8BKH (SK), of Parma, Ohio. At the right is the front of the card.**

You Can't Tell a Touch Key by its Package!

This is the WA3ENK touch key from the November 2005 issue. I bought a touch key kit from the author at a hamfest and went to work building it. Later, my wife and I were Christmas shopping when I spotted the Hershey's KISS tin, and the gears began to turn...

"Works good!" writes Bob Bastone, WC3O, of Tarentum, Pennsylvania, of his uniquely packaged touch key, based on a *QST* design by Rod Kreuter, WA3ENK.

Inside the top, there are automotive stick-on wheel weights to give it some stability. The PowerPoles inside are to allow the dit and dah sides to be switched, depending on how the go-between cable is wired or operator preference. A sticky pad is glued onto the bottom to keep it from rotating. The paddle is a piece of trim wood held in by hot glue with double sided tape and copper foil for touch pads. — *Bob Bastone, WC3O*

COURTESY HARRIS RUBEN, N2ERN

Just click on 3D: **Someone told me to check out local.live.com/ for some neat photos and maps, courtesy of Microsoft's *Virtual Earth* software. "Yep," writes Harris Ruben, N2ERN, of Berkeley Heights, New Jersey, "that's my little house, garage and truck, along with my Explorer-14 and DB-1217 [Hy-Gain antennas]."**

COURTESY KG4GJ/KB7GJ

Gitmo visit something to cheer about: **As luck would have it, when Bill Gallier, W4WX, of Middleburg, Florida, traveled to Guantanamo Bay, Cuba, in September, he shared his incoming and outgoing flights with, yes, the Dallas Cowboys Cheerleaders. They were visiting US troops stationed at Gitmo. He was there to operate the CQ World Wide RTTY DX Contest.**

BOB CAROLLO, KB1JCL

Bob Carollo, KB1JCL, of Gilford, New Hampshire, chose his vanity license plates carefully!

S. KHRYSTYNE KEANE, K1SFA

HB, OM! **Artie Van Allen, W2AVA, of Hicksville, New York, celebrated his 85th birthday November 10 by firing up 20 meters SSB at W1AW. "I've been to W1AW before," he said, "but I couldn't think of a nicer place to be on my 85th birthday than operating here."**

H. O. TOWNSEND, K5CX

H. O Townsend, K5CX, happened across this farm road in northwest Motley County in September while he drove his wife Anita, N5AOK, through 34 counties during the 2006 Texas QSO Party. "A CW op must have settled this place in the late 1800s," he writes.

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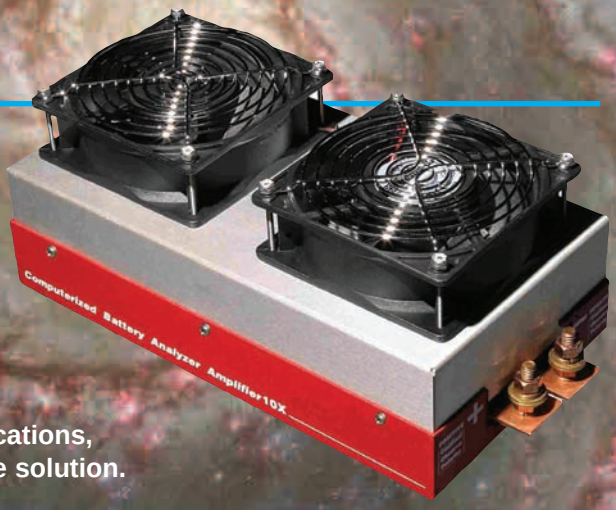

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CORRESPONDENCE

HOW MUCH IS TOO MUCH BACKGROUND?

♦ I must take exception with the background checks being required by the American Red Cross, since these checks would include financial information. Since the Red Cross is having a vendor do the background checks, it is the vendor who controls security of the information and who has access to the information. We have all seen the worry some veterans are going through because of security issues of personal information. Having been a police office for 21 years and having investigated identity theft cases, I can say that some creditors are not understanding and do not care about the trouble the victim is experiencing recovering their finances.

A better solution, if background checks will be required for EmComm operators, would be for the Emergency Management Agency to request the appropriate police agency to run a limited background check. The completion of this background check should be monitored by the local ARES group working with the local EMA, with certification by the local ARES group or local emergency management. This could be paid for by the local EMA, and security of personal information should not be a problem, since local police agencies would be checking local people. After all are we not just looking to make sure the volunteers are of "good character?" There is no practical reason why the Red Cross, or any other served agency, could not accept this type of background check for character quality anywhere in the nation.

If the American Red Cross, however, insists on having an outside vendor perform background checks that includes financial information, I will not submit to one. I feel that the financial security of my family is as important as providing EmComm communications. Besides, isn't the first rule of EmComm to make sure you and your family are safe?

JERRY PALMER, N3KRX
Houston, Delaware

♦ My local American Red Cross (Huntsville, Alabama) told me that they are receiving hundreds of calls about the credit check for ARES volunteers. The credit check disclaimer on the credit check company's Web site is standard for every organization the company works for, and they will not take it off for the ARC.

The ARC has stated that they cannot see anything about credit, and they only see a clear or hit on the criminal and social security number. The ARC check is actually very minimal; it only checks for the past seven year criminal history and if your social security number matches your name.

Third-party contractors are almost standard these days. The last two military bases I have been on use contractors. The major government contract firms use contractors. The ARC is only one of the many served agencies that do now, or will soon, require background checks. And they all will want to do their own separate check.

These checks are a good thing. Would you want your wife, sister, mother, child, brother or little kids sitting in a shelter with workers that have not been vetted? You would also want to know if your social security number is being use by someone else.

GREG SARRATT, W4OZK, ARRL Life Member
Alabama Section Manager
Harvest, Alabama

[Read more about this issue in "Happenings," beginning on page 72. — *Ed.*]

ARISS IS ALL RIGHT!

♦ In the article "Astronaut Honored for WAS, Inspiring others from space" [September 2006, page 69], a prospective licensee was mentioned who learned he could talk with the ISS via ham radio and later made a contact with astronaut Bill McArthur in March 2006.

That ham was me and I would like to elaborate about my experience so that others may be motivated to do the same.

In 2005, my friend Collins Conover, KG4OFW, was telling me of his experiences using his 2 meter rig and hearing the ISS talk to a school. From that point on, I was on a mission to get my license and talk with an astronaut.

After many attempts and failures, I was getting very discouraged in my quest. One morning, I turned on my radio to see if NA1SS was talking. Much to my surprise, the radio sprang to life with McArthur's voice. I hooked up the antennas and started calling. After several calls, a signal came back "NA1SS go ahead." I couldn't believe it! This was the biggest rush I have ever had! I explained to him what an inspiration he was to me and an integral part in me getting my ticket. A post on the AMSAT Board later confirmed that he heard what I said and was elated with the contact.

I was later able to talk to McArthur one more time before he returned to Earth. I have since made over 200 contacts via amateur satellites and enjoy that aspect of ham radio. I'm sure that my story is only one of many unforgettable moments that Bill will be able to tell people around the world. I can assure you that I will never forget that morning when I talked to the Space Station.

The recording of my contact can be heard at **www.thelenharrs.com/index.php?name=News&file=article&sid=31**. I am willing to help anyone interested in talking with the ISS (you can reach me via e-mail at **kb3nds@gmail.com**).

PAUL LENHARR II, KB3NDS
Lusby, Maryland

AMATEUR RADIO KEEPS ON GOING

♦ I read with interest of "What Will Amateur Radio be like in 2016?" [November 2006, pages 47-49], and I would like to add a few comments. First of all, I wish to be alive in 2016! I will be 69 years old then, and nowadays that doesn't seem too old, but still.

I have been a licensed amateur since 1971, and there is one thing that has, besides electronic theory, remained constant: the ARRL. There always seems to be someone's "steady hand" at the helm. The changes possibly coming down might be *QST* available "on line," as well as some of the smaller publications, this to reduce printing costs and to keep the

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.

information more up to date.

Hams always seem to be experimenting, creating something just for the enjoyment of it. I am on a mailing list for the Kenwood TS-520-530-820-830s, and they are keeping these fine radios on the air by replacing the older parts with newer ones, in some cases actually making improvements. It's the same thing with the kit builders; now that there is no bulky power supply needed, there are a lot of ideas coming out.

It seems every month there is something new coming out. Back in the 1970s I remember someone that traded in their Collins line for a Motorola HT — it had two crystals and at the time it was the "top of the line." Now I can get a pocket-sized radio that covers 6, 2 and 440 and can receive other frequencies.

All we can do is relax and enjoy the coming years, being sure to make our contributions to this wonderful hobby we call Amateur Radio.

JOHN SMALE, K2IZ
Copiague, New York

LOGGING ON TO *LoTW*

♦ I have spent quite a few hours lately in converting my old logs into electronic format for inclusion in the *Logbook of the World*; my goal is to get all my QSOs included. That will take a while, since my original license was issued in 1965. But it's been a lot of fun, and I've found QSOs I didn't remember, with places I'd forgotten about.

As I have thought about this I realize that I'm doing more than making my state and county available for confirmation. I'm actually contributing to an archive of one segment of American history. It's possible that someone, someday, might want to analyze data in the *LoTW* database for any number of reasons — historic propagation studies, personal histories and contest record research being only a few which come readily to mind. I am also "insuring" that my logs will be preserved in case there is a fire or other natural disaster which destroys my written records. Having my records on the *'Book* is just a good thing, to me.

I wish that all amateurs would participate in this service, but I know that's not anything like a realistic idea. Most amateurs probably believe that their old logs are not important enough to upload. It's their privilege to so believe as they choose. But there are some of us who have information whose importance goes much further into the ham community. I'm referring to those who have old logs from DXpeditions, Silent Key operators and from those who are no longer amateurs. I fear that much of this data will be lost to posterity upon the death of the ham who now has custody of these documents. After all, old logs will not be very interesting to survivors, particularly if they are from people that the survivors do not know.

I would encourage anyone who has such documentation to make a special effort to get it uploaded. Possibly some volunteer labor could be found to do this for someone. It would mean another small piece of our ham history will not be forever lost.

ED BURRIS, WA5SOG
Van Buren, Arkansas

CLEAN AIR ACT

♦ I read with interest and heartily agree with Bernie Skoch, K5XS's, Op-Ed ["A New Diplomacy," November 2006, page 97]. He focused on a real sore spot in present day Amateur Radio operation. I occasionally listen on 75 meter SSB late in the evening, and the things you hear are sometimes quite embarrassing — lots of plain stupidity.

I don't understand why anyone would take the time to get a ham license, spend money on equipment and antennas, and then clutter up the band with their ignorant, unthoughtful remarks. Perhaps this is enjoyment for some, but not for most of us. Let's clean up our act.

DON CHRISTENSEN, W8WOJ
Midland, Michigan

GULF COAST THANKS

♦ Now that a year has passed, the Mississippi Gulf Coast is seeing the fruits of the labor provided by the many generous people who have tirelessly assisted in our recovery and rebuilding efforts. We would like to thank the members of the American Radio Relay League who have given of their time, hearts and hands.

As we continue to rebuild our coastal community, we are inspired by the ongoing commitment of so many people around the country, such as the members of the ARRL. Because of this kindness, the ARRL and its members have a permanent place in our hearts.

If your membership would like to see how we're progressing, please visit our Web site, **www.gulfcoast.org**. Thank you again for all the hope you have provided.

STEPHEN B. RICHER
Executive Director, Mississippi Gulf Coast Convention and Visitors Bureau
Gulfport, Mississippi

QST

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All these data cables are included with the amplifier.

Features

- Lightest and most compact 1kW HF amplifier in the industry.
- The amplifier's decoder changes bands automatically with most ICOM, Kenwood, Yaesu.
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- Equipped with a control cable connection socket, for the HC-1.5KAT, auto antenna tuner by Tokyo Hy-Power Labs.
- Two antenna ports selectable from front panel.
- Great for desktop or DXpedition!

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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., 930W CW (typ.)
50MHz 650W PEP max.

Matching Transceivers for Auto Band Decoder:
Most modern ICOM, Yaesu, Kenwood

Drain Voltage:
53V (when no RF drive)

Drain Current:
40A max.

Input Impedance:
50 OHM (unbalanced)

Output Impedance:
50 OHM (unbalanced)

Final Transistor:
SD2933 x 4 (MOS FET by ST micro)

Circuit:
Class AB parallel push-pull

Cooling Method:
Forced Air Cooling

MPU:
PIC 18F452 x 2

Multi-Meter:
Output Power – Pf 1Kw
Drain Voltage – Vd 60V
Drain Current – Id 50A

Input/Output Connectors:
UHF SO-239

AC Power:
AC 230V (200/220/240V) – 10A max. (default)
AC 115V (100/110/124V) – 20A max.

AC Consumption:
1.9kVA max. when TX

Dimension:
10.7 x 5.6 x 14.3 inches (WxHxD)/272 x 142 x 363 mm

Weight:
Approx. 20kgs. or 45.5lbs.

Accessories Included:
AC Power Cord
Band Decoder Cables included for Kenwood, ICOM and Yaesu
Spare Fuses and Plugs
User Manual

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– *QST*, May 2006

About the display:

"Everyone who used the review radio raved about the '7000's color TFT display screen. The incredible resolution, bright colors and excellent contrast make the display easy to read under a variety of lighting conditions and viewing angles. The characters are crisp and clear, and everyone who used the radio could easily see and use the screen labels and graphics." – *QST*, May 2006

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AH-4

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- HF / 50MHz
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A Simple Add-On RF Stage for Regenerative Receivers

Charles Kitchin, N1TEV

Improve both your and your neighbor's reception with an easy to build RF stage for your old-timer.

The performance of almost any regenerative receiver can be improved with the addition of an RF isolation stage between the regenerative detector and the antenna. Two circuits are presented here: one is designed for use with the "Simple Regen Radio for Beginners" project featured in the September 2000 issue of *QST*.[1] The second version is a simple add-on for vacuum tube radios such as classic *two tube bloopers* that are still built and operated by many hams.

Both circuits provide a dramatic reduction in detuning (frequency shift) from hand capacitance. Hum modulation, from RF feeding into the antenna, is largely eliminated. Potential interference to other nearby receivers is also reduced by 10 to 30 times. This is very important with "two tube bloopers" whose detectors can easily transmit more than 100 mW of RF. Finally, additional sensitivity is provided, which is useful at the higher shortwave frequencies.

An RF stage with an untuned input and grounded base was selected for this project rather than the frequently seen tuned input grounded emitter stage. This makes construction much simpler, as RF stages with tuned inputs are fairly difficult to design and build. They are also very prone to oscillation. The grounded base configuration was used because it provides a low impedance input and a high impedance output, good RF isolation, wide bandwidth and modest voltage gain.

[1]Notes appear on page 30.

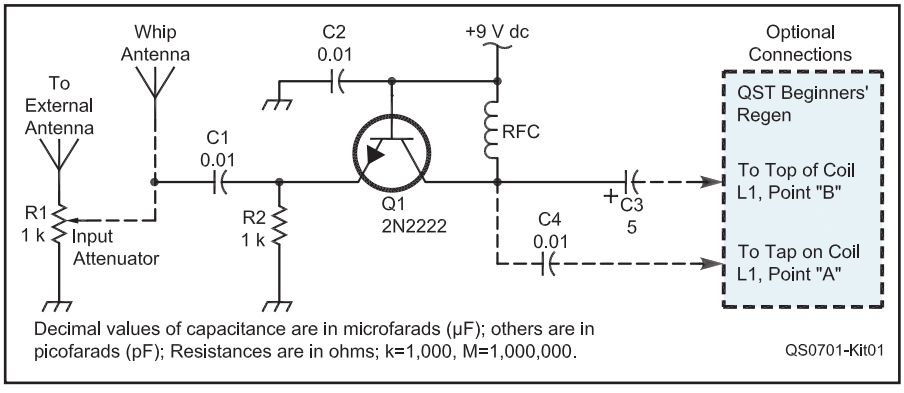


Figure 1 — Schematic diagram and parts list for a simple RF amplifier designed for the "Simple Regen Radio for Beginners." AES is Antique Electronic Supply (www.tubesandmore.com), RS is RadioShack (www.radioshack.com) and TTS is The Tube Store (www.thetubestore.com).

C1, C2, C4 — 0.01 µF disk ceramic capacitor (RS 272-131, AES C-C10000-3000).
C3 — 5 pF to 10 pF mica capacitor (TTS CA-SI-10pF-500V, OSE CD-10N); see Note.
Q1 — 2N2222 transistor (RS 276-1617).
RFC — For connection to point "A," 100 µH (RS-273-102).
RFC — For connection to point "B," 50 µH or similar HI Q RFC; see text.
R1 — 1 kΩ linear potentiometer.
R2 — 1 kΩ, ¼ W carbon resistor (RS 271-1118).
Note: In place of a mica capacitor for C3, an approximately 3 pF *gimmick* capacitor constructed of two pieces of 22 gauge insulated solid hookup wire twisted tightly together.

An RF Stage for the *QST* Regen Radio

Figure 1 shows an add-on RF stage designed to be used with the *QST* Beginners' Regen radio. As with the original project, there are provisions for both an external antenna and an internal 39 inch whip.

Circuit Description

Capacitor C1 simply blocks the dc voltage at the emitter of Q1 and protects the RF stage in case the antenna is accidentally grounded. Resistor R2 sets the RF stage operating current. Since the base of Q1 is bypassed and connects directly to the +9 V supply, the emitter of Q1 will be approximately 0.7 V lower, or about 8.3 V. Therefore, the emitter current flowing through R2 will be 8.3 V divided by 1 kΩ or about 8.3 mA. The selection of R1's value is a tradeoff between RF stage current consumption and undesired AM detection of strong local broadcast stations.

The RF choke prevents the signal at the collector from entering the +9 V supply. There are two simple ways to connect the output of the RF stage to the beginner's regen radio. Capacitors C3 and C4 are both shown but only one is needed.

You can connect capacitor C4 to the tap point on coil L1. This connection is preferred when using the Radio Shack 100 mH RF choke (RFC) and an external antenna along with the R1 input attenuator. An external antenna, consisting of a 50 foot length of insulated hook-up wire run to a nearby tree, will provide excellent results. This option allows a wide variety of RF chokes to be used and

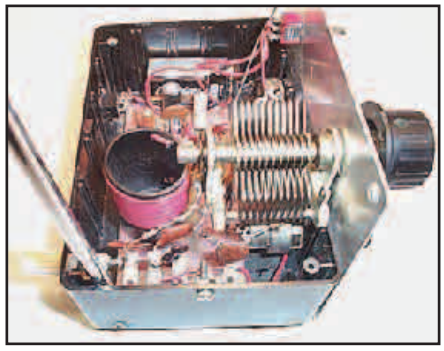


Figure 2 — A close-up of the RF amplifier mounted in the simple regen. It's the small group of parts on the terminal strip near the rod antenna.

greatly minimizes AM detection of strong local AM broadcast stations because the RFC is shunted by the relatively low inductance between the tap and the bottom of L1.

If it is desired to use only a *short* whip antenna, then the second connection to point "B" should be used and both the RFC and C3 should be selected for the highest gain possible. The signal output at the collector of Q1 feeds through C4 to the top of the coil in the beginner's regen set. This is a very high impedance point. Therefore, C3 needs to be very small, to preserve the receiver's selectivity.[2]

After much experimentation, I have found that the best RF chokes to use for connection B from the ham junkbox are wire wound RFCs with a dc resistance of 5 Ω or less and an inductance of around 50 µH. See Figure 2 for a view of the amplifier mounted in the simple regen. A PC board version is also available; see Figure 3.

An RF Stage for Two Tube Bloopers and Other Vacuum Tube Regens

Figure 4 shows a similar design, this time modified for use with vacuum tube regen radios. This small circuit is easy to add to any existing tube regen and has the advantage that it is powered from the 6.3 V filament supply available in most tube sets. The ac filament voltage is rectified by D1 and filtered by capacitor C7 to provide +9 V dc.

Because the tube detector's gain is far lower, a much higher RF input level will be need and that requires an external antenna.[3]

Circuit Description

This circuit, shown in Figure 3, uses a rotary switch and three capacitors to allow the operator to adjust the antenna input coupling. Capacitance values for C1, C2 and C3 were chosen for use with a 50 foot long wire antenna. Longer antennas (and dipoles) generally require larger values, shorter antenna, smaller values. A resistive input attenuator, as in Figure 1, can also be used.

If desired, the RFC and capacitor C5 in the RF stage may be omitted by rewiring the circuit so that the tube set's input winding is connected between the collector of Q1 and the 9 V dc supply voltage. A third option, for radios lacking an input winding, is to connect directly to the top of the receiver's coil, using a small mica or "gimmick" capacitor of a few pF, as was done in Option "B" of the previous circuit. The final unit is shown in Figure 5.

Construction and Trouble Shooting

The regen radio itself should be built and tested before adding the RF stage. The radio should be checked to ensure that its regenerative detector oscillates through the entire tuning range. It is also very important that the REGENERATION control be carefully adjusted from a low setting, up through the RF oscillation threshold and beyond to be sure that the circuit does not detune. It should be possible to adjust the REGENERATION so that the audio bandwidth is noticeably reduced just below the oscillation threshold. Finally, check that the oscillation point on the REGENERATION control is the same when going up through oscillation as when going back down. If the circuit suddenly flips to a high oscillation condition while missing the oscillation threshold, then coil leads usually need to be made shorter. If the radio lacks a metal front panel, consider adding a small grounded metal plate behind the tuning control to prevent detuning from hand capacitance.

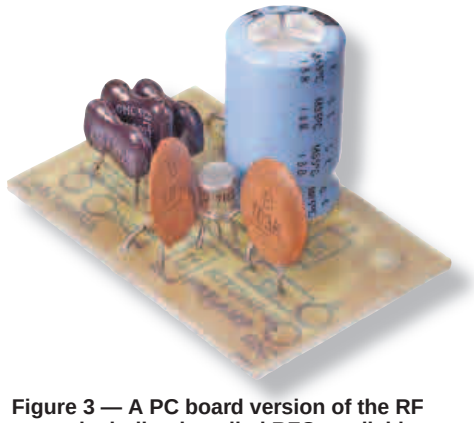


Figure 3 — A PC board version of the RF stage, including installed RFC, available from FAR Circuits (www.farcircuits.net).

The RF stage itself can be easily built using a four or five lug terminal strip. The circuit should be mounted within 2 inches of the receiver's main tuning coil. The

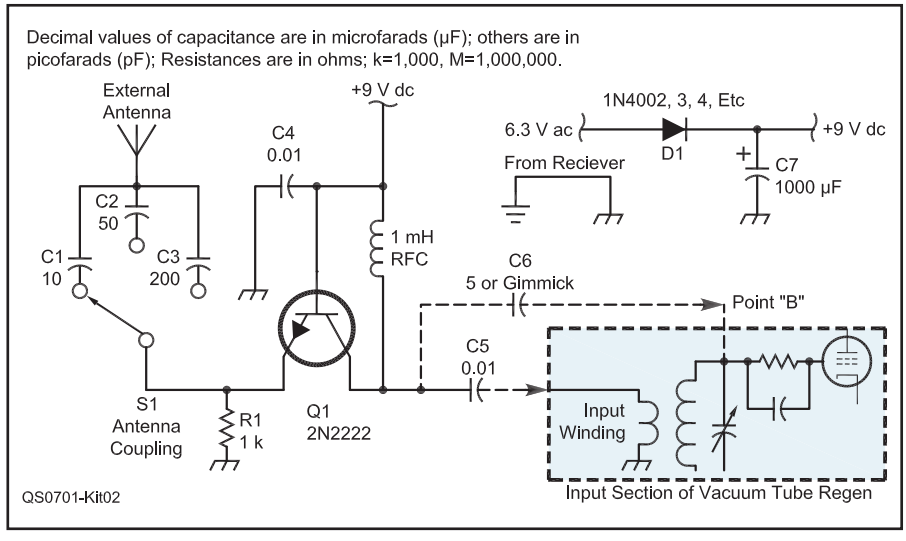


Figure 4 — Schematic diagram and parts list for a simple RF amplifier modified for use with vacuum tube regenerative receivers. AES is Antique Electronic Supply (www.tubesandmore.com), DK is Digi-key (www.digikey.com), RS is RadioShack (www.radioshack.com) and TTS is The Tube Store (www.thetubestore.com).

C1 — 10 pF mica, ceramic or Mylar capacitor (part of RS assortment 272-123).
C2 — 50 pF mica, ceramic or Mylar capacitor (part of RS assortment 272-123).
C3 — 200 pF mica, ceramic or Mylar capacitor (part of RS assortment 272-123).
C4, C5 — 0.01 µF disk ceramic capacitor (RS 272-131, AES C-C10000-3000).
C6 — 5 pF mica capacitor (TTS CA-SI-10pF-500V, OSE CD-10N); see Note.
C7 — 1000 µF capacitor (RS 272-1047).
D1 — 1N4002, 1N4003, 1N4004 or similar diode (RS 276-1653).
Q1 — 2N2222 transistor (RS 276-1617).
RFC —1 mH RF choke (DK M7102-ND).
RFC — For connection to point "B," 50 µH or similar HI Q RFC; see text.
R1 — 1 kΩ, ¼ W carbon resistor (RS 271-1118).
S1 — SP3T rotary switch or SPDT toggle switch with center off position.
Note: In place of a mica capacitor for C6, an approximately 3 pF *gimmick* capacitor constructed of two pieces of 22 gauge insulated solid hookup wire twisted tightly together.

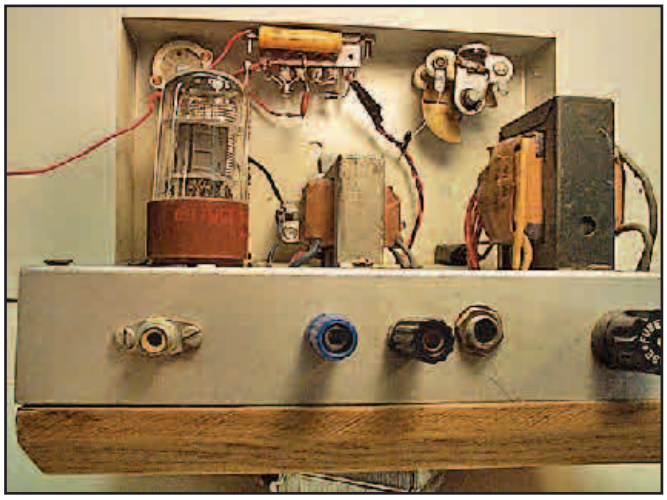


Figure 5 — A close-up of the RF amplifier mounted in a vacuum tube regen. It's mounted on the terminal strip at the top of the front panel.

terminal strip should be oriented so that the output wiring from Q1 through the coupling capacitor is kept very short. In general, keep all wiring as short as possible. Once constructed, test the voltages at Q1. The collector voltage should be close to the +9 V battery voltage. The emitter voltage should be 0.7 V lower, or about 8.3 V. Then connect the antenna and check reception. Sensitivity should be the same or better than it was without the RF stage. Detuning and hum should be significantly reduced.

Notes

[1]C. Kitchin, N1TEV, "A Simple Regen Radio for Beginners," *QST*, Sep 2000, pp 61-64. Available at the ARRL Web site, **www.arrl.org/tis/info/pdf/0009061.pdf**. See also C. Kitchin, "High Performance Regenerative Receiver Design," *QEX*, Nov/Dec 1998, pp 24-36, and C. Kitchin, "Regenerative Receivers: Past and Present," *Communications Quarterly*, Fall 1995, pp 7-26.

[2]The simple expedient of clipping one or two 1 foot jumper wires to the top of the whip antenna will greatly improve reception and allow the use of the Point "A" connection, which is easier to implement. Extending the length of the whip antenna was not possible in the original project as whips over 39 inches stopped the detector from oscillating. With the added RF stage, the whip can be of any length.

[3]The 2N2222 transistor detector used in the Sep 2000 *QST* beginner's radio has a regenerative gain of around 100,000. A typical tube detector's regenerative gain at shortwave frequencies is a few thousand.

Charles Kitchin, N1TEV, is a hardware applications engineer at Analog Devices' semiconductor division in Wilmington, Massachusetts. His main responsibilities include writing books and other technical publications and in developing new applications circuits. He also teaches 4th and 7th grade science classes as a volunteer one or two days per week. He has published over 80 technical articles, several books and a large number of application notes. Chuck has been an avid radio builder and shortwave listener since childhood and holds a General class license His other hobbies include astronomy and oil painting. You can reach Chuck at 26 Crystal St, Billerica, MA 01821 or **Charles.Kitchin@analog.com**.

Strays

W1AW TO CHANGE ITS 80 METER DIGITAL FREQUENCY

♢In response to the expansion of the 75 meter phone band down to 3600 kHz, W1AW will shift its 80 meter digital bulletin frequency down to 3597.5 kHz. The new frequency will be in use beginning with the regularly scheduled 6 PM EST (2300 UTC) digital bulletin on Friday, December 15, 2006.

The old 80 meter digital frequency (3625 kHz) has been in use for well over two decades. The expansion of phone privileges on 75 meters (part of the rules changes that will take effect December 15 as a result of *Report & Order*, WT Docket No. 04-140) prompted the change. See Happenings, elsewhere in this issue, for more on 04-140.

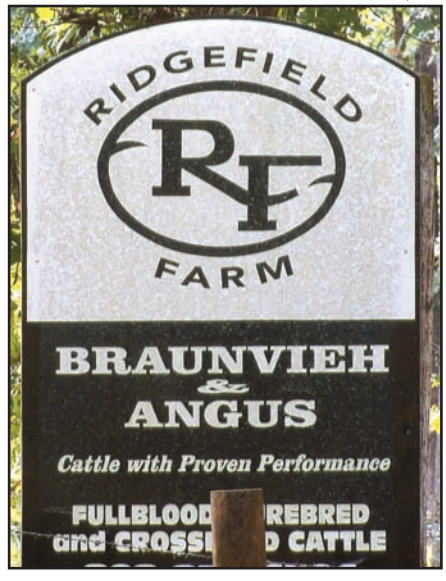
A possible change in the 80 meter CW frequency is being considered. — *Joe Carcia, NJ1Q, W1AW Station Manager*

GHERY S. PETTIT, N6TPT

ISLANDS ON THE AIR PROGRAM ANNOUNCES ICOM SPONSORSHIP DEAL

♢Effective October 1, ICOM became the new corporate sponsor of the Islands on the Air (IOTA) program, the Radio Society of Great Britain (RSGB) has announced. "This three-year worldwide sponsorship deal is a major boost to IOTA both in the UK and internationally," said the RSGB, which sponsors IOTA, **www.rsgbiota.org/index.php4**. "Principally involving sponsorship from both Icom UK and Icom America, this deal is set to build this already-popular program into 2009 and beyond." Since IOTA's launch in 1964, both Yaesu and Kenwood have served as program sponsors.

ROBERT OCHS, K4NB



There have been various theories through the years, but Robert Ochs, K4NB, of Murphy, North Carolina, has found the place all RF originates: this farm in Brasstown, North Carolina.

High Sensitivity Crystal Set

Build a "crystal radio" that does not require an outside antenna or ground by using a new zero-voltage-threshold MOSFET.

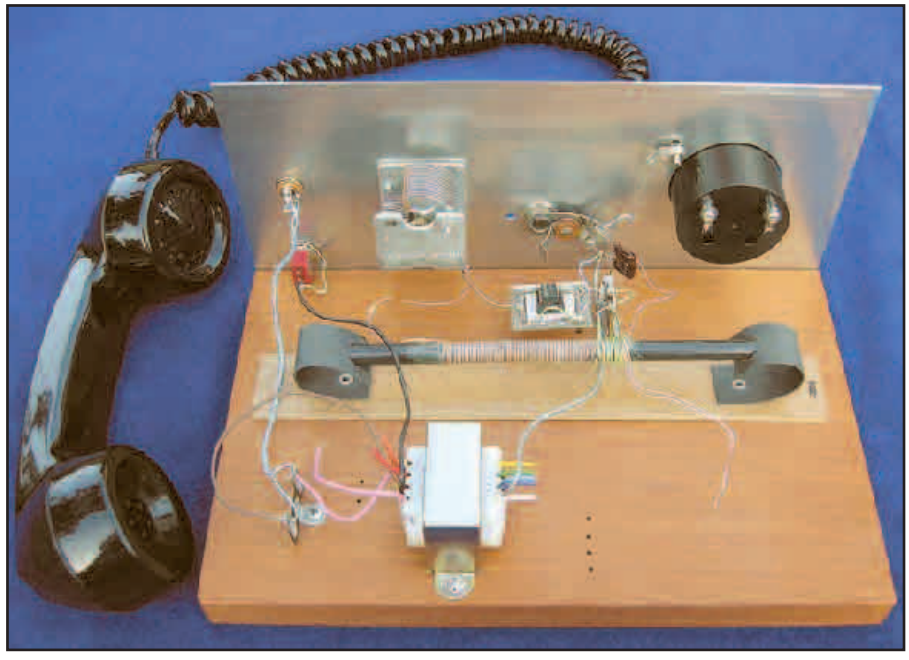
Bob Culter, N7FKI

If you are like me, you may have been bitten by the "radio bug" while building an AM broadcast band crystal set. In my case, I was using a galena "cat's whisker" detector.[1] Such a radio typically required a long outside antenna and ground rod or water pipe ground connection to function, even with the use of a low-threshold (0.3 V) germanium detector diode such as the well-known 1N34A.

To rekindle the spark of your youth or to interest young people in radio, consider building a radio that doesn't need an outside antenna or ground that might be hard to come by with modern high-density housing, antenna restrictions, and the danger of power line proximity or lightning. Fortunately, a new detector has been developed that does just that.

Anyone who has experimented with simple crystal sets knows that there is a trade-off between sensitivity and selectivity, or the ability to separate stations that are close in frequency. To understand that, refer to Figure 1, the schematic diagram of a typical crystal set. For highest sensitivity, it is desirable to place the detector diode at the top of the LC resonator (which provides the means for selectivity) where the maximum RF voltage appears with the hope of exceeding the 0.3 V threshold of the detector diode. Placing the detector and headphone load at the top of the resonator at point A results in "de-Q-ing" the resonator, largely destroying selectivity.[2] Placing the detector at a tap point on the inductor, typically 10% of the way up from the ground end at point B, results in much less loading of the resonator and preserves selectivity. Unfortunately, the top of the resonator must now see 3 V peak in order for point B to provide 0.3 V to the detector, so sensitivity is severely affected.

Referring to Figure 2, it is possible to have your cake and eat it, too, with a circuit using the newly introduced ALD110900A zero-threshold-voltage MOSFET IC made by Advanced Linear Devices.[3] Figure 2 shows the circuit topology, which was motivated by a similar circuit using a JFET and battery gate bias configuration developed by David W. Cripe, NE4AM (formerly KC3ZQ).[4] The circuit is essentially a synchronous rectifier. It uses the high voltage end of the resonator formed by a ferrite antenna rod, L1, and tuning capacitor, C1, to drive the gate of the MOSFET, resulting in rectifier action from the channel. The MOSFET source and drain replace the anode and cathode of the usual 1N34A diode connected to a separate 8-turn winding on L1, which is equivalent to the 11% tap point on L1.



Rear view of the AM band high sensitivity crystal set showing a GTE telephone handset as the headphone. The panel meter is not used for this project.

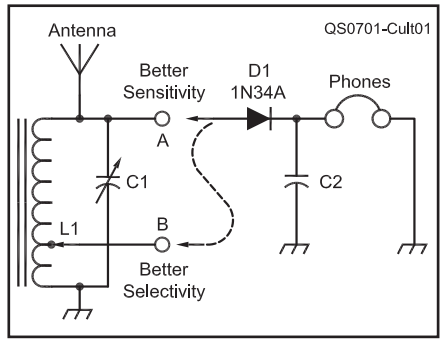


Figure 1 — Schematic diagram of a typical crystal set with diode connected to A for sensitivity and B for selectivity.

In a synchronous rectifier, the MOSFET acts like a switch, turning on during the positive half cycles of the applied RF voltage and off during the negative half cycles. The 2000 pF capacitor, C2, integrates the pulsating dc to create the audio modulation in the headphones. In this circuit, the gate voltages are not high enough to create a perfect switch, and so the MOSFET modulates the resistance of the source-drain channel over some impedance range whose average approximates the impedance of the headphone load for maximum energy transfer.

In the radio shown in Figure 2, both FETs of the dual-FET ALD110900A, U1, have a common-source connection and are connected in parallel to better match the headphone impedance. The resulting detec-

[1]Notes appear on page 33.

tor has an off resistance (0 V on the gate) of 52 kΩ and an on resistance of 250 Ω with a peak voltage of +5 V on the gate. In this radio, the maximum measured gate voltage is only 0.25 V peak, so the channel modulation creates an average source impedance to the headphones of approximately 25 kΩ. An antique pair of 25 kΩ headphones can be used directly if you have them, but most headphones will require an impedance transformer, in this case the multi-tapped Bogen T-725 public address matching transformer.

Most of the other parts are scarce or no longer in production. You may have to wind your own ferrite rod to emulate the J. W. Miller 2000 antenna rod or adapt the rod from an old AM transistor radio. To wind your own, obtain an Amidon Associates ferrite rod, part number R61-050-750, which is 7.5 inches long and 0.5 inch diameter.[5] Using 15/44 or 15/46 Litz wire, wind 70 turns in the center of the rod spaced to fill 3 inches.[6] The 8-turn secondary can be ordinary magnet wire wound over primary, on the lower end of the main coil. A high-quality 365 pF air variable tuning capacitor can be purchased or obtained from an old radio. A good junk box and resourcefulness are in order.

There is No Magic

Even though the zero threshold of the MOSFET detector greatly improves performance, the available power is low and the acoustic power from the headphones depends on extracting the greatest efficient from every component in the radio.

The use of high-sensitivity earphones is critical to the success of your radio. The best inexpensive stereo earphones have a sensitivity of 108 dB sound pressure level per milliwatt (SPL/mW), where 0 dB SPL is 20 microPascals SPL or the 0.0001 pW/cm² threshold of human hearing, and an impedance of 8 to 64 Ω. Although these can be matched to the radio with the Bogen T-725 transformer (which has a separate 8 Ω winding) and offer superior bass response, this is a very low sensitivity compared to what is desired. The receiver of an old dial type or early model tone access pad telephone may be a better choice. I have used an audio signal generator and RadioShack sound level meter to measure the sensitivity of telephone receiver elements such as the GTE D-51030A or Western Electric U-1 or LB-1, which can be obtained from old telephones in thrift shops for several dollars. The sensitivity is about 122 dB SPL/mW or 14 dB better than stereo headphones, although the response is limited to about 3 kHz. If we assume an earphone aperture of 1 cm², this is an efficiency of 16% in converting electrical power to sound power. The Knowles Acoustics CM-3152 balanced-armature element

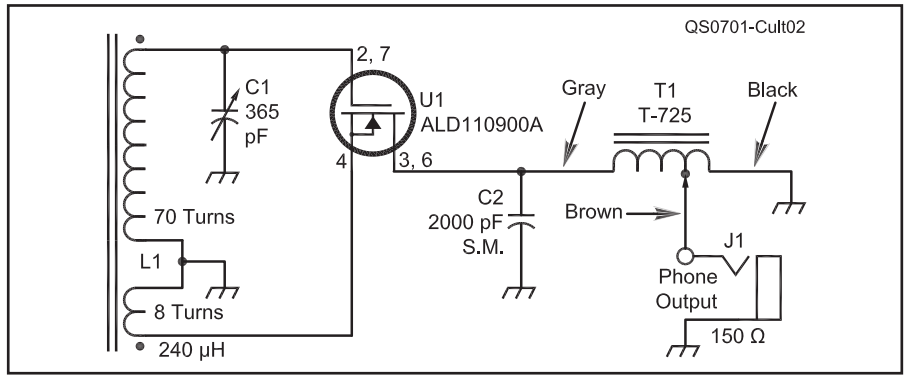


Figure 2 — Schematic and parts list for high sensitivity crystal set.

C1 — 15-365 pF air variable capacitor (www.midnightscience.com or see text).
C2 — 2000 pF silver mica or ceramic capacitor.
J1 — Mono headphone jack.
L1 — 240 µH, 7.5-inch ferrite loop antenna (J. W. Miller Model 2000 or see text). Eight turn secondary wound on lower end, over 70 turn primary winding.
T1 — Bogen T-725 public address matching transformer (www.schmarder.com or www.Grainger.com). Note: Only three of many taps shown to match 25 kΩ output to 150 Ω headphone impedance.
U1 — ALD110900A dual MOSFET (www.mouser.com, part number 585-ALD110900APAL for PDIP-8 or 585-ALD110900ASAL for 8-SOIC).
Headphones — See text.

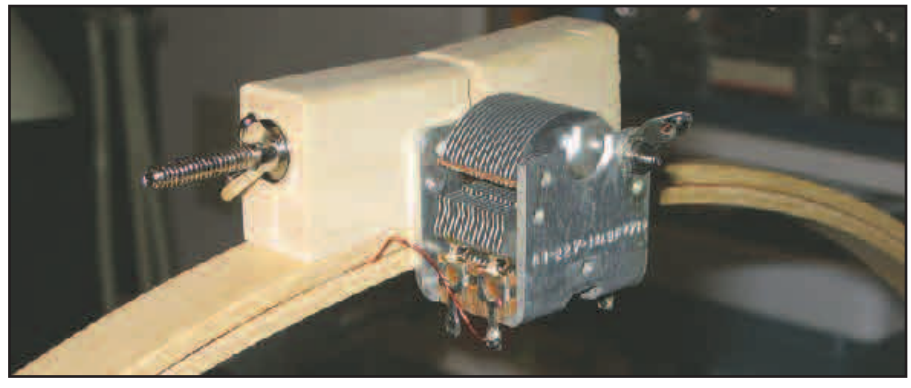


Figure 3 — Variable capacitor mounted on auxiliary quilting-hoop loop antenna.

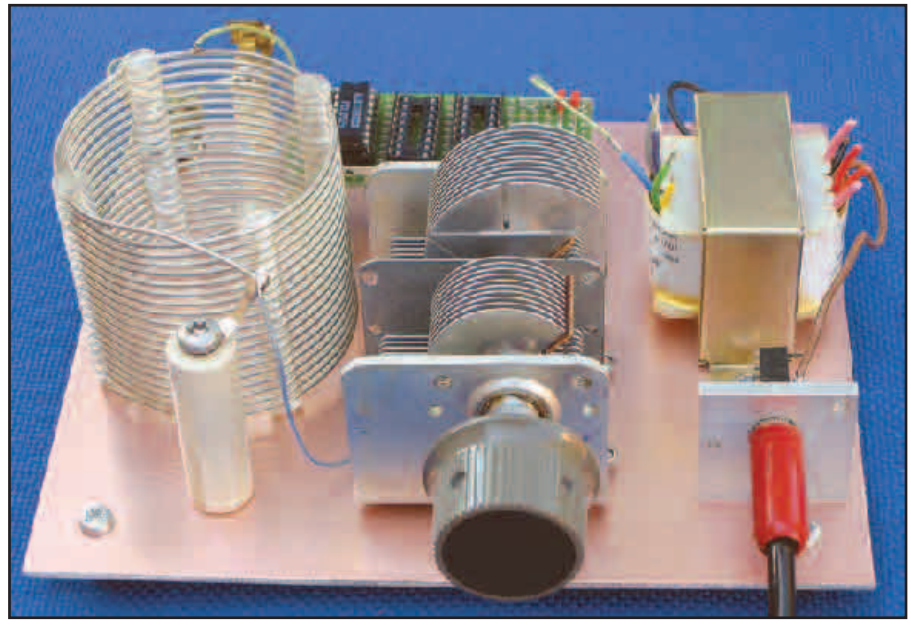


Figure 4 — This photo shows the 90 meter to 40 meter shortwave version of the high sensitivity crystal set.

should offer similar performance.[7] All of these elements have an impedance of 150 Ω at 1 kHz.

Making it Even Better

An additional improvement in received volume can be obtained by coupling a high-Q tunable loop antenna to the ferrite rod antenna in the manner of a "loose coupler." I have used an 11-inch diameter Select-A-Tenna loop to obtain 65 dB SPL A-weighted volume (about normal conversational volume with 3.3 µW electrical input) from a 5 kW station 3 miles away.[8] Replacing the MOSFET with a 1N270 germanium diode resulted in no discernable output. It has been possible to hear seven local stations in a 25 mile radius with no difficulty. You can search for your station locations on the FCC Web site.[9] Signals with 30 dB SPL (whisper level) volume are quite listenable with only 0.1 µW electrical input to the earphone. It only takes 5 to 10 mV peak-to-peak on the source of the MOSFET to provide an adequate volume level.

You can make your own "amplifying" tunable loop antenna with a 23 inch diameter wooden quilting hoop. This will come apart as an inner hoop and a split outer hoop with wooden ends and a tightening screw. Close-wind 12 turns of AWG no. 24 magnet wire in the middle of the outside surface of the inner hoop and tape the ends in place. Next, at about 2 to 3 inch intervals, carefully separate the turns to spread them evenly across the ¾ inch width of the inner hoop and tape in place as you proceed. Mount the outer hoop over the inner hoop and tighten in place using the long metal screw. Mount a 365 pF air variable tuning capacitor on the large wooden blocks as shown in Figure 3. It will be necessary to drill an additional hole in the mounting blocks to pass the shaft of the capacitor. Use a shaft extension with a knob to provide tuning ability. Solder the two ends of the coil to the stator and rotor of the capacitor.

The auxiliary loop that you have created has an inductance of about 240 µH and will tune the entire AM broadcast band with a 365 pF capacitor. Place the loop off the end of the crystal set's ferrite loop. A line across the diameter of the loop should point to the desired station. Tune in a station on the crystal set and peak the volume by tuning the large loop. The received signal strength will be dramatically increased. With this larger loop, the station previously mentioned increased in volume to 72 dB SPL using a GTE telephone receiver.

Shortwave Version

I have constructed a version of this receiver to cover the 90 to 40 meter shortwave spectrum. Figure 4 is a picture of this receiver and Figure 5 shows the schematic diagram and parts list. Shortwave performance is difficult, especially at my US West Coast location where few powerful shortwave stations can be heard and severe fading is evident. With this receiver I was able to reliably receive HSK9, Radio Thailand, broadcasting from the 250 kW International Broadcasting Bureau (IBB) transmitter in Delano, California on 5890 kHz. I was using an external 40 foot wire antenna.

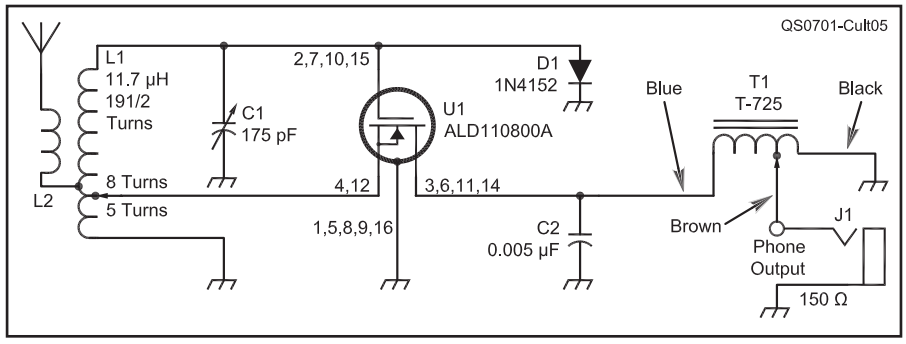


Figure 5 — Schematic and parts list for 90 meter to 40 meter shortwave version of high-sensitivity crystal set.

C1 — 175 pF air variable capacitor.
C2 — 0.005 µF ceramic capacitor (or two 0.0022 µF capacitors in parallel).
D1 — 1N4152 silicon diode (see text).
J1 — Mono headphone jack.
L1 — AirDux coil, 19.5 turns, 2 inch diameter, 10 turns/inch, tapped at 5 and 8 turns.
L2 — 9 turns FT 50-43 toroid (see text).
T1 — Bogen T-725 public address matching transformer. (Note: BLU tap, 5 kΩ, is different from AM version.)
U1 — ALD110800APCL Quad MOSFET (Mouser 585-ALD110800APCL).

The detector consists of four MOSFETs in parallel using the quad version of the detector IC in order to better match the lower resonator impedance. The source tap point was also changed to the 25% point on the inductor. The resulting loaded Q was 44 at 6 MHz compared to 53 for the AM receiver at 1 MHz. The integrator capacitor was changed to 0.005 µF and the transformer tap was changed to the 5 kΩ tap (BLU). In order to protect the gates of the MOSFET array, the V– and substrate diode connections were grounded and a 1N4152 silicon diode was placed from gate to ground. This diode does not participate in any detector action.

As with any crystal receiver, antenna matching is important to transfer as much power to the receiver as possible. I found that connecting the antenna to the eighth turn of the inductor was optimum. Substantial interference from local FM and TV stations can be greatly reduced by placing a 9 turn FT50-43 toroid in series with the antenna.

Make it Your Own

This article is intended to motivate experimentation in radio at the most fundamental level. If you build either of these sets, you will learn much about high-efficiency radio design and construction, and you will appreciate how the human ear can hear audio signals with energies much less than 1 µW. You will have to adapt the materials you have or can obtain. There is no joy in radio quite like listening to a radio where the only energy is being provided by the station itself, but you will have to cultivate the "art of listening." Hopefully, you can pass on this learning and joy to young people and help them catch the "radio bug." They may well become future hams and extend this wonderful hobby for some time to come.

I would like to thank Wes Hayward, W7ZOI, for valuable discussions during the development of these receivers.

Notes

[1]A. Morgan, *The Boy's First Book of Radio and Electronics*, Charles Scribner's Sons, New York, 1954, pp 126-159.
[2]W. Hayward, R. Campbell, and B. Larkin, *Experimental Methods in RF Design*, ARRL, 2003, pp 3.8-3.9.
[3]**www.aldinc.com/pdf/ALD110800.pdf**.
[4]D. W. Cripe, KC3ZQ, "Nostalgia For The Future," *73 Amateur Radio Today*, Dec 1995, pp 14-16.
[5]**www.amidoncorp.com**.
[6]**www.schmarder.com**.
[7]**www.digikey.com**, part number 423-1036-ND.
[8]**www.selectatenna.com**.
[9]**www.fcc.gov/mb/audio.amq.html**.

Bob has been licensed since 1983 and holds an Advanced class license and a General Radiotelephone Operator License. He has a BA in Physics from Portland State University and works as a design engineer at Phoseon Technology. Bob's interests include QRP, homebrewing, shortwave listening and musical instrument construction. Bob's wife Terry, KA7VAF, is a social worker and is very supportive of his many projects. You can contact Bob at 5860 SW 161st Ave, Beaverton, OR 97007; **n7fki@teleport.com**.

A Two Element "Wonder Bar" Beam for 17 Meters

Who says nostalgia isn't what it used to be? As with the original, this antenna provides good performance in a compact, almost invisible package.

Gary A. Cook, W9JSN

Nostalgia, plus a need for a better 17 meter antenna, recently led me to revive and adapt an antenna design popular during the late 1950s. The result was more than a trip down memory lane: I now own a compact, 2 element, 17 meter beam that works very well.

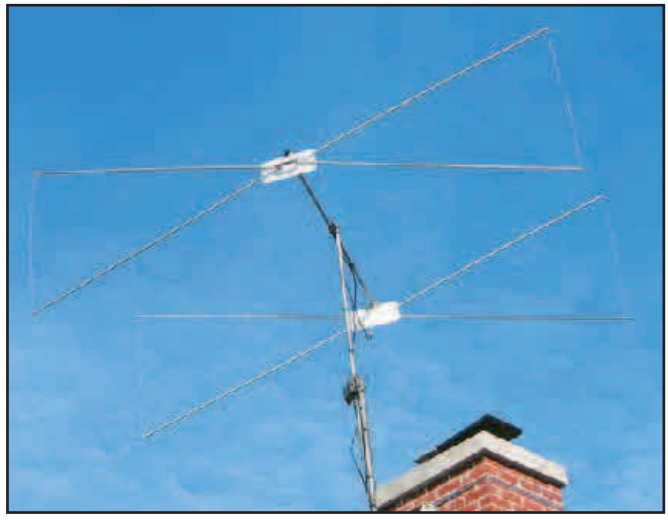


Figure 1 — The finished Wonder Bar beam, ready for action.

So What's a Wonder Bar?

When an article describing the easy construction and outstanding performance of a "Wonder Bar" antenna for the 10 meter band appeared in the November 1956 issue of *QST*, I was a 17 year old high school student, licensed as WØVNX and living in a small Iowa town.[1] Lacking the money to invest in a factory made beam, I jumped at the idea of building an inexpensive antenna that might help me work some DX stations on 10 meters.

I immediately sent off to Allied Radio in Chicago for the B&W Miniductor and stand-off insulators I would need for the center loading coil of this shortened, bow tie shaped, rotatable dipole. But, unhappily, that was as far as I went with my antenna project. Somehow other things distracted me and I never managed to round up the remaining materials needed for the antenna, much less actually build it.

The Miniductor and stand-off insulators eventually got used for something else and disappeared from my junk box. Meanwhile I went off to college, followed by graduate school, and then spent nearly 40 years teaching college students. But I never forgot about the Wonder Bar. I held on to the original 1956 article, and even accumulated a file folder of related articles — one about a 20 meter version, and two *Hints & Kinks* items written by hams who had added an element or two to the original 10 meter antenna to make a beam.[2, 3]

That Was Then, This is Now

Last fall I began thinking seriously about building some kind of antenna for 17 meters, and the design of the old Wonder Bar came once again to my mind. I was looking for an antenna that would be directional, rotatable and have some gain over a dipole. I also wanted it to be relatively small and inconspicuous, so as not be the cause of any adverse comments from either my neighbors or my spouse.

I decided that a 17 meter Wonder Bar used as a driven element, along with another Wonder Bar tuned and mounted to function as a reflector, would be just the ticket. A little work with a calculator allowed me to enlarge the dimensions of the original 10 meter version of the antenna for 17 meters. Each of the two elements would be only 12 feet 8 inches across — approximately half the length of the elements on an ordinary full sized beam for this band. A look at several antenna handbooks revealed that I could expect good results with the two elements spaced just 6 feet 7 inches apart. I also concluded that I could wind my own coils and build the whole antenna from materials readily available at local hardware and discount stores. The result was a new and improved version of the project I had envisioned, but never completed, almost 50 years ago. See Figure 1.

For the benefit of readers who might want to try their hand at building a similar antenna, here is a detailed description of the materials and construction involved in my completed 17 meter Wonder Bar beam. I am indebted to the authors of all the articles cited in the notes for suggestions that helped me arrive at the final design of this antenna.

Construction

I cut the two center supports of the beam from a single 15 × 20 × ⅜ inch Poly kitchen cutting board purchased at a local household goods store. (This construction idea occurred to me one morning while I was cleaning up the kitchen!) I used a small power saw to cut across the cutting board 7 inches from each of

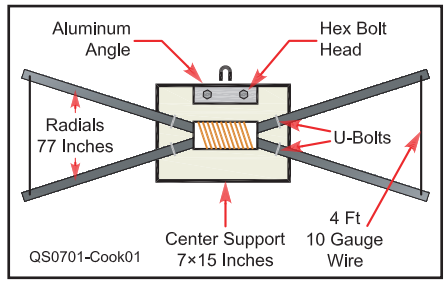


Figure 2 — Construction details of Wonder Bar beam.

[1]Notes appear on page 36.

the ends on the long sides to obtain two 7 × 15 inch pieces. I then used an electric sander to smooth the edges and round the corners of the newly cut side of each piece. The eight diagonal radials are each 77 inches in length, and can be made from ¾ inch diameter aluminum tubing, copper tubing or steel electrical conduit. I opted to go first class with aluminum radials (cut from 8 foot lengths obtained at a nearby building supply store) to hold down the overall weight of the beam. Copper tubing might be a good compromise since it is less expensive and not much heavier than the aluminum. The steel conduit would be the least expensive choice but it would add considerable weight to the finished antenna.

One end of each radial must be flattened for a length of about 2 inches. I tried at first to accomplish this by compressing the tubing in a shop vise but found that my vise was not heavy enough to do the job. After a little frustration, I took the radials outside and did it the way I would have done it when I was 17: I pounded one end of each radial flat with a hammer on a cement block. Once this was done, I drilled a ¼ inch diameter hole half an inch from the end of each flattened section.

After I cut the radials to the appropriate length by means of an inexpensive tubing cutter (easier and neater than a hacksaw), I fastened the flattened ends to the center supports using ¼ inch hex bolts (2½ inches long) and ¾ inch U bolts, as shown in Figure 2. I had to spread the legs of the U bolts open a fraction of an inch farther so that they would slip over the radials. It is a good idea to use washers and lock washers under all nuts to hold them in place and also to keep them from cutting into the cutting board center support.

You may also want to use extra washers and nuts as needed to make spacers between the center support and the flattened ends of the radials. I mounted the two center bolts for each element 5 inches apart — that is, 2½ inches on either side of the center of the support board — to allow room later for the center loading coil. You should fan out the radials slightly more than 4 feet at the far ends before they are fastened down with U bolts. This will put a little tension on the wire tie bars once you attach them to the far ends of the radials. Pencil lines drawn vertically and horizontally through the center point of the support board help in lining up the center bolts and U bolts so that the four radials of each element appear visually symmetrical.

For the tie bar at the end of each element, I used a piece of 10 gauge bare copper wire slightly less than 4 feet long. I soldered a ring terminal to each end of this wire, and then used a small screw through the terminal to attach the end of the wire to the radial half an inch from the far end. As mentioned earlier, you will want a slight amount of tension on these tie bars to hold them tight and to keep them looking straight.

Figure 3 — Close-up of the back side of the modified cutting board used as a center support and insulator.

I made the identical loading coils for the centers of the two elements from 7 foot lengths of 12 gauge bare solid copper wire, wound on 6 inch sections of 1 inch (inside diameter) PVC plumbing pipe. The local hardware store sold me a single foot of this pipe very inexpensively. I could obtain only the insulated version of the 12 gauge wire for the coils, so I fastened one end of each wire in a vise and used a wire stripper to carefully remove the insulation without nicking the wire. Each coil occupies the center 4 inches of a PVC form. Drill small holes for the ends of the wire about 1 inch from each end of the form. Insert one end of the wire far enough through the hole to allow several inches for eventual mounting and hookup. Hold the other end of the wire in a vise to keep it tight; then turn the form slowly to wind the coil on the form. I also drilled a ¼ inch diameter hole ½ inch from each end of the coil form so that I could eventually slip the ends of the form over the tips of the two center bolts fastening the radials to the center support board. Solder ring terminals to the wires extending from the ends of each coil, and fasten these to the two center bolts using lock washers and nuts.

I used a smaller coupling coil to link the feed line inductively to the driven element of the antenna. This coil consists of two turns of 12 gauge insulated solid copper wire wound fairly tightly around the loading coil for the driven element. I soldered one end of this coupling coil to the inner conductor, and one end to the outer conductor, of a short length of 52 Ω coax. The other end of this coax was terminated in a standard PL-259 plug, to which I attached a PL-258 coax coupler, so that I could later connect my 52 Ω coax feed line to this adapter by means of another PL-259 plug.

I was lucky enough to have on hand an 8 foot aluminum boom, along with a boom to mast mount, left over from an old citizens band (11 meter) beam that someone had given me. I cut this boom down to a length of 6 feet 8 inches centered on the mast mount. Any suitable length and diameter of aluminum tubing or steel pipe would, of course, work just as well for the boom. And a small sheet of metal or heavy plastic (such as the left-over material from the kitchen cutting board mentioned above), along with two pairs of U bolts (one pair for the boom and one pair for the mast), could be used to fashion a boom to mast mount.

I used a 6 inch length of 1½ inch aluminum angle stock (1/16 inch thick) and a U bolt to mount each of the center supports of my two elements to the boom. (This aluminum angle stock is available in 4 foot lengths at the local hardware store.) I used two hex bolts, ¾ inch in length, mounted 5 inches apart, to fasten the inner side of the angle stock to the side and over the top of the center support. Two holes drilled in the top side of the angle stock to accommodate the legs of an appropriately sized U bolt made it possible to hang the center support board underneath the boom. See Figure 3. Be sure that you center the angle stock and the holes for the U bolt horizontally on the center support board. Use a small carpenter's level during the final installation to make sure that each element is hanging properly.

Although it was probably not necessary, I used a mast clamp with serrated edges (borrowed from an old TV antenna) for the U bolt attaching each element to the boom. It should be easy to slip the U bolt for each element over the end of the boom and to slide the element back and forth on the boom if necessary while assembling and tuning the antenna.

Making it Play

Once you've built the two bow tie elements and have them mounted temporarily on the boom, the only part of this project calling for critical measurements begins. Tune the center loading coils of both elements to the proper frequencies, and then adjust the coupling coil on the driven element. Back in 1956 this part of the project would have been a real chore, but by putting off my antenna project until 2006 I was able to enjoy the fruits of recent technology. For these tasks you will want to own or borrow a good

antenna analyzer. I used an MFJ-259 portable antenna analyzer to tune both coils to the appropriate frequencies and to adjust the coupling coil for the lowest possible SWR.

Based on a good deal of trial and error, I would recommend the following procedure for this stage of the project.

- Temporarily mount the antenna on a short mast or on top of a self supporting ladder where it will be well away from all metal objects and yet within reach for easy adjustment of the loading coils.
- Tune the coil on the reflector element, mounted by itself temporarily on the boom. Tune it so that it is resonant at a frequency approximately 5% below the bottom of the 17 meter band (around 17.165 MHz). I removed one prong from a two pronged spade terminal and bent the remaining prong so that it would fit snugly on the wire of the loading coil but at the same time slide easily around the coil for purposes of adjustment. I soldered this spade terminal to an insulated 12 gauge stranded copper wire with an alligator clip at the other end. Once the spade terminal was set in place, I temporarily fastened the alligator clip to the wire at one end of the coil, thereby shorting out the turns between that end of the coil and the spade terminal.
- Begin by shorting out six or seven turns at one end of the coil. Then temporarily link the antenna analyzer inductively to the coil and adjust the frequency of the analyzer until you see a small dip in the meter, indicating the resonant frequency of the element. The inductive link connecting the antenna analyzer to the loading coil of the reflector can be a coupling coil of a two turns wound temporarily around the outside of the antenna loading coil, or a small coil — such as the one that comes with the dip kit for the MFJ 259 — inserted inside the coil form of the loading coil.
- The other end of the inductive link should be connected to the antenna analyzer via a short length of coax and the appropriate plug. Once you determine the initial resonant frequency of the bow tie element you will know whether you need to short out more turns and thereby raise the resonant frequency, or the reverse. Keep adjusting the tap on the loading coil until you find the point at which the element resonates at the desired frequency.
- Use the same procedure to tune the driven element to the center of the 17 meter band (about 18.12 MHz). In this step the two turn coupling coil that will be a permanent part of the antenna can serve as your link between the loading coil and the antenna analyzer.
- Finally, adjust the coupling coil on the driven element, by sliding it to various positions along the length of the loading coil, and also by varying the tightness around the outside of the loading coil, for minimum SWR. This is a crucial step and requires some experimentation. I found that I achieved the lowest SWR by locating the coupling coil near the end of the loading coil farthest from the shorted turns.

Figure 4 — The front side of the center support showing the loading coil, the coupled coil and the element radial mounting. Note the two plastic cable clamps that hold the coax and the coupling coil mechanically solid.

The readings you will get in the three final steps above are somewhat interdependent, so you may have to repeat the steps several times to find the best settings. It is likely that the resonant frequency of the driven element will shift upward somewhat once the antenna is raised to its final position. By proper adjustment (and this definitely requires both persistence and patience), you should be able to obtain an SWR of less than 1.7:1 across the entire 17 meter band.

Once you find the best settings for the loading and coupling coils, solder all the connections with a heavy duty soldering gun. I used two ½ inch plastic cable clamps fastened to the center support of the driven element with small screws to hold the coupling coil, and the short length of coax attached to it, firmly in place. See Figure 4. This is important, since even a slight movement of this coil can affect the SWR of the antenna.

Performance

Prior to the construction of this beam, I had on a number of occasions tried operating 17 meters with an all band Windom antenna that had served me well on 40, 80 and 160 meters. But the results of these attempts were far from impressive. I typically received mediocre signal reports from stateside contacts and seldom made any contact at all with the European stations I called.

In the month or so that I have used the two element Wonder Bar beam, my results with 100 W on 17 meter phone have been most gratifying. With the antenna mounted at a height of only 30 feet, and using a small TV rotator, I have worked stations throughout the US and Canada with many reports of S9+. Better yet, I have been able to work European stations with ease, receiving signal reports ranging from S5 to S9, whenever the band has been open to that part of the world.

Casual tests run with several stateside contacts indicate that the beam has a front to back ratio of approximately 10 to 15 dB, and that both the gain and the directional pattern of the antenna resemble those you would expect from a full sized two element Yagi. Not bad, I would say, for an antenna design that comes fully equipped with warm feelings of days gone by. My only regret now is that I was not smart enough to build a 10 meter version of this beam back in 1956 or '57. I could have used it to work some serious DX when the sunspot activity of Solar Cycle 19 was reaching its historic peak!

Notes

[1]E. Bishop, K6OFM, "The 'Wonder Bar' Antenna," *QST*, Nov 1956, pp 32-34, 138. See also S. Leland, W1JEC, "The Old Timer's Notebook: Remember the Wonder Bar Antenna — A 10 Meter Bow Tie?" *QST*, Apr 1980, pp 59-60. Another version of the original 10 meter Wonder Bar (this version by Jim, K2JXW) can be seen at **www.hamuniverse.com/wonderbar.html**.

[2]R. Rosenbaum, W5ECP, "A 'Wonder' on 20 Meters," *QST*, Jun 1957, pp 44-45.

[3]G. Ryan, " 'Wonder Bar' Beam," *QST*, Feb 1957, pp 43,134; F. Masho, W3CBM, "A Three Element Wonder Bar for 10 Meters," *QST*, May 1981, p 46.

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Old Amplifiers — Boat Anchors or Bargain Basement Opportunities?

Turn that old sow's ear back into a silk purse and save some dollars.

Tom Sowden, KØGKD

PAUL B. PETERS, VE7BZ

One of the great thrills of Amateur Radio is the joy of completing a do-it-yourself project and making it work. Many of us who have been around this hobby for a long time grew up putting together Heathkits. While somewhat of a *paint by the numbers* endeavor, the results were usually very satisfying, in spite of the occasional frustrating moment. The Heathkit manuals were good at explaining circuit functionality as you soldered along. If you diligently followed the directions, results were good.

Today's hams are faced with a wide choice of commercial gear that is ready to go out of the box. Prices for new HF linear amplifiers are right up there with solid state transceivers, perhaps making them a hard sell for the family budget.

I suspect that many amateurs are fearful that older amplifiers will not work, or they are apprehensive of their skills in keeping them running. If one understands the basic circuits and gets comfortable with the nuances of the older vintage radios you can maintain them for years, and they will perform watt for watt with the high-priced alternative. You will also be very proud of your growing knowledge and skills.

Where to Start?

Many of the older amplifiers were of a grounded grid configuration using one of a number of power triode tubes. The Heathkit SB-220 (or the similar SB-221) is a good example of a very popular vintage amplifier. There were thousands of these kits sold in the 1980s. The SB-220 used a pair of Eimac 3-500Z power triodes. They put out an amazing punch doing yeoman's duty on a daily basis. Today an SB-220 or '221 sells for around $600, depending on condition, on the popular auction or used equipment Web sites. When you consider that a comparable current model commercial amplifier costs perhaps three to four times this amount, they can represent a great value — if they work!

Many older units use tubes that are no longer produced and can be very expensive or not even available. The 572B and the 3-500Z power triodes used in the SB-200, SB-220 or SB-221 and many other amplifiers are still produced in various off-shore facilities and are generally available.[1] It is a good idea before you buy any used amplifier to make sure that the tubes are available at a price you are willing to pay. There have been successful conversions of some amplifiers to allow the use of substitute tubes, but they often require significant modifications.[2]

Watch the Heavy Duty Pieces

The condition of the power transformer can be a major risk in buying used amplifiers. Several years ago I purchased a Heathkit SB-221 on an auction site. Before bidding I e-mailed the seller to inquire about the condition of the power transformer. He responded that the high voltage reading was 2700 V, and that the tube filaments lit up when power was applied. This confirmed that the transformer was likely to be functional. If you do get a bad one you can often find replacements at auction for about $100 to $150. The Peter Dahl Company offers new replacement transformers for both the '220 and '221, as well, but at somewhat higher cost.[3]

[1]Notes appear on page 41.

Figure 1 — Inside view of the author's Heathkit SB-221. Note the component layout.

Switch to Safety!

Before you get your screwdriver out it is important to review and then follow a few basic rules. While working with high voltage equipment, safety should be in your thoughts at all times. Figure 1 is an inside view of my SB-221 showing the DANGER sign — take it seriously! Always keep a mindset that lethal voltages are present in high power amplifiers. Many of us who grew up in the solid-state generation are not familiar with working around high voltages. An attitude adjustment is in order — you cannot be too cautious when working with lethal voltages!

- Never work on the unit when it is connected to a source of electricity.
- Use a "chicken stick" (see *QST* September 2003 or Figure 2) to make sure every contact that you intend to touch or could accidentally touch with your hands is not "alive." This is especially important around the high voltage section where electrolytic capacitors could be still charged.
- Do a second grounding check with the chicken stick to verify that there are no voltages present around the working area.
- Wear rubber-soled shoes so that your feet are not grounded.
- Never stand on wet surfaces.
- If possible use only one hand keeping the other in your pocket.
- Never work on amplifiers if you are tired.

Wall Power

High power linear amplifiers require a lot of input power. An amplifier that puts out 1000 to 1500 W usually requires at least of 20 to 30 A at 120 V ac, which will likely overload the service to your shack, dim the lights and trip the circuit breakers. Using 240 V ac is almost a must unless you have unusually heavy feed lines for your 120 V ac service. It is relatively easy to wire in the higher voltage as most homes have 240 V ac service to their electrical panel.

Have an electrician install a separate circuit breaker at the service box of appropriate size to handle your amplifier. Another box with an easy to reach breaker in the shack is a good safety feature. The electrician should provide an outlet for the correct capacity (unlike the common 120 V plugs and sockets, 240 V sockets are different sizes and pin configurations for different capacities). Next you will need to obtain a matching plug for your line cord, if the right one wasn't on your amplifier.

What's in the Box

Understanding the basic flow of the schematic is important to gain a comfort level in working with amplifiers. I segment the schematic so it is more easily understood. Let's start with the high voltage supply. The Heathkit circuit is typical of most amplifiers in that the design uses a voltage doubling circuit to save on the size and cost of the power transformer.

The Power Supply

A look at the transformer connections, Figure 3, indicates the manner in which one can use either a 120 or 240 V supply by properly connecting the dual primary windings. If 240 V is to be used, the primary windings are simply connected together in series at the mid-point (terminals 2 and 3) so they act as a single winding. Conversely, the midpoints can be wired in parallel for 120 V (1 and 2, 3 and 4). This results in the same voltage across the secondary of the transformer windings. Note the switch on the primary windings. This is to lower the high voltage for the heavier duty cycle required using CW mode.

The high voltage power supply circuit is fairly conventional. The secondary windings have about an 8:1 or 4:1 ratio to the primary windings — depending on how you wired the primary. The voltage across the secondary will be about 960 V ac.

To understand how voltage-doubling circuits work one only has to follow the flow of current during the ac cycle. A simplified schematic of a voltage doubling supply is shown in Figure 3. We know that household electricity is alternating at 60 cycles per second. During the positive phase the voltage starts at zero and quickly rises to its peak of about 158 volts. The secondary voltage, 960 V_{RMS}, will have a peak at 1357 V.

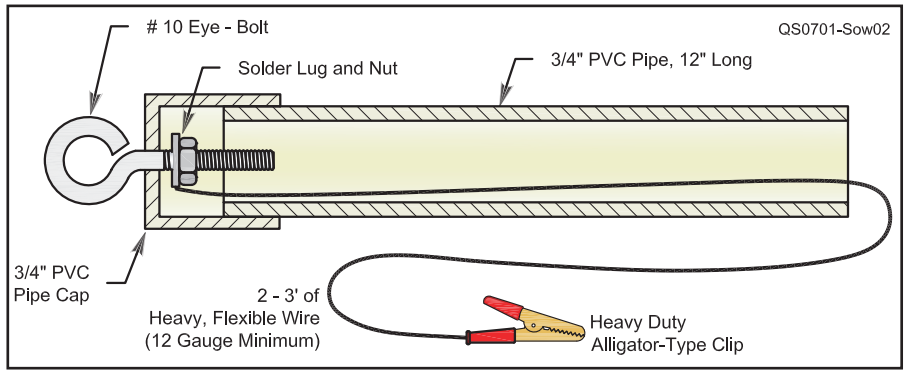


Figure 2 — Chicken stick. Adding a 10 Ω, 10 W resistor in series with the grounding lead will avoid discharging capacitors too fast and possibly damaging them.

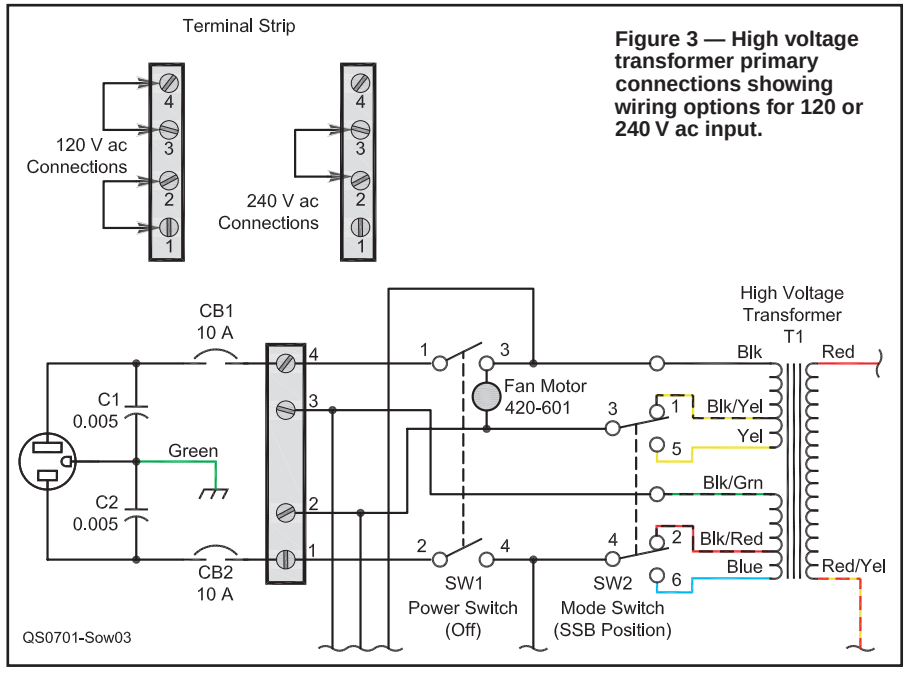


Figure 3 — High voltage transformer primary connections showing wiring options for 120 or 240 V ac input.

During the positive portion of the cycle, the rectifier diodes wired for the positive voltage, as shown in Figure 4, begin to conduct and charge the filter capacitors. Heathkit engineers used eight electrolytic capacitors, linked together as two sets of four in series, to handle the high voltage.

Rectifier Voltage Doubling Circuit

When the cycle goes negative the positive directed diodes stop conducting and the negative directed diodes start up allowing current to flow into the negative terminals of the second set of four electrolytic capacitors. This current also terminates to the return secondary winding.

Voltage measurements across these four capacitors will be the same as the first four, or about 1357 V. After one complete cycle the voltage across both sets of four capacitors in series will add to 2714 V, from the top of the first set to the bottom of the second set. The effect is to double the peak voltage of the power transformer secondary. A pretty slick trick!

Voltage Doubling Downside and the Cure

The main disadvantage of these circuits is less than stellar voltage regulation. A high sustained current will draw down the capacitor voltage significantly. This is understandable if you think of the capacitors as if they were batteries. Of course, the more net capacitance in the circuit the more they can deliver before the voltage drops too much. Heathkit engineers used 200 µF electrolytic filter capacitors. Since there are a total of eight in series, the net capacitance is about 25 µF (200/8).

With computer grade electrolytic capacitors available at reasonable prices, replacing the older capacitors with brand new ones that have considerably higher ratings is recommended. Changing them out is a good idea as more than likely the originals are the same age as the linear and likely "leaky." There are usually telltale indications of age, especially

if the containers look bloated. I used new replacements rated at 470 µF, 450 V.

The new ones were about half the length and the same diameter as the originals. The net capacitance after the change works out to 58 µF (470/8). This is more than twice the original total of 25 µF! They all easily fit into the original casing.

Make sure you wire the new capacitors taking into account the marked polarity. Follow the schematic to make sure you are wiring them properly. You might want to take a digital picture of the original wiring to use as a guide. When you get done have someone look over your work to make sure you have them properly connected.

Some hams like to replace the bleeder resistors with higher values such as 100 kΩ, in order to reduce the heat dissipation from the original 30 kΩ wire wound units. I used the originals and made sure they were mounted with a reasonable amount of clearance in order to allow proper convection cooling. The 30 kΩ resistors provide improved voltage regulation compared to higher value units and are very sturdy. Either approach will work okay.

One of the issues with the increased capacitance is the surge of current that happens when the amplifier is first turned on. While I designed a circuit (**www.k0gkd.com/sb220.html**) for my conversion I don't believe it is necessary addition. At worst you may kick out your circuit breaker in the shack. Harbach Electronics makes a suitable surge delay circuit, which is easy to install.[4]

Check Those Diodes

The rectifier diodes should be examined. More then likely they are good. You can check them while they are in the circuit by using an ohmmeter set to the 1000 Ω range. (Be sure capacitors have been discharged with the "chicken stick.") By placing the positive (red) lead on the anode side of the diode (away from the point of the arrow marking), and the black or negative lead on cathode marking you should obtain a relatively low resistance. Reversing the leads of the ohmmeter should show a much higher resistance. By checking each diode this way you can ensure that they are all functional. Diodes that have broken down due to voltage or current excesses almost always show a direct short. If you replace them, do so with higher values than the original diodes, and replace all of them. Use new ones that have at least a 1000 V PIV and 3 A rating. You can buy them for about $0.35 each.

Keep in mind the diodes are hooked up in series so they can take the high voltage across the capacitor bank of approximately 3000 V. Shunting each diode with a ½ W, 470 kΩ resistor, and a 0.01 µF, 1 kV bypass capacitor, is a good idea, and absolutely necessary if you use dissimilar diodes.

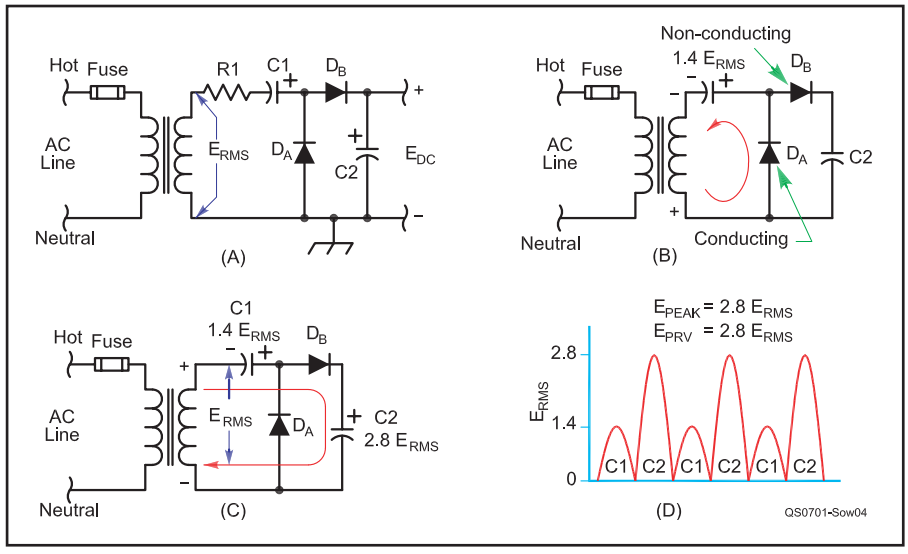


Figure 4 — Simplified schematic of a half-wave voltage doubling power supply as used in many amplifiers of the period (A). B shows the first half cycle charging C1. At C, during the next half cycle, C2 charges in series with C1 resulting in the sum at the output. D shows the voltages levels each capacitor charges to as a function of time.

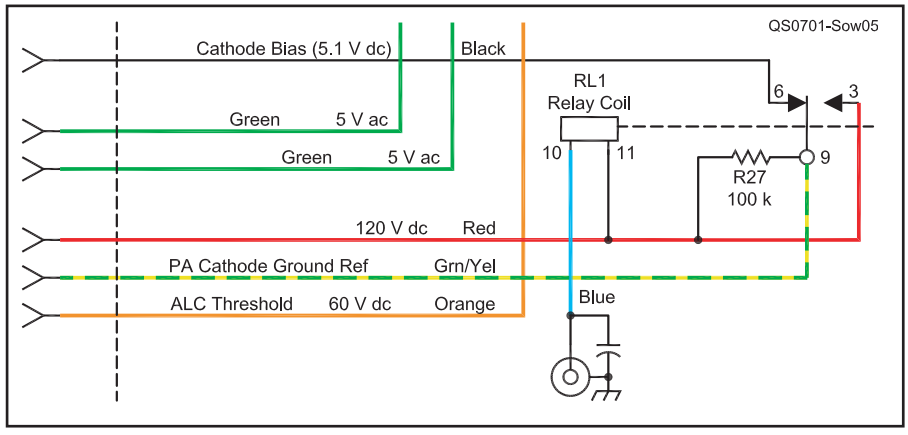


Figure 5 — SB-221 bias switching circuit.

Bias Supply

Most amplifiers such as the SB-220 have separate bias power supplies. The bias filter capacitors should also be replaced since they are likely to dry out and fail in time. You can usually find a substitute in the parts box that will handle the voltage (150 to 200 V dc). Make sure the polarities are connected properly. Also check the rectifier with the ohmmeter to make sure it has not failed.

There as are many different bias configurations as there are different amplifiers. The bias supply for the SB-220 uses positive dc voltage rectified off of T2, which also operates the K1 relay and supplies the ALC threshold voltage.

Bias Schematic

Let's follow the bias around so we can comprehend the role it plays with the 3-500Zs. The positive dc voltage is connected to lugs 3 and 11 of the TR relay, RY1, as shown in Figure 5. In the receive mode the bias is applied through lug 9 to the center tap of the filament winding. See Figure 6. This positive voltage increases the potential difference between the tube grids, which are grounded, and the tube filaments, which now carry both the ac filament voltage and the bias. The grids are therefore cut-off and no plate current flows. On transmit, the TR relay switches the 120 V bias through R27 (100 kΩ) at which point it is grounded through the 5.1 V zener diode ZD1, and the 0.82 Ω, 2 W resistor R3. This drops the bias to about 2 V and allows the 3-500Z's idle plate current to rise to about 125 mA.

The zener diode In the SB-220/221, ZD1, should be evaluated. Some manuals show ZD1 mounted on the rectifier diode board, but it was later removed due to heat considerations. It should be mounted on the side aluminum panel, which acts as a heat sink, adjoining the rectifier diodes. It has a feed through insulator to keep the mounting bolt from coming in contact with the panel and a

mylar washer for the mounting nut. Usually the diode will fail because it shorts out to the panel. It must be kept insulated from the chassis. If you need a replacement it can be ordered from RF Parts (1N3996A with hardware).[2]

TR Switching

Many newer transceivers have lower limits for TR switching voltage and current than the levels present at the TR jacks of vintage amplifiers. My FT-990 will not take 100 V of the SB-220, for example. The high bias voltage will damage the circuit so a modification is necessary. The easiest approach is to use a small 9 V dc relay, readily available at RadioShack. The terminals of the relay can provide the grounding function. By re-connecting the bias voltage wire that goes to the back of the amplifier at the TR terminal to one of the contacts on the relay, and the other relay contact to ground, the bias voltage is isolated to the relay. To power the relay I strapped a 9 V battery with the negative lead grounded and the positive lead wired in series with the relay coil and the terminating lead connected to the ANTENNA RELAY terminal on the back of the amplifier. When the 9 V dc is grounded by the external transceiver, the relay is activated grounding the 100 V bias through the new relay contacts, which in turn activates the Heathkit transmit/receive relay, RL1. See Figure 7, shown in receive mode.

The battery should last at least a year in normal operation. Alternatively, most modern transceivers have their supply voltage of 12 to 13.5 V available at the back of the unit. You could use a 12 V relay by providing the transceiver voltage to activate the relay. The return lead for the 13.5 V can be routed to ground through the transceiver's circuit. Use shielded cable for both the voltage and the relay grounding wires to avoid the possibility of picking up stray RF.

Parasitic Suppressors

Make it a point to examine the parasitic resistors used on the plate feed for the 3-500Z tubes. The parasitic suppressors show up clearly in Figure 1, near the plate caps.

These resistors are in parallel with the small RF chokes and connected to the plates of the tubes (note the top of each 3-500Z). Normally they are carbon 2 W, 33 Ω resistors. Often they are burned because of runaway currents resulting from the amplifier being mistuned. If they look charred, they should be replaced.

Heathkit tied the grids to ground in the SB-220/221 through a series of capacitors and RF chokes in order to reduce parasitic oscillations, An Eimac application note for a pair of 3-500Zs shows the grids firmly grounded and everything I have read advocates this approach. Accordingly, I disconnected the chokes and capacitors and wired the grids to ground with copper wires. The amplifier seems to load more easily after the change.

Tuned Input Network

Check over the input circuit during your restoration. Most of these circuits are very basic networks designed to provide a 50 Ω load to the exciter. The original Heathkit input coils in my SB-221were falling apart and impossible to tune. Over the years they just disintegrated. Accordingly, I decided to change the front end of my amp altogether. Following an application note from Eimac, I installed simple L/C circuits as shown (see T1 through T5 in Table 1).

This modification works well providing you are not having problems loading the amplifier using the original input circuit. Heathkit did not provide tuned input networks for 15 and 10 meters. Adding these using the

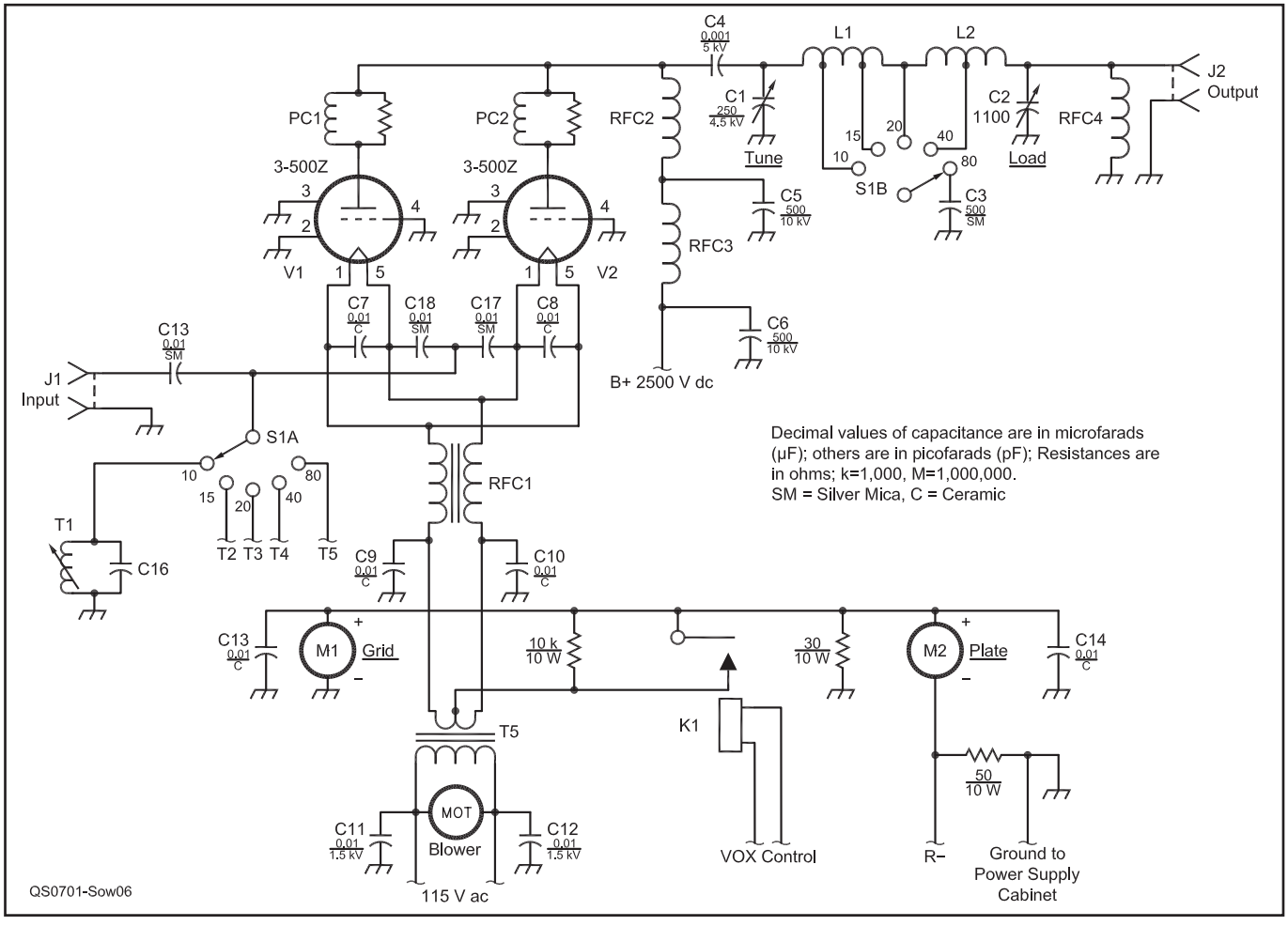


Figure 6 — RF amplifier circuitry of SB-221.

Table 1
Input Network Components

Part	*Band*	*Inductance*	*Capacitance**	*Resonance*
T-1	10 meters	0.15 µH. 4 turns #14 AWG on ½" form, ½" long	200 pF	28.7 MHz
T-2	15 meters	0.15 µH. same as T-1	470 pF	21.3 MHz
T-3	20 meters	0.31 µH. 6 turns #14 AWG on ½" form, ½" long	470 pF	14.2 MHz
T-4	40 meters	0.31 µH, same as T-3	940 pF***	7.2 MHz
T-5	80 meters	1.3 µH, 13 turns #18 AWG on ½" form, ½" long	940 pF***	3.8 MHz

*All capacitors 1 kV silver mica in parallel with inductor.
**National XR-50 slug tuned form.
***Two 470 pF in parallel.

Eimac data may improve performance.

Output Network

Look over the output network circuitry to see if there are any telltale signs of trouble. Make sure the RF choke has continuity. Also the isolating "door knob" capacitor should be observed (C4 in the Eimac application above). I like to make a continuity check using a volt/ohm meter with one lead on the anode, where the parasitic choke and resistors feed the tube, and the other to ground. If there is a safety interlock switch, place a folded piece of paper between the contacts before making the continuity check. Be sure to remove it before powering up. You should get a nominal reading of about 100 kΩ. If you show a short to ground you need to look around and find the problem.

Initial Smoke Test

Once you have examined the unit for these types of potential problems, and made all of the final checks, you can fire up the amplifier without the tubes.

Before going further make sure the amplifier is grounded separately in addition to the electrical ground (through the power leads). Also many amplifiers have interlock safety switches that short the HV to ground when the inside panels are not secure. So make sure you have the shielding panels secure.

Place the amplifier on your workbench in a manner that will allow you to safely check the bias voltage. Make sure the power switch is off and plug in the unit. Turn on the power switch. Carefully check the bias voltage with your voltmeter. It should read about 120 V dc. Check the filament pins to confirm they are being fed with the proper voltage. (Remember you are checking ac voltages at the filament pins, and dc on the bias supply). Don't worry if the voltage is a little low. The filament wires coming off of the transformer are usually green, and the choke is on the underside of the chassis.

The filament choke feeds the filaments with the current they need, and at the same time provides a high impedance to the RF drive voltage being fed directly to them, to isolate the RF from grounding through the center tap of the transformer winding.

Power On Test

If everything checks out, insert the tubes and you will be ready for a dummy load test. With the unit grounded, and a adequate dummy load hooked to the output of the amplifier, route the coax from the transceiver to the INPUT connector, and terminate the OUTPUT to the dummy load. Connect the relay terminal to the exciter or transceiver as noted in your manual using shielded cable — note: the circuit should be open in the receive mode. (The shield can act as the return.) Plug in the amplifier. Hook up a PTT microphone to the transceiver. After double-checking all of the connections turn on the power of both units. Make sure that the transceiver and amplifier are set to the same band.

With the drive level of the transceiver at the lowest power setting and in the CW mode key the transceiver on. The amplifier relay should engage and the plate current should now indicate about 100 to 120 mA. Very slowly increase the drive until the plate current of the amplifier starts to rise. Immediately dip the plate tuning capacitor of the amplifier for minimum plate current. Follow the operating manual loading instructions, which probably suggest you tune to maximum RF output. The amplifier should load to 700 mA of plate current. Note the color of the tubes, as they should start to glow a pinkish hue. Each tube should glow about the same as its twin.

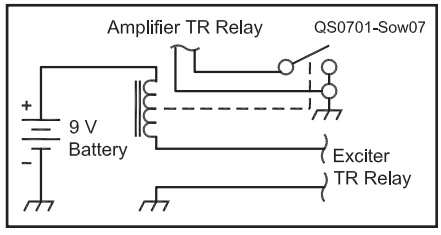


Figure 7 — Auxiliary TR switching relay circuit.

Place the transceiver in SSB mode and reduce the mike level to the minimum. Key the microphone and begin speaking and advancing the mike level or drive until voice peaks move the plate current to the 300 to 400 mA range. With a well shielded receiver (or spectrum analyzer, if you have one), remove the receive antenna connection and adjust the gain and attenuation so it is not overloaded. Listen to your signal for signs of distortion. Tune around your signal frequency looking for spurious signals. If there are no problems you are set to move forward.

On the Air

In operation you will normally have more than enough drive to reach full output with a 100 W exciter. Running the amplifier at a reduced level will extend the life of the tubes for years, and make very little difference in the output of the unit. It is always a good idea to monitor the power output and the SWR while operating.

If at any time during the entire process you are not sure that you understand what you are doing get help from a fellow amateur. It is a good safety idea to have someone run the tests with you. Always remember to be aware of the high voltage and follow good safety practices. Safety should be firmly set in your mind so that you will not become careless. This awareness will allow you to work with confidence.

Now you will have that added punch that will get you a 59+ report, and the bigger thrill to some degree of "rebuilding your own"! Trust me – it is much more satisfying to use your rebuilt "boat anchor" than the commercial one, and the cost savings really help the pocket book. Remember, think "safety"!

Notes
[1]RF Parts (**www.rfparts.com/tubetran.html**) carries a good selection.
[2]For an elegant example, see **www.dk9ip.ba-karlsruhe.de/pdf/mla2500**.
[3]**www.pwdahl.com**.
[4]**www.harbachelectronics.com**.

Tom Sowden, KØGKD, received his General class license at age 15 in the small town in Kansas where he grew up. Tom has always enjoyed building equipment. During his teenage years he built Heathkit equipment to be able to get first class gear at an affordable price.

He graduated from Northwestern University in Evanston, Illinois with a degree in investment management and first worked in New York as a trainee for Standard & Poor's Corporation. He then joined the Navy and served on a minesweeper off the coast of Vietnam. He has had several careers including 20 years in the flour milling business and 20 years in the bag business. He is still involved with the latter in the Kansas City area where he owns and manages his own company.

Tom has three children and four grandchildren. You can reach him at 4450 W 188th St, Stilwell, KS 66085 or at **k0gkd@arrl.net**.

The Golden Anniversary of the Collins KWM-1

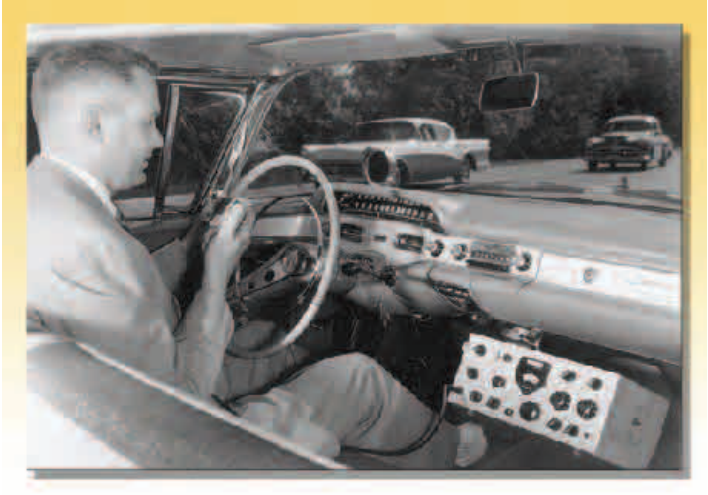
2007 marks the 50th anniversary of the introduction of the amateur rig that became the model for modern radio communication gear—the Collins KWM-1 transceiver.

Mike O'Brien, KØMYW

COURTESY JAY MILLER, KK5IM

When Gene Senti was reflecting in 1991 about his homebrew experiments that pointed the direction that radio manufacturers have followed over the half-century since, he modestly conceded that his brainchild, the KWM-1, "turned out to be a pretty good little rig."

COURTESY ROD BLOCKSOME, KØDAS/COLLINS RADIO CO ARCHIVES



The Collins KWM-1 in a 1958 Chevy Impala. This picture, from a Collins ad in the July 1958 issue of *QST*, featured John Hunt, K7XE (ex-WØYBE), the amateur product manager for Collins. The car belonged to Arlo Meyer, WØLBK, who designed the KWM-1's mobile mount.

Not much larger than a shoe box, the KWM-1 was in stark contrast to the typical amateur station setup of hefty separate receiver and transmitter, the latter sometimes as bulky as a refrigerator. The *QST* review (Apr 1958, pp 23-27) of the new transceiver prophetically observed that "… the KWM-1 may well mark the end of one era and the beginning of another."

Although the KWM-1 was developed by the renowned Collins Radio Co, one of its most remarkable aspects is that it originated not in a sophisticated factory laboratory but rather in a home basement workshop. In 1956 Gene Senti, WØROW (SK), then 38 years old and in his 14th year as an engineer with Collins in Cedar Rapids, Iowa, began tinkering with his personal 75A-4, the top-of-the-line receiver he had designed for Collins a couple of years earlier. He described his home experimenting as "…taking the receiver's block diagram and running it backward."

"I was trying to figure out a way to use the 75A-4's high-stability PTO (permeability-tuned variable oscillator), with its good linearity, along with the crystal oscillator for injection purposes in a transmitter," Senti told me in a 1991 interview.

"I took the signals from the oscillators out of the 75A-4 with some pieces of coax and re-combined them in a separate chassis. I also took out the BFO (beat frequency oscillator). So I was using all three of the receiver's oscillators. All I had to do was come up with new mixers."

While he toyed with the circuitry, Senti also began dreaming of the convenience such a setup could bring to his amateur station.

"After I saw where I was heading, I thought to myself, 'Gee, this could be neat! All I'll have to do is tune in a signal and my transmitter will be zero-beat with it.' So I went ahead and hooked it up — and, by golly, it worked!"

Refinement of Old Idea

The concept of a station-in-a-box can be traced back to the very beginnings of Amateur Radio. It might be said that early regenerative receivers were accidental transceivers because their oscillations sometimes could be copied a mile or more away.

Compact transmitter/receiver combos were popular as far back as the 1920s for portable and emergency use. In the 1930s, the ARRL's *Radio Amateur's Handbook* promoted such rigs for the 5 meter (56 MHz) band because short antenna length requirements encouraged mobile operation.

The 1935 *Handbook* used the term "transceiver," noting, "In such a unit the same tubes, power supply and other components are used for both transmission and reception, with the obvious result of reduction in the cost, size and weight of the apparatus."

Over the next 20 years, many homebrewers and a few commercial manufacturers produced rigs that were called transceivers, though they were mostly separate transmitters and receivers packaged together in one cabinet. They did not have the KWM-1's ability to electrically vary receiving and transmitting

The KWM-1 and Military Spies

Although the KWM-1 was marketed as a ham rig, the US military and government agencies were among the first to put the transceiver to use.

For instance, when Richard Nixon visited South America in 1958, the Secret Service detail accompanying the Vice President carried a KWM-1 in a special suitcase. When the trip was disrupted by violent mob scenes in Venezuela, agents used the transceiver to communicate with Washington and coordinate a hasty exit for Nixon, according to Jay Miller, KK5IM, in his book *A Pictorial History of Collins Amateur Radio Equipment* (Trinity Graphic Systems, 1999)

Art Collins' personal friendship with Strategic Air Command chief General Curtis LeMay, KØGRL (later K4FRA and W6EZV) (SK), and SAC's vice commander, General Francis "Butch" Griswold, KØDWC (SK), led to widely publicized airborne demonstrations of Collins SSB equipment that helped promote acceptance of the mode in the mid-1950s.

But SAC's most exotic application of the KWM-1 went unpublicized — because the transceivers were installed aboard U-2 aircraft that were secret until one piloted by Francis Gary Powers was shot down over the USSR in 1960.

KWM-1s in the U-2

Powers' plane was operated by the Central Intelligence Agency and, contrary to ham lore, was not equipped with a KWM-1. The CIA fleet of U-2s carried no long-range radios "for fear that any HF transmission from an overflying U-2 would give away its position to the unfriendlies on the ground below," says Chris Pocock, author of *50 Years of the U-2* (Schiffer Publishing Ltd, 2005), the comprehensive history of the spy plane.

After Powers' shootdown, the CIA did install an HF rig, the Collins 618T avionic transceiver, in the agency's U-2s, but only to transmit automatic bursts of data that indicated aircraft performance during flights over hostile territory.

Meanwhile, the mission of U-2s procured by SAC was not to invade enemy airspace, but rather to sniff for high-altitude traces of nuclear testing while staying in friendly or international skies. So, says Pocock, in late 1957 SAC began installing KWM-1s in its U-2s to allow pilots "…communication during their long, lonely sampling flights across remote wastelands."

The choice of the KWM-1 for that role probably came from Ray Meyers, W6MLZ (SK), who at the time was manager of radio operations for Lockheed Aircraft Co, which created the U-2 in its clandestine "Skunkworks." Generals LeMay and Griswold, avid Collins buffs, no doubt readily concurred.

The only spot in the cramped U-2 that initially could be found for the KWM-1 was a pressurized compartment called the Q-bay, located behind the pilot, says Joe Donoghue, who served with an overseas CIA U-2 detachment in the 1960s and more recently has researched declassified U-2 documents in the National Archives. Later, space was found to mount the KWM-1 in the U-2's "cheek" behind the rightside engine intake, although that installation required addition of a pressurized box to house the transceiver to ensure proper operation at the U-2's extreme operating altitudes (70,000 plus feet).

Because the KWM-1 was out of the pilot's reach in either configuration, there has been speculation in ham circles that mechanical extensions must have been fashioned to allow the pilot to operate at least some of the transceiver's panel controls; however, Lockheed documentation specifies only an electrical wiring harness.

Both Pocock and Donoghue describe the KWM-1's setup aboard the SAC U-2s as "fixed channel." With the KWM-1 pre-tuned to a locked frequency, all the pilot would need was a push-to-talk microphone — and not even that if VOX were used — and receiver audio plumbed to his helmet.

In that light, it seems likely that a couple of rare KWM-1 accessories made available to amateurs by Collins may have been rooted in the transceiver's mission aboard the SAC U-2s. The 399B-1 was billed as a "DX Adapter," allowing split-frequency operation of the KWM-1 (an "export model" was labeled the 399B-2). The 399B-3, described as a "Novice Adapter," provided crystal control of the KWM-1 transmitter section to comply with restrictions imposed upon Novice class licensees for 15 meter CW operation in the 1950s.

The KWM-1s in the U-2s operated by SAC apparently remained in operation until the mid-1960s, when they were replaced by the more cockpit-friendly 618T.

frequency synchronously with a single knob.

By the 1950s, Collins engineers were very familiar with the advantages of easy-to-tune rigs, thanks to extensive experience with designing avionics for military, commercial and private aircraft. So it was natural for employees such as Phineas Icenbice, W6BF (then WØNKZ), to explore to transceiver schemes — in his case, experimenting with a 75A-2 receiver and a simple exciter that he still displays in his California shack.

Warren Amfahr, WØWL (then WØWLR), was working for Boeing in Wichita, Kansas in 1954 when he put his own homebuilt SSB rig on the air and found himself talking with Art Collins, WØCXX (SK), who was using one of the first Central Electronics 10A SSB exciters to drive the final stage of a Collins KW-1 AM transmitter as a linear amplifier. Collins invited Amfahr to Cedar Rapids for an interview. When Amfahr accepted Collins' job offer, he found other engineers, such as Leon Griswold, WØDXN, toying with the idea of using common oscillators to control the frequency of a receiver and transmitter simultaneously.

Amfahr says he may have influenced Art Collins' leaning toward a mobile transceiver. "I went in to work on a Saturday morning and parked my car on the first row, which was something you didn't dare do during the week because it was Arthur's row. Just as I was getting out of my car, Arthur pulled in next to me.

I thought I was going to be in big trouble. But he wanted to look over my homebrew mobile rig. I was using a pair of 6146s as the power amplifiers. That was unusual for a mobile setup in those days, and Arthur expressed quite a bit of interest. Of course, the KWM-1 wound up using a pair of 6146s."

Top Boss Gets Involved

Of all the Collins engineers experimenting on their own with transceiver schemes, Gene Senti was having the most success. He shared his growing excitement with fellow engineers at the factory. Scuttlebutt eventually reached the top boss, and there came a knock on the door of the Senti home one evening in the spring of 1956.

"Mr Collins came to my basement for a demonstration in my junky workshop," Senti recounted. "I was kind of embarrassed, but he seemed to enjoy it."

Art Collins promptly set a factory team to work on Senti's concept. Before the year was out, 25 pre-production KWM-1s were up and running.

The KWM-1 employed two dozen vacuum tubes, putting out about 175 W of SSB or CW. In keeping with the company philosophy of promoting SSB, there was no provision for AM in the KWM-1, although at the time, AM still was the dominant mode of voice transmission on the amateur bands.

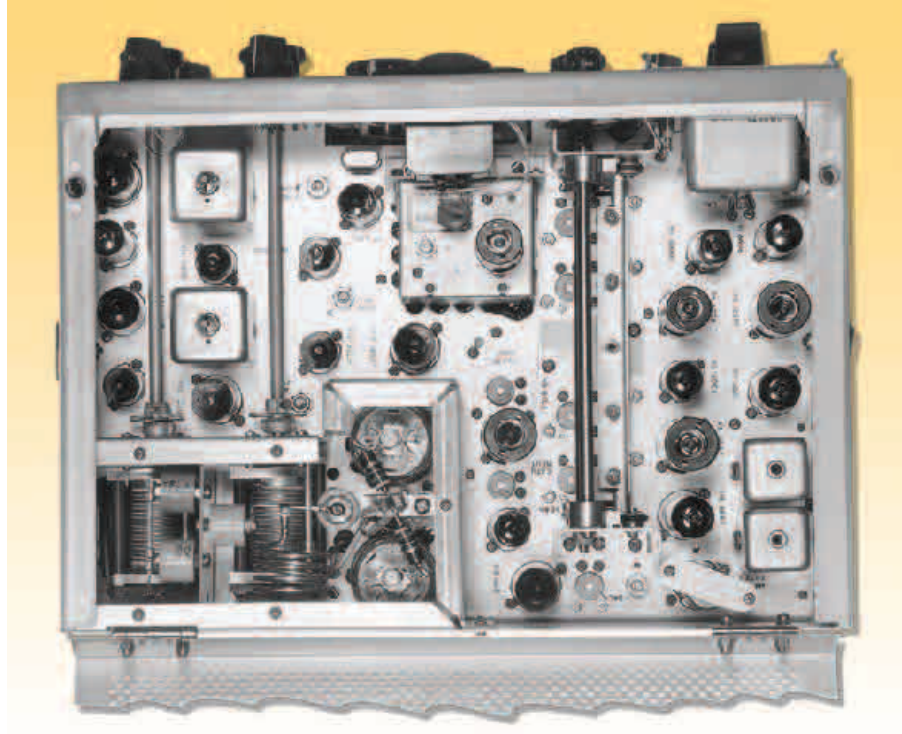
The 15 pound KWM-1's dimensions — 14 inches wide, 10 inches deep and just a bit over 6 inches tall — would make it an impossible fit in most of today's tightly packed automobile interiors. But there was sufficient free space beneath the dashboard in most 1950s sedans to mount the KWM-1, with the separate mobile power supply going into the trunk. A Collins mechanical engineer, Arlo Meyer, WØLBK, who later helped Senti design the 30L-I amplifier, was called in to create a mounting kit.

"Ernie Pappenfus, K6EZ (then WØSYF) (SK), director of SSB development for Collins, told me, 'I'll give you one of the (KWM-1) prototypes, if on your own time, you'll go figure out how to mobile-mount the thing,'" Meyer recalls. "I took a wooden mockup to all the local car dealers and made measurements to see what length of brackets and screws would be needed to mount the rig under the dash or on the floorboard of all the popular models."

COURTESY ROD BLOCKSOME, KØDAS/COLLINS RADIO CO ARCHIVES

The front of the KWM-1.

COURTESY ROD BLOCKSOME, KØDAS/COLLINS RADIO CO ARCHIVES



An inside look at the KWM-1.

Introduction of the KWM-1

When introduced in the spring of 1957, the KWM-1 carried a list price of $770. A 12 V transistorized dc mobile power supply (516E-1) was priced at $248, while a 115 V ac power supply (516F-1) for fixed use sold for $103. Other available accessories included the MM-1 handheld dynamic microphone for $25; the 351D-1 mobile mounting tray for $22; the 312B-1 speaker in cabinet for $25, and the 312B-2 speaker console with a directional wattmeter and phone patch for $146.

The KWM-1 featured a plug-in module that held 10 crystals, each allowing the transceiver to cover a 100 kHz span. The operating crystal was selected by a rotary switch. The standard crystal complement covered much of the 20, 15 and 10 meter amateur bands. (The 11 meter band was closed to amateurs in September of 1957, just as the first production KWM-1s were hitting the airwaves.)

A rare accessory was the 399B-1/2, the "DX Adapter," which replaced the standard crystal module and allowed the KWM-1 to transmit and receive on split frequencies. An even scarcer item was the 399B-3 "Novice Adapter" that provided fixed crystal control for the transmitter.

The KWM-1's standard ability, however, to precisely vary the transmit and receive frequency with one dial led Art Collins to conclude that "the simple frequency control would appeal to the mobile operator because he wouldn't have to take his eyes off the road so much to tune," said Senti.

Just making SSB intelligible was a challenge to many AM-oriented operators in the 1950s. In his *QST* review of the KWM-1, Byron Goodman, W1DX (SK), observed, "There are still some hams who claim that tuning in a side-band signal is something that

The April 1958 *QST* ad targeting XYLs.

requires the patience of Job, the fine touch of a cross between a surgeon and Michelangelo, the luck of a Croesus and a lot of natural talent. They have never tuned the KWM-1. Combining a slow tuning rate (22 kc per knob revolution) with a good avc system makes it no trick at all to tune in a side-band signal."

Practical mobile antennas also played a role in the decision to limit the KWM-1's coverage to 14-30 MHz, according to Senti. "Mr Collins said to us, 'The lower in frequency you go, the more loading coil and less antenna you have.' He told us to concentrate on 10 through 20 meters, and to worry about the rest later. Also, there were bad spurious emissions in the 80 meter band in our early models that weren't the type of thing you'd want to sell to the public."

Clever and Successful Marketing

Despite the early emphasis on mobile operation, Collins eventually began touting its advantages for home stations, as well. Recalled Chuck Carney, WØDGJ (SK), Collins amateur product manager in the late 1950s, "Our field salesmen were mentioning little incidents at the ham shows and symposiums. A couple would come up to the KWM-1 table, and she would say something like 'Now why can't your radio look like that?' with maybe a little elbow jab. And I decided to try something that I don't believe had ever been done before — direct some of our magazine ads to the XYL."

For instance, in the usual page 2 full-page Collins advertisement in *QST* for April 1958, the headline addressed the message "To XYL's Only" and asked:

"Does your OM's hamshack resemble a surplus store? Are you afraid to clean 'that corner' for fear the vacuum cleaner will inhale cables, spare tubes or crystals? For your own future peace of mind, why not describe Collins' compact KWM-1 to him: small enough to fit neatly into the bookshelves in the living room…"

Present day company engineer Rod Blocksome, KØDAS, has determined approximate production totals for several pieces of vintage Collins amateur gear, combining surviving company records with survey results conducted among members of the Collins Collectors Association. When KWM-1 production ceased in the autumn of 1959, about 1150 transceivers had been built, Blocksome's research indicates.

By that time, the Collins 32S-1 transmitter and 75S-1 receiver were on the market, with the capability of being cabled together for common frequency control. November 1959 saw introduction of the KWM-1's successor, the KWM-2 transceiver, which added 40 and 80 meters and other refinements to the original KWM-1 package. The KWM-2 continued in production until 1982, with nearly 30,000 built, according to Blocksome.

The Collins legacy continues under the Rockwell Collins banner. The company is a major producer of electronic hardware and software for the military and the aviation industry.

The last Collins rig marketed to amateurs was the KWM-2's successor, the Rockwell Collins KWM-380. That solid-state transceiver was introduced in 1980, and about 3000 (including a general coverage version, the HF-380) were built during its six year production run.

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For more information on the KWM-1 and its competition, visit **www.arrl.org/files/qst-binaries/obrien0107.pdf**.

Mike O'Brien, KØMYW, an Amateur Extra class licensee, was first licensed in 1957 when he was 12. After 20 years as a newspaper journalist, he came back to ham radio and began acquiring the rigs he lusted after in his youth. Currently a college journalism instructor, he continues to write for newspapers and other publications. He has been published before in QST*, writing articles on early Hallicrafters transmitters and the 1947 Gatti-Hallicrafters DXpedition to Africa. Mike lives in Springfield, Missouri and can be reached at* **k0myw@sbcglobal.net**.

How the FCC Helped to End World War II

A first-hand account how the Federal Communications Commission helped make portions of the Pacific Theatre safer for pilots and brought WWII to a speedier end.

M. Walter Maxwell, W2DU

Have you ever heard of the RID, the Radio Intelligence Division of the FCC? Unless you were born before 1930, it is likely that you never have. Due to the secrecy of its operations during World War II, there was practically no publicity surrounding its existence. There was one article, however, in the October 1944 issue of *QST*, "Hams in the RID," by Oliver Read, W9ETI, which described its operations at the primary FCC monitoring station at Allegan, Michigan.

What was the Radio Intelligence Division of the FCC? To answer that question, you need to know some of the wartime history of the FCC. I say "some" of the history, because of the rules governing the secrecy of some wartime activities. Intelligence cases are prohibited from being divulged for 75 years following the end of WWII, leaving almost 15 years before those cases can be made public. This is the beginning of what can be told now, as some of the activities of the RID have been cleared for publication.

Prose Walker, W4BW, and Charles Ellert, W3LO. Before retiring as Chief of the FCC's Amateur Division, Walker was an engineer with Collins, and Chief Engineering Officer for the National Association of Broadcasters. Ellert was Chief of the FCC Laboratories in Maryland, where he designed the Adcock direction finders.

The NDO, the RID and WWII

With the war already raging in Europe in 1939, people at the State Department knew they were missing vital war intelligence being exchanged by radio, especially transmissions going between Germany and South America. They queried the FCC Field Division in early 1940 about monitoring to intercept the intelligence; the Field Division operated the original primary monitoring stations, performing regulatory and enforcement duties. At that time, however, the Field Division personnel had their hands full just monitoring domestic operations and had no time for intelligence monitoring.

Congress was alerted to the need for additional personnel and equipment to enable the FCC to monitor intelligence, and it approved funds for establishing a new section, the National Defense Operations section (NDO). The NDO began operations September 3, 1940, and was later upgraded to a division, becoming the Radio Intelligence Division (RID). To head the NDO, the late George E. Sterling (W1AE/W3DF) was elevated from Assistant Chief Engineer, to FCC Chief, NDO Section, and later to Chief, RID. To obtain personnel for the new Section, he instructed one of his assistants, the late Harriette Koster, to search through the file cards that contained the basic information on licensed amateur and commercial operators. She selected more than 500 operators from the file cards and sent telegrams to those selected, offering them positions of Radio Operator ($1800 per annum), Assistant Monitoring Officer ($2400) and Monitoring Officer ($3200). The entire personnel for the new NDO Section, including myself, were obtained from responses to those telegrams. I later married Harriette, and together we had four children.

The Congressional funding also supported building many new secondary monitoring stations throughout the country, each equipped with Hallicrafters SX-28 and S-27 receivers, as well as Adcock (skywave) direction finders, used to determine the location of radio stations suspected of clandestine operation.

George Sterling, WAE/W3DF, in front of the famous little grass shack in Kealakekua, Hawaii. Sterling was formerly Assistant Chief Engineer of the FCC, then Chief of the NDO Section and finally Chief of the RID.

One of eight Adcock Direction Finders (DFs) in the Hawaiian Islands. These helped pilots find their way from the Mainland to the Islands. The DFs each used Hallicrafters SX-28 receivers.

In addition, Hudson automobiles equipped with the receivers and a loop direction finder, used for mobile close-in surveillance, were a part of each secondary station.

Immediately following the attack on Pearl Harbor, December 7, 1941, the FCC RID mobilized a group from the monitoring stations to go to the Hawaiian Islands to set up and operate eight new secondary stations: one each on Oahu, Molokai, Kauai, Maui and Lanai, and three on the Big Island, Hawaii. NDO Chief Sterling accompanied the group, of which the late Prose Walker, W4BW (then W2BMX and later WØCXA), and I (then W8KHK/W8VJR) were from the primary station at Allegan, Michigan. The late Charles Ellert, W3LO, Chief of the FCC Labs at Laurel, Maryland, who designed the eight Adcock antennas we carried with us for use at each secondary station, was also in the group.

Using the Beverage Antenna

As a monitoring officer with the RID in Hawaii during WWII, I was privy to some interesting situations. Our State Department was, of course, aware of the operations occurring in the Pacific Theatre, as well as the propaganda being spewed by the Japanese short-wave broadcasters. But State was curious concerning what the Japanese living on the homeland were being told — were they being told the truth, or the same propaganda as told on the short-wave broadcasts, or an even totally different story. State asked the RID to determine whether we could obtain such information.

We cruised the AM broadcast band and found several nighttime signals from Japanese mainland stations, but most were too weak to copy; JOAK in Tokyo on 640 kHz was S9, but there was a problem in copying it. KFI in Los Angeles was also on 640 kHz with an S9 signal — copying intelligence from JOAK was impossible. How can we eliminate or reduce KFI's signal level? A Beverage wave antenna, perhaps?

We then proceeded to the northern portion of Oahu and constructed a Beverage a half mile long and 5 feet above ground that was aimed at Tokyo, terminating with a 1000 Ω pot resistor to ground at the Tokyo end. We discovered that by varying the pot resistance, we could null the KFI signal to almost zero. The resistance terminating the Beverage that produced the null was around 600 Ω. Because the matching resistive termination rendered the Beverage a traveling-wave antenna with no standing wave, the signal arriving from JOAK was terminated by the input of our receiver, while the signal arriving from KFI was dissipated in the matched resistance at the Tokyo end of the Beverage — no KFI signal was reflected toward the receiver. Voilà! JOAK was now perfectly readable for recording.

Correct Polarization Saves Lives during the War

After arriving in Hawaii in 1942, Prose Walker was appointed Chief of the newly established Radio Security Center (RSC) of the FCC's RID, located in the Dillingham Building, Honolulu (long after WWII, Walker was Chief of the Amateur and Special Services Division of the FCC). In his position as Chief RSC, Walker learned many military aircraft and its personnel were being lost, due to ditching at sea while flying from the US Mainland to Hawaii. There were two reasons for being lost: "navigationally impaired" pilots (government jargon for lost), and totally drained fuel tanks. There was naturally a limit to the size of the fuel tanks, but what caused the pilots to become navigationally impaired? That point preyed on Walker's mind, and upon investigating, he discovered a deplorable situation that needed fixing.

Dozens of green flight teams just out of flight school were awaiting new aircraft and were anxious to get aboard and proceed to the South Pacific area as soon as possible. The navigators and radio operators were taught how to use the loop direction finders (DFs), standard equipment on the aircraft. But loop DFs were incapable of obtaining reliable directional information from signals propagated by sky waves reflected by the ionosphere. The DFs aboard the aircraft were capable of delivering reliable data only when the electromagnetic energy in the received signals is vertically polarized, but the navigators and radio ops didn't know that.

Unfortunately for them, on reflection and refraction through the ionosphere, a linearly polarized wave, either vertical or horizontal, is converted into an elliptically polarized wave. This causes a continual shift in the null obtained by the loop DF, as the polarization angle of the incoming signal rotates elliptically during propagation. Consequently, once the aircraft has left the Mainland and can no longer receive the vertically polarized waves from AM broadcast stations, the only reception remaining is from sky waves propagated

far beyond the range of the ground waves of the AM stations. Therefore, bearings taken using the loop DFs aboard the aircraft when at sea beyond the ground wave signal were useless. The only way for the navigator to determine the position of the aircraft was through celestial navigation. The situation gets pretty bad on cloudy days, and that's when the pilots became navigationally impaired.

At this point Walker came up with a solution that ended the era of lost aircraft flying between the Mainland and Hawaii. Fortunately, every FCC monitoring station in the US, Hawaii, Alaska and Puerto Rico had Adcock direction finders as standard equipment. Adcocks are susceptible only to the vertical component of the arriving wave, regardless of its angle of polarization. Therefore, instead of constantly wandering as with the loop DF, the null obtained with the Adcock remains stable at constant angle, even though the angle of polarization of the arriving wave is continually rotating elliptically. In other words, Adcocks give accurate directional information obtained from sky waves.

Walker's reasoning was that triangulation from bearing measurements obtained by the FCC Adcocks taken on signals transmitted from the lost aircraft could determine its precise location, determining a course for the aircraft to fly directly to Hickam Field in Honolulu. The problem then was how to organize the communications to achieve the necessary procedure.

The CAA (then the Civil Aeronautics Administration) operated a terminal in Honolulu with facilities for communicating with all aircraft. A direct Teletype connection was set up between the CAA and the RSC, which had a kW transmitter used to communicate with the monitoring stations on all the Islands, each of which had Hallicrafters HT-9 transmitters. When the pilot of the aircraft determined they were lost, the radio operator signals the CAA, who instantly puts the aircraft's frequency on the Teletype and rings its bell, alerting the RSC operator of the situation.

The RSC operator then sends the following message in CW to all monitoring stations that are continuously monitoring the RSC frequency: LOS LOS LOS 4250 4250 4250, where LOS meant lost aircraft and 4250 was the frequency being transmitted by the aircraft. The operator of the Adcock DF station immediately tunes to the 4250 kHz frequency, hears the aircraft, and begins taking continuous bearings. The aircraft radio operator is sending long dashes, MO MO MO, enabling the DF operator to be certain he was hearing the right signal, obtaining a satisfactory bearing angle on a moderately constant signal.

As each bearing is taken by all stations, the bearing angle is transmitted to RSC, where a great circle map of the entire Hawaiian Pacific area is hanging on the wall. A compass rose is printed on the map at the location of every monitoring station in the Islands, with a hole in the center of the rose through which a weighted string is hung. A pin is attached to the opposite end of the string, and the string is stretched across the compass rose at the angle of the bearing obtained by the station represented by the rose. The pin is then pressed into the map, securing the string at that bearing angle. As the strings representing each station reporting are secured they intersect at the point indicating the location of the lost aircraft, the intersection point called a "cocked hat." It was routine for the aircraft's position to be determined within 10 minutes after the pilot alerted the CAA of its being lost.

After the aircraft's position is located, it is then given a course to fly to Hickam Field, and the bearing measurements are reported continually until the pilot can see the field. During this time, the aircraft's location is followed all the way in to the field, thus verifying the accuracy of the bearing measurements and the pilot's success in following the directions.

Once Walker's plan was in operation, no more aircraft were lost due to navigational impairment while flying between the Mainland and the Hawaiian Islands. In 1943 alone, 273 aircraft were saved by the FCC Adcocks, and more than 600 were saved during the duration of the war.

Unfortunately, planes were still lost on the run between Hawaii and the South Pacific, so the US military invited Walker to investigate. What he found there was almost unbelievable. The Army Air Corps was using Mercator projection maps for those runs, unaware that using maps of that projection produced directional errors of humongous and fatal proportions. On Walker's advice, once they acquired new maps with great circle projection, the number of planes lost on the South Pacific run dropped to zero.

All photos taken by the author in February 1942.

M. Walter Maxwell, W2DU, is an ARRL Technical Advisor working with antennas and transmission lines. A Life Member of the ARRL and QCWA, as well as a Fellow of the Radio Club of America, he was licensed at age 14 as W8KHK in 1933, and has been licensed continuously ever since. He served as antenna consultant for AMSAT, as a member of the FCC's advisory committee for WARC-79 and as trustee for K2BSA, the Amateur Radio station at the Boy Scouts of America national headquarters. He can be reached at **walt@w2du.com**.

Strays

QST congratulates…

◊Ulrich Rohde, N1UL, for being honored as a "Microwave Legend" by the staff and readers of *Microwaves & RF* magazine. See **www.mwrf.com/legends/Index.cfm**.

◊Three Kalamazoo County (Michigan) hams who received awards at the 2006 Michigan Emergency Management Association Awards Banquet in Traverse City:

Charles "Charlie" Chapman, KB8SFR, who received the Volunteer of the Year Award over 60,000 Residents for his efforts as the 5th District Radio Amateur Civil Emergency Services (RACES) District Coordinator and as a dedicated volunteer for the Kalamazoo County Office of Emergency Management.

Lt Paul R. Baker, KC8OEM, Director of the Kalamazoo County Office of Emergency Management, who accepted the Special Community Award on behalf of the county, which was singled out for "the unique manner in which first responders, planners, government agencies, volunteers, etc, pull together to create a solid commitment to serving people and the community first."

James Gorka, N8JG, Kalamazoo County Emergency Management Solution Area Planner, who received the 2006 Mitigation Award for his Kalamazoo County Hazard Mitigation Plan. — *tnx N8JG*

◊Matt Kiner, N3SOZ, who has been appointed to fill a vacancy as Mayor of Lewisberry, Pennsylvania. — *Glenn Kurzenknabe, K3SWZ*

TWO NEW YV AWARDS

◊The Radio Club Venezolano offers two new awards, the Venezuelan States Award and the Venezuelan Islands Award. Rules (in English) are available on the RCV Web site, **www.radioclubvenezolano.org**.

The Venezuelan States Award

The Venezuelan Islands Award

Going, Going, Gone!

If you've ever participated in an online auction such as the ones on eBay, you know the rush you get when you are in the last seconds of grasping that coveted item, and then ultimately being declared the winner. And while waiting for the UPS driver to bring your new treasure to your house, you are almost giddy with excitement — I know I am!

The first-ever ARRL Online Auction wrapped up Friday, November 3. And it wasn't just the winners of the 109 auction items that were giddy — ARRL staff, too, had "auction fever."

"All staff members who worked on the project enjoyed it as much as the bidders, as we saw the prices climb and bidding wars ensue," said Debra Jahnke, K1DAJ, ARRL Business Services Manager and leader of the Auction effort. "We also thoroughly enjoyed the one-on-one contact with bidders who were grateful for prompt responses to their questions, and shared our excitement with the winners."

ARRL COO Harold Kramer, WJ1B, agreed: "Everyone had a lot of fun! I always love the community-building aspects of an auction, not only in-house with the staff, but with the members, too."

Of the 109 items up for Auction, bids were received on 105. Almost 4400 people registered for the Auction, which raised $37,340 for ARRL's General Fund. According to Kramer: "Everybody had a lot of fun with this. The funds we raised will go a long way to helping realize the ARRL's four pillars of Public Service, Advocacy, Education and Membership."

The ARRL Online Auction featured both big and small ticket items. Major gifts included an acoustic guitar autographed by all members of The Eagles, graciously donated by Joe Walsh, WB6ACU; it eventually went for $3353, $1000 more than its original asking price. An Orion II HF transceiver, purchased by the ARRL for a product review, sold for $3901, $900 more than the original asking price. A Kenwood TS-2000 Limited Edition HF/VHF/UHF transceiver with serial number 73 received a winning bid of $2511, more than $1000 over its original asking price.

Plans are already underway to make the ARRL Online Auction an annual event!

S. Khrystyne Keane, K1SFA

Bid-wise, the most popular Auction item was a Yaesu FT-897D transceiver. With a starting bid of $425, it eventually went for $1001, receiving a total of 57 bids.

Another popular feature of the Auction was the abundance of vintage radio gear, some of which can be seen on the cover of this month's issue.

It seemed the items that sparked the most interest were the "junque boxes," the brainchild of Ed Hare, W1RFI, ARRL Laboratory Manager. "It was a lot of fun putting together the Lab junque boxes. When we cleaned the Lab and put the junque in the boxes, I had guessed that we would get $20 or so for each box. It was great to see the support from hams in bidding those boxes up, and in appreciation, we opened the boxes and put in better junque. I am still sworn to secrecy about the contents of these mysterious boxes, but the new additions to the box were some brand new pieces of equipment that hams can really use. The winning bidders got a lot more than the 'junque' they had probably expected. The boxes will be back for next year's Auction!"

"We'll Be Back!"

That's right — the ARRL Online Auction will indeed be back next year. According to Jahnke, "Based on feedback, I think it safe to say (to paraphrase Arnold Schwarzenegger): 'We'll be back.'"

Comments received from online bidders were exemplary. One exclaimed, "This is too much fun — I'm high bidder on two items! And just a beginner! What a riot!" Another said, "I sure appreciate the great folks like you who are working all the time to make ham radio a great hobby! My wife and I both hope that you have more of these great Auctions for the ARRL. It keeps hams involved and interested in our great organization. I was grateful that hams like Joe Walsh, WB6ACU, and the many generous contributors that thought enough of the ARRL to make such generous contributions. Our hobby still rocks!"

ARRL staff members who assisted with the Online Auction included Mike Tracy, KC1SX; Ed Hare, W1RFI; Mary Hobart, K1MMH; Rick Lindquist, N1RL; Jon Bloom, KE3Z; Bob Inderbitzen, NQ1R; Dave Patton, NN1N; Steve Capodicasa; Janet Rocco, W1JLR; Lisa Tardette, KB1MOI, and Diane Szlachetka.

S. Khrystyne Keane, K1SFA, is QST*'s Assistant Editor and also Managing Editor of* NCJ. *She lives with her family, husband Michael, K1MK, and sons Lynn and Sean, in Watertown, Connecticut. Khrystyne can be reached at* **k1sfa@arrl.org**.

School Club Roundup 2007

Lew Malchick, N2RQ

COURTESY LEW MALCHICK, N2RQ

At the North Clarion School in Tionesta, Pennsylvania, W3NCS ARC members, February 2006.

For more than 20 years students and other young people have been enjoying the School Club Roundup (SCR). For many it has been their first time on the air. Educators have used the SCR as part of their integration of Amateur Radio into classroom activities. Local clubs and individuals have helped with operation and by bringing demonstration stations to schools and other youth groups. After this exposure, many students have been motivated to study and earn their licenses.

In 2006 we responded to numerous requests for an event earlier in the school year and ran the 21st SCR session during October. As this is written, it is too early to know the final results, but the first few entries received indicate that there were at least 25 school stations on the air. The Winter/Spring SCR will be the 22nd session during its traditional period, the second full week of February. The next session, number 23, will be in the fall during the third full week of October. Join in the fun!

School Club Roundup is sponsored by the Council for the Advancement of Amateur Radio in the New York City Schools (CAAR/NYCS), the ARRL and its Hudson Division Education Task Force to foster contacts with and among school radio clubs.

Rules

Complete rules are available at **www.arrl.org/scr**.

1. Exchange QSO info as below with any class of stations, but especially with school stations.

2. The **Operating Period** is unusual. For the Winter/Spring event, it is Monday through Friday in the second full week of February beginning **February 12, 2007** at 1300 UTC and ending **February 16** at 2400 UTC. In the Fall it is the third full week of October beginning **October 15, 2007** at 1300 UTC and ending at 2400 UTC **October 19**. You may operate no more than 6 hours out of 24 and you may not count more than a total of 24 hours.

3. **Entry Classes**, single transmitter only:

(**I**) Individual or Single Operator (non-club);

(**C**) Club or multi-operator group (non-school);

(**S**) School club or group (grades k-12, colleges and universities). (Any station operated at a school for the operating period. This includes any group formed for the sole purpose of participating in the SCR.)

If multiple transmitters are used, such as for demonstration purposes, care must be taken to include only the results from one at a time.

4. **Exchange**: Your call sign, RS (T), class ("**I**ndividual", "**C**lub" or "**S**chool"), US State, *Canadian Province* or DXCC country. (Multioperator group stations must choose one call sign to use for the whole operating period.)

5. **Scoring**: Stations may be contacted once each on phone and CW (packet, RTTY and other modes count as CW). No repeater contacts except satellite and "real time" packet. Count 1 point for each phone QSO and 2 points for each CW QSO.

Multiplier: [*Number of US States plus Canadian Provinces plus DX countries*] plus 2× ["C" class QSOs] plus 5× ["S" class QSOs]. School stations and Marty, KA2NRR get a multiplier of 5, which should make them the most desirable stations to work. (KA2NRR was the founding Chairman of the CAAR/NYCS and creator of the contest that became the SCR.)

Final score: Multiply QSO points by multiplier. *Please use our summary form to avoid errors*, especially if this is your first time in the SCR (see 6 below).

Suggested frequencies: All amateur bands except 60, 30, 17 and 12 meters are permitted. On VHF and UHF, repeaters are not to be used. Only recognized simplex frequencies may be used. US examples include 144.90-145.00; 146.49, .55, 58; and 147.42, .45, .48, .51, .54 and .57 MHz. The national calling frequency, 146.52 MHz, may not be used. Similar restrictions apply in other countries.

6. **More info**: Sample LOG and ENTRY forms and the latest version of *SCR-LOG*[1] written by AD8B can be downloaded from **home.earthlink.net/~scr-log** or the files section of our e-mail reflector, **groups.yahoo.com/group/SCR-L/**. You can also subscribe to the reflector by sending and e-mail to **scr-l-subscribe@yahoogroups.com**. Paper forms are available by sending a large self-addressed, stamped envelope or an address label and postage. KC7MOD's logging software *LogIt!* can be found at **www.asu.edu/clubs/amateur_radio_society/logit/index.html**. Also, check **www.arrl.org**.

Address all questions to **SCR-L@yahoogroups.com** or **n2rq@arrl.net**.

7. **Reporting**: You should clearly list the call sign used, entry class, type of school, return address (where you want inquiries and certificate sent), phone number, e-mail address, number of operators/loggers, and number of hours. Logs must include exchange information, bands, and signature of all operators (and authorized club official or trustee and address, phone number and e-mail). Dupe check sheets are *required* for entries over 100 QSOs. Computer generated entries are appreciated. Use *SCR-LOG* or a text format. Please include a printed summary sheet and instructions including file names and formats. Entries should be sent to SCR, c/o Lew Malchick, N2RQ, Brooklyn Technical High School ARC, 29 Fort Greene Pl, Brooklyn, NY 11217. Entries must be postmarked not later than 30 days after the end of the operating period (March 19, 2007 or November 19, 2007).

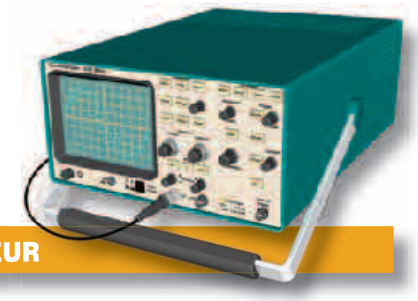
8. **Certificates**: All participants who send a label and return postage will get participation certificates. The top three entries in each class will be issued an 8.5 × 11 inch certificate. The **S**chool **C**lub class will be divided into elementary, middle, high school and college/university. DX will be listed separately at the end of US entries in each category. If requested, a certificate will be issued for any station contacting 10 or more school clubs. Please include a mailing label and sufficient postage or IRCs.

Suggested School Club Roundup Frequencies

Phone (kHz)	*Tech Plus and Novice*	*CW (kHz)*	*Tech Plus and Novice*
1855-1865		1800-1810	
3850-3880		3530-3580	3685-3705
7225-7255		7030-7080	7110-7130
14,250-14,280		14,030-14,060	
21,300-21,330		21,050-21,080	21,110-21,130
28,550-28,580	28,350-28,400	28,050-28,080	28,110-28,130

[1]*SCR-LOG* Windows, Macintosh and Linux versions have been revised for 2007. The DOS V. 7 is still available. This program will generate the report information in several formats.

The Doctor is IN



PROJECTS AND INFORMATION FOR THE ACTIVE AMATEUR

Q David Rife, AD2Q, asks: This evening I heard several SSB stations operating at 7151.5 kHz. One station had a bandwidth (as seen on *Digipan*) of about 2800 Hz. I thought one had to keep most of the sidebands above the lower voice band limit of 7150 kHz [7125 kHz effective December 15 — *Ed.*]. His sidebands must have extended 1300 Hz below 7150 kHz. Please tell me if this is legal.

A Right on, David! It is a requirement that you keep all of your SSB signal in the portion of the band in which it is authorized. This means that if you are operating lower sideband (LSB), as is common practice on 160, 75 and 40 meters, your signal will extend *down* in frequency below the (suppressed) carrier frequency shown on the radio dial. You need to know your sideband bandwidth and offset frequency to determine how close you can go. For example, if you had a perfect 2100 Hz sideband filter, and your carrier frequency were 300 Hz above the filter cut-off, you would need to have your carrier frequency at least 2400 Hz above the lower band edge. In real life, your sideband filter is not perfect, and neither is your frequency indication.

If you look at the specifications for your filter, you will find its skirt characteristics listed. A typical 2100 Hz crystal or mechanical filter might be 2100 Hz wide at 3 dB down, but will be perhaps 4000 Hz wide at 60 dB down. Thus, you should allow another 1 kHz for your filter skirts, plus whatever error you may have in your frequency calibration. If you have a wider bandwidth filter, adjust accordingly and leave additional room for the wider skirts. For most properly aligned radios with typical filters, leaving a clearance of about 5 kHz should be safe, but check all your numbers!

Note that on the higher bands, using upper sideband (USB), you have the same issue at the top of the band edge. Here it's potentially worse, in that your spurious signal will not just be in the wrong portion of our amateur band, but will be completely out of the ham band and will potentially interfere with some other service.

Q Doug, WA2SAY, notes that in the October 2006 column, I answered the question about the best way of feeding open wire transmission line through a wall with a focus on lightning protection. So Doug asks: What are the other issues about feeding open wire line through a wall?

A Doug, open wire, window line and even TV twin lead operate very differently from coaxial cable. With properly terminated coax, the electromagnetic field carrying the signal is contained entirely between the inner conductor and the shield. Thus coax doesn't much care if you wind it up, run it in a pipe or even bury it (make sure it has a jacket rated for direct burial and that no one will plant roses there). Popular balanced lines have their fields between wires and in the region around the outside of the structure. The two electric field structures are shown in Figure 1. The general rule is that most of the fields are within 2 to 4 times the spacing. They operate properly if air (or a vacuum) is in that region. The farther away you go the less effect any material will have.

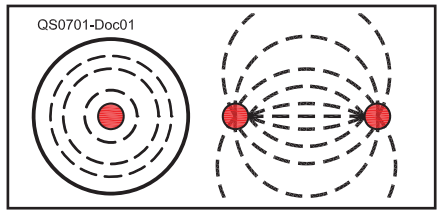


Figure 1 — The electric field lines of properly terminated coax (left) and balanced transmission lines (right).

Material within the region can have two different effects:

- *Insulating material*; any dielectric material within the region will act like a more lossy dielectric than the air you are trying for. It will also have a higher relative dielectric constant and thus slow down the propagation, perhaps changing the tuning of a matching section, for example. For most walls, the distance will be small enough that there will not be a significant change in either loss or delay. On the other hand, if you put it in a long run of PVC pipe and buried it, the lossy dirt would likely attenuate much of the signal.
- *Conducting material*. A good conductor within the region will result in a change in the characteristic impedance and may upset the line balance if closer to one wire than another. It should not impact the loss or delay significantly unless the dielectric is resting on a duct, for example. Then it becomes a "balanced strip line with poly dielectric on a ground plane," Again, for short distances it shouldn't be too much of a problem.

Other issues can be arcing and possible fire hazard. These are more of a problem with bare open wire line, but with high power and high SWR, can also happen with ladder line. You could have a fire hazard if there is any arcing.

The real problem with most walls is that you don't usually know what's in there. One possibility is to open up one side of the wall (probably inside the house), just large enough to install a plastic electrical box. You can then manage the environment, remove or relocate any extraneous material, provide

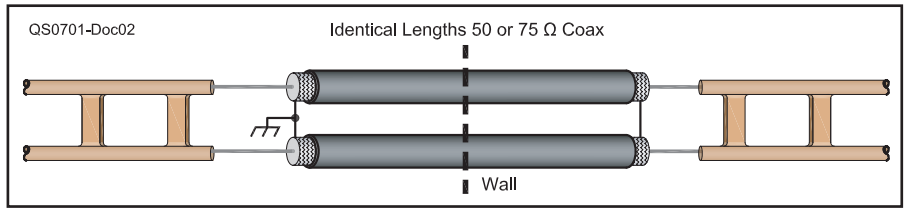


Figure 2 — The use of dual coaxial cables as a shielded balanced transmission line. Note that the spacing between the cables is not relevant, as long as each is the same length and the ends come together for connection to the unshielded balanced line.

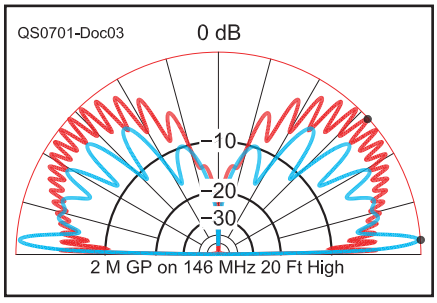


Figure 3 — Elevation pattern of a 2 meter ground plane 20 feet above real ground. Blue at 146 MHz, red at 446 MHz.

a passage for the line and then cover the box with a plastic cover plate drilled and slotted to just pass the ladder line. While it's open you can caulk the inside and outside of the exterior wall to keep the critters at bay. Be sure to have a "drip loop" outside so water that runs down the line won't follow the line inside.

Another possibility is to convert to balanced coax as you pass through the wall. I've used this technique with good success. Two equal lengths of 50 (or 75) Ω coax with their shields tied together at both ends act like a section of 100 (150) Ω balanced line if both inner conductors are fed with the conductors of the balanced line as shown in Figure 2. While the ends need to be together to meet the ladder line and tie the shields together, the rest of the coax can run at any spacing, since the fields are within each coax, not between them. This is also good for running through any RF sensitive area.

The bad news is that the loss is the same as with a single coax of the same length at whatever SWR results from the mismatch (not generally an issue with short lengths at HF). Check the line voltage rating of the coax and compare to half the voltage your ladder line (considering SWR) will apply to the coax. It also will put an impedance discontinuity in the line. This is not usually an issue with the typical "tuned feeder" approach. Thus, each coax can be run through the wall using any of the usual arrangements for routing coax, without worry about surroundings. Coaxial lightning arrestors may be used as well, but check the operating voltage.

Q Harry, KZ1V, notes: I have befriended a senior ham who has recently sold his house and moved into a compact dwelling unit. He would like to maintain communications with ham friends around the country, but isn't allowed outside antennas and doesn't want to let his new (and close) neighbors to know that he is operating a radio station. He asks what kind of equipment and antennas we would recommend to allow him to be successful — and anonymous.

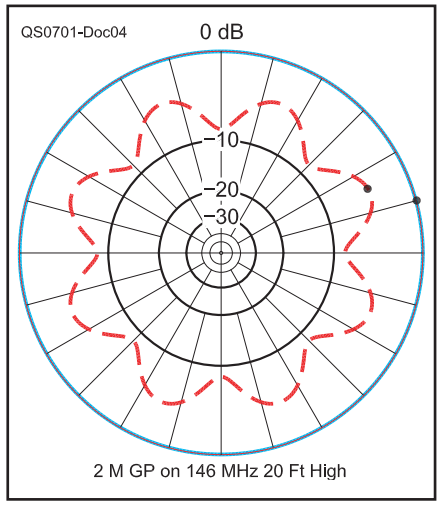


Figure 4 — Azimuth pattern of the ground plane at 5° elevation. Blue at 146 MHz, red at 446 MHz.

A This sort of situation is becoming common among hams whether antennas are allowed or not. First, if we're talking casual communication around the US, I would recommend any of the compact "entry level" 100 W HF transceivers available from each of the major manufacturers. Some also provide VHF and UHF operation, which might be fun as he gets to know the members of the local amateur community.

There are two keys to the anonymous aspect of the question:

- Use indoor or, if he can, outdoor "invisible" antennas. There have been many papers on both topics and many are available on **www.arrl.org/tis/info/antind.html**. The appropriate antenna, and likely antenna tuner, will make the most difference in his success.[1]
- Make sure that his signals don't get into any local systems where they will cause interference. All it takes is one fire alarm to be tripped for everyone to know what he is doing. This will require an understanding, perhaps with the help of a friendly building maintenance superintendent, of the location of alarm, CATV and telephone wires, and an antenna solution that is as far as possible from them. The use of the minimum power necessary for communication will also be helpful, in addition to being one of our FCC rules. It may also be helpful to choose his operating times to be such as to minimize the likelihood that others will be aware of his activity.

[1]*Low Profile Amateur Radio,* 2nd Ed. by Al Brogdon, W1AB, has just been published. Catalog number 9744.Check your local dealer or the ARRL Bookstore at Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

♢ *In the October 2006 Doctor column I noted that I wasn't aware of commercial products that performed two important functions — baluns for 6 meters, and lightning arrestors for balanced lines. For those who prefer commercial solutions to the home-made options I proposed, Jay Terleski, WXØB, of Array Solutions (***www.arraysolutions.com***) was kind enough to note that they offer both 1:1 and 4:1 baluns that work on HF through 60 MHz. In addition, he noted that ICE Radio Products (***www.iceradioproducts.com***) offers lightning protection devices designed for both single and balanced antennas and transmissions lines.*

Also in October, I discussed the use of a 2 meter ground plane on 70 cm. While the conclusion was on target, some folks thought that I should have shown the more realistic pattern of the antenna above ground, rather than my simpler "above the horizon — free space" plot. The above real ground plot includes the effect of ground reflections, resulting on a null at the exact horizon for both bands and the typical fine grain detail. See Figure 3 for the real deal at a height of 20 feet over typical ground. It was also pointed out that while the 2 meter ground plane has a nice omnidirectional pattern on 2 meters, the longer rods result in a less than ideal azimuth pattern with a 4.4 dB variation on 70 cm. See Figure 4, shown at 5° elevation.

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

New Products

HAMCALC ELECTRONICS UTILITY SOFTWARE

♢ Version 86 of *HAMCALC* software for *Windows* or *MS-DOS* contains more than 300 utility programs for radio amateurs and electronics professionals. Developed by George Murphy, VE3ERP, the software is said to contain much information not readily found in current popular handbooks. George says that *HAMCALC* is easy to install and use and is easily understood by nontechnical hobbyists. Most of the programs can be run in either metric or Imperial/USA units of measure. *HAMCALC* is available free of charge by download (1.2 MB file) from **www.cq-amateur-radio.com**. Click on HAMCALC at the bottom of the left side of the CQ home page. CD-ROM versions are no longer available.

SHORT TAKES

K4AVU Coax Crimper

Larry Wolfgang, WR1B
ARRL Senior Assistant Technical Editor

The July 2006 issue of *QST* included a New Products announcement about the K4AVU Coax Crimper on page 36. Several readers asked if we tried this device, and whether it really worked. Steve Ford, WB8IMY, ordered a crimper and asked if anyone was interested in testing it. Since I needed a couple of patch cables, I offered to try it.

The crimper consists of two ⅝ inch thick blocks of steel 2½ inches by ¾ inch, with a three sided notch in the center of each block. (This provides a hexagonal crimp, which seems ideal.) Figure 1 shows the crimper ready to go.

The instructions are pretty simple. Loosen the bolts so the crimper will fit over the PL-259 body where you would normally solder the coax braid to the connector. (It goes without saying that you install the connector on a piece of coax as if you were going to solder the connector.) Tighten one bolt a bit, and then the other, continuing to alternate sides so the crimper closes evenly around the PL-259 body. Paul, K4AVU, suggests using a socket wrench, although not one with a 1 foot handle. Paul also suggests using only Amphenol connectors because he has found that some other brands use a metal that is too hard, and it may be difficult to crimp them.

As I prepared to install connectors on my length of RG-8 cable, I realized that one concern would be that the crimper has nothing to crimp *against*. With the braid backed only by the soft center dielectric, what would keep the braid pressed against the crimped PL-259 shell? Coax connectors designed for crimp-on installation come with a metal ring to place under the braid, for the crimp to press against, or else the connector body itself slides under the braid, to provide some backing for the outer ring to crimp against. I decided to lightly tin the braid on one connector and not on the other, to see what difference it might make. I used one Amphenol connector and one silver plated "hamfest special" with "Made in the USA" stamped on the body. I had no trouble tightening the bolts to crimp either connector. To complete the installation, I soldered the center pins.

I took my new patch cable to ARRL Lab Engineer Michael Tracy, KC1SX, and asked him to run some tests to determine if the connections were solid. Michael told me the cable tested okay, but he had found a small problem. Upon careful inspection, both of my connectors had cracked under the stress of the crimper. The "Made in the USA" connector had a clear crack much of the way around the body at the point where the back of the connector meets the braid-connection indent. See Figure 2.

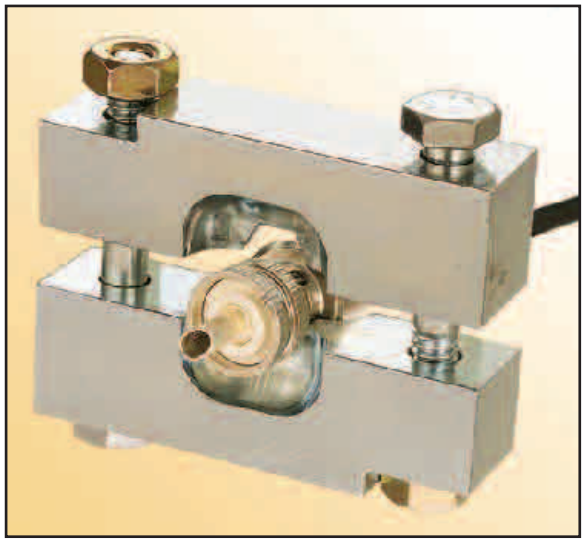


Figure 1 — The K4AVU Coax Crimper ready to clamp down on a PL-259.

Figure 2 — You can easily see the cracks in the connector body in this photo.

Michael had also installed Amphenol connectors on pieces of RG-8 as well as RG-58 coax. He agreed that crimping the connector onto the RG-58 with the reducer bushing seemed like it would be more secure because the braid was crimped against the solid backing of the reducer. Michael had also discovered small cracks in the connectors he installed.

As we pondered the cracked connectors, we realized that the Coax Crimper leaves a bit of "play" on the indented section of the connector body. With one of the connectors I installed, the crimper had been all the way forward on the connector body, and the other was all the way to the back. Michael's connectors also were crimped at the extremes of the crimp space. We wondered what difference it would make if you carefully aligned the crimper in the center of that space. Michael went back to the Lab to install more connectors. He found that if you were able to keep the crimper centered in the space, then the cracks in the connector body were less severe. In fact, I needed a magnifier to see some of the cracks.

Will the cracks affect the performance of the crimped connections? Initial tests indicate that the connections are solid. What will happen over time, with possible flexing, connecting and disconnecting the coax from a rig, and other use? It is difficult to predict when or if the connector bodies might fail. It doesn't leave me with a good feeling to have a connector with a cracked body, though. For now, I will continue to solder my PL-259 connectors, using the technique described in *The ARRL Handbook* and *The ARRL Antenna Book* and my heavy old soldering iron.

For more information, contact Paul Marsha, K4AVU, 200 Garden Trail Ln, Lexington, SC 29072; **k4avu@yahoo.com**. Price: $37, shipping included. QST

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

RF Activated Timer

Build this little circuit and stop timing out your repeater.

Allen T. Poland Jr, K8AXW

I've spent a great deal of time searching for an RF activated timer to eliminate the embarrassment of timing out our local repeater. I never found one that had all the features I wanted. Then I read the *QST* article, "An RF Driven On-Air Indicator" by Keith Austermiller, KB9STR.[1] His fine article coupled with a classic article, "A Versatile Timer Circuit," by J. J. Coleman, KA6A, provided the combination that I was searching for.[2]

[1]Notes appear on page 55.

Putting it All Together

Keith's circuit provided a voltage-doubling circuit for higher input drive and used a readily available input integrated circuit. The circuits used by Coleman provided alternate input options and a dual timer on a single IC. I built my timer using elements from both articles.

When I key my 2 meter radio, a yellow light emitting diode (LED) illuminates for 2 minutes. At the end of the 2 minutes, it is extinguished and a red LED flashes for the next 30 seconds. At the end of that interval, the red LED goes out. Our repeater has a 3½ minute timer, so this allows plenty of

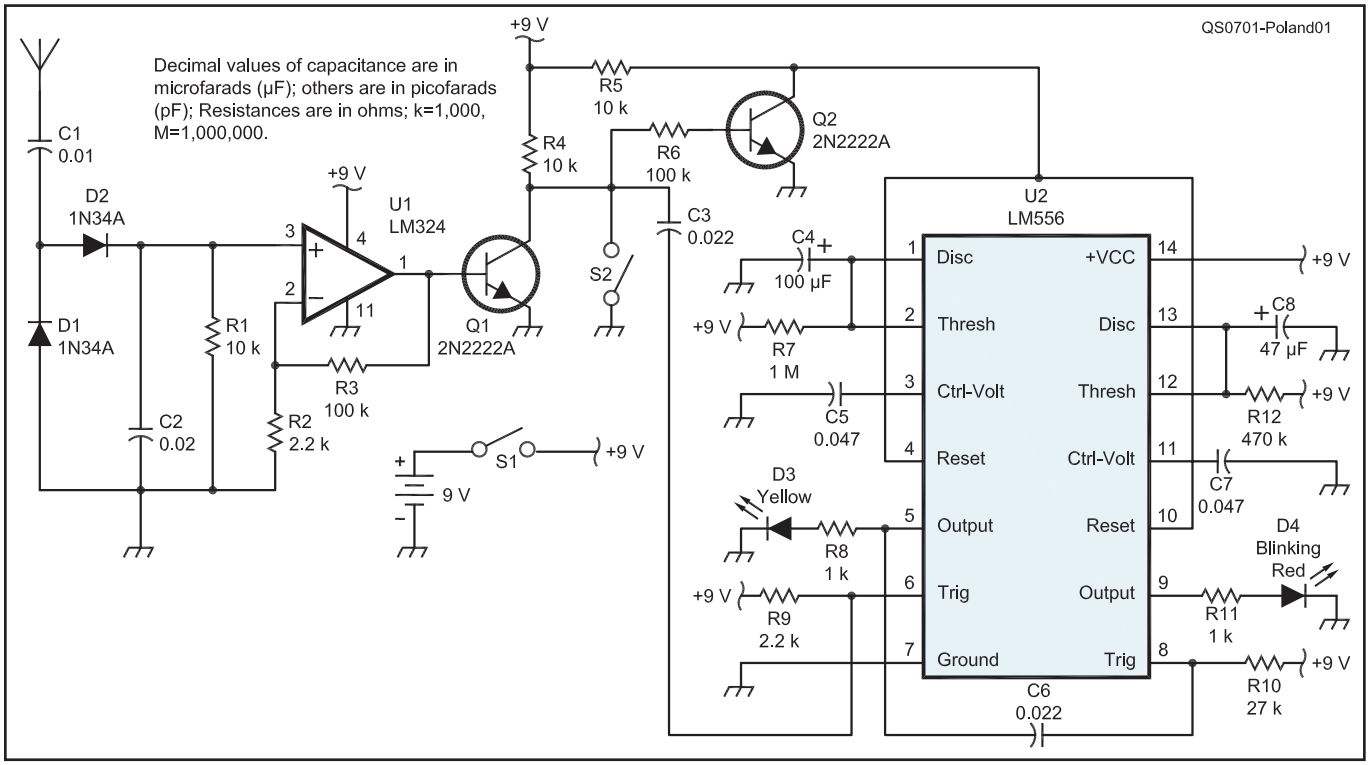


Figure 1 — Schematic and parts list of RF activated timer. Resistors are ¼ W. Mouser parts are available at www.mouser.com, RadioShack at www.radioshack.com.

C1, C2 — 0.01 µF disk capacitor (RadioShack 272-131).
C3, C6 — 0.022 µF metal film capacitor (RadioShack 272-1066).
C4 — 100 µF, 35 V electrolytic capacitor (RadioShack 272-1028).
C5, C7 — 0.047 µF metal film capacitor (RadioShack 272-1068).
C8 — 47 µF, 35 V electrolytic capacitor (RadioShack 272-1027).
D1, D2 — 1N34A germanium diode (Mouser 526-1N34A).
D3 — Yellow LED (RadioShack 276-021).
D4 — Blinking red LED (RadioShack 276-036).
Q1, Q2 — 2N2222A (Mouser 610-2N2222A).
R1, R4, R5 — 10 kΩ.
R2 — 2.2 kΩ.
R3, R6 — 100 kΩ.
R7 — 1 MΩ.
R8, R11 — 1 kΩ.
R9 — 2.2 kΩ.
R10 — 27 kΩ.
R12 — 470 kΩ.
S1 — SPST switch to fit.
S2 — SPST momentary contact.
U1 — LM324 (RadioShack 276-1711).
U2 — LM556 (RadioShack 276-1728).

time for a reasonable monologue with a little time to spare. The flashing red LED is an excellent attention getter.

Of course the timing can be anything you want. Just change the timing resistors and capacitors according to the formula. This means the timer can be used as a repeater timer or a 10 minute ID timer. For that matter, with proper switching, it can be used for both!

How it Works

RF is coupled to the circuit via C1 into a voltage doubling circuit consisting of the two 1N34A diodes and C2. The output of the voltage doubling circuit is coupled to U1, an LM324 quad op-amp. If you are able to get a copy of Coleman's article, you will see that he uses the CA3130 chip instead of the LM324. The CA3130 seems to be more sensitive but they are not as readily available as the LM324. Either IC works fine.

I used 2N2222A transistors for Q1 and Q2. Starting with Q1, the circuit was changed to the one used by Coleman in his article. Q1 and Q2 provide the start and reset states to U2, an LM556 dual-timer. Coleman uses a zener diode on the base of Q1 to protect it against overvoltage. Since I didn't have a zener diode in my junk box, I just eliminated it. So far, I haven't had a problem with Q1.

The capacitor and resistor combination connected to pins 1 and 2 and pins 12 and 13 sets the timing values for each timer. I used a yellow LED on the output of U2A. A yellow LED seems to be more visible than green with the 1 kΩ dropping resistor I used to lower current consumption. I used a flashing red LED on the output of U2B, which certainly attracts your attention during the timing period of U2B.

To calculate the values needed for each timing circuit, use the formula:

$T_{sec} = 1.25 \times R \times C$, where the resistance is in megohms and the capacitance is in microfarads.

I used a 100 µF electrolytic on pin 1 with a 1 MΩ resistor on pin 2. This gives a timing period of 125 seconds. I used a 47 µF electrolytic on pin 13 with a 470 kΩ resistor on pin 12. This combination gives a timing period of approximately 27 seconds. Of course, component tolerances will change these times a small amount. Or as they say, your mileage may vary.

Putting it Together

The collector of Q1 has a SPST switch as shown in Figure 1. I use this to time the unit without having to use RF and also to see if it is working. Since a 9 V battery is used for power, this switch lets you check the on/off state and provides a rough indicator of battery level. A POWER ON LED uses additional current which I wanted to avoid.

Measured current drain is approximately 12 mA in the idle state and approximately 18 mA with the yellow LED on. The current drain is less with the flashing red LED because of the lower duty cycle.

I built three units using point-to-point wiring on a RadioShack 276-150 board because of its small size. It presented a host of layout and wiring problems. I recommend using the RadioShack 276-168 layout board, even though it's somewhat larger. This board has a maze of power buses and plenty of useful pads to each IC pin.

The antenna connector can be any kind that allows connecting a piece of wire. The random length wire is then wrapped several turns around the radio's antenna coax. Reliable triggering is accomplished by experimenting with the wire length or the number of turns needed to couple enough RF to the unit. I use 20 turns around the coax and about an extra foot to reach the timer box. My timer triggers with 4 W on 2 meters.

Now when I use the repeater my contacts are much more enjoyable because I don't have to worry about how long I've been talking.

Notes

[1]K. Austermiller, KB9STR, "An RF Driven On-Air Indicator," *QST*, Aug 2004, pp 56-57.
[2]J. Coleman, KA6A, "Versatile Timer Circuit," *QST*, Feb 1980, pp 36-37.

Allen Poland, K8AXW, has been a ham for 50 years. He obtained his Conditional class ticket and call K8AXW while stationed in Bad Aibling, Germany in 1956. His German call was DL4TPO and he also held the call K3FKA for several years while living in Maryland. He presently holds Amateur Extra class and First Class Radiotelephone licenses. His main interest in ham radio has been building equipment. He is now retired from the Westvaco Corporation, Luke Mill, after working 40 years as a power plant operator. You can reach him at 1335 Ludwick St, Keyser, WV 26726 or at **k8axw@arrl.net**.

New Books

ARRL'S VINTAGE RADIO

◊ *ARRL's Vintage Radio* is a collection of articles published in *QST* describing vintage equipment and restoration. Included are personal experiences and interesting points in the history of Amateur Radio that will evoke a sense of nostalgia. This collection covers vintage radio articles published between 1977 and 2003, and includes three years' worth of "Old Radio" *QST* columns by John Dilks, K2TQN. A selection of *QST* advertisements from the '20s through the '70s helps round out this fascinating look back in time. Enjoy ads from Collins, Drake, Heathkit and more.

Published by ARRL, $19.95 plus shipping, Order Number 9183. Check your nearest Amateur Radio dealer or the ARRL Bookstore (telephone toll-free in the US 888-277-5289 or 860-594-0355 elsewhere; **www.arrl.org/shop**; **pubsales@arrl.org**).

Strays

HEATHKIT STILL IN BENTON HARBOR

◊ Heathkit is still in business selling electronic home study courses and sells copies of their old amateur and test equipment manuals. Heathkit has a Web site and several hams maintain Heathkit information and support sites. There are links to a few of these sites on the Heathkit site, **www.heathkit.com**. — *George Beloin, WA1PIX*

I would like to get in touch with…

◊ anyone working in public health who is a licensed Amateur Radio operator and is interested in getting in on the ground floor of developing a national network of "Hams in Public Health." If you are interested in participating, please contact Dave Cox, NB5N, at **dcox@tulsa-health.org**.

NØAX

HANDS-ON RADIO

Experiment #48 — Baluns

Balun (pronounced *bă-luhn*) is an abbreviation meaning "balanced-to-unbalanced." *Balanced* means *equal and opposite* voltages and current in a signal source, transmission line or load. In addition, a balanced transmission line's conductors are required to be identical, such as in ladder line. *Unbalanced* lines and loads have voltage or current that is higher in one conductor or terminal than the other with one terminal often grounded.

Terms to Learn

- *Balanced load* — a load that presents equal impedances at each terminal.
- *Balanced transmission line* — a symmetric transmission line whose conductors carry equal voltages and currents.
- *Common mode* — currents or voltages that appear equally on all conductors of a transmission line.

Balancing Act

A coaxial transmission line, while balancing voltage and current between the center conductor and inside of the shield, has a third conductor — the outside of the shield — carrying different voltages and currents and so cannot be balanced. At RF, the outside and inside of the shield are effectively separate conductors due to the *skin effect* that causes ac current to flow very near the surface of a conductor. Coaxial feed lines can have completely independent currents flowing on the two surfaces of the shield!

What is a balun, anyway? A balun is an electrical device used to transfer power between balanced and unbalanced loads or lines. Some are wound on cores in the manner of transformers while others are constructed from segments of transmission line. Baluns can be designed to work at a single frequency or over a wide range.

There are two basic types of baluns. *Voltage baluns* force the voltages at their outputs to be equal and out of phase. *Current baluns* force currents at their output terminals to be equal and out of phase. The current balun is the most useful to amateurs because in antenna systems, radiated power is determined by the currents in the antenna and not feed point voltage. In addition, most antennas (even perfectly symmetric ones like dipoles) are not electrically balanced due to the proximity of other conductors, so equal voltages at the feed point terminals do not guarantee equal currents.

Choke Baluns

Let's begin with a simple design — the *common-mode choke current balun*. This balun connects an unbalanced coaxial feed line to a symmetric, balanced antenna such as a dipole. Figure 1 shows three types of choke baluns: ferrite bead, toroidal and coaxial. (We'll concentrate on baluns that use ferrite cores or beads.) All of them suppress or "choke" common mode RF current flow on the outside of the coax shield by creating an inductance from the outside of the feed line shield. The resulting *common mode impedance* prevents current from flowing along the outside of the shield. The equal and opposite currents inside the feed line are then transferred *only* to the antenna terminals. Bead baluns are generally the most effective.

Figure 1 — All three of these choke baluns work by forming an inductance from the outside of the coax shield. The resulting reactance blocks RF currents from flowing, while leaving the currents inside the coax unaffected.

By preventing current flow on the outside of the coax shield, currents are forced to be equal in each half of the dipole and the antenna's radiation pattern is not altered by currents radiating from the coax shield. It also reduces RF current on the outside of feed lines that can interfere with other signals and upset power and SWR measurements.

You can make bead baluns by placing ferrite beads over coaxial cable. The outside of the coax shield acts as a "one-turn" winding inside the core while signals inside the coax are not affected. The bead balun in Figure 1 is made from seven Amidon FB-77-1024 beads over RG-213 coaxial cable. Any similar bead made from type 31 or 73 ferrite will work on the HF bands. Use type 43 ferrite for VHF and UHF applications. Wrap the beads with good quality electrical tape (such as Scotch 33), then install the connector or waterproof the exposed conductors.[1]

Stepping Up and Stepping Down

The balun is often combined with a *transmission line impedance transformer*. Although they are often called "baluns," they actually combine the functions of a choke balun and an impedance transformer. (The common-mode choke baluns of Figure 1 are 1:1 baluns, meaning the ratio of input to output impedances is unity.)

Impedance transformers don't change the impedances of whatever is connected to them, but they do convert electrical energy from one ratio of voltage to current (impedance) to another. Impedance ratios of 4:1 and 9:1 are common. For example, a 4:1 impedance transformer has half the current and twice the voltage at the load as it does at the input.

By using a single *bifilar* winding (see Experiment #47), the primary and secondary of the transformer become a transmission line.[2] If the transmission line is then wound

[1]R. D. Straw, N6BV, Editor, *The ARRL Antenna Book*, 20th edition. Chapter 26, Available from your ARRL dealer or the ARRL Bookstore order no 9043. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]"Hands-On Radio" experiments can be found at **www.arrl.org/tis/info/HTML/Hands-On-Radio**.

H. Ward Silver, NØAX ♦ PO Box 927, Vashon, WA 98070 ♦ n0ax@arrl.org

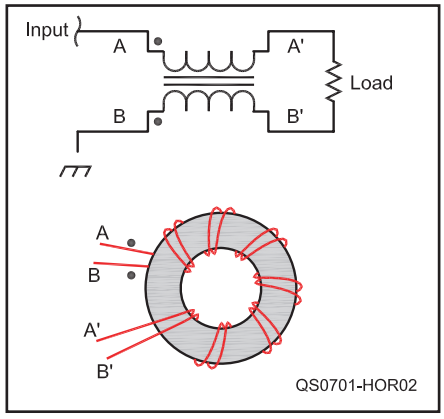


Figure 2 — By making the transformer windings bifilar, a transmission line is created. Winding the transmission line on the toroid core creates the same choking effect as winding a coaxial cable on the core.

on a toroidal core as shown in Figure 2, it becomes a 1:1 choke balun. The high impedance presented to common mode currents allows us to treat the end labeled A'B' as if it were a separate signal source! Figure 3 shows how to change the 1:1 to a 4:1 balun by connecting the load between the input and output, instead of across the output. (This design is known as a *Ruthroff balun*.) Here's how it works:

First, the current *i* at B is equal to and out of phase with the current flowing into A.

The current *i* flowing into B' must be equal to the current at B, so it is equal to the current *i* at A. (Similarly at A' and B.)

The sum of currents from the input signal source is *2i*, twice what flows in the load.

Since no power is created or lost, the product of voltage and current must be the same in the source and load, meaning the source voltage must be one-half that across the load at twice the current. Thus, the source is presented with one-fourth the impedance of the load.

Having the bifilar winding act as a transmission line is a good thing, but the electrical length of the line (and the various connections) adds a small delay. That delay means that the signal at A'B' is out

Dots It!

What are those strange dots often seen on transformer symbols, such as Figure 2? Those are *phasing dots*. An increasing voltage at one dot produces an increasing voltage at the other. Current entering one dot causes current to leave the other dot. If two windings are shown with a dot at the same end of the winding symbol, it means that both windings should be wound on the core in the same direction.

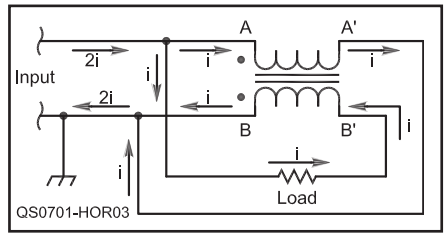


Figure 3 — The common-mode impedance of the transmission line allows ends A-B and A'-B' to be treated independently at RF, while the magnitude and directions of the currents in the two windings must be equal and opposite. The effect is to cause the input source to see ¼ of the load impedance.

of phase a little bit with that at AB. The phase difference also means the currents don't sum exactly and so the impedance the input source sees is not exactly ¼ of the load impedance. The higher the frequency, the longer the line becomes electrically, and the greater the delay and error.

At low frequencies, the common-mode impedance drops to the point where the ends of the line are no longer isolated. These two errors put a definite upper and lower frequency limit on the use of any transmission line transformer.[3]

Building a 4:1 Current Balun

This balun can be configured for 1:1 or 4:1 impedance ratios and will handle 1 kW of power from 160 through 10 meters. You'll need an SWR analyzer, such as an MFJ-259, to test the balun or you can experiment with it on the air. (Use low power during tests!)

An FT-240-61 core is selected because type 61 material is designed for use in the HF range, the permeability (μ=125) creates enough reactance, and the 240 size core is large enough to handle the necessary power.

Carefully straighten a pair of 7 foot enameled wires so that there are no kinks or sharp bends. Use small strips of electrical tape to hold the wire together every 2 or 3 inches. Use paper labels to show which wire is A, B, A' and B'.

Wind the balun as shown in Figure 2, spreading the windings evenly around the core and secure the ends of the winding with electrical tape.

Create the 4:1 configuration by connecting an SO-239 connector center conductor to wire A and the shell to B. Connect wire A' to the shell and leave wire B' unconnected.

Connect the analyzer to the SO-239. Solder a 220 Ω resistor load between wire B' and wire A. Set the analyzer to 10 MHz and confirm that the SWR is about 1:1. If the analyzer has a resistance meter, it should show slightly more than 50 Ω. Replace the 220 Ω resistor with a 390 Ω resistor. SWR should now be about 2:1 and the resistance value slightly less than 100 Ω. Experiment with different resistor values to confirm the 4:1 impedance transformation.

Change to a 1:1 configuration by disconnecting A' from the shell and removing the resistor load. Attach a 100 Ω resistor between A' and B'. Confirm with the analyzer that the SWR is about 2:1. Experiment with other resistor values to confirm the 1:1 impedance ratio.

Reconfigure the balun for 4:1 using the 220 Ω resistor load. Find the frequencies above and below 10 MHz at which the SWR becomes 1.5:1 (resistance value of 75 Ω). These are the frequencies at which the assumptions of negligible line length and sufficient choking reactance break down. Anywhere in the middle, you can use your balun on the air!

Shopping List

- 100, 220 and 390 Ω resistors.
- Coaxial socket, type SO-239.
- FT240-61 ferrite core and 14 feet of 14 gauge solid, enameled or insulated wire.

The AB-240 balun kit includes the above core and wire. It is available from Universal Radio (**www.universal-radio.com**) or Amidon Associates (**www.amidoncorp.com**).

Recommended Reading

The most detailed books on transmission line transformers in the amateur literature are *Transmission Line Transformers* and *Understanding, Building and Using Baluns and Ununs* both by Jerry Sevick, W2FMI.[4] The article "Baluns: What They Do and How They Do It" is a good introduction at **www.eznec.com/Amateur/Articles/Baluns.pdf**.

Next Month

Let's keep the fifth year of Hands-On Radio rolling with a frequently requested topic — how to *read* a schematic. So many articles assume the reader knows them well, when a tutorial might be just what the doctor ordered!

[3]W. Hayward, W7ZOI, R. Campbell, KK7B, and R. Larkin, W7PUA, *Experimental Methods in RF Design,* p 3.33. Available from your ARRL dealer or the ARRL Bookstore order no 8799. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[4]J Sevick, W2FMI, *Transmission Line Transformers,* order no TLT-4 and *Building and Using Baluns and Ununs,* order no 8982. Both are available from your ARRL dealer or the ARRL Bookstore. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Simple Audio Computer to Transmitter Morse Keyer

Have you ever looked at the interfaces available for your PC to send Morse but you didn't want or need all the available features? I did and I decided they weren't for me, so I designed and built my own.

Dennis McCall, KF3AD

Although I was first licensed in 1959, I was only active during the first year. A few years ago I decided to get back into radio, but just long enough to get my Amateur Extra class license. I've listened to CW from time to time to keep up some speed but hardly ever did a QSO. About three years ago I built an OHR 100A low power (QRP) 40 meter transceiver and some equipment to go with it, but never did try very hard to make a contact.[1] Ham radio slipped into the background of my interests. A few months ago my interest increased, so I began to try again. Then came the difficulty.

In the intervening years I had injured my right hand. It had gradually returned to near normal use, but I found the injury was making my code somewhat hard to send and worse to read. I practiced with some PC code readers, and with practice my code improved somewhat but I still had difficulty sending the numeral 3. That normally wouldn't be too much of a problem except that my call was KF3AD.

Bring on the PC

I decided to look at some of the computer-to-CW interfaces currently on the market. My research revealed that what was available was either too expensive for what I wanted, or had more features than I would ever use for the type of CW operating I wanted to do. I wanted to type on the PC and have the PC key the transmitter. That's it — nothing else. I was also only interested in QRP CW and felt that something really simple should be available.

After much searching of the Internet, I didn't find anything that was either simple or inexpensive. Around this time I purchased a used Yaesu FRG-100 receiver for general listening. I added a crystal filter for CW. My intention was to use it as my receiver and use the transmitters I already had, such as my still great Heathkit HW-8, for transmitting. I also have an old AMECO 40 meter 15 W tube transmitter that I would love to get back on the air. I also had intentions of building some more QRP CW-only transmitters.

Life Gets Complicated

Through the years I had made a number of different interfaces to receive CW and had also developed some receiving software. All of these interfaces used either the serial port or the parallel port to access the interface hardware via toggling specific pins on these ports. When I started looking at interfaces again I found that the serial ports have disappeared and been replaced by USB ports and all my expertise in earlier ports was basically worthless. *BASIC* software had changed so much that I couldn't program the way I used to either.

After taking all this under consideration I decided that I needed to bypass the USB problem and that an audio activated interface was my best solution. I figured the best way would be to find an available CW software program that played through an external speaker of the PC and have the interface activate a relay that was in parallel with the hand key. This in turn would key the transmitter. I wanted the parallel connection because I didn't want to give complete transmitter control to the computer.

It All Comes Together

My first impulse was that I needed some type of rectifier and filter to convert the tone to an on and off pulse. This approach was successful. I then needed something to activate the relay. A transistor switch looked like it would do exactly what I wanted.. What I ended up with was a half wave rectifier consisting of a 1N914 switching diode and a 1.0 µF non-polarizing capacitor. An audio transformer was used to raise the level to that needed to drive the base of a 2N2222 NPN switching transistor that controlled a small SPDT relay. The relay is in parallel with

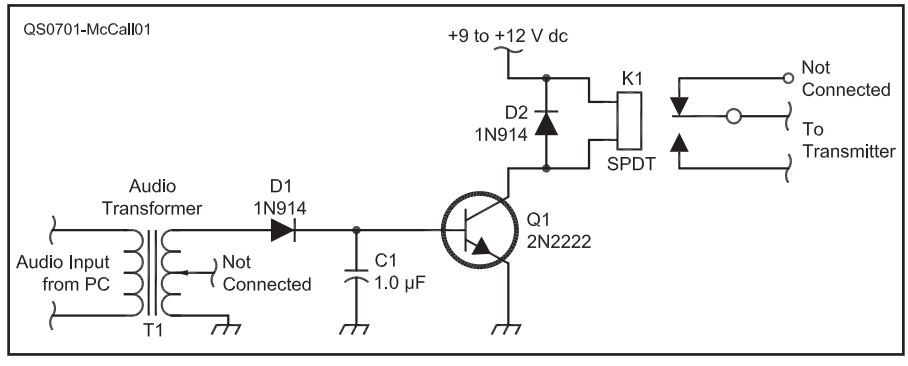


Figure 1 — Audio Morse keyer schematic and parts list.

C1 — 1.0 µF, 50 V, non-polarized electrolytic capacitor (RadioShack 272-996).
D1, D2 — 1N914, or equivalent, silicon diodes (RadioShack 276-1620).
K1 — Relay, 12 V dc, SPDT, Micromini, contacts rated at 1 A at 120 V ac or 24 V dc (RadioShack 275-241).
Q1 — 2N2222, or equivalent, NPN switching transistor (RadioShack 276-1617).
T1 — Miniature audio output transformer 1 kΩ center-tapped to 8 Ω (RadioShack 273-1380).

[1]See **www.ohr.com/ohr100a.htm**.

another 1N914 diode to protect the 2N2222 from the back EMF resulting from the opening and closing of the relay.

The schematic is shown in Figure 1. It is about as simple a project as you can get. This is the one thing that has perplexed me about this project. Why haven't I seen it done before? It's very easy to put together and works really well.

Software Makes it Play

Now I needed some software. There is a lot of CW learning, plus send and receive software on the Internet. A good share of it is based on *DOS* and uses a serial port, but I didn't find any that used a USB port. I needed software that would output the CW to the external speakers. After much searching and testing I found that *CwType*, available from **www.dxsoft.com** as freeware would more than meet my needs. Figure 2 shows the *CwType* interface screen. It not only provides type-ahead sending and allows correction but also includes many handy macros. One can use a different function key for NAME, QTH, RST, CQ and much more. It has adjustable sending speed and can even send Farnsworth spacing with a little effort by using its INTER-LETTERS SPACE control (ILS).

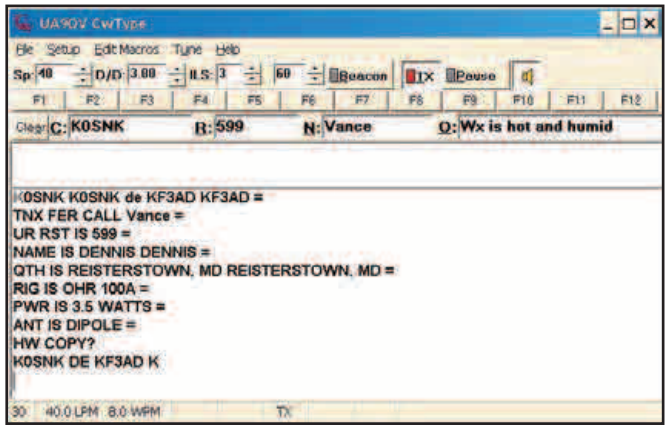


Figure 2 — Screen shot of *CwType* operator interface.

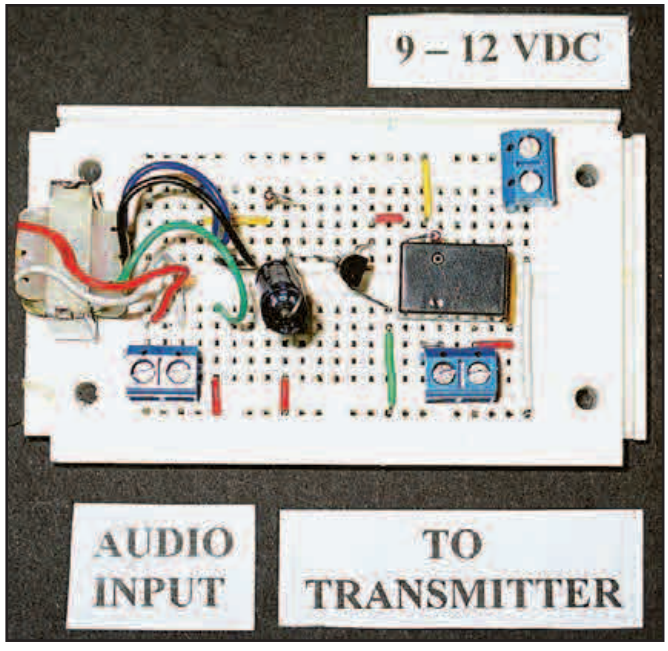


Figure 3 — Prototype of Morse keyer circuit layout.

The audio input for the Morse keyer is plugged into your PC's external speaker jack and is controlled by either your computer's external speaker volume control or another volume control method. I have a separate jack on the right speaker I can plug into and control the volume output with the speaker volume control. You adjust the volume to get a good crisp-sounding contact of your relay. It shouldn't be underdriven and chattering and not overdriven and stuck.

This Morse keyer should be of use to persons who have either a minor or major impediment to using a key but still have a limited typing ability. *CwType* has a very large macro capability that will keep extensive manual typing to a minimum. Two other advantages are the speed option and the type-ahead feature. One can adjust the sending speed so as to not exceed one's typing ability. Typing ahead gives you the opportunity to correct any mistakes that were made in typing.

Capacitor C1 appears to have a range of values over which it will function. The lower the capacitance the higher the speed that can be used, limited by the relay no longer functioning properly due to lack of filtering. I've only tested up to 35 WPM but am sure it can go higher. Higher capacitor values will reduce the maximum WPM rate and at some point the relay will stick closed.

Figure 3 shows the breadboard prototype and how simple it is. Figure 3 also shows three RadioShack 276-1388 two position PC board terminals, which I used for audio input, dc power input and keyer connection to transmitter.

Special thanks to Lester Hudgins, N3LH, who not only did the photos for this article but listened to my theories on Morse Code sending and receiving without laughing too loud.

Dennis McCall, KF3AD, is a retired Air Force officer. He is now employed as logistics engineer with a defense contractor. He is a member of the Historic Electronics Museum Amateur Radio Club (HEMARC) in Linthicum, Maryland. You can reach him at 1215 Nicodemus Rd, Reisterstown, MD 21136 or at **dvmccall@comcast.net**. *Please contact Dennis with a description of your experiences with this project, especially those that involve its use by anyone with disabilities and limitations in using Morse code.* QST

New Products

MFJ RF BYPASS SWITCHES

♢MFJ's 1705 (300 W rating) and 1705H (1500 W rating) RF switches are designed for switching antenna tuners, linear amplifiers, preamps, power meters and other devices in and out of the feed line. Both switches are rated for dc to 60 MHz and for use with 50 or 75 Ω coaxial cable. Price: MFJ-1705, $19.95; MFJ-1705H, $29.95. To order or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

QSO WIZARD SOFTWARE FROM ORCASTAR

♢*QSO Wizard* is a Macintosh software package that includes logging features, a custom QSL card maker, beam heading path plots, multiple clocks, a schedule editor and other features for the active operator. The software is built around images of the Earth centered on the user's location. Worldwide prefixes, time zones, grid locators and other information is available by clicking on the image or searching included databases. Available for Mac OS X only, *QSO Wizard* is customized for the user's call sign and QTH (North American locations only) at time of order. Price: $69.95. More details are available at **www.orcastar.com**.

Wire Antennas — Keeping Them Up

Antennas are at their best when in the air — here's how to help keep them there!

Joel R. Hallas, W1ZR

Wire antennas may be the most popular amateur antennas for HF operation. I haven't taken a survey, but even hams with one or more rotary arrays often have a wire antenna or two for some bands. Many use wire antennas exclusively, and why not — they're inexpensive, adaptable and can be very effective — especially in terms of dB/$.

Well, that's true only while they stay up!

Most of my more than 50 years of ham radio experience has been limited, for many of the usual reasons, to wire antennas. I hesitate to guess at how many I've had, but will confess that most have come down more than once of their own volition. Perhaps that's the flip side of wire antennas, they are easy to put up, but often come down just as easily — and rarely on a nice day!

So Why Do They Fail?

My degrees are in electrical, not mechanical, engineering so I don't pretend to be an expert in structural theory. I do, however, feel comfortable sharing the experiences I've had over the years in the hope that it will help some readers. It is, after all, not bad to learn from others' mistakes. The issues can be divided up in a number of areas:

Support Structures

The ideal wire antenna would be supported by rigid and immovable supports at each end or junction, as well as one at the feed point to support the transmission line. I've seen wire antennas of this sort in my army days, but few in the amateur world. If you could put up three towers, would you use them to hang a dipole? Probably not. In my experience, most amateur wire antennas rely on trees for some portion of their support, and often have the transmission line hanging in the breeze from the center. This arrangement is almost a perfect design for failure. The transmission line can sway and put large forces in the middle, while tree motion not only can pull the antenna unnaturally tight, but also can wear the surface of the halyards.

Halyards

I think more of my antennas have come down from halyard abrasion and wear than from any other cause. I've learned a few things from this and my problems have moved elsewhere.

For best results use a pulley at the tree, as shown in *The ARRL Antenna Book*.[1] This arrangement avoids wear on the halyard and stretch on the antenna wire. Add a "downhaul," so that the pulley and attachment point can be reused if (when) the antenna wire breaks. If you can't get a fixed attachment point into the tree, a second halyard can be used to haul up the pulley. The second halyard will move with the tree and should not suffer much wear. Adjust the counterweight for the appropriate tension, as specified in the tables in *The Antenna Book*.[2]

If you can't manage that arrangement, and the halyard must go over a tree fork, use the best rope you can afford. I find sailors' yacht braid a suitable rope that has lasted a long time at W1ZR. It has an abrasion-resistant polyester jacket over a low-stretch polyester core. While nylon rope is less expensive and has potentially beneficial stretch, it chafes through very quickly in my experience. Tie the bottom of the halyard to the same tree it's over. That way the rope moves with the tree, minimizing chafe. If you don't know your knots, check out "The Knots of Ham Radio" in June 2006 *QST*.[3]

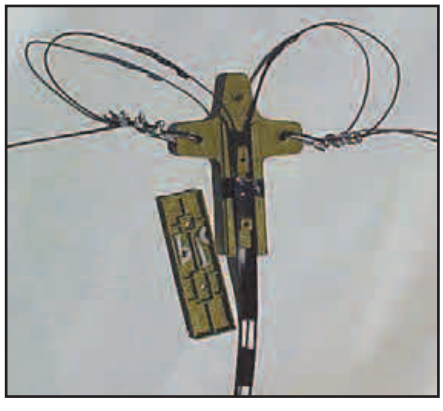


Figure 1 — Details of the center connection of a dipole discussed in the text. The "T"-shaped insulator is the "LadderLock."

Connections

The next most likely spot for problems is at the connections, particularly to a swinging feed line. There are a few ways to minimize the likelihood of failures at this key point. Make sure that both the antenna and feed-line connecting wires are supported — that the connection is not holding up the feed line. The center of a recent W1ZR center-fed antenna is shown in Figure 1. The LadderLock center insulator supports the ladder line and the hardware store *thimbles* and clamps minimize stress on the antenna wire.[4] Note the way I moved the connection points out of the structural path.

Antenna Wire

Almost any wire will meet the electrical requirements for a wire antenna. If you want it to last, however, the wire should meet the strength requirements listed in the previously referenced *Antenna Book* sections.

If the wire supports its own weight, and especially if it also is holding up a transmission line, it should not be subject to significant stretch. This generally translates to Copperweld, copper plated steel or hard drawn copper wire. If insulated wire is used, it will need to be about 2% shorter than bare wire of the same size, depending on the type and thickness of the insulation. There is no measurable performance penalty at HF either way. Also give thought to a good way to support the transmission line.

Notes

[1]Figure 1, p 22-1. Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order no. 9043. Telephone 860-594-0355, or toll-free in the US 888-277-5289, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]R. Straw, N6BV, Ed., *The ARRL Antenna Book* (Newington 2003), pp 20-2 to 20-6.

[3]R. Collins, WX3A, "The Knots of Ham Radio," *QST*, Jun 2006, pp 57-58.

[4]Available from **thewireman.com**. Ten-Tec also offers a more compact clamping insulator for either coax or ladder line, the Acro-Bat Antenna Hanger, **radio.tentec.com/Amateur/Accessories/TT3003**.

Joel R. Hallas, W1ZR, is QST *Technical Editor. He can be reached at* **jhallas@arrl.org**.

WR1B

HINTS & KINKS

MORE THAN IDIOT LIGHTS

Illuminated Barrier Strips Make Projects Interesting

◊ When I built the dc-to-dc converter module for my latest microwave transverter (24 GHz), I wanted to clearly label the output terminals so that there would be no need to "guess" at what connection does what. The chassis box was not large enough, however, to allow a nice label to be attached. See Figure 1.

Figure 1 — KH6WZ recently built this dc-to-dc converter. It has three outputs, but has little room for a nice panel label, so an alternative "marking method" was needed.

Since I use nylon insulated barrier strips to make interconnections between modules in my rigs, I thought it might be interesting and fun to insert little LEDs inside the barrier strips, to indicate an "on" condition. Then I decided to take this idea one step further, and choose certain colors to indicate voltage, since the dc converter has multiple outputs. See Figure 2. The red LED indicates 12 V dc, for the input, while green means 5 V and yellow means 24 V.

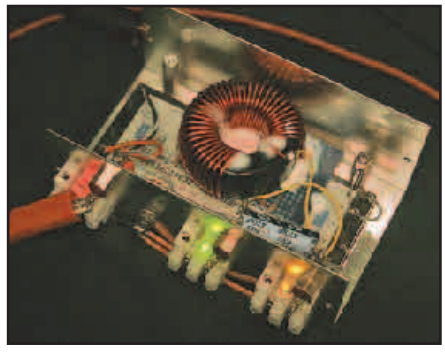


Figure 2 — LEDs illuminate and indicate "power on" and the colors show what voltages are present: Red is 12 V for the input, green is 5 V and yellow is 24 V.

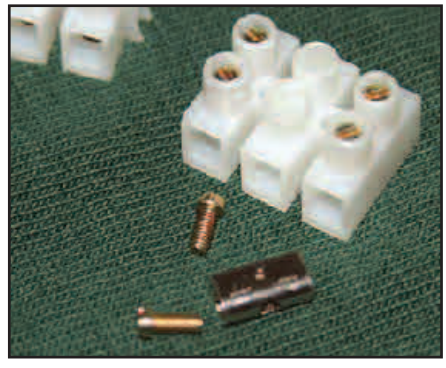


Figure 3 — Remove one of the contacts in the nylon barrier strip to make room for the LED and dropping resistor. Once the small flat-head terminal screws are removed (you may have to pry them out), the contact barrel can be pushed out.

This looked so "cool" that I decided to use the idea on as many of the modules inside my rig as possible. Now I know that power is going to each individual module, and also what voltage is applied. Of course, this is by no means an accurate way to actually measure the voltage. These are truly "idiot lights" that simply tell me that voltage is going there. Some of the LEDs indicate transmit or receive status (green for receive, red for transmit). I have so many lights inside the rig that I decided to name my 24 GHz transverter system "LightShow."[1] By the way, I have also standardized wire insulation colors in my rigs, too. That simplifies tracing the wires while troubleshooting and modifying the rig.

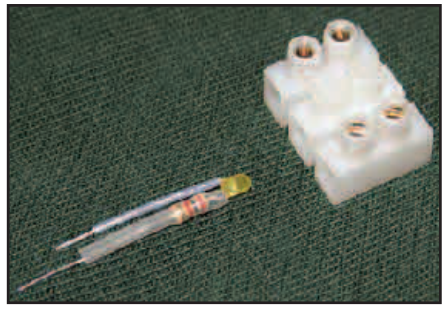


Figure 4 — Pre-wire a dropping resistor on one of the LED leads, and use heat-shrink or nylon tubing to insulate the bare wires.

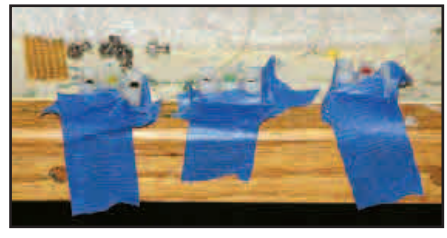


Figure 5 — After the LEDs are pushed into the barrier-block body, glue the LEDs in place. Here, epoxy was used, but other adhesives might be less messy. See the text for other ideas.

Here's how I added LED indicators to my equipment. The barrier strips are the translucent nylon types available at most parts shops, and are available in various sizes determined by current rating. Depending on the size of your terminals, you can use 3 mm or 5 mm diameter LEDs. This trick will require an additional terminal to house the LED, so for a simple dc power connection, you need three terminal locations, one for the negative (ground) wires, one for the positive wires and one "space" for the LED. Select the location for the LED, then remove the two terminal screws and push the little metal sleeve out. Figure 3 shows the pieces.

Pre-wire an LED and appropriate dropping resistor, as shown in Figure 4. Insert the LED into the housing, and wire the LED so it is powered from the appropriate terminal.

I use clear epoxy adhesive to hold the LED in place. Masking tape prevents the epoxy from dripping all over the place. (See Figure 5.) I used 5-minute epoxy in the prototype, but other glues are probably more safe and suitable. In fact, I now use a GE adhesive called "Special Projects Adhesive Caulk," GE stock number GE16204. This stuff does not emit an acidic smell (vinegar) when curing, so it should be okay to use with electrical things.

The completed illuminated barrier strip

[1]Many of the San Bernardino Microwave Society (SBMS) members name their rigs, just as sailors name their ships.

Larry D. Wolfgang, WR1B ♦ Senior Assistant Technical Editor ♦ h&k@arrl.org

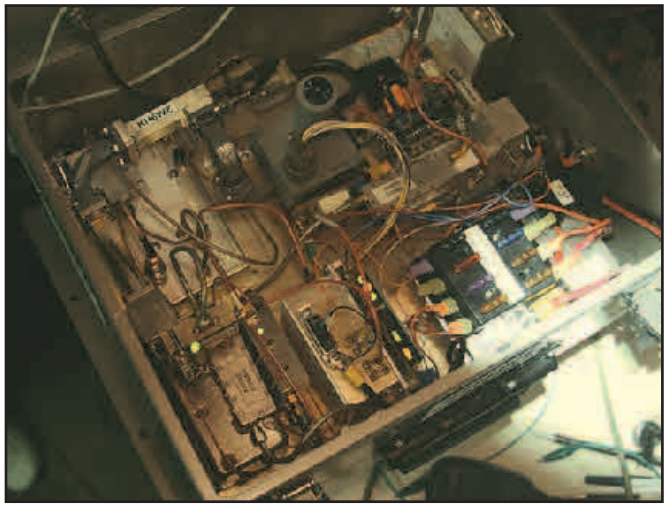


Figure 6 — The 24 GHz transverter system includes LEDs that do more than say "on." The various colors, sizes and shapes indicate specific voltages, conditions and states. It looks pretty neat in the dark, too.

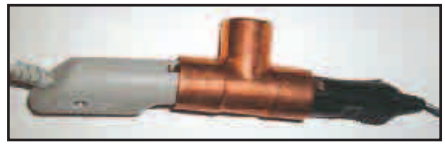


Figure 8 — K2PNK used a ¾ inch copper pipe T to join two cigarette lighter plugs. The center pins of the plugs make contact in the center and the T provides the ground connection. If you are not using the side tap on the T, you might consider closing it with a pipe cap to prevent fingers or loose objects from falling into the T and shorting the center pins to ground.

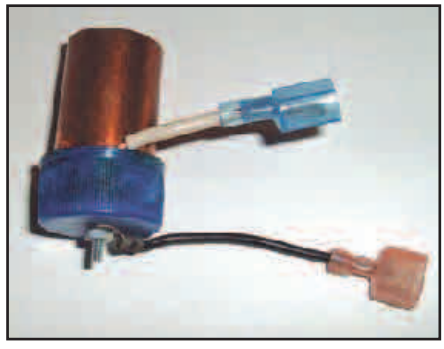


Figure 9 — K2PNK made a cigarette lighter receptacle using a ¾ inch copper pipe coupling. This photo shows how he used a small machine screw in a soda bottle cap for the center pin connection. The ground lead is soldered to the pipe coupling and the cap is glued in place using epoxy.

looks great in any project, especially in the dark. See Figure 6. In my 24 GHz rig, the LEDs indicate more than "on." The LEDs show voltage to various stages by color and relative size. For example, a 5 mm red LED indicates 12 V when in transmit at the amplifier power supply relay, while a 3 mm rectangular red LED shows 5 V (the transmitter bias voltage) at the transmit module. — *Wayne Yoshida, KH6WZ, 16428 Camino Canada Ln, Huntington Beach, CA 92649*; **kh6kine@earthlink.net**

Figure 7 — W1VAK glued a rubber grommet to the front of his MFJ Antenna Analyzer to prevent the unit from being turned on during transit or storage.

PADDLE HINT

◊ Following up on the editor's comment to K2PO in the July 2006 Hints & Kinks column about right-handed operators learning to send with their left hand to avoid dropping a pencil in the right hand — you already have the skill; you just don't know it.

Right-handed ops, take the paddle and turn it around 180° so the back of the paddle faces you. Place your left hand on top of the paddle, so your left thumb rests on the dit paddle and your left index finger on the dah paddle.

Start sending CW. Amazing, isn't it? You will be able do it with virtually no practice required. This is an ability now referred to as an obsolete contester skill. In the days before computer logging it would allow a CW contest operator who was paper logging to send with one hand and log with the other while minimizing hand movement. — *73, Scott Robbins, W4PA, 3225 Whittle Springs Rd, Knoxville, TN 37917*; **w4pa@yahoo.com**

MFJ ANTENNA ANALYZER ON/OFF SWITCH

◊ If you have been the owner of an MFJ HF/VHF antenna analyzer for any length of time, you have probably experienced the agonizing feeling when you went to use it and found that the batteries were dead because the ON/OFF switch was accidentally pushed ON at some time. The switch is exposed on the front panel, which makes this scenario quite likely. It only happened to me once after buying a fresh set of AA cells before I found a simple solution.

I glued a rubber grommet on the front panel around the power switch and the problem went away. See Figure 7. You could use any ring-shaped device as long as it is higher than the switch protrudes from the front surface. The batteries last a lot longer now. — *73, Ed Denton, W1VAK, 14 Holland St, Falmouth, MA 02540*; **w1vak@verizon.net**

CIGARETTE LIGHTER ADAPTERS

◊ I recently purchased a solar-powered car battery charger and wanted to use it to charge my 2 meter radio. For this I needed a way to connect two cigarette lighter plugs. Visiting my local hardware store, I discovered that a standard copper T fitting for ¾ inch tubing works perfectly. (The fitting itself has ⅞ inch openings.) See Figure 8. The extra opening on the T can be used to monitor voltage, or, with a scrap of two-sided circuit board, current.

A standard ¾ inch straight coupling is too short to hold two cigarette lighter plugs, but it can be used to build a female connector for such plugs by fitting it with a plastic end cap with a screw terminal in the center. A screw-on soda bottle cap and some epoxy seems to work. Figure 9 shows a completed connector. — *Arnold Reinhold, K2PNK, 14 Fresh Pond Pl, Cambridge, MA 02138*; **k2pnk@arrl.net**

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

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

PRODUCT REVIEW

ICOM IC-R2500 Communications Receiver

Reviewed by Steve Ford, WB8IMY
QST Editor

If you read the October 2006 *QST* Product Review, you probably saw my commentary on the ICOM IC-PCR1500/IC-R1500 communications receiver.[1] I was impressed by this little black box and the dc-to-daylight (10 kHz to 3300 MHz, cell blocked) receiver within. What made the IC-R1500 particularly attractive was the fact that you could control the radio with the supplied *Windows* software using a simple USB cable, or connect its control head and operate it like a conventional radio.

Not long after my review went to press, ICOM announced the debut of the next generation: the IC-R2500. Talk about rapid evolution!

The two receivers have much in common. As with the IC-R1500, you can control the IC-R2500 via computer (it is functioning as the IC-*PC*R2500 in this application), or you can attach the control head for a more "traditional" hands-on experience. The IC-R2500 also offers all of the same features such as the band scope, audio recording capability, voice squelch, *beaucoup* memories and your choice of several display options.

When it comes to scanning, the R2500 is every bit as competent as the R1500. Scanning modes include memory scan, program scan, CTCSS and automatic memory-write scan. Another welcome feature carried over from the R1500 is the multichannel monitor that displays scanning activity graphically, allowing you to check the action on your favorite frequencies at a glance.

My IC-R1500 wish list included features such as a synchronous AM detector, a 12 kHz IF output to use for decoding Digital Radio Mondiale (DRM) shortwave broadcasts, a better noise blanker, and better cloning software to make memory information in the computer software and in the radio more compatible. The IC-R2500 doesn't address any of these items.

With so much in common between the two radios, what's different? You get your first clue when you examine the rear panel of the IC-R2500 (Figure 1) and spy the twin antenna jacks and data ports.

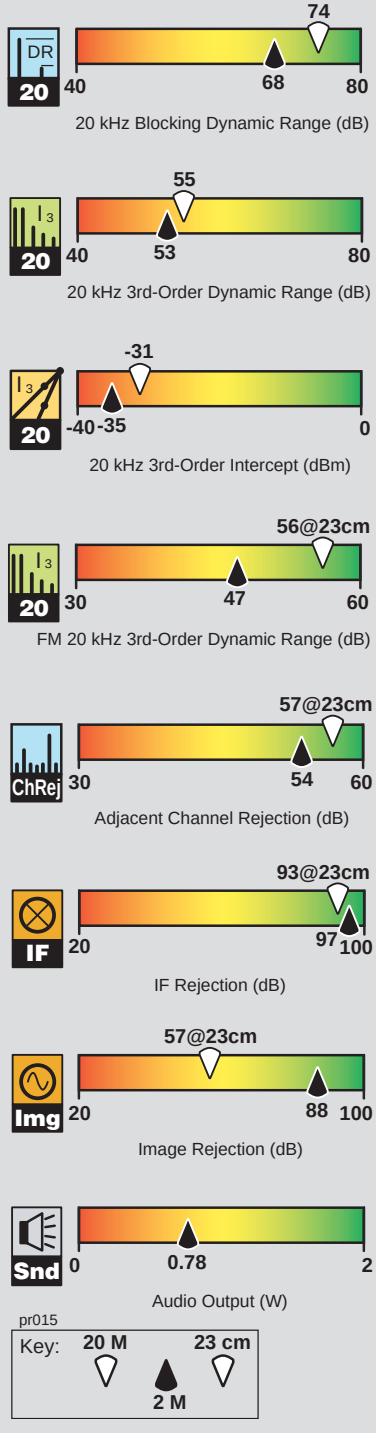
Two Receivers

No doubt you've heard the ancient axiom about two heads being better than one. The old sage was commenting on the benefits of diverse ideas, but in the IC-R2500 the "two heads" are two separate receivers called "main" and "sub." The receivers are not quite identical. The main receiver covers the full 10 kHz to 3300 MHz range in all modes. The sub receiver is limited to 50 through 3300 MHz coverage in AM, FM and wide FM only. Otherwise the two receivers offer the same performance. Antenna port 1 connects to the main receiver and antenna port 2 connects to the sub receiver. Both receivers have their own data ports.

Having two receivers in a single package opens the door to some interesting possibilities. The most obvious,

[1]S. Ford, "ICOM IC-R1500 Communications Receiver," Product Review, *QST*, Oct 2006, pp 69-73. *QST* Product reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

Key Measurements Summary



Bottom Line

The IC-R2500 adds a second receiver and optional D-STAR and P25 digital mode capability to ICOM's wideband computer controlled receiver lineup. The price of the receiver with options does add up, though.

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

shown in Figure 2, is the ability to listen to two widely different frequencies (and modes) simultaneously. While reviewing the IC-R2500, I set up some odd combos such as an AM shortwave broadcast on the main receiver and local fire dispatch on the sub receiver. One evening I listened to a net on 75 meter SSB while eavesdropping on air traffic control chatter on 125.575 MHz AM.

The most intriguing aspect of the IC-R2500 dual-receiver design is the ability to set both receivers to the same frequency for monitoring in the *diversity reception* mode (see Figure 3). When using diversity reception, the IC-R2500 continuously measures and compares the signal strengths between the two receivers. The result is improved reception of stations with fluctuating signals, such as mobiles. In one of my diversity tests, I connected my 2 meter omnidirectional antenna in the attic to the main receiver and a simple J-pole 2 meter antenna to the sub receiver. It was fascinating to watch the diversity feature at work while listening to mobile operators on the input of a local FM repeater. There would be abrupt signal changes as one antenna/receiver combo became "dominant" over the other.

There are limits to diversity reception in the IC-R2500, though. Remember that the sub receiver only works above 50 MHz and only in AM or FM. That substantially limits the signals you can monitor in diversity mode. In fact, diversity reception is essentially limited to FM signals only — and relatively strong ones at that. The manual states that diversity reception is "…not intended for use when receiving a weak signal in the FM mode with the squelch open." Without enough signal to "quiet" the receiver, the diversity reception algorithm can't separate the signal from the noise.

Dual Watch

Most of us are familiar with "watch" functions that essentially interrupt the signal we're listening to for a split second while checking for activity on another frequency. In the IC-R2500, however, the watch function becomes "dual watch," allowing you to effectively monitor two frequencies simultaneously while listening to other content. This is multitasking taken to a new level! During the review I used the dual-watch function to keep tabs on local police and fire. The feature worked quite well, although the sudden interruptions were disconcerting. This is true of any watch function, however, and you eventually become accustomed to it.

The Joys of DSP

When we conducted our IC-R1500 re-

Table 1
ICOM IC-R2500, serial number 0501391

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.01-810, 851-867, 896-1811, 1852-1868, 1897-2306, 2357-2812, 2853-2869, 2898-3110, 3136-3155, 3181-3300 MHz.	Receive, as specified.*
Modes of operation: FM, WFM, AM, SSB, CW, DV, P25.**	As specified.
Power requirements: 1.2 A (max audio), 10-13.8 V dc.	0.82 A (max volume, no signal), tested at 13.8 V dc.
CW/SSB sensitivity (10 dB S/N): 0.5-1.8 MHz, 5 μV; 1.8-50, 700-1300 MHz, 0.5 μV; 50-700 MHz, 0.4 μV.	Noise floor (mds), dBm: 1.0 MHz, –117; 3.5 MHz, –132; 14 MHz, –131; 50 MHz, –134; 144 MHz, –134; 222 MHz, –136; 432 MHz, –134; 902 MHz, –132; 1240 MHz, –133.
AM sensitivity (10 dB S/N): 0.5-1.8 MHz, 25 μV; 1.8-50, 700-1300 MHz, 2.5 μV; 50-700 MHz, 2 μV.	10 dB (S+N)/N, 1-kHz tone, 30% mod: 1.0 MHz, 3.6 μV; 3.8 MHz, 0.78 μV; 53 MHz, 0.62 μV; 120 MHz, 0.59 μV; 146 MHz, 0.62 μV; 440 MHz, 0.61 μV.
FM sensitivity (12 dB SINAD): 28-50 and 700-1300 MHz, 0.63 μV; 50-700 MHz, 0.5 μV; 1300-2300 MHz, 5.6 μV; 2300-3000 MHz, 18 μV.	FM narrow, 12 dB SINAD: 29 MHz, 0.27 μV; 52 MHz, 0.25 μV; 146 MHz, 0.24 μV; 222 MHz, 0.19 μV; 440 MHz, 0.23 μV; 906 MHz, 0.27 μV; 1296 MHz, 0.28 μV; 2400 MHz, 1.4 μV.
WFM sensitivity (12 dB SINAD): 50-700 MHz, 1.4 μV; 700-1300 MHz, 1.8 μV; 1300-2300 MHz, 18 μV; 2300-3000 MHz, 56 μV.	100 MHz, 0.73 μV.
Blocking dynamic range: Not specified.	CW mode, 20 kHz offset: 3.8 and 14 MHz, 74 dB; 50 MHz, 70 dB; 144 MHz, 68 dB; 222 MHz, 71 dB; 432 and 902 MHz, 74 dB; 1240 MHz, 77 dB; 5 kHz offset: 3.8 MHz, 72 dB; 14 MHz, 75 dB; 144 MHz, 67 dB.***
Two-tone, third-order IMD dynamic range: Not specified.	Third-order dynamic range, 20 kHz offset: 3.8 MHz, 54 dB; 14 MHz, 55 dB; 50 MHz, 53 dB; 144 MHz, 53 dB; 432 and 902 MHz, 55 dB; 1240 MHz, 58 dB; 5 kHz offset: 3.8 MHz, 46 dB; 14 MHz, 45 dB; 144 MHz, 45 dB.***
Third-order intercept: Not specified.	Intercept point, 20 kHz offset: 3.8 MHz, –31 dBm; 14 MHz, –31 dBm; 50 MHz, –35 dBm; 144 MHz, –35 dBm; 430 MHz, –31 dBm; 902 MHz, –27 dBm; 1240 MHz, –31 dBm; 5 kHz offset: 3.8 MHz, –36 dBm; 14 MHz, –36 dBm; 144 MHz, –39 dBm.***
Second-order intercept point: Not specified.	14 MHz, +31 dBm.

Figure 1 — The IC-R2500 main unit looks similar to the R1500. Note the addition of additional antenna and PACKET jacks for the second receiver.

Manufacturer's Specifications	Measured in the ARRL Lab
FM adjacent channel rejection: Not specified.	20 kHz offset: 29 MHz, 58 dB; 52 MHz, 57 dB; 146 MHz, 54 dB; 440 MHz, 57 dB; 906 MHz, 59 dB; 1240 MHz, 57 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 29 MHz, 49 dB; 52 MHz, 48 dB; 146 MHz, 47 dB; 440 MHz, 50 dB; 906 MHz, 51 dB; 1240 MHz, 56 dB; 10 MHz channel spacing: 52 MHz, 96 dB; 146 MHz, 93 dB; 440 MHz, 82 dB.
S-meter sensitivity: Not specified.	S9 indication: 1 MHz, 87 μV; 14 MHz, 120 μV; 50 MHz, 81 μV; 144 MHz, 80 μV; 440 MHz, 78 μV; 902 MHz, 94 μV 1240 MHz, 85 μV.
Squelch sensitivity: SSB, 0.5-1.8 MHz, 71 μV; 1.8-50 and 700-1300 MHz, 7.1 μV; 50-700 MHz, 5.6 μV; AM, 0.5-1.8 MHz, 18 μV; 1.8-50 and 700-1300 MHz, 0.89 μV; 50-700 MHz, 0.71 μV; FM, 28-50, 700-1300 MHz, 0.63 μV; 50-700 MHz, 0.5 μV; 1300-2300 MHz, 5.6 μV; 2300-3000 MHz, 18 μV; WFM, 50-700 MHz, 5.6 μV; 700-1300 MHz, 7.1 μV; 1300-2300 MHz, 71 μV; 2300-3000 MHz, 224 μV.	At threshold: SSB, 14 MHz, 0.15 μV; 146 MHz, 0.22 μV; 440 MHz, 0.23 μV; 906 MHz, 0.23 μV; 1240 MHz, 0.24 μV.
Audio output: 0.5 W at 10% THD into 8 Ω load.	0.78 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW: 214-2073 Hz (1859 Hz); USB: 294-2700 Hz (2406 Hz); LSB: 280-2688 Hz (2408 Hz); AM: 295-2630 Hz (2335 Hz).
Spurious and Image rejection: Not specified.	IF: 14 MHz, 87 dB; 50 MHz, 96 dB; 144 MHz, 97 dB; 222 MHz, 49 dB; 430 MHz, 81 dB; 902 MHz, 88 dB; 1240 MHz, 93 dB; Image: 14 MHz, 95 dB; 50 MHz, 90 dB; 144 MHz, 88 dB; 222 MHz, 100 dB; 440 MHz, 66 dB; 902 MHz, 52 dB; 1240 MHz, 57 dB.
Bit-error rate (BER), 9600-baud: Not specified.	146 MHz: BER at 12-dB SINAD, 5.5×10^{-3}; BER at 16 dB SINAD, 3.0×10^{-3}; BER at –50 dBm, 2.5×10^{-3}; 440 MHz: BER at 12-dB SINAD, 6.6×10^{-3}; BER at 16 dB SINAD, 3.5×10^{-3}; BER at –50 dBm, 3.2×10^{-3}.

Size (height, width, depth): main unit, 1.6 × 5.8 × 8.1 inches; controller, 2 × 5.5 × 1.1 inches; weight: main unit, 2.9 pounds; controller, 8.8 ounces.

Price: IC-R2500 receiver, $999; UT-106 DSP module, $139; UT-118 D-STAR module, $199; UT-122 APCO25 (P25) module (available at no additional cost until December 31, 2006), $199. Price as tested $1536.

*Receive sensitivity degraded below 0.5 MHz. Sub band receiver covers 50-1300 MHz only.
**DV and P25 require optional modules. See text. Sub band receives AM, FM and WFM only.
***Filter blow-by was observed at 5 kHz offset. At 2 kHz offset, the offset signal was within the filter passband.

Figure 2 — Listening to a shortwave broadcast on the main receiver (left side of display) while monitoring aviation traffic on the sub receiver (right).

view, we didn't have the optional UT-106 Digital Signal Processing (DSP) module installed. Its absence was most acute when it came to the IC-R1500's noise blanker. I commented that the standard IC-R1500 noise blanker performed poorly, hardly seeming to work at all. The noise blanker in the R2500 worked about the same.

For this review we installed the DSP module and took it for a spin. What a difference! The UT-106 did an outstanding job of keeping irritating noise at bay. The noise reduction also made HF AM and SSB monitoring more comfortable, reducing the "listener fatigue" that often occurs when you're trying to discern signals on a noisy band.

Speaking of reduced fatigue, the UT-106 also includes an "auto notch" function to instantly remove annoying carriers. If I were purchasing an IC-R2500 for my own use, I'd definitely spring the extra bucks for the UT-106 module.

Digital Reception

Speaking of modules, another major difference between the IC-R2500 and the IC-R1500 is the addition of optional digital reception. Depending on the module you purchase, you can receive APCO25 transmissions (the up-and-coming digital standard for public safety communications) or signals from the new D-STAR rigs (D-STAR is an Amateur Radio digital standard developed in a joint effort between the Japan Amateur Radio League and ICOM). It is important to note that digital reception is possible on the main receiver *only*.

We installed the UT-118 D-STAR module and tried the IC-R2500 with the D-STAR radios at W1AW. Using the IC-R2500's whip antenna on 1200 MHz resulted in very limited range, as you might imagine. Despite this, when D-STAR signals were decoded the voices were crystal clear. It's interesting to note that whenever the R2500 picked up W1AW's D-STAR transmissions, the *DV Received Call Record* and *DV Message* windows opened automatically as shown in Figure 4. In other words, the module does more than simply decode voice data.

For APCO25, we purchased the UT-122 module and turned the IC-R2500 over to Bill Moore, NC1L, the ARRL DXCC Manager. Bill is our resident scanner guru and we asked him to evaluate the IC-R2500's APCO25 capability.

APCO25, better known as Project 25 or simply P25, is a digital communication standard established in a joint effort between the Association of Public Safety Communications Officials International (APCO), the National Association of State Telecommunications Directors (NASTD), selected Federal agencies and the National

Trunking with the IC-R2500

In the past, listeners usually tuned in on one or more frequencies to monitor their local public service traffic, usually with separate frequencies for police, fire, EMS and so on. Today, with *trunked* radio systems this type of monitoring is completely different. In fact, monitoring a trunked communications system with a conventional scanner is almost impossible.

Trunking is a method of maximizing the capacity of a two-way radio system by assigning various users to shared *talk groups* rather than a single radio frequency. When a user transmits, his or her radio automatically sends a burst of data to a central computer that is monitoring a dedicated frequency called the *control channel*. This bit of data identifies the user as belonging to a certain talk group. The controller decodes the data and instantly sends a digital signal to all radios in the talk group, instructing them to automatically switch to the frequency assigned to that talk group. When the user finishes transmitting, the radios in the talk group return to monitoring the control channel.

All of this frequency hopping happens in a split second, so you can understand why a conventional scanner is helpless to make sense of it. To monitor a trunked system, you need to program the various talk group designations and frequencies into the radio, then have the radio monitor the control channel and automatically switch frequencies to follow the action. That's a pretty tall order!

To complicate matters further, there are several different types of trunking systems in use. Radio scanners designed for trunking cover most of the types that are out there, but not all of them. Before you purchase a trunking scanner be sure to do a little research ahead of time.

The ICOM IC-R2500 is not specifically designed as a trunking scanner. However, there is software available that will allow the receiver to operate in this fashion. I tested the radio with *Trunk PCR* by Jay Bray. *Trunk PCR* claims to work with conventional systems as well as with Motorola, EDACS and MPT1327 trunking. I was able to get it working with EDACS, but Motorola systems may take a little more effort. *Trunk PCR* is not entirely intuitive, so you'll need to spend some time figuring it out. Nonetheless, the software did allow me to listen to trunked systems with the IC-R2500, effectively turning this "conventional" scanner into a trunking scanner. It worked with my old IC-PCR1000 and supports the IC-R1500 as well. You'll find *Trunk PCR* on the Web at **members.cox.net/fiftyone.50/trunkpcr/trunkpcr.html**. — *Bill Moore, NC1L*

Figure A — Turning the IC-R2500 into a trunking scanner with *Trunk PCR* software.

Figure 3 — Diversity reception on 2 meter FM. The *Meter/Scan Panel* shows the varying signal strength as the IC-R2500 "chooses" the main or sub receiver. Only the main receiver is displayed in the *Tuning Panel* while in the diversity mode.

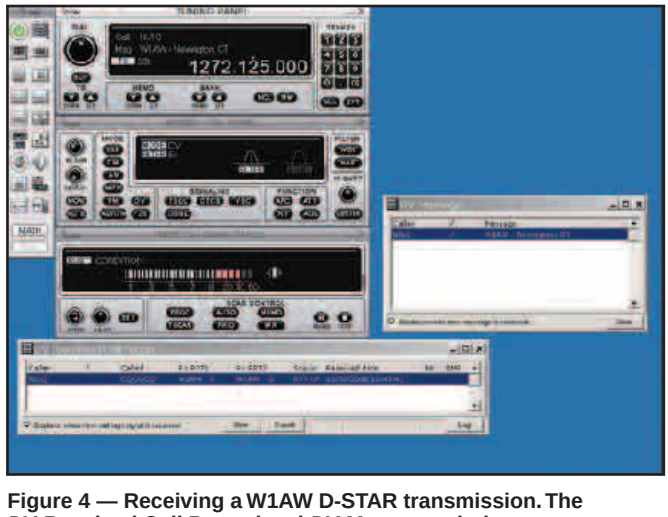


Figure 4 — Receiving a W1AW D-STAR transmission. The *DV Received Call Record* and *DV Message* windows open automatically.

Communications System (NCS). They created APCO25 to address the need for common digital public safety radio communications standards for first responders and Homeland Security/Emergency Response teams. You can learn more about APCO25 by visiting the site on the Web at **www.project25.org**.

We have several services in central Connecticut that are using APCO25. Bill reported easy success in monitoring their activities with the IC-R2500 and its UT-122 module. "As with our D-STAR tests, I heard clear P25 voice transmissions," Bill commented. "They only began to waver or break up when the signals weakened, as you'd expect."

Some readers have wondered about the ability of the IC-R2500 to monitor trunked radio networks. Bill's comments are included in the sidebar, "Trunking with the IC-R2500."

Conclusion

Adding diversity reception, dual watch and the optional ability to receive digital signals adds substantial functionality to the IC-R2500, making a good design even better and certainly more useful. The ability to add trunking functionality is icing on the cake.

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

ElmerRadio Crystal Radio Receiver Kit

Editor's Note: The IC-R2500 reviewed this month is a clear example of how far receiver technology has come. This next item is about as basic as it gets — a crystal radio receiver for the AM broadcast band. Using a handful of parts, it offers the builder a chance to learn a bit about radio theory and practical construction. Although this kit conveys the flavor of the earliest radios, it makes a few concessions to modern technology, including use of a Schottky diode instead of a galena crystal for the detector. The end result is a receiver that snatches signals out of the air without using batteries or ac power. Magic!

Reviewed by HB Kaplan, N1DJQ

We were very excited to be asked to review the ElmerRadio Crystal Radio Receiver Kit. As of this summer we have become an all ham family. We're not necessarily the most active hams, but we have a consistent presence on the VHF bands and spend some time on the low bands as well. Between the three of us we have 57 years and 3 months of experience on the air. Does that help us when putting together the kit? Well no, not in my case. I have done little soldering in my life but my husband David, WA1OUI, has many years of practical experience which was well appreciated before we were through.

My husband generously sat back and let the two tyros run with the project, occasionally interjecting his voice of experience, like..."Gee, you wouldn't have burned yourself if you had used the pliers like I suggested." Actually the project went forward steadily and took us about 6 hours all told. This was definitely no record but reasonable since the kit was completely built by our 12 year old son Keiko, KB1NUN.

More than a Typical Crystal Radio Kit

When I first heard about the crystal radio set, I was doubtful that the kit would be age appropriate, having had less than stellar experiences with a variety of no-solder kits. Once I read the instructions and saw the amazing color photos, I was hopeful that this would be a meaningful project.

The instructions were very clear and the color parts layout drawing and photo gallery were invaluable. The pictures could have been a bit more detailed, and it would have helped if the photos had been numbered and referenced in the instructions.

For the most part, Keiko didn't have problems putting together the kit. I was surprised that the instructions never mentioned the importance of components not touching the circuit board anywhere except at their solder points and that the solder needed to stay within the bounds of the solder pads.

One problem experienced was trying to solder components to the circuit board and to the antenna and ground binding posts. They were so large that they acted as heat sinks and we ended up with a mess of cold solder joints. Since our Weller soldering station wasn't powerful enough, we resorted to a soldering gun. By the time my son finished the kit he was stripping wires and tinning them easily, and his soldering technique had greatly improved. It's a bit awkward for a beginner to hold the soldering iron, solder, pliers and the circuit board. This makes the project a good family activity or a good "development opportunity" to learn to be more self-reliant.

Bottom Line

The ElmerRadio Crystal Radio Kit can provide a good introduction to basic radio construction and function, but it would be helpful to have someone at hand to assist.

A Few Bumps on the Road to Success

We were fortunate enough that the radio didn't work the first time. This enabled our son to experience the joys of troubleshooting.

The radio still didn't work after diagnosing and fixing the first error (misconnecting C2). The next error was misconnecting the red leads from the audio transformer. The layout drawing was unclear and the photo gallery wasn't much better. A written description would have been easier especially since the connections are a bit tricky. Success was that much sweeter once both problems were remedied.

The kit didn't come with earphones although the manual listed a few good ones. Not having any of them on hand, we tried to use a pair of iPod earbuds as well as several

pairs of small stereo headphones, but they didn't allow us to hear any signals. Finally, an old RadioShack mini mono amplifier/speaker worked wonderfully and we picked up several stations which had good strong signals.

This is certainly the fanciest crystal radio set I've ever seen and it seemed to have the best sound quality. The instructions were well written, but they could use a little improvement.[2] Pictures were mislabeled and the wrong components were referred to a few times. None of the errors were very serious because it wasn't too difficult to figure out what was actually meant.

The technical explanations were better in places than the Technician license manual. In fact, I wanted more theory particularly with respect to learning to read schematics. This kit is probably not a good first kit to build on your own, but it's lots of fun for someone with a bit of experience soldering or an Elmer to help you over the rough spots.

Manufacturer: ElmerRadio, 844 E Silver Shadow Dr, Murray, UT 84107, e-mail **elmerdude@xmission.com**; **www.elmerdude.com**. Price: $26.

[2]As they built the kit, the Kaplans kept track of errors and places where the instructions could be improved. The kit supplier has revised the instructions based on these comments and will include the revised manual with future shipments. In addition, a set of suitable earbuds will be offered as an option. I built one of these receivers too, but couldn't find any of the recommended earbuds. I looked for the most sensitive set I could find locally, and the receiver worked fine with Sony earbuds from Kmart and Koss earbuds from RadioShack. — *Ed.*

Building the Crystal Radio Receiver Kit

When I first opened the crystal radio kit, I'm like, "whoa, that's small." I've done a few other soldering projects, but this one had so many parts that I was seriously daunted. I mean, who's heard of "solder pads"? What's more, they don't include headphones with the kit. Why would you go and buy one of the recommended pairs if you have four pairs just lying around your house? My first impression was not that good.

Now, I pull out the instruction manual (don't lose the insert) and start to leaf through it. First thing I found was a checklist to make sure you have all the parts. That was a welcome surprise! I found I had everything, so I pulled out our soldering iron and got to it.

DAVID KAPLAN, WA1OUI

Figure B — Keiko Kaplan, KB1NUN, building the ElmerRadio crystal radio receiver kit.

Before I was halfway done, I could tell: *This is not a beginner's kit.* I melted parts of the plastic case of the variable capacitors and the whole thing took about 6 hours to build. What's more, I ran out of solder partway through. I was glad we had some of our own. The instructions aren't always clear either.

Finally, I finish the soldering (and the troubleshooting). We don't have any of the headphones suggested and I couldn't hear anything with what we have. Luckily, we have a speaker/amplifier with which I could hear fine. It's hard to tune to a station at first, but easy to get the hang of. I've heard about three stations so far. You wouldn't think so, but the sound quality is superb. The sound is crisp and distinct.

From my notes, it may sound like this is a bad kit, but it's actually fun to build (and to melt). I recommend this kit for anyone who has done some soldering. — *Keiko Kaplan, KB1NUN*

MFJ-1164 AC Line Filter

Reviewed by Michael Tracy, KC1SX
ARRL Test Engineer

The phenomenon known as "RFI" is all too familiar to a majority of Amateur Radio operators. Although the most publicized cases involve interference from transceivers to consumer electronics of various kinds, interference is just as likely to occur in the opposite direction. Some consumer electronics equipment — personal computers, for example — generate low level RF signals during normal operation. Other equipment uses poorly filtered switching power supplies with switching frequencies in the usual AF to IF range that can have lots of harmonics into the RF range.

In every case, the best solution is to correct the problem at its source, or as close to it as possible, and often this means applying multiple fixes to the equipment to "put a stopper in all the leaks" as it were. One of those leaks is right where the equipment gets its power. While power connections are intended only as inputs, they also often provide a path for signals to go the other way, especially at RF where the unshielded wires can look a lot like antennas when the wiring of the building itself gets into the act! So what is the stopper to use for this particular leak? The answer is an *ac line filter* that, when properly installed, can greatly

Bottom Line

The MFJ-1164 ac line filter is an effective tool in combating RFI, but our review unit exhibited potential safety issues. All noted issues have been addressed by MFJ in a newer MFJ-1164B version.

attenuate the leaking RF currents flowing out of the power cord.

Some Good News

There are a number of ac line filters on the market, but the new MFJ-1164 warranted a closer look with its combination of features and attractive pricing.

The good news is that you get four ac outlets with plentiful spacing for large plug-mounted power supplies (also known as "wall warts"). The filter uses a sturdy aluminum case with a separate grounding terminal and tabs for permanent wall or desk mounting, and it has an easily accessible fuse.

With chokes in all three conductors and capacitors and MOVs (metal oxide varistors, for surge suppression) from line to ground and neutral to ground, protection is provided in both directions — from the equipment plugged into the filter to the house wiring and vice-versa. Lab testing showed that with a very noisy lighting fixture, the filter provides 10 to 35 dB of suppression across the HF range (frequency dependent) without using a supplemental ground.

Some Bad News

The bad news is that our review unit presented a few potential safety problems. The first of these is that the fuse holder is wired opposite of some manufacturers' recommendations. As shown in Figure 5, the power cord hot wire connects to the ring terminal of the fuse holder. This is the terminal closest to the outside the cabinet. It can present a shock hazard from finger contact when the fuse is removed. Reversing the connection — attaching the hot wire from the power cord to the end terminal — eliminates the possibility of contact with 120 V ac with the fuse removed. We confirmed that our unit is not the only one wired this way.

A second issue also relates to the fuse. The one in our review unit is rated for 30 A, but it's a glass body AGC series fuse rated at only 32 V. A better choice, perhaps a bit harder to find, is an ABC or 3AB series ceramic body fuse rated for 30 A at 125 or 250 V. Now, some argue that because a fuse operates on current, the current rating is all that really matters. This is not exactly the case because fuse reaction times are based on a complex profile involving both current and voltage.[3] So while the 32 V fuse will provide protection, it may not do so in the same manner that a 125 or 250 V fuse would.

While I had the filter apart, I noticed another potential problem. The outlets are lined up in a neat row and bare buss wire lengths

[3]"Selecting a Fuse Value," *Compliance Engineering*, Winter 1993.

Figure 5 — The MFJ-1164's power cord hot lead is connected to the fuse holder ring terminal, placing 120 V ac near the outside of the cabinet. Reversing the connection so that the power cord hot lead is at the end terminal removes this potential shock hazard.

Figure 6 — The power outlet ground terminals are tack-soldered to a ground buss. A more secure mechanical connection is desirable, especially if the filter is subject to vibration.

Figure 7 — MFJ addressed all of the concerns in this review in the MFJ-1164B. The new version uses PC board construction.

are soldered to the tabs on the back of the outlets. For the hot and neutral conductors, each outlet has a short connecting jumper also made of bare buss wire. For the ground wire, however, each tab is tack soldered to the wire as it passes by (see Figure 6). While failure of this connection is not likely to be common unless the filter is placed in an environment with a lot of vibration, without a better mechanical connection there is a remote possibility that an outlet might lose its ground connection altogether.

Finally, I noticed a wiring error that may be unique to the review unit. The hot and neutral conductors are connected to terminal strips inside the filter where the coils, capacitors and MOVs are mounted. On the neutral terminal in our unit, one strand of wire was touching the grounded case of the filter. Since this conductor is not fused, it could conduct a significant amount of current to the house ground if a piece of equipment that is plugged into the filter were to have an internal cross-wiring fault.

Some Great News

As this review was wrapping up, we learned that MFJ has discontinued the model reviewed here and is offering the MFJ-1164B. The revised filter uses PC board construction, completely eliminating the wiring and mechanical issues noted in the review unit. The fuse holder is wired with the line cord hot connection on the end terminal, and the fuse has a 250 V rating. MFJ indicated that owners of original MFJ-1164 filters should contact MFJ to arrange to return the units for inspection and repair.

With the correction of these wiring issues, the MFJ-1164B ac line filter is an excellent addition to the ham shack.

Manufacturer: MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759; tel 662-323-5869; fax 662-323-6551; **www.mfjenterprises.com**. Price: $59.95 (be sure to specify the MFJ-1164B model when ordering). QST

Going Once, Going Twice...

In order to present the most objective reviews, ARRL purchases equipment off the shelf from dealers. ARRL receives no remuneration from anyone involved with the sale or manufacture of items presented in the Product Review, Short Takes or New Products columns. Items declared surplus following such reviews are offered at auction on the ARRL members' Web page at **www.arrl.org/prauction**.

TECHNICAL CORRESPONDENCE

HOW TO GET YOUR ELECTRIC POWER UTILITY TO FIX NOCTURNAL RF NOISE

◊ About a year ago, I had a severe noise problem, very pronounced on 80 meters, and evident across all HF bands! The problem started gradually, and got worse as the days and weeks went by. Eventually, the noise level was anywhere from 10 to 40 dB over S9! At that level, only the strongest signals were getting through, and were often distorted by the adaptive noise processing of my Ten-Tec Pegasus digital software radio. This radio is a marvel of high technology, and its noise reduction capabilities and frequency accuracy and stability are nothing short of miraculous compared to legacy analog rigs. Nevertheless, it can only do so much, and if the signal to noise ratio is below a certain level, which appears to me from observation to be about 10 dB, its ability to separate the two degrades, resulting in loss of intelligibility.

This was "shot noise," so my noise blanker was effective, but reduced reception somewhat, especially during exceptionally noisy periods. Sometimes whole words and phrases can be lost with high noise levels. We all know that the best solution is to eliminate the noise at the source, but what is the source, how do you find it, and how do you get it fixed? Ah, there's the rub!

Calling for Help

I complained to my local electric power utility, Jersey Central Power and Light, a First Energy Company, by calling their emergency number. The customer service representative at first did not know what I was talking about when I told her I needed the services of the RF interference section. Calls for this type of problem are apparently rare, and I had to explain to her that the electric power utility is required by law to investigate and mitigate, if possible, any radio interference caused by the electric power grid. After consulting her supervisor, my complaint was recorded and forwarded to the Network Services Division (NSD) in my area for resolution.

The NSD responded a few days later, and suggested the cause could be corona discharge across a defective (probably cracked or dirty) high voltage insulator or neon lights, a common source of RF noise. I had a noise problem a few years ago, and at that time they replaced my old high voltage insulators on the wires across the street from my house, which was helpful at that time. There is a small store across the street from me with neon lights, but their lights have never been a problem before. NSD investigated but with no findings on the cause. I found out later that they only investigated in the daytime, during which the problem was less obvious or nonexistent. This daytime only procedure was critical to the lack of progress!

The noise was continuous until an ice storm coated trees and electric wires one day in early December 2005. That evening, the noise was gone! Within a day or two the noise started again, but instead of being continuous, it now had a periodic behavior, starting up gradually and running for about 40 seconds, then shutting off for about 1 minute. Furthermore, in the morning (daylight) the noise vanished! Now I had a good idea what this noise source was — a defective street light! After characterizing the behavior for several nights, I contacted the NSD again.

Blinking Lights

At first I didn't hear back from them, so I decided to see if I could find the bad light. I didn't have far to go to find it! It turned out that a street light only about 200 yards away was continuously attempting to restart, and would light for several seconds, only to go out again, and repeat the cycle about every minute and a half; exactly the timing of my noise problem. Furthermore, it was located directly perpendicular to my 80 meter dipole antenna!

I eagerly called the NSD and was told the "little secret" to getting power grid nocturnal noise problems resolved. I was told that the utility company will not pay overtime except for significant emergency problems. Unfortunately, RF interference isn't considered an emergency.

On Your Own in the Dark

If your noise source is nocturnal in origin, *you* may have to do your *own* investigation to find the probable source and then report the necessary information to the utility to get it resolved! You can complain till the cows come home, but the NSD cannot help you because they will not be paid to work at night to find the source of your problem! To resolve it, they must work on their own time, which naturally they are reluctant to do. They are very frustrated about this, and understand customers getting irate about their apparent lack of action, but they have their hands tied by a profit-oriented system that wants to trim costs to keep earnings up. They personally would love to investigate and solve your problem, as that is their job and they want to do it, but they are stymied by the system. I was told that what I did, find the source myself by looking for it at night, is *exactly* what the customer must do to get action on this type of problem.

So, having been suitably empowered, I now decided to see if there are other sources of noise contributing to my noise problem. I got in my vehicle and drove virtually every street within approximately a 1 mile radius of my house! Since I live in a rural part of central New Jersey, there are not too many roads, and so my search only took about an hour. In an urban area, it could take considerably more time, and the search may have to be reduced to a 1/2 mile radius. I was told by the NSD that a street light up to 2 miles away could cause the type of interference I was experiencing, albeit at a much lower level at that distance!

As a result of my exhaustive search, I found one more light cycling on/off about 1 mile away, but it would stay lit for several minutes before cycling. I also found a light that was completely dead about a half mile away, which probably was a significant source of noise at a reduced level in months long past! Later, I found another light cycling with a long "time constant." This type of cycling behavior is typical for mercury and sodium vapor area lighting bulbs when they approach the end of their life.

Now the NSD also told me that I need to record the street that the light is located on, any cross street nearby or other adjacent landmark, and most importantly, the *pole number* of the pole the light is mounted on. I collected this information and reported it to the NSD, and after a delay due to the Christmas and New Year's holidays, and a gentle reminder in early January, they fixed/replaced the defective street lights/bulbs.

Subsequently, I discovered on the First Energy Web site that you can report via the Web site any lights that are out or cycling! There is a form to fill out requiring information about you, your location, and the type and location of the problem light. I reported one cycling light this way. I then discovered that you must give them complete informa-

Larry D. Wolfgang, WR1B ♦ Senior Assistant Technical Editor ♦ tc@arrl.org

tion or they will promptly e-mail you saying that they cannot fix it. Once they have a completely filled out form, they do fix the problem light!

The Sounds of Silence

As a result of this ordeal, I now enjoy 80 meters and the other HF bands with just the normal band noise. I can once again hear weak transmissions, as well as strong ones, without the necessity of using my noise blanker at all! Amateur Radio life is good once again! My thanks to the decent and dedicated personnel in the Network Services Division for educating me about how to make their system work for the customer, and for being prompt and efficient in fixing RF interference problems here in central NJ! My hat's off to you!

I am an electrical engineer working for the US Army at Fort Monmouth, NJ. I hope this article helps many people get action in resolving their nocturnal RF noise issues, wherever they live. — *Owen O'Neill, N2IWN, PO Box 222, Clarksburg, NJ 08510-0222*; **n2iwn@arrl.net**

ANOTHER POWER LINE NOISE HUNTING IDEA

♢ One method of finding the source of "local" noise is with a portable AM broadcast receiver. Using the directivity of the ferrite loop stick antenna, you can get a general idea where the noise is originating. If you feel it is power pole related, just walk around each pole with a sledge hammer and whack the bottom of the pole while listening to the radio. People will think you are crazy, but it works!

If you feel that it is not power pole related (like a constant buzz) a likely source is the over-heat thermostat on a doorbell transformer (or in-home intercom system). To protect the transformer from overheating, they use a bimetal strip to shut the transformer down if it gets hot. If the bimetal strip is faulty or old, it will vibrate just like a buzzer. I was faced with this problem some years ago, and it was my neighbor's transformer over 200 feet away!

I hope this information will help someone with noise problems. — *Al Lee, WA4EWV, 7137 Dolphin Bay Blvd, Panama City Beach, FL 32407-5473*; **wa4ewv@wa4ewv.net**

COMMENTS ON THE CAT5 CABLE AND CONNECTOR TESTER

♢ I am writing with regard to "A CAT5 Cable and Connector Tester" by Allen Poland, K8AXW, published in the July 2006 issue of *QST*.[1] The author should be commended for addressing the common, but not necessarily simple, problem of testing CAT5 Ethernet cables. *QST* readers, however, need to know that the tester described in the article can produce misleading results. It is possible for a cable to test "good" yet, in fact, be faulty.

As described, the tester will indeed verify dc continuity. Of equal concern, however, is that all cable pairings be correct for proper operation of the cable when used with high-speed signals such as those found in a 100 Mbps Ethernet network. By design, CAT5 cable uses twisted pairs of the cable's eight conductors to form four circuits. The EIA/TIA T568A/B wiring standards pair wires 1-2, 3-6, 4-5, and 7-8. The twisting is essential for reducing crosstalk interference.

It is entirely possible for a cable to be miswired and test "good" using the K8AXW tester. Such a cable is likely to fail in-circuit, because of this improper pairing. For example, if the brown/white (pin 7) and the orange/white (pin 1) wires were accidentally swapped in the cable connectors, the cable would pass the tester. In reality, the pairings of two out of four circuits are now incorrect and could cause the cable to fail in operation due to noise and crosstalk. This type of wiring error is known as a "split pair."

This is one reason why commercial Ethernet cable testers can be expensive. They test for faults other than simple continuity. While the K8AXW tester can detect some Ethernet cable wiring faults, it should not be relied upon for complete and thorough cable testing. Installing a seemingly good cable that in fact is faulty can result in the most bedeviling of networking problems to solve. — *Wayne Greaves, WØZW, PO Box 16, San Patricio, NM 88348*; **w0zw@arrl.net**

[Charles Hansen also wrote to point out that he priced the parts (with an enclosure and shipping) for the CAT5 Cable and Connector Tester project. He found that he could buy a tester on eBay that also tests USB and RJ11 connectors and cables for about $9 with shipping. Of course much of the fun of ham radio for many of us is building equipment, and some of us are willing to pay more for the thrill of saying "I built it myself!" — *Ed.*]

[1]A. Poland, K8AXW, "A CAT5 Cable and Connector Tester," *QST*, Jul 2006, pp 52-53.

Technical Correspondence items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given idea will work for your situation, we make every effort to screen out harmful information.

Materials for this column may be sent to ARRL, 225 Main St, Newington, CT 06111; or via e-mail to **tc@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether praising or criticizing a work, please send the author(s) a copy of your comments. The publishers of *QST* assume no responsibility for statements made herein by correspondents. QST

Feedback

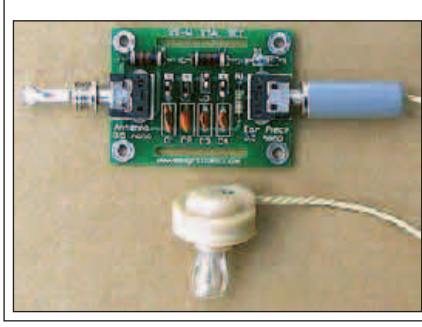
♢ In "The MicroR2—An Easy to Build 'Single Signal' SSB Receiver" [Oct 2006, pp 28-32], Note C in Table 2 has part numbers C31 and C32 interchanged. C30 and C32 should be 0.1 µF and C31, C33 and the two inductors are eliminated in the "low hum" version as discussed in the text and shown in Figure 5.

♢ The Short Takes review, "A 30 and 80 Meter Module for the Elecraft KX1 CW Transceiver" [Nov 2006, p 63], indicated that the Canadian time/frequency radio station transmits full-carrier LSB on 3.330 MHz and 7.335 MHz and 14.670 MHz. John Wilson, KK6KU, points out that CHU transmits full-carrier USB on those frequencies. That means that the KX1 can be used to receive CHU only on the two higher frequencies. The KXB3080 module enables CW and LSB reception in the range from 1.000 MHz through 5.505 MHz when the KX1 is switched to the 80 m/75 m band. USB reception is available on the KX1 only between 5.000 MHz and 16.505 MHz. — *Bruce Prior, N7RR*

New Products

XTAL SET SOCIETY CRYSTAL RADIO KIT

♢ The Xtal Set Society XS-W crystal radio kit is assembled on a 1.5 × 2 inch PC board and is said to be small enough to wear on your wrist. An end-fed antenna and high-impedance ear piece attach to the PC board via 3.5 mm mono plugs. A manual is provided, and solder assembly is required. For most hobbyists, kit assembly is said to require less than one hour. The XS-W tunes the AM broadcast band (550-1650 kHz) via an array of capacitors jumper-selected on the PC board. These jumpers may be changed for tuning after assembly. Small size is achieved by using molded inductors for the main LC circuit and for antenna coupling. As with all crystal sets, operation is maximized when the set is grounded and attached to a sufficient antenna. Price: $16.95. For more information or to order, visit **www.midnightscience.com**.



"Omnibus" Amateur Radio *R&O* Published in *Federal Register*, Phone Band Expansion Takes Effect December 15

With publication in the *Federal Register* November 15, the long-awaited changes to the amateur rules are set to take effect 30 days later, at 12:01 AM EST December 15. The so-called "Omnibus" Amateur Radio proceeding, WT Docket 04-140, includes a significant expansion of the 75 meter phone band and a variety of other changes. The highlights:

- For Amateur Extra class licensees, the 75 meter phone band will start at 3600 kHz, while Advanced class licensees start at 3700 kHz and Generals at 3800 kHz. The high end of the CW/RTTY/Digital band is now 3600 kHz (although CW is allowed on the entire band).
- On 40 meters, Amateur Extra and Advanced licensees will be able to operate phone beginning at 7125 kHz, while Generals start at 7175 kHz. The top end of the CW/RTTY/Digital band will be 7125 kHz (although CW is allowed on the entire band).
- There are no changes to the 20 meter band.
- On 15 meters, the General class phone band now starts at 21,275 kHz.
- On 10 meters, Novice and Technician Plus licensees can now operate CW/RTTY/Digital from 28000 kHz to 28300 kHz.
- In addition, Novices and Tech Plus licensees can use CW only on the same frequencies as General and Advanced licensees on the 80, 40 and 15 meter bands: 3525 kHz-3600 kHz; 7025 kHz-7125 kHz and 21025 kHz-21200 kHz.

As expected, the *Report & Order* as published in the *Federal Register* clarified two items that had raised some concerns when it was first released October 10: That the 80/75 meter band split applies to all three IARU Regions, and that FCC licensees in Region 2, which includes North America, can continue to use RTTY/data emissions in the 7.075-7.100 MHz band.

Still to be resolved are three controversial aspects of the proceeding:

- Expansion of the 75 meter phone band all the way down to 3600 kHz (thus reducing the privileges of General, Advanced and Amateur Extra class licensees, who had RTTY/data privileges in the 80 meter band, and CW privileges of General and Advanced class licensees)
- The elimination of J2D emissions, data sent by modulating an SSB transmitter, of more than 500 Hz bandwidth (thus making PACTOR III at full capability illegal as well as several other data modes), and
- The elimination of access to the automatic control RTTY/data subband at 3620-3635 kHz.

Other Highlights

The FCC also:

- implemented rules to discourage multiple vanity call sign filings on the same day from the same applicant;
- permitted auxiliary stations to transmit on portions of the 2 meter band;
- permitted the use of spread spectrum on 222-225 MHz;
- permitted amateurs to retransmit communications from the International Space Station;
- permitted amateur licensees to designate a specific Amateur Radio club to receive their call sign *in memoriam*;
- eliminated certain restrictions governing the manufacture, marketing and sale of external RF power amplifiers intended for Amateur Radio use;
- clarified that "amateur stations may, at all times and on all frequencies authorized to the control operator, make transmissions necessary to meet essential communication needs and to facilitate relief actions";
- deleted the frequency bands and segments specified for Radio Amateur Civil Emergency Service (RACES) stations;
- deleted the requirement to publicly announce Amateur Radio examination locations and times, and
- permitted Amateur Radio stations in Alaska and surrounding waters more flexibility in providing emergency communications.

The FCC also took several other miscellaneous actions.

The ARRL Board is discussing the possibility of a petition to reconsider several items in the *R&O*.

ARRL Regulatory Information Specialist Dan Henderson, N1ND, commented: "The release of the *R&O* in the *Federal Register* has started the countdown clock. Many are looking forward to being able to use the refarmed Novice frequencies starting on December 15."

For more information, see "Frequently Asked Questions on WT Docket No. 04-140" at **www.arrl.org/wt04-140faq**. The FAQ Web page includes a band chart. Both the FAQ and the chart have been updated to reflect the *R&O* as it was published in the *Federal Register*.

As this issue goes to press, FCC action was still pending in the separate Morse code proceeding, WT Docket No. 05-235. Meanwhile, a 5 WPM code test is still required for those taking General and Amateur Extra class exams.

LEAGUE SEEKS FCC'S WRC-07 SUPPORT FOR 150-kHz 60-METER AMATEUR ALLOCATION

The ARRL has asked the FCC to throw its support behind a *Draft Proposal* seeking to have World Radiocommunication Conference 2007 (WRC-07) delegates consider a worldwide, secondary Amateur Radio allocation from 5260 kHz to 5410 kHz. The ARRL included the request in comments it filed October 27 in IB Docket 04-286, "Recommendations approved by the Advisory Committee for the 2007 World Radiocommunication Conference." WRC-07 Agenda Item 1.13 will review allocations to all services between 4 and 10 MHz. The League told the FCC that a contiguous band of frequencies in the range of 5 MHz is an important goal of the amateur

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

FCC News

FCC CONSIDERING COMMENTS ON RULE MAKING PETITIONS

The FCC is considering comments it solicited last fall on two Amateur Radio-related petitions for rule making. Both petitioners seek changes in the FCC's Part 97 Amateur Service station identification rules, specifically §97.119(a). That rule now requires stations to identify "at the end of each communication, and at least every ten minutes during a communication . . ." The comment deadline ended November 29.

RM-11346, filed by Murray Green, K3BEQ, would raise the required ID interval to 30 minutes as well as at the end of each communication. Green argues in his petition that while he has no problem with the Commission's requirement that Amateur Radio stations identify, "less frequent identification should not hinder the Commission's enforcement of Amateur Radio regulations, as demonstrated by the station identification requirements for other radio services." He suggests the current 10-minute requirement is a result of "an abundance of caution" on the FCC's part.

A second petition, RM-11347, filed by Glen Zook, K9STH, proposes requiring radio amateurs to transmit the call sign(s) of stations with which they are in communication plus their own call sign at the start and end of each single transmission or of a series of transmissions between stations in communication "each transmission of which is of less than three minutes' duration" (operators could omit the ID at the end when the entire series is less than three minutes), at least every 10 minutes during a series of transmissions between stations in communication, and at least every 10 minutes during any single transmission more than 10 minutes long.

"Unfortunately, too many Amateur Radio operators, especially when using FM repeaters, do not identify during their first transmission," Zook asserted in his petition. "In fact, a considerable number of these operators never seem to get around to identifying even after 10 minutes of operation and a 'fair' number never seem to get around to giving their call sign at all." Zook says his suggested changes will "clarify the existing regulations and to help eliminate problems with station identification" and actually legalize some commonplace on-air station ID behavior.

Amateur Enforcement

♦ ***Loaded for Bear*: FCC Issues Warnings Regarding Unlicensed Use of Ham Bands:** FCC Special Counsel in the FCC Spectrum Enforcement Division Riley Hollingsworth in October warned seven Michigan residents that unlicensed use of Amateur Radio transmitting equipment on 2 meters to facilitate their bear hunting activities is illegal and may result in substantial fines.

"While many hunters use Citizens Band radio or Family Radio Service equipment, the use of Amateur Radio equipment requires a license," Hollingsworth said. He also sent an *Advisory Notice* to the Michigan Bear Hunters Association with the suggestion to post it on the Association's Web site.

In a similar situation, the Commission attempted to enlist the aid of Quest Air Soaring Center in Groveland, Florida, in spreading the word that glider pilots using the facility also need to avoid unlicensed operation on 2 meters. Hollingsworth said unlicensed use of airborne radio equipment not only violates federal law but causes widespread interference to licensed stations. He suggested the soaring center post the *Advisory Notice* on its Web site as well.

The FCC also warned yet another trucking firm of apparent unlicensed operation on 10 meters by two of its drivers this past summer. Hollingsworth wrote Sysco Corporation of Houston, Texas, October 10, citing reports that the transmissions were spotted during August on 28.115 MHz while the drivers were on the road in Michigan.

In all three instances, Hollingsworth pointed out that violators face fines of up to $10,000 as well as possible imprisonment and seizure of transmitting equipment.

♦ **Licensees told to expect hearing designations:** The FCC has alerted two radio amateurs that the Wireless Telecommunications Bureau (WTB) has referred their Amateur Radio license renewal applications to the Enforcement Bureau for review. FCC Special Counsel in the FCC Spectrum Enforcement Division Riley Hollingsworth has told each licensee to expect a *Hearing Designation Order* from the Commission.

Hollingsworth told David O. Castle, WA9KJI, of Evansville, Indiana, October 11 that the WTB referral was the result of "long-standing complaints against the operation of your station" involving interference on HF and 2 meters. In another case, Hollingsworth wrote William F. Crowell, W6WBJ (ex-N6AYJ), of Diamond Springs, California, that his license renewal application had been designated for hearing after a review of "numerous complaints filed against the operation of your station" alleging deliberate interference.

At hearings before an administrative law judge in Washington, DC, applicants have the burden of proof in showing they're still qualified to be Amateur Radio licensees. Over the past several years, the FCC has asked both licensees to respond to deliberate interference allegations.

community, domestically and internationally.

"For reliable communications, an Amateur allocation in the vicinity of 5 MHz is the solution," the ARRL told the FCC. Citing the *Draft Proposal*, the League noted that there are times when the propagation at 5 MHz bridges a significant gap between 40 and 80 meters. Originating with ARRL, the *Draft Proposal* from Informal Working Group 4 (IWG-4) follows up on disaster relief-related changes to Article 25 of the international *Radio Regulations* made at WRC-03.

IWG-4 *Draft Proposal* background information notes that Amateur Radio provides local, national and international emergency communication as an adjunct to normal communication and may serve as the only communication link when telecoms infrastructure is destroyed."

Several countries — including the US, Canada, Finland, Iceland, Norway and the UK — already have permitted Amateur Radio operation on spectrum between 5250 and 5450 kHz, the ARRL said, again citing the *Draft Proposal*. The five 60-meter channels have been in regular use by US radio amateurs since 2003 "without any instances of interference reported by primary users," the ARRL noted.

The League took issue with remarks contained in the ITU Conference Preparatory Meeting (CPM) draft report with respect to Agenda Item 1.13 that suggest otherwise. Among "disadvantages," the *Draft CPM Report* asserts an expanded allocation "would increase congestion and potential interference to fixed and mobile services at 5 MHz." It argues that compatibility between amateur and fixed service systems in the vicinity of 5 MHz "has not been shown" and a decision to create an Amateur Service allocation there "could seriously affect reliable 24 hours [sic] communication capabilities of the fixed and mobile services." The *Draft CPM Report* also notes the advantages to the Amateur Service of such an allocation.

The ARRL's request in its IB Docket 04-286 comments is separate from its October 10 *Petition for Rule Making* (*PRM*), in which the League asked the FCC to expand operating privileges on 60 meters and to

swap one existing channel for a new one. As of press time, the FCC had not yet assigned a rule making (RM) number to the petition nor invited comments.

Specifically, the League wants the FCC to authorize radio amateurs of General and higher class to run 100 W effective radiated power (ERP) instead of the 50 W it now permits and to allow Morse code and narrow-band digital modes, including PSK31 and PACTOR 3. It also asks the Commission to replace the 5368.0 kHz center-frequency channel with 5358.5 kHz, so amateurs can avoid federal government digital traffic on the current channel. Operation on 60 meters would remain on a secondary basis, and radio amateurs would still have to avoid interfering with incumbent federal government and other services.

The National Telecommunications and Information Administration (NTIA), which oversees spectrum allocated to federal government users, derailed the FCC's proposal to grant ARRL's request for a 150-kHz amateur band at 5 MHz several years ago. The current five channels, upper sideband only, 50 W ERP and maximum 2.8 kHz bandwidth were a compromise worked out between the NTIA and the FCC.

The NTIA is far more favorably disposed to the ARRL's latest request, however. Its Office of Spectrum Management told ARRL that the Interdepartment Radio Advisory Committee (IRAC) had considered the League's requests and "would look favorably" on the channel change, use of additional modes and power increase proposals. The IRAC would not support a 50 kHz-wide domestic secondary allocation, however.

The NTIA has cautioned that digital users "must take care to limit the length of their transmissions" so federal agencies could readily reclaim a 60-meter channel in an emergency. NTIA said it would support the power hike "on the presupposition" that amateurs would continue to use voice-operated transmit (VOX) on USB phone. The ARRL's proposed Part 97 rule changes specifically accommodate these concerns.

The FCC is but one of the federal agencies that provide input toward positions the US delegation will take on various WRC-07 issues. Should WRC-07 delegates eventually consider and agree to the international allocation at 5 MHz that ARRL proposes, it still would be up to the FCC — in conjunction with the NTIA — whether to authorize such a band in the US.

NEW YORK COMMISSION RECOGNIZES BPL INTERFERENCE CONCERNS

The New York Public Service Commission (NYPSC) has adopted a policy statement on deployment of BPL systems in the Empire State. While asserting that BPL technology "may provide significant benefits to New Yorkers," the commission also acknowledged that BPL "poses a myriad of both traditional and unique technical and regulatory challenges." The policy statement, issued and effective October 18, says that while most BPL providers, equipment makers and vendors believe FCC rules address interference, that was not the consensus of those commenting to the Commission.

"Most parties were uneasy about potential interference problems that could arise with the deployment of BPL technology," the NYPSC policy statement pointed out, citing RF interference as "a major issue." The NYPSC policy affirmed a decision that electric utilities should not be BPL providers. Utility Consolidated Edison still operates a BPL trial system in the Westchester County community of Briarcliff Manor that has been the target of BPL interference complaints from radio amateurs. The policy puts primary responsibility for RFI on BPL providers, who, under the NYPSC model, would lease power grid access.

In his oral comments to the NYPSC, Robert Mayer, director of the New York Office of Telecommunications, characterized the interference issues as "serious and unresolved." Mayer told the Commission that radio interference is "probably one of the most fundamental questions" facing BPL and that it remained unresolved.

"It's one of the things that this commission needs to be most vigilant about as these trials are deployed to make an assessment of what interference issues exist," he said. Mayer also predicted an uphill battle for BPL in gaining market share. The NYPSC's policy statement encourages electric utilities, BPL equipment manufacturers, and third-party BPL operators to participate in such trials.

ARRL CEO David Sumner, K1ZZ, said the policy statement effectively damns BPL with faint praise. "In sharp contrast to the vacuous endorsements of BPL that sometimes emanate from public utilities commissions, New York State's has actually taken the time to assess the risks posed by BPL and to take steps to insulate the electric utilities and their customers from them," Sumner said. "The Commission found that BPL is not yet — and may never be — commercially viable, and that radio interference is a 'major issue' that has not been put to rest by the FCC."

ARRL PRESIDENT AIRS RED CROSS BACKGROUND CHECK CONCERNS

ARRL President Joel Harrison, W5ZN, has advised Amateur Radio Emergency Service (ARES) and other ham radio volunteers to tread cautiously if they submit information for an American Red Cross (ARC) background check. The ARC, with which the ARRL has a *Statement of Understanding* (*SoU*), **www.arrl.org/FandES/field/mou/redcro.html**, last summer notified local chapters that volunteers and staff members submit to criminal background checks by October 31. In an October 24 statement (see **www.arrl.org/FandES/field/RC-Background-Checks0610.pdf)**, Harrison said the League recommends those submitting personal information for a background check very carefully read what information they are giving the ARC permission to collect.

ARRL President Joel Harrison, W5ZN

"The Red Cross is requiring volunteers to grant permission for more than just a criminal background check," Harrison asserted. "They are also requiring permission to draw a consumer and/or investigative consumer report on the volunteer." Harrison said that could also include credit and mode-of-living checks. "The Red Cross has stated that they will not use credit reports," he noted. "Requiring that volunteers authorize the procurement of a credit report is inconsistent with this assurance."

The ARC has contracted with MyBackgroundCheck.com LLC (MBC) in Anderson, California, to handle the on-line background checks. Prospective volunteers visit a secure Web site, click on the ARC logo and submit name, address, Social Security number (or other acceptable government ID), telephone number and date of birth.

In the course of applying, prospective volunteers must agree to let MBC obtain a wide range of personal information bearing not just on criminal background and creditworthiness but, MBC says, "character, general reputation [and] personal characteristics." MBC advises, "The nature and scope of this disclosure and authorization is all-encompassing . . ."

Some ARES leaders have expressed concerns to the ARRL about the Red Cross policy. The Red Cross says its new policy is aimed at safeguarding clients, volunteers and employees alike.

"Unfortunately, in this day and age it is critical that the American Red Cross and other agencies, employers and organizations

perform due diligence in researching the people who will represent them," the Red Cross said in a statement supplied to ARRL.

ARRL Field and Educational Services Manager Dave Patton, NN1N, whose department supports the ARRL Field Organization, is among those who believes the Red Cross stands to lose a fair number of volunteers because of the requirement, and not necessarily just ARES volunteers. "ARES members who are providing communications for ARC are working for ARC," Patton maintained, "and, as such, will follow their guidelines." He said the decision to go along with the new Red Cross policy is up to individual volunteers.

The ARC apparently has not disseminated policy specifics at the national level. The only reliable information on what the background checks will entail is that on the MBC site. Various chapter-level memoranda the ARRL obtained contain conflicting information. At least one memo indicated to an ARRL Section Manager that ARES volunteers did not have to submit to background checks.

The *SoU* between the League and the ARC is ambiguous as to whether ARES volunteers become Red Cross volunteers when supporting ARC disaster relief efforts, nor does it address background checks. While the document says "each organization retains its own identity in providing service," it further stipulates that ARES volunteers "in such cases when the operators are required to carry American Red Cross identification" must register as American Red Cross volunteers. The *SoU* comes up for review this year.

Radio amateurs who volunteered in the wake of Hurricane Katrina last year and following 9/11 in New York City were badged in as ARC volunteers. The practice still upsets some ARES volunteers.

The Red Cross says it's gone to great lengths to ensure prospective volunteers are not giving out their Social Security numbers to anyone other than the contractor, and then only through a secure, encrypted Web site. The Red Cross says the overall results of the background check are not shared with the ARC.

AMSAT'S PROJECT EAGLE SATELLITE SHIFTS DIRECTION

AMSAT-NA has announced it's revamping the design of its high-Earth orbit (HEO) Project Eagle satellite, currently in the development stages, **www.amsat.org/amsat-new/eagle/**. The next generation satellite will take maximum advantage of software-defined transponder (SDX) technology to offer a broader range of easily accessible Amateur Radio payloads. The AMSAT Board of Directors okayed the Eagle upgrade plans during the 2006 AMSAT-NA Space Symposium and Annual Meeting held October 6-8 in San Francisco. Eagle Project Manager Jim Sanford, WB4GCS, outlined the changes at his Space Symposium forum October 7.

"The structure which we have been presenting for several years is not going to meet our mission needs," Sanford explained.

AMSAT's Project Eagle plans call for a mode U/V transponder for SSB, CW and other modes. The design goal is that it be usable over 75 percent of Eagle's orbit by an AO-13 or AO-40-capable ground station. A second mode L/S1 (1.2/2.4 GHz) transponder for SSB, CW and other modes using fixed antennas also should be accessible by an AO-13 or AO-40-capable ground station.

Something new to Amateur Radio satellites is a planned low-rate text messaging system similar to cellular telephone SMS. Sanford said the text-messaging capability may prove valuable for providing emergency and disaster communication. It will operate in mode U/V and also will be available to modest ground stations over 75 percent of Eagle's orbit.

Eagle will also carry an advanced communications payload (ACP). The ACP will accommodate voice communication using an S2 band (3.4 GHz) uplink and a C band (5.8 GHz) downlink via a single 60 cm dish on the ground. As an alternative — for stations in those parts of the world where 3.4 GHz is unavailable — Eagle will provide an additional L band uplink. The ACP also will offer high data rate communication including the possibility of full-motion compressed video in S2/C mode. The same mode also could support an Internet link.

The current design plan would make the satellite's S2 band uplink and C band downlink phased arrays electronically steerable to mitigate the effects of the spacecraft's spin and maximize its accessibility. All other Eagle antennas will be fix-pointed and subject to spin modulation and off-pointing effects. In a subsequent forum, AMSAT board member and well-known satellite expert Tom Clark, K3IO (ex-W3IWI), described a system of interferometers to do the pointing on the basis of "master beacon signals" uplinked from different points on Earth's surface. "It [Eagle] will measure where they are and know where to point the beam," he explained.

In a presentation on applying SDR techniques to satellite transponders, Howard Long, G6LVB, described and demonstrated a prototype SDX board. "This is the holy grail of what we've been trying to do," he told his audience.

Sanford concluded his presentation by saying it's time to take the AMSAT board's concrete decisions and plan, schedule and build Eagle. "We're about to start spending some serious money," he said. During a later question-and-answer session, Sanford stressed that reliability of the ultimate Eagle satellite is a key goal. "I want no single-failure mission kills on this satellite," he said.

Eagle Project Manager Jim Sanford, WB4GCS.

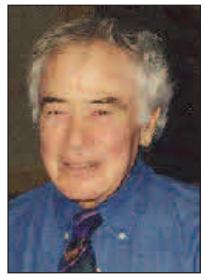
AMSAT board member and satellite expert Tom Clark, K3IO (ex-W3IWI).

ISS Expedition 12 Commander Bill McArthur, KC5ACR, regaled the AMSAT Space Symposium banquet. "I enjoyed more than I can possibly tell you talking to so many of you," McArthur told the audience. Among the crew members ever to live aboard the ISS, McArthur was the most active on Amateur Radio. He said the tremendous enthusiasm of the radio amateurs he talked with helped him to focus on why he was aboard the ISS.

ARRL HONORARY VICE PRESIDENT MARSHALL QUIAT, AGØX, SK

Past ARRL Rocky Mountain Division Director and Vice Director Marshall Quiat, AGØX, of Denver, Colorado, died October 15. He was 84 and an ARRL Life Member. A memorial service was held November 1. Following his board service, the ARRL Board of Directors in 2000 elected Quiat — an attorney, former judge, state legislator and notable contributor to Amateur Radio antenna law — as an honorary vice president.

Quiat stepped down as Rocky Mountain Vice Director for health reasons in 2000 after earlier swapping seats with Walt Stinson, WØCP, who was elected as Rocky Mountain Division Director in 1998. Quiat served as Vice Director from 1981 until 1987, as Director from 1987 until 1999 and as Vice Director until August 2000. He also served as an ARRL Foundation Director from 1994 until 1999.



Marshall Quiat, AGØX

Among his other accomplishments, Quiat chaired the Legal Strategy Committee appointed in 1986, and served as a member of the Part 97 Rewrite Committee in 1988. He also was instrumental in the success of the League's PRB-1 effort. He once chaired the Membership Services Committee and served on the Volunteer Resources Committee.

ARRL First Vice President Kay Craigie, N3KN, recalls Quiat as possessing a sharp intellect and a "great passion for doing the right thing for the League and Amateur Radio." One of his contributions was the development of the League's Alternative Dispute Resolution (mediation and arbitration) service, she said.

Fellow attorney and ARRL Dakota Division Director Jay Bellows, KØQB, described Quiat as "one of those true characters you just had to know: a man of a thousand stories, frequently true, invariably pertinent and almost always funny." Bellows recalled consulting with Quiat regarding the landmark *Pentel v City of Mendota Heights* Amateur Radio antenna case, then headed for appeal to the US Eighth District Circuit Court. Bellows was handling the case *pro bono*.

"From the first call he was a willing ear and an invaluable source of sound advice and ever present wit throughout the appeal," Bellows recounted. The *Pentel* appeal ultimately reaffirmed the "reasonable accommodation" and "minimum necessary regulation" principles of PRB-1.

During the AMSAT-NA annual meeting October 8, President Rick Hambly, W2GPS, expressed his enthusiasm for Project Eagle. "I think it will be the greatest thing we've ever done!" he said. Eagle could launch by 2010. The whole project will cost some $600,000.

ARRL EXECUTIVE COMMITTEE DISCUSSES FCC INERTIA, STRATEGY, BPL

The issue of FCC inaction on Amateur Radio proceedings highlighted the report of ARRL President Joel Harrison, W5ZN, to the ARRL Executive Committee (EC), which met October 7 in Memphis, Tennessee. In his report, Harrison said FCC inaction on pending rule makings important to the Amateur Service was impeding progress. While the FCC did release a *Report and Order* in WT Docket 04-140 — the so-called "omnibus" Amateur Radio proceeding — shortly after the committee met, Harrison noted that the amateur community was still awaiting a *Report and Order* in WT Docket 05-235, which deals with the Morse code requirement. Harrison said other services also have complained to the Commission about the lack of attention to their particular concerns.

During the session, ARRL General Counsel Chris Imlay, W3KD, reviewed other strategies the League is pursuing to combat harmful interference from BPL systems. These include legislative initiatives and aggressive pursuit of complaints in cases of ongoing interference from the few BPL systems now operational. It was noted that PowerGrid Communications had launched a BPL trial in Baton Rouge, Louisiana, that is causing serious interference to HF reception.

The EC also discussed and approved plans to pursue a judicial appeal of certain aspects of the FCC's 2004 and 2006 BPL orders. The League subsequently filed notice to appeal with the US Court of Appeals for the DC Circuit.

Committee members devoted the bulk of the session to reviewing and revising the output of the Board of Directors' July 22 strategic planning session and voted unanimously to recommend adoption of the revised *Strategic Plan* draft by mail vote. The Committee also selected several strategies to include in the 2007 operational plan.

In other matters, the EC reviewed a draft of the *Petition for Rule Making* seeking improvements in Amateur Radio privileges in the 60-meter band. Harrison's report further noted that ARRL and International Amateur Radio Union (IARU) have been working to support Amateur Radio's interests at World Radiocommunication Conference 2007 (WRC-07). The League's prime objective, he pointed out, is to defend gains made at WRC-03 and prevent any loss of spectrum in ITU Region 2 (the Americas) and possibly pursue additional improvements as well.

SECTION MANAGER NOMINATION NOTICE

To all ARRL members in the Maryland/DC, Nevada, New Hampshire, Northern New Jersey, Rhode Island, San Joaquin Valley, Utah and West Texas Sections: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. Photocopied signatures are *not* acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms (FSD-129) are available on request from ARRL Headquarters but are not required. We suggest the following format:

(Place and Date)

Field & Educational Services Manager, ARRL
225 Main St
Newington, CT 06111

We, the undersigned full members of the _____ ARRL Section of the _____ Division, hereby nominate _____ as candidate for Section Manager of this section for the next two-year term of office.

(Signature__ Call Sign__ City__ ZIP___)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on March 9, 2007. Whenever more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before April 2, 2007, to full members of record as of March 9, 2007, which is the closing date for nominations. Returns will be counted May 22, 2007. Section Managers elected as a result of the above procedure will take office July 1, 2007.

If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning July 1, 2007. If *no* petitions are received from a section by the specified closing date, such section will be resolicited in the July 2007 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Field & Educational Services Manager. You are urged to take the initiative and file a nomination petition immediately.—*David Patton, NN1N, Field & Educational Services Manager*

Arizona Section Creates Emergency Database

Tom Fagan, WB7NXH,
Arizona Section Manager
wb7nxh@arrl.org
www.az-arrl.org/

In March 2006, Arizona hams Rick Aldom, W7STS, and Jim Hoff, N7XXX, formed a partnership that has evolved into a Web design of statewide proportions. Rick, the Arizona Section Emergency Coordinator (SEC), felt as most SECs do, that a change was needed in how he approached EMCOMM registration. The existing form was woefully inadequate for planning in any major disaster. Living in a county that is bigger in area than the state of Connecticut, he wondered how anyone could know the capabilities of people on the other side of Phoenix, much less the on the other side of the section.

Jim is an Emergency Coordinator for the Maricopa County Department of Emergency Management (Maricopa County encompasses the city of Phoenix and its surrounding area), and the department wanted a system to manage ham radio volunteers. When Rick saw the demonstration site Jim had cobbled together, he wanted to know if modifications could be made to accommodate the entire Section. Jim replied that "it wouldn't be terribly hard to add counties," and it was at that point Rick realized he had stumbled on some incredible talent!

Security and control of the data were the highest priority from day one, as he understood the necessity for limited access, as well as technological enhancements like Secure Socket Layer (SSL) encryption schemes. Rick knew they had to ensure personal information was treated with the utmost care, or people would flatly refuse to participate.

The project matured as a series of manageable steps or building blocks. In the early stages, Rick and Jim focused on getting the operator interface complete. When the operator interface was done, the alpha and beta testing became a real team effort. Bill Hosking, W7JSW, Rick's Assistant SEC, was the sounding board for ideas as well as one of the beta testers. Without Bill's insight and assistance, this project would have been much longer in the making. Hosking also assisted in producing help files and slides for each level of access on the site.

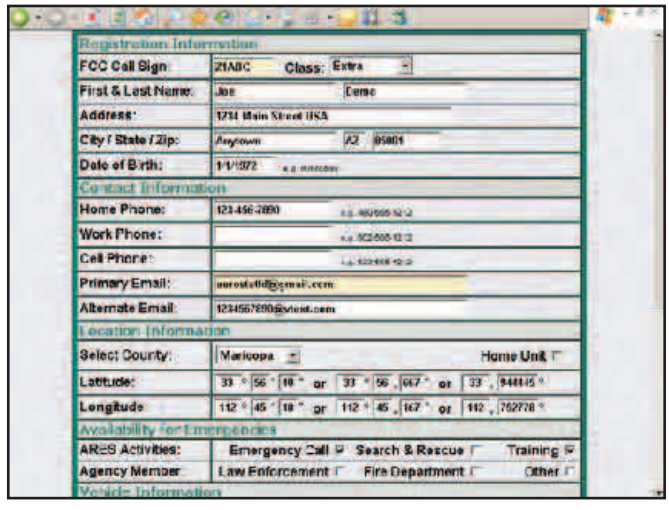
Comments were solicited from the District Emergency Coordinators (DECs) to ensure the tools would meet their needs. While in Dayton for the 2006 Hamvention, Rick showed the site to ARRL HQ staff members who were very impressed. After a suggestion was made that we track operator hours, Rick called Jim and requested a tool to track hours; Jim had it done before Rick returned home to Arizona.

On June 1, 2006, the site was released to the public, and through some statewide e-mail list servers, the ham population was exposed to the project; 26 operators created accounts that very first day. In those early days, the site collected operator data; however, the "tools" to sift and filter the data were still in the design phase. As soon as the site went live, the focus shifted to tool production, but we all focused on resolving account creation issues: cookie issues and the wonderful world of spam filters.

Early on, the knowledge of the site spread on the list servers, and then by word of mouth, but what was interesting was the continuous bump in subscribers every time the Arizona Section Manager's monthly letter was released. Section Managers and SECs from around the country were also checking out the site. A dummy login account was created so that they could see the capabilities of the sight. Everyone was calling, wanting their own database.

"We have a tool, a real tool for building credibility within the Emergency Management fabric around our entire state and nation. No one has the data I have at my fingertips when I pop onto the Internet and can search for any of more than 140 criteria which operators willingly share!" said Rick. "EMCOMM is an exercise in relationship building. The easy work is on the radio, it's just an extension of what we do in our spare time, but the hard work is forging the

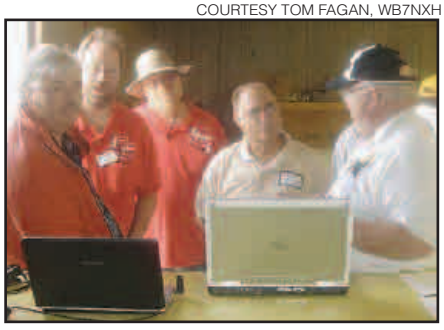
A screen shot of the ARES database program.



Information for Arizona ARES members is available at the touch of a key.

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

COURTESY TOM FAGAN, WB7NXH



Rick Aldom, W7STS (left), shows off the database to several Explorer Post 599 members. Meanwhile, Jim Hoff, N7XXX (far right), shows Carl Gardenias, WU6D, Orange SM, the capabilities of the database at the Arizona Section Convention in Williams.

COURTESY TOM FAGAN, WB7NXH

Rick Aldom, W7STS (left), Arizona Section Emergency Coordinator, presents Jim Hoff, N7XXX, with the Arizona EMCOMM Ham of the Year Award.

relationship and the trust with the community."

Another measure of success is how badly other people want it. In July, Carl Gardenias, WU6D, Orange (California) SM, traveled to Williams, Arizona, for the Arizona Hamfest. While there, Carl spent several hours getting the advanced tour of the site from Jim and Rick. By the convention, I had received many requests for information from other Section leaders. We knew the site was popular, but we also knew giving it up had implications. Carl made a strong plea for assistance, and Rick put the question to Jim on how to support them. Hoff's answer was to go for it.

There were issues that had to be resolved. We had hard-coded the word *Arizona*, for example, all through the code. The changes were made. Carl bought a Web site URL, the SSL certificate and then gave Jim all the passwords. In about a week, the site was up and running.

"I think it surprised Carl on how fast Jim was able to set them up." said Rick. At the end of August, there were more than 230 registered members on the Arizona site, and 50 in the Orange Section site. We now have a site that can provide mutual aid across our borders in a time of disaster in either section.

Tool generation has been a constant priority of the project. Having data and no way to sift, filter or sort it isn't productive. Since the project went live in June, they have had a means of pushing messages to operators when they log in, operators can log hours spent on public service events, training or emergencies, and operators can indicate organization memberships, including what group they will respond with in case of an activation. An advance search tool allows searches for any of the operator supplied data, and search criteria can be saved for future use so planners won't have to "reinvent the wheel" each time they need to pull operators from the database. Several administrative audit tools have been added that allow administrators to look for operator sign-up issues.

"The jewel of the site is in the planning stages right now," said Rick. "We are developing a planning tool which will allow distributed planning." This new tool will allow planners to share a common list of operators to be contacted. When contacted, the planners can "plug in" the operator into an open time slot or indicate if the operator is unavailable. This will greatly increase efficiency because planners won't be contacting the same operator repeatedly. Duty schedules will be printable, and can be developed days in advance.

We want to share this database engine, but we also know the commitment required to support it. Rick explained that Webmaster support is the real issue facing any real effort to share the site. Jim has more than 1000 hours in development; Rick estimates he has invested about 700 hours in testing and user support.

When they shared the code with the Orange Section, it set their tool development back about two weeks while Jim stripped out the hard coded references to *Arizona* and all the Arizona counties. He is working on a configuration engine to make sharing the code easier, but that won't replace the user support needs.

"There is a finite learning curve. Most of the operator interface is pretty simple, but we still have to teach the more advanced features. Administration is another issue; someone has to know how to reset passwords, and how to audit the site. There ain't no such thing as a free lunch!" laughed Rick. "What we have is 90 percent of a transportable site and we are working on the rest."

"We created an incredible system in a remarkably short period of time, and it happened because of synergy." Rick added. His team spent countless hours within an open framework of collaboration.

Without the dedication of each and every person in Arizona ARES, we wouldn't have accomplished 10 percent of our goal. Each person who had a problem or issue taught us how to make the site better for the next person.

Jim Hoff, N7XXX, is a retired telephone engineer who is active in several aspects of community service. In July 2006, he was awarded the 2006 EMCOMM Ham of the Year by Rick Aldom, W7STS. He volunteers as a Net Control Operator on Maricopa County's largest public service event, he's an EC for Maricopa County and he develops Web sites for projects he feels warrant his expertise. One such project, the Future Cities Competition, helps 7th and 8th grade kids learn engineering principles in a structured, competitive setting. Jim developed a multi-user Web site to help judge the team entries. Additional information can be found at **www.futurecity.org**.

Rick Aldom, W7STS, flies unmanned helium balloons for a living as an Aerostat Flight Director on the Tethered Aerostat Radar System (TARS) in Yuma, Arizona. TARS provides look-down radar coverage of the southern Arizona border, and is a key player in reducing contraband shipments into the county. Additionally, Rick is Director of the Maricopa County Emergency Communications Group that has a combined focus on EMCOMM and providing event communications for charitable events in central Arizona. While on a temporary assignment in Virginia in 2003, Rick weathered hurricane Isabel from within the Chesapeake Emergency Operations Center (EOC), assisting with Amateur Radio communications between the municipal and State EOCs, as well as between local Red Cross shelters. He travels between Yuma and Phoenix every other week for work. Rick may be reached at **w7sts@arrl.net**.

GRANT SUPPORTS MARA PROJECT

Jim Larsen, AL7FS
President, Anchorage Amateur Radio Club

On August 4, 2006, the Anchorage Amateur Radio Club (AARC) presented a check to the Matanuska Amateur Radio Association (MARA) for $15,534.49. This grant will help fund MARA's new Mobile Communications Center, a project estimated at $26,000. MARA, located 35 miles north of Anchorage, has a long history of public service and emergency communications support.

MARA proposes to build a mobile communications center, comprised of an 8 foot × 16 to 20 foot long enclosed trailer. Inside the trailer will be three operator positions, heat for winter operation and miscellaneous electrical items required for operation. Collapsible antenna masts

COURTESY JIM LARSEN, AL7FS

The Anchorage Amateur Radio Club presents a check to the Matanuska Amateur Radio Association in an August, 2006 ceremony. From left to right: Tom Rutigliano, NL7TZ, MARA Vice President; Richard Plack, KL7DY, MARA President; Jim Larsen, AL7FS, President of AARC, and Tim Comfort, NL7SK, MARA Secretary.

Feedback on Previous Article

We recently received some feedback on "What to Take to the Disaster Area" (Nov 2006 *QST*, p 86).

Under "Vaccinations and Medications," there are two recommended vaccinations listed: Tetanus and Hepatitis B. Check with your local doctor or Public Health District Travel and Immunization Clinic, to see if he or she recommends four vaccinations for people going to disaster locations in the United States: DPT (Diphtheria, Pertussis and Tetanus), Typhoid, Hepatitis A and, especially for people who may be working directly with patients, Hepatitis B. If you are going out of the USA, there may be several more recommended. These vaccinations are not something that you can run down to your doctor's office and get on the way to the airport. The Hepatitis B series of three injections usually takes a minimum of six months, but should be completed in one year following the first injection. — *Thanks to Debby Riehl, N7FL, and Ralph Javins, N7KGA*

will be attached to outside of the trailer.

Primary power for the communications center will be a bank of four 12 V dc batteries. The battery charge will be maintained by a 45 A power converter/battery charger. Long term power will be supplied by a small 120 V ac gasoline generator set. In the event fuel can't be located for the generator set, power can be alternately supplied by the tow vehicle alternator. During battery operations, a small static inverter will supply power for laptop computers and other items requiring 120 V ac.

Operators will supply their own radio gear for use inside of the communications center. Each operator position will have 12 V dc, 120 V ac and UHF/VHF antenna connections available. One position will have HF antenna connections available.

Depending on the operating site, VHF/UHF omni-directional or Yagi directional antennas will be utilized. VHF band pass filters can be installed in the communications center to allow for simultaneous operation of two VHF transceivers. HF operations will utilize a G5RV type dipole antenna with an antenna tuner. Internal lighting will be operated from 12 V dc or 120 V ac as dictated by available power.

If you're interested in public service and emergency communications, subscribe to the ARES e-Letter at **www.arrl.org/ares-letter**. *It's free to ARRL members!*

Field Organization Reports

Public Service Honor Roll
October 2006

This listing is to recognize radio amateurs whose public service performance during the month indicted qualifies for 70 or more total points in the following 6 categories (as reported to their Section Managers). Please note the maximum points for each category:
1) Participating in a public service net, using any mode. —1 point per net session; maximum 40.
2) Handling formal messages (radiograms) via any mode. —1 point for each message handled; maximum 40.
3) Serving in an ARRL-sponsored volunteer position: ARRL Field Organization appointee or Section Manager, NTS Net Manager, TCC Director, TCC member, NTS official or appointee above the Section level. —10 points for each position; maximum 30.
4) Participation in scheduled short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emergency tests and related practice events. This includes off-the-air meetings and coordination efforts with related emergency groups and served agencies. —5 points per hour (or any portion thereof) of time spent in either coordinating and/or operating in the public service event; no limit.
5) Participation in an unplanned emergency response when the Amateur Radio operator is on the scene. This also includes unplanned incident requests by public or served agencies for Amateur Radio participation. —5 points per hour (or any portion thereof) of time spent directly involved in the emergency operation; no limit.
6) Providing and maintaining a) an automated digital system that handles ARRL radiogram-formatted messages; b) a Web page or e-mail list server oriented toward Amateur Radio public service—10 points per item.

Amateur Radio stations that qualify for PSHR 12 consecutive months, or 18 out of a 24-month period, will be awarded a certificate from Headquarters upon written notification of qualifying months to the Public Service Branch of Field and Educational Services at ARRL HQ.

650
KI4GEM
599
W2LTB
545
W7TVA
520
W7ARC
470
WA2WMJ
400
KI4GWC
380
KD8BGQ
367
AB2IZ
365
KG4TND
360
KB2RTZ
340
K2DYB
KA2ZNZ
325
W4DNA
320
N2QZ
310
N2LTC
307
W2MTA
270
W2LC
265
K4RLD
261
K5SFM
242
N4VAD
230
K7EAJ
226
KK1X
225
K7BC
221
KA2BCE
218
KC2MVC
215
KØIBS
207
W4CAC
206
WA2BSS
205
N7CM
WI2G
K3CSX
W4EAT
203
KA2GJV
200
KC2ODN
WB8RCR
196
W5PY
195
WAØVKC
190
KC2LIX
AG4AC
181
KBØDTI
180
AK2Z
KC2MQU
177
KF4ZLU
176
N2LJD
175
K9LGU
WB5ZED
172
K2MPE
168
KB2ETO
167
N2GJ
163
NØYR
160
KGØGG
NØUKO
AC5XK
158
W2DSX
W2DWR
157
K2ABX
155
K8AMR
152
N2RTF
150
W8UL
KK1A
KE5HYW
KD5TXD
145
AB4BL
AF2K
KA8ZGY
AA3SB
WB7WOW
143
N1UMJ
W3CB
140
K7BFL
137
N2VC
135
W3YVQ
W4NCD
133
KO4OL
132
N5KWB
130
NN7H
K9FHI
AG9G
KD7THV
KE4UOF
W5DTR
W4FAL
129
WB6UZX
KV4AN
125
K4DND
120
WOØA
N8IO
W7IG
KA4FZI
KW1U
N1LKJ
W1GMF
K6JT
KC5OZT
K4IWW
WØUCE
K2UL
K6YR
115
W1YCQ
K4IWW
NR2F
113
W4ZJY
112
K4BEH
110
N5FP
WØLAW
KA8WQL
N7YSS
N4ABM
WV8RG
N1IQI
KD1LE
N3ZOC
NØMEA
KE4JHJ
WØWSP
W7GB
W7QM
WB6OTS
K5MC
N3YTD
KK5GY
N8FPN
K8AE
AF4NS
100
K4GK
108
N2JRS
KI4CIA
106
KA5KLU
105
NUØF
104
K2GW
103
K5ER
WB1CHU
101
N7DRP
WB2KNS
W4TTO
100
WAØTFC
WA8SSI
K2AN
K2VX
WA4EIC
N3OZP
WA2YL
WB4FDT
N4MEH
W3TWV
KF6SHU
W3ZQN
KB2KLH
KF4OCU
KG4YNM
WA2YBM
W7GHT
N7EIE
KE7DVV
W3GQJ
WX4H
N9MN
N5OUJ
KB5PGY
K4SCL
K8ZJU
K8KV
99
W9XAN
W7LG
98
WD9FLJ
97
KD4FUY
WB2LEZ
95
WG8Z
KB3LFG
K2TV
K8MFK
94
W5GKH
92
KF7GC
90
KA1RMV
NX1Q
KA1GWE
N8DD
WB8SIQ
WD8Q
KG2D
WB2IJH
KA8WNO
WD8DHC
NY4E
NG1A
N1JX
WE2G
KI4YV
W5UYH
W8IM
K1JPG
KF4WIJ
NY4E
N3KB
K4WKT
WB4KIT
88
KD7ZLF
W8CPG
WA4UJC
87
AL7TN
W4LN
86
AA4BN
AE5V
W4NTI
85
W1REP
82
KA4LRM
KB3CEZ
KM1N
81
W9JDH
80
KC2PFV
K7MQF
78
WDØGUF
K3IN
77
N2OMK
K4RCK
WA1JVV
NØZIZ
76
K4FQU
73
W5XX
KK7TN
KB8DNS
KD1SM
72
KI4JQB
W4DGH
KR4JI
70
KØNLE
KAØFUI
N3SW
NØMHJ

Section Traffic Manager Reports
October 2006

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, ENY, EMA, EPA, EWA, GA, ID, IL, KS, LA, MDC, MI, MN, MO, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, OH, OK, OR, SB, SD, SFL, SJV, SNJ, STX, TN, WCF, WMA, WNY, WPA, WV, WWA, VA, WY.

Section Emergency Coordinator Reports
October 2006

The following ARRL Section Emergency Coordinators reported: AK, AZ, EWA, GA, IL, KS, KY, ME, MI, MO, NC, NFL, NNJ, NV, OH, SD, SFL, SNJ, STX, SV, WTX, WV, WWA.

Brass Pounders League
October 2006

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 points or a sum of 100 or more origination and delivery points for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in standard ARRL radiogram format.

Call	*Orig*	*Rcvd*	*Sent*	*Dlvd*	*Total*
N1IQI	0	411	1804	0	2215
WB5ZED	32	1110	897	65	2014
W4ZJY	0	1029	922	0	1951
KA9EKG	42	581	562	5	1190
WZ9I	20	505	19	503	1047
KW1U	0	425	539	1	965
W1GMF	0	150	627	0	777
WX4H	0	348	372	11	731
WØUCE	0	316	328	1	645
N8IXF	0	308	285	8	601
W4EAT	0	274	244	3	521

W3ZZ

THE WORLD ABOVE 50 MHz

Solar Cycles and the Coming of Cycle 24: *Part 2*

Part 1 of this series, last month, described much of what we know about the physics of solar sunspot cycles, the solar activity cycle, the solar magnetic cycle and some of the complex interactions within the sun that lead to the cyclic activities that influence radio propagation so strongly here on Earth. So what does this mean for the upcoming Cycle 24? Here in Part 2 Jim Kennedy, K6MIO/KH6, describes the scientific predictions for the next cycle, how large it may get and when the next maximum may occur.

Figure 1 — Three Editors. The current and previous two editors of the World Above 50 MHz column met at a little gathering of 6 meter operators this past September in Rhode Island. Left to right: W3XO, W3ZZ and W3EP.

Predicting Cycles

At the current time there are at least twelve different published professional predictions of the characteristics of Cycle 24; almost all are of the statistical variety. In principle, there are two broad approaches to predicting the performance of a future solar cycle: physics and statistics. The key parameters one might predict are the maximum amplitude of the cycle (for example, the smoothed sunspot number, R_z, or the 10.7 cm radio flux), the date of the peak and the length of the cycle.

Until the last cycle or so, very little was known observationally about what was actually happening below the visible surface of the Sun, simply because it could not be seen or measured. As a result, for decades the only real approach was predicting future cycles on the basis of statistical relationships seen in past cycles. This still remains the most common approach today. There is one novel method, however, that applies solar interior data to a physical model of the solar interior. These various methods produce answers that range from a very strong maximum, perhaps a year earlier than expected, to one of the lowest on record — and everywhere in between.

Statistical Methods

This approach involves amassing a database of the solar and terrestrial observables from as many past cycles as possible. These might include the length of the cycle, the rate of rise and fall of the cycle amplitude, peak amplitude of cycle maximum, amplitude and polarity of the global field, intensities of the local magnetic fields, various geomagnetic and other indices. Then one might attempt to find statistical correlations between these different factors and those observed in the following one or two cycles. If a dependable set of correlated factors could be found, then one could look at the values of the most recent one or two cycles and use those relationships to predict the values of the next cycle. There is much disagreement about which measurable characteristics are the most important predictors, however. Table 1 shows the solar maximum and peak smoothed sunspot number for the previous five sunspot cycles.

As a simple example of a statistical prediction approach, there seems to be a systematic, cyclic pattern in the length of the cycles with a period of about 240 years. With some fluctuations, cycles get shorter for about 120 years and then get longer for about 120 years, and then the cycle appears to repeat. Since about 1912 (Cycle 15), the pattern has been toward shorter cycles. If this pattern persists, Cycle 24 could be expected to be a "short" cycle, that is, less than 11 years. However, it may not. (It would also appear that Cycle 25 might be the turning point to the length beginning to increase again.)

This Month

January 4	Quadrantids meteor showers
January 21	Good EME conditions*
January 20-22	ARRL VHF Sweepstakes

*Moon data from W5LUU

Wilson's "Rule"

Of course, predicting the date of the next maximum would also depend on when the preceding minimum occurred. Known as "Wilson's Rule," there is the statistical observation that recent cycle minimums usually occurred about 34 months after the first full day that happens to show no visible spots on the Sun. The date of solar minimum is also important in a practical way, since almost all prediction methods are reasonably good once the new cycle starts and accumulates a little history. Furthermore, the next maximum usually occurs four years after the minimum.

As noted by David Hathaway, at NASA's Marshall Space Flight Center, the first spotless day of Cycle 23 occurred on January 28, 2004. Based on Wilson's Rule alone, the Cycle 23 minimum should occur in November or December 2006. (The Sun was entirely spotless almost throughout the whole month of February 2006.) This date is consistent with the recent trend toward short cycles, mentioned above. This suggests that the Cycle 24 maximum may occur around November or December 2010. (However, some more sophisticated methods disagree!) Another statistical approach, currently used

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Table 1
Solar Maximum and Peak Smoothed Sunspot Number for the Previous Five Sunspot Cycles

Cycle	*Date Max*	*R_z Max*
19	Mar 1958	201
20	Nov 1968	111
21	Dec 1979	166
22	Jul 1989	159
23	Apr 2000	121
24	?	?

by John Kennewell at Australia's IPS Radio and Space Services, is based on weighted averages of the characteristics of a few recent cycles.

Precursor Methods

Several seasoned researchers in the field hold that the precursor prediction methods are among the best. These methods are based on the hypothesis that the configuration of the Sun during one cycle determines the major features of the Sun during either the next cycle or the one after that. Without access to the details of the Sun's current internal configuration, precursor methods look for gross measurable indices as "proxies" for the real details.

Geomagnetic Precursors

Some of these methods rely on variations of the geomagnetic aa index at the preceding solar minimum as a predictor of the following maximum, such as one by Joan Feynman at NASA's Jet Propulsion Laboratory. The aa index is derived from the three-hour averages of the K index at two antipodal stations. Richard Thompson, recently retired from IPS Radio and Space Services in Australia, uses the number of days during the previous cycle that the geomagnetic field was disturbed. More recently, Hathaway has developed a hybrid method that incorporates the parts of both the Thompson and Feynman approaches.

Solar Precursors

Ken Schatten, at Ai-Solutions, Inc, some time ago constructed an index relating to the Sun's buried dynamo fields. He assumed that if geomagnetic effects have some prediction success, then actual solar magnetic field measurements should work even better. He uses an index that tracks the total magnetic field, including both the polar and toroidal components. Leif Svalgaard, at ETK, uses a somewhat similar method based only on the strength of the polar field at solar minimum.

Magnetohydrodynamic Models

Developments permitting actual observation of the interior of the Sun are beginning to offer intriguing new possibilities in solar cycle prediction. The field of helioseismology uses sound waves traveling through the interior of the Sun to visualize the structure and dynamics of the inside of the Sun, somewhat like a medical CT scan. Projects at the National Solar Observatory [The Global Oscillation Network Group (GONG)] and Stanford's Wilcox Solar Observatory [the Michelson Doppler Imager (MDI) experiment on the SOHO spacecraft] have collected a full solar cycle of data on the evolution of the interior structure.

Armed with these and other data, one could construct predictive magnetohydrodynamic models that start from first principles, the physics of the Sun itself. One such model has been developed by Mausumi Dikpati and her collaborators at NCAR's High Altitude Observatory. While still being fine-tuned, she inserts structural data from previous cycles into a computer model of how the flows interact, and predicts what a subsequent cycle should look like. This model has been very successful in reproducing previous cycles, including the double maximum in Cycle 23.

This sort of first-principles approach could be quite accurate at predicting one or two cycles in the future. There is an important caution, however. There is good reason to believe that, like weather on Earth, the fine details of the flows in the Sun are basically chaotic processes. That means that, like weather, short-term predictions can be fairly accurate, but the longer the term of the prediction, the more it looks like random noise.

Who to Believe?

Table 2 shows a comparison of the predictions of six respected forecasters. These are samples chosen to reflect the diversity of predictions based on various approaches. You will notice that they range from awful to terrific. (The same is true for predictions of previous cycles.) In the current case, the two solar precursor methods are making very pessimistic predictions, while the two geomagnetic precursor methods are making optimistic predictions. One would think that the solar precursor methods, based on parameters closer to the root source — the solar magnetic field, would be more reliable. But, the Dikpati model, if correct, should be the most accurate. Curiously, it disagrees with the solar precursor methods, and produces the most optimistic prediction of all, even exceeding those of the geomagnetic methods. Whatever actually happens, we should learn something.

Beware the Error Bars

One has to take the prediction values with a grain of salt. The error estimates are often quite large and this range of values predicted by the same method can be confusing to interpret. For example, what would a prediction of $R_z = 150 \pm 50$ really mean? Taken at first glance it might look like a prediction for a moderately good cycle. But in reality, it predicts R_z to be somewhere between 100 (a very poor cycle), and 200 (a rival for the amazing Cycle 19)!

When Will the DX Start?

From a DX perspective, the question isn't "When is solar maximum?" It is really about, "When will the rising cycle reach high enough levels to trigger good propagation?" If Cycle 24 is a strong cycle, then 6 meters will heat up before maximum. For example, if Hathaway's precursor method is correct, while solar maximum will peak in June 2010 with R_z 147, it will hit levels comparable to the peak of Cycle 23 (122) between October 2008 and April 2009, and then get even better.

So when does the DX start? We'll have to wait and see.

Cycle 25 and Beyond

Some people are even beginning to think

Table 2
Predictions of Solar Maximum and Peak Smoothed Sunspot Numbers Using Various Solar Precursor, Geomagnetic Precursor and Magnetohydrodynamic Models

Lead Researcher	*Method*	*Cycle 23 Min Date*	*Cycle 23 Min R_z*	*Cycle 24 Max Date*	*Cycle 24 Max R_z*
Dikpati	Flux Transport Dynamo	Late 2007-Early 2008		2012	169±12
Hathaway	Super Geomag Precursor	Aug-Sep 2006	7.2	Jun 2010	147±24
Hathaway	Wilson's Rule	Nov-Dec 2006	NA	Nov-Dec 2010	NA
Kennewell	Recent Cycle Statistics	Oct 2007	8.5	Aug 2011	134±50
Schatten	Solar Precursor SODA Index			Oct 2011	100±30
Svalgaard	Solar Precursor Polar Field	Oct 2006		2011	75±10

50-MHz Standings

Published 50-MHz standings include call-area leaders as of October 1, 2006. For a complete listing, check the Standings Boxes on the "World Above 50 MHz" ARRL Web pages at **www.arrl.org/qst/worldabove/**. To ensure that the Standings Boxes reflect current activity, submit reports at least every two years by e-mail to **standings@arrl.org**. For printed forms, send a request with an SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

Call Sign	State	States	DXCC	Grids	DX† (km)K1TOL
ME	50	170	1210	—	
W1JJ	RI	50	170	—	15,594
K1SIX*	NH	50	165	1009	15,549
K1SG*	MA	50	148	500	14,521
W1JR	NH	50	145	700	14,455
K1AC	NH	50	142	—	14,535
K1MS	MA	50	138	—	14,498
NT1Y	VT	50	135	711	14,589
W1AIM	VT	50	128	531	14,928
K1TEO	CT	50	125	903	14,430
K1CA	NH	50	119	—	—
K7BV	CT	50	111	623	14,813
W1LP	MA	50	109	575	15,295
2					
K2ZD	NJ	50	154	468	15,610
K2MUB	NY	50	148	—	—
K2OVS	NY	50	112	497	13,124
K2PS	NJ	50	95	590	11,718
K1JT	NJ	50	90	561	14,150
K2SIX	NJ	50	86	326	12,119
3					
W3JO	PA	50	157	—	14,929
W3NZL	MD	50	141	—	15,855
W3ZZ	MD	50	140	855	15,769
AE3T	PA	50	132	—	16,097
N3DB	MD	50	131	850	15,083
N3II	MD	50	127	728	15,876
AK3E	MD	50	103	679	14,445
4					
K4MM	FL	50	147	—	16,326
WA4LOX	FL	50	133	—	15,664
K6EID/4	GA	50	131	905	14,564
NN4DX	NC	50	128	124	14,675
W4TJ	VA	50	127	725	15,688
K4RX	FL	50	127	131	—
NW5E	FL	50	123	701	15,103
WA4NJP*	GA	50	122	985	13,171
W4SO	FL	50	122	—	—
KE4WBO	FL	47	119	205	8,600
K4RWP	TN	50	115	748	15,228
WB4WXE	GA	50	114	112	14,320
K4QI	NC	50	112	777	—
5					
K5CM	OK	50	164	—	—
W5OZI	TX	50	155	1077	15,131
K5SW	OK	50	138	—	16,746
K5AM	NM	50	136	847	17,861
WA5JCI	TX	50	121	800	—
AA5XE	TX	50	115	725	15,142
WB5HJV	TX	50	115	—	15,106
AA5AM	TX	50	109	687	14,963
W5HNK*	TX	50	109	468	14,815
W4UDH	MS	50	101	830	14,180
K5AB	TX	50	101	—	—
6					
K6QXY*	CA	50	137	—	15,555
N6CA	CA	50	123	—	18,445
WA6PEV*	CA	50	117	—	18,246
N6CW	CA	50	103	677	—
KB6NAN	CA	50	81	701	16,638
N6ZE	CA	46	70	330	—
KR7O*	CA	50	68	586	12,783
7					
W7RV	AZ	50	133	1007	18,227
AA7A*	AX	50	112	800	18,073
WA7JTM	AZ	50	110	800	18,138
W7GJ*	MT	50	107	—	10,962
W7KNT	MT	50	98	720	15,557
8					
K8MFO	OH	50	152	—	—
W8PAT	OH	50	106	487	13,459
W8TN	WV	50	101	475	12,436
WB8TGY	MI	50	94	521	13,940
K4OM	WV	50	85	—	15,533
K8ROX	OH	50	77	525	11,138
N4DB	OH	50	76	367	11,037
9					
W9RPM	WI	50	124	539	14,092
W9JUV	IL	50	106	400	15,865
W9RM	IL	50	102	656	13,712
W9VA	IL	50	97	500	13,964
Ø					
KØFF	MO	50	123	740	16,246
NØLL	KS	50	122	812	14,901
KØGU	CO	50	103	778	17,142
KØCS	CO	50	82	526	13,409
KØCJ	MN	50	78	—	15,500
Canada					
VE1YX		50	171	1150	—
VE2PEP	PQ	50	95	663	11,574
VE3AX	ON	49	93	—	—
International					
SV1DH		29	235	950	16,600
GØJHC	INT	42	208	1071	15,951
SM7FJE	INT	43	204	1117	15,912
SM7AED		42	198	1019	15,931
SP5EWY		—	178	—	15,256
F5DE	INT	36	163	717	15,789
ZS6NK*		22	125	424	19,360
NP3CW	PR	50	101	574	13,533

†Terrestrial
*Includes EME (moonbounce) contacts
— Information not supplied

about Cycle 25. There is a statistical pattern in cycle lengths that suggests that Cycle 24 might be shorter than other recent cycles, or the first cycle to get longer. In either case, this would suggest that Cycle 25 would be longer in any case. Supporting that idea, Dikpati predicts that Cycle 24 will arrive "late." Similarly, Hathaway notes that there is evidence that the meridional conveyor belt is slowing down, especially in the south, which would lead to a longer cycle — if not now, then in Cycle 25. He goes on to note that statistically, slow conveyor belts lead to poor cycles and he expects that effect to be very noticeable in Cycle 25.

It could be that all of the predictions in the table are more or less correct, but it isn't clear whether all the effects will be felt in this cycle or the next.

ON THE BANDS

Interesting activity was quite limited this month. Some TEP and a little E_s on 6 meters. A few tropo openings on 2 meters and above. Let's see.

6 Meters

It may be sunspot minimum but TEP continues at a reasonable clip. Using reports and the propagation reflectors it appear that there was some TEP on at least 16 days in October. Walter, LW3EX (GF05) finds openings to PY and to the Caribbean on 9 different days (Oct 7, 10, 14, 15, 16, 17, 21, 22, 25). Only two contacts with the US: W4SO and KE4WBO both in EL96. Julio, NP3CW (FK68) reports TEP on 8 different days (Oct 1, 6, 8, 14, 20, 23, 27, 28). Here in the States TEP is reported by Dan, K3ZXL (EL87) on the 20th, Graham, KE4WBO (EL96) on the 20th (OA4B/B) and Dave, N3DB (FM18) on the 22nd. Jon, NØJK (EM17) reports a rare October double hop E_s opening on the 29th: EM60 to DM08, CM98, CM87 in CA. CA was working TX as well and weak aurora was reported at high latitudes. Brock, W6GMT (DM05) worked widely into NM, AZ and CO. A reasonably widespread E_s opening occurred in the southern US on Oct 22/23. W6GMT and Roger, K6LMN (DM04) worked into the Pacific northwest as far as CO70. Several stations report openings into Central America (HR, HP, TI, V31) and the Caribbean including Sam, K5SW, Chuck, K5IX (EL29), KE4WBO and N3DB. The DXWorld reflector notes that HK3JRL was worked from EM89 to FN41. Other openings included KS to the mid-Atlantic on the 6th (thanks NØJK) and Chuck, N6KW (CN87) into DM79 on the 26th.

Tropospheric Ducting

This has not been a good tropo season so far. NØJK reports enhanced propagation according to Stuve diagrams on the 7th. Justin, N5BO (EM60) worked EN61 and EM48. The next morning the opening expanded to include stations west to EM12 (TX), northwest to EN41 (IA), north to EN92 (VE3) and east to EM66 and EM75 (TN). Justin also reports a coastal Gulf coast opening on the 18th including EL17, EL29 in TX and EL49, EM40 in LA.

Digital

Bill, WAØKBZ (EM39) completed his first digital EME contact with KB8RQ on 2 meters on the 9th. N5BO reports 52 contacts and 19 countries in recent months with a small station on 2 meter EME JT65. Lance, W7GJ, records 6 meter digital country no. 53 with ZL8R (Kermadecs). Finally, WAØKBZ reminds us how effective FSK441 is on random meteors, for instance 1690 km to FN31.

HERE AND THERE

ARRL January VHF Sweepstakes

This VHF contest has both the greatest amount of activity and the largest degree of club participation. The contest starts at 1900 UTC on January 20 and ends at 0400 UTC on January 22. More information is available in December 2006 *QST* and on the Web at **www.arrl.org/contests/rules/2007/jan-vhf-ss.html**.

Quadrantids Meteor Shower

The Quadrantids, a short-lived but quite strong meteor shower, peaks ~0030Z January 4. Maximum rates (ZHR) approach ~100/hr at speed of 40 km/s.

Transatlantic Beacon

On Oct 29 2006 Brian, WA1ZMS/4, activated a trans-Atlantic beacon in FM07fm on 144.285 MHz. The beacon uses a pair of Directive Systems DPM144-5 Yagis pointed at Europe with 1400 W ERPd.

RufzXP — the Road to CW Speed 200 WPM

The art and skill of copying Morse code is still popular around the world, and is part of a fascinating game for the young and old alike called RUFZ. RufzXP, *designed for the* Windows *computer operating system has been released, and it provides the chance for users to hone their CW skills from 5 words per minute all the way through 200 WPM. Unbelievably, many operators are routinely copying call signs at speeds over 150 WPM!*

High-speed telegraphy competitions are very popular in Europe, and have attracted a large following of young competitors who can copy CW at speeds that are incredible to most mere long-time Extra class hams. Below, courtesy of Mathias Kolpe, DL4MM, follows the story of RUFZ, *the abbreviation of the German word* Rufzeichen-Hören, *which means "Listening to Call Signs."*

Perhaps many readers remember the *DOS* program *RUFZ*. This program has filled telegraphy friends with enthusiasm for more than 14 years. At the beginning, I asked myself: for what reason is RUFZ so popular? There are an abundance of CW programs available.

The mystery is perhaps that *RUFZ* functions with the simplest PCs, the program is small and above all it's easy to handle. You have "only" to listen to call signs. Everyone will understand the program within minutes. Thus one could say it's rather boring. Not at all, since no program other than *RUFZ* is able to entice out of the user his maximum listening speed.

RUFZ starts with a call, transmitted at an individually chosen speed, with the speed increasing after each successfully copied and entered call. If the call entered is wrong, the speed is reduced by one step. In other words, *RUFZ* adapts automatically to individual capacities and does even a little more, which has an enormous training effect.

By means of the International Toplist, **www.Rufzxp.net**, you can compare your performance both on a local and an international level every time you want. This is very encouraging, indeed. At the end of 2005, more than 730 participants were registered worldwide.

As *RUFZ* author, and operator of the *RUFZ* Toplist, I am surprised time and again by the enormous advances of quite a number of participants. In 1992 I estimated 80 WPM (according to the PARIS method) to be the highest possible speed. But the system's highest transmission speed of 147 WPM was too slow for those on top!

RUFZ became a success on an international scale, as well. According to an IARU stipulation, *RUFZ* was declared an official discipline in the Telegraphy World Championships.

COURTESY MATHIAS KOLPE, DL4MM

A screen shot of *RUFZ* shows the result of entering an incorrectly heard call sign sent at 54 WPM.

Radical Change

Unfortunately there were problems, too. One was the fact that the maximum transmission speed of 147 WPM was no challenge any longer for the top competitors. Also, in the *Windows* era, it became ever more difficult to get the *DOS* program running. For some time I had planned to establish a *RUFZ Windows* version. The project fell through time and again, but the situation was saved through Alessandro Vitiello, IV3XYM, who is an excellent programmer. At the beginning of 2005, Alessandro mailed me a demo with a *Windows* CW generator, offering his help to switch *RUFZ* over to *Windows*, which convinced me to move ahead. I'd like to add that through our joint work we became friends, and the new *RufzXP* emerged within a short time. After a comparatively long testing phase, the official *RufzXP 1.0* was released in April 2006, enjoying lively response immediately.

Now after six months, the new *RufzXP* has been downloaded almost 10,000 times and I've received more than new 1000 user scores so far. As a consequence, I was no longer able to check incoming scores manually. Now by help of MS *Access* database I have at my disposal a semi-automatic system for reading score mails and creating the files for the *RufzXP* International Toplist. So please test the new system! New scores from the US or from anywhere else are very welcome.

What's New with *RufzXP*?

As the name suggests *RufzXP* runs under *Windows XP* as well as *2000*, *NT*, *ME* and *98*. With *Visual Basic.NET*, *RufzXP* has a completely new program with a completely new interface. Installation problems with sound cards are a thing of the past. Safe maximum speed now is 833 WPM!

In addition, there is essentially more comfortable score management. And it is possible to send scores via the integrated mail function for publishing in the International *RufzXP* Toplist. There are comprehensive configuration and export/import modes as well as a new training mode, expanding *RufzXP* to a comprehensive CW training program. All details are obtained from the integrated help function. In addition *RufzXP* contains a new call database with about 54,000 call signs.

Installation and Operation

Installation and operation are child's play. The setup file can be downloaded from **www.RufzXP.net**. As mentioned above, *RufzXP* is programmed according to .NET technique. In other words, an installed MS .NET framework is a prerequisite. The *RufzXP* setup explains itself.

As a first step, with a push of F2 you can switch on the tone and various options. After a click on START, both your own call and the desired starting speed is called up. And here you go. With ENTER, the next of altogether 50 calls appears. When you have finished your round, a table appears with both transmitted and received calls, errors marked in color, speed, points and further details.

In a different window, a list with the results appears, and stores all your attempts, so you can check your progress. You can easily e-mail your top results to the International *RufzXP* Toplist. But don't try to alter your score in the e-mail, because the system uses a test to screen for alterations.

Outlook

The IARU has adopted *RufzXP* for the next international championship. In addition, *RufzXP* passed the acid test successfully at both the German national championship and the National Telegraphy Cup. In both competitions, the pile-up software, *Morserunner*, by Alex Shovkoplyas, VE3NEA, was used, along with *RufzXP*, rounding out the all-*Windows* competition. The new challenge is to copy 200 WPM — Goran Hajosevic, YT7AW, and Fabian, Kurz, DJ1YFK, have done it in training, but who will be the first to achieve this goal in an official competition? To this end, the author will donate a valuable prize. QST

WB8IMY

ECLECTIC TECHNOLOGY

An HF E-Mail Alternative?

Today, if you want to send or receive Internet e-mail via an HF link, the Winlink2000 PACTOR network is the mode of choice. The network is highly reliable and has served the ham community well for both public service and day-to-day use.

However, despite the obvious benefits of Winlink, there are issues such as the wide PACTOR III signal bandwidth and the expense of the SCS multimode controller needed to use PACTOR modes on HF ($1000+).

Rein Couperus, PAØR, has developed an alternative known as *PSKmail*. PSKmail uses the PSK63 mode created by Skip Teller, KH6TY, with added ARQ (*A*utomatic *R*epeat re*Q*uest) capability to allow error-free communication within a bandwidth of only 100 Hz. PSKmail works with your computer sound card; there is no external hardware. The software includes an Internet/HF gateway using POP and SMTP protocols. This means that it can easily transfer e-mail to and from the Internet.

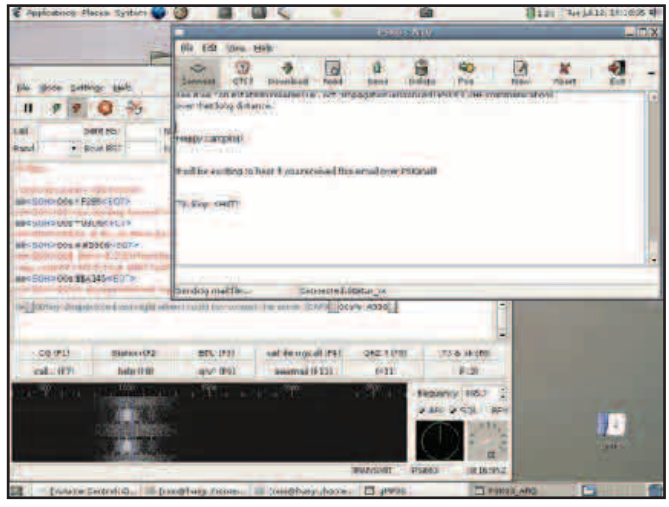
In the ARQ mode, PSKmail chops the text into 8 blocks of 16 to 128 characters, depending on band conditions. Small blocks are transferred when conditions are poor; larger blocks when conditions are good. If errors are detected, the receiving station sends a short status block to tell the transmitting station which blocks were damaged. These are added to the next frame.

PSKmail is substantially slower than PACTOR II or III in terms of throughput. You probably wouldn't use it for e-mails with file attachments unless you are willing to wait a *very* long time to complete the transfer.

The other issue is that PSKmail only functions under the *Linux* operating system at the present time. But if you are a *Windows* user, don't turn the page! There is a way you can try PSKmail without installing *Linux* on your PC—at least not permanently.

1. Go to **www.crusefalk.se/psklive.htm**. Scroll to the bottom of the page and you'll find a link to download the PSKmail "live CD" image. This is a big ISO file that will take a while to download, even for broadband users.

2. Burn the ISO file to a CD. A simple "copy-and-burn" procedure won't work. This step requires specific software such as the *Nero* suite. Alternatively, there is a free ISO burner you can download from **isorecorder.alexfeinman.com/isorecorder.htm**.



PSKmail running under *Linux*.

3. When you have the CD ready, put it in your CD drive and reboot your computer. As your PC reboots, it should read the CD and start a distribution of *Linux* known as Mandriva. Congratulations! Your computer is now running *Linux*.

On the *Linux* desktop you'll find PSKmail, along with some other goodies that Rein has included. If all goes well, you should be able to start the application right away. When you're finished, remove the CD and reboot back into *Windows*.

Rein has a PSKmail server running on 10.148 MHz at PI4TUE in Eindhoven, so give it a shot. Check out Rein's PSKmail Web page at **sharon.esrac.ele.tue.nl/~pa0r/pskmail/** for complete details. My hope is that some of you will establish experimental PSKmail servers here in the US. If you do, let me know and I'll publish the frequencies and schedules in a future column.

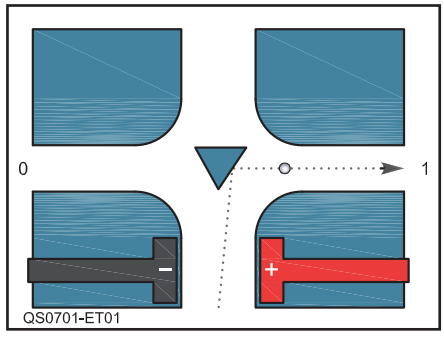


Figure 1— Ballistic Deflection Transistors use inertia to literally bounce electrons and direct their trajectory.

Playing Billiards with Electrons

Scientists and engineers have been trying to improve on the transistor for more than half a century. Most improvements involve variations on the basic theme of running electrons through the transistor like a stream of water and using energy to redirect the flow.

Engineers at the University of Rochester have come up with an approach that is radically different. The so-called *ballistic* design bounces individual electrons off deflectors as if playing a game of atomic billiards (see Figure 1). The Ballistic Deflection Transistor bounces electrons into their chosen trajectories, using inertia instead of wrestling the electrons into place with brute force.

An integrated circuit composed of Ballistic Deflection Transistors (BDTs) would use little power and generate almost no heat. These ultra-tiny transistors wouldn't be nearly as noisy as conventional designs and they would be easy to manufacture. The National Science Foundation recently granted the University of Rochester team $1.1 million to develop a prototype. If the prototype performs as predicted, it may not be long before we start seeing BDT technology in consumer and amateur gear. QST

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

W3UR

HOW'S DX?

New DXCC Countries?

At a meeting in early November 2006 in The Hague an agreement was made which would give autonomous status to both Curacao (PJ2) and St Maarten (PJ7). In October it was agreed that the islands of Bonaire, St Eustatius and Saba would receive special status within the Netherlands. The status of all of the Dutch Caribbean islands has been "a point of controversy with the mother country for years." The new administration is expected to take effect July 1, 2007. At this time it is probably too early to know exactly what changes, if any, will take place on the DXCC Entity list.

DX NEWS FROM AROUND THE GLOBE

3B7 — St Brandon

St Brandon, 3B7, is the next destination for the FSDXA, "Five Star DXers Association." The operation is planned for September, 2007. This group previously did the operations from 9M0C, Spratlys, in 1998; D68C, Comoros, in 2001; and 3B9C, Rodrigues, in 2004. Yaesu will be the principal sponsor of this one, providing 12 FT-2000 transceivers and six Quadra VL-1000 amplifiers. The group is asking for the call sign 3B7C, with the C standing for "Chiltern DX Club," which is very involved in FSDXA operations, and to be consistent with their previous expedition call signs, of course. The mega-DXpedition group has a goal of making more than 100,000 QSOs. FSDXA was the first group to hit that number previously. The operation will be on the air 24 hours a day for three weeks. The last 3B6/3B7 operation was 3B7RF in 1998 that made 53,533 QSOs and 3B6RF in 2001 that made 64,239 QSOs. 3B7 was ranked 45th "most needed" worldwide in 2005, up from 75th in 2004. It is 19th on the US West Coast. Organizers expect it to move up another 10 spots by the 2007 expedition date. Signed on to go along so far are 9M6DXX, DK7YY, DL7AKC, EI5DI, GØOPB, G3BJ, G3IZD, G3NHL, G3NUG, G3SVL, G3XTT, G4KIU, G4TSH, K3NA, N6HC, SM5AQD, W3WL and WF5T. Contributions are being sought due to high costs including $2000 per day for eight days of the chartered ship, and fuel for generators — there is no commercial electricity on the island. Contact **john@g3wgv.com** to make donations, or mail him at The Five Star DXers Association Treasurer, John Lniford, G3WGV, Pennine View, Sleagill, Cumbria CA10 3HD, England. Make checks payable to "Five Star Expedition Fund." US contributions may be sent to Wes Lamboley, W3WL, 690 Hunterhill Way, Roswell, GA 30075, e-mail **Blamboley@aol.com**. Make your check payable to Wesley Lamboley.

Japanese donations may go to Taizo Arakawa, JA3AER, 2-974-8-1502 Sayama, Osakasayama, Osaka 589-0005, Japan, e-mail **ja3aer@ares.eonet.ne.jp**.

4U1UN — United Nations Headquarters

LA5IIA (ex T68G, YA8G), Johnny is now working for the United Nations UNICEF organization in New York City, just across the street from the 4U1UN — United Nations Headquarters station. He is hoping to be there for the next few years and plans to increase activity at the club station. QSL 4U1UN via HB9BOU.

5A1A Receives New German Call

5A1A, Abubaker, has been in Germany for the past few years and is a student. He recently received his German call sign, DL1AL, and is looking forward to getting on the air soon. He does not have any equipment and will be contacting some locals about borrowing some equipment. Abubaker still has his 5A1A logs and QSLs.

5H — Tanzania

Serge (aka Sam), F6AML, is making another trip to Tanzania. He will be on Zanzibar Island, AF-032, January 18-29. Serge is also ex-TO7C, 5H1C and TX6A and is currently the President of the Provins/F6KOP ARS. He will be on 80-10 meters CW and SSB with his FT-857, 400 W amp designed by EA4BQN and verticals. He will concentrate on Japan and North America. QSL via F6AML. For direct, Serge's address is current in the databases available. Enclose a self-addressed envelope and 1 IRC, 2007 type, or $1 for Europe or $2 for outside Europe.

A3 — Tonga

A35GN, Tonga, will again be active, this time December 25-January 3, with operator Mark, VK2GND, at the radio. Look for him on 7050, 14195 and 14273. QSL via VK2GND.

CCF & OHDXF Contest & DX Meeting

Members of the Contest Club Finland (CCF) and OH DX Foundation (OHDXF) have announced the 12th CCF & OHDXF Contest and DX Meeting which will be held January 19-21. The event will take place aboard a ferry which will sail the Baltic Sea starting in Helsinki, Finland with a quick stop in the Åland Islands, then on to Stockholm and then back to Helsinki.

Here is the Cruise schedule (local time)

Friday, January 19, 17:30: Ferry leaves Helsinki (OH)

Saturday, January 20, 09:40: Arrival in Stockholm (SM)

Saturday, January 20, 16:45: Ferry leaves Stockholm (SM)

Sunday, January 21, 09:55: Arrival in Helsinki (OH)

Presentations take place on Friday evening and on Saturday from 11-16 local, while in Stockholm. Daytime visitors are welcome. A contest-DX buffet takes place on Friday evening and an à la carte dinner on Saturday evening.

More details of cruise packages, agenda, how to register etc, will be available on the CCF Web site at **www.contestclubfinland.com**. This is a great event. Your editor and his wife both attended this one last year. Make your bookings now!

HBØ — Liechtenstein

Tom, DL2OBO, will be QRV again from "Chalet Barsuela" in HBØ, Liechtenstein, January 1-9. He will focus on 160-30 meters CW, will do a little SSB, and will try to be on RTTY and PSK for the first time.

HI — Dominican Republic

Miguel, HI/CT1EHX, will be on from the Dominican Republic December 24-31, 80-10 meters SSB and RTTY. QSL via CT1EHX direct or bureau.

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

KH2 — GUAM

Look for JM3PIT to be operating from Guam from December 20-22. No word on the call sign. QSL via JM3PIT.

KH8/S — Swains Island

An international team of twelve experienced operators led by Hrane Milosevic, YT1AD, and co-led by David Collingham, K3LP, will activate Swains Island (DXCC's Newest Entity), April 3-16, 2007, using the call sign N8S. Hrane and David have been in direct contact with Larry Gandy, AH8LG, to gain a clear understanding of the island's requirements for permission to operate. The Swains Island permission to operate was confirmed via e-mail from Larry Gandy on October 23, 2006. The team has reached an agreement that meets the specified Swain Island requirements.

The N8S DXpedition team includes: YT1AD, K3LP, K1LZ, N3KS, N6TQS, RK3AD, RA3AUU, SV2BFN, UA3AB, RZ3AA, YZ7AA and YZ1BX.

The team will depart for Swains Island on the morning of Monday, April 2, 2007. The boat ride from American Samoa will take approximately 24 hours with the team arriving and setting up camps on Tuesday, April 3, 2007. The operation will begin late Tuesday, April 3, and will end late Monday, April 16, providing 14 days of active operation. There will be a CW camp, SSB camp and Digital/6 Meter camp each supplied with three ICOM radios, ACOM amplifiers and required antennas. The team will depart Swains Island around noon (local time) on Tuesday, April 17, and arrive back in American Samoa on the morning of Wednesday, April 18.

The QSL Manager and Web site information will be provided at a later date. At this time, there is no plan for daily online logging. The logs will be posted online after April 27. Watch your favorite DX Bulletin for the latest news on this one.

Rare IOTA — NA-219

A group of German Amateur Radio operators will be QRV from the rare Elbow Cay, part of Cay Sal Bank (NA-219), Bahamas early next year. For those who collect ARLHS lighthouses this is BAH 018. The team will include Bodo, DL3OCH; Rene, DL2JRM; Dan, DL5SE, and Daniel, DL5YWM. They will head for Key Largo, Florida sometime around January 3, then QRV from the very rare IOTA NA-219 until January 9. The exact dates depend on local weather. Plans are to have two stations QRV on 10 through 160 meters on CW and SSB on the normal IOTA frequencies. Also Bodo will have an EME station for activity on 70 and 23 cm. Donations for this operation are being sought to help offset the high costs. The call sign for this operation will be C6ARI. The group does have a Web site at **www.qslnet.de/na219**. The QSL manager for this operation will be DL3OCH.

S2 — Bangladesh

DXpedition project BANGLADESH 2007, which has been in the works over the last two years, will take place in mid-January. A group of Spanish Amateur Radio operators will be QRV as S21EA January 10-16. They are Josep, EA3BT (team leader); Tony, EA2PA; Nuria (YL), EA3WL; Fer, EA5FX, and Juan, EA8CAC. Plans are for activity on 6 through 160 meters on CW, SSB and RTTY. "Our aim is to

give the new one to the maximum number of station(s), and that's why we will have 3 station(s) on the air simultaneously" says team leader EA3BT, Josep. A DXpedition Web page is up and running now at **www.ea3bt.com/s21ea.html**. QSL via EA3BT either direct or via the bureau.

VP2M — Montserrat

Members of the Buddipole Users on Montserrat (BUMS) have announced their plans to mount a DXpedition to Montserrat (VP2M) January 29-February 6. Montserrat, often referred to as the Emerald Island of the Caribbean, got its name from Christopher Columbus in 1493 during his second trip to the New World. The operators will be Budd Drummond, W3FF; Chris Drummond, W6HRP; Dan Gagnon, WZ1P; Paul Van Dyke, KB9AVO; Mike Greenwood, KC4VG, and Scott Andersen, NE1RD. Each of the team members is limited to packing 100 pounds so they will be taking lightweight transceivers and portable antennas. VP2M calls, QSL info suggested frequencies and operating schedules are expected before their departure in January. The team will have a Web site (**dxpedition-vp2m.com/**), which is currently under construction. Montserrat was a popular tourist destination until the Soufriere Hill Volcano violently erupted in July 1995. Buddipole Antennas (**www.buddipole.com**) is the premier sponsor for this DXpedition.

VU7 — Lakshadweep Islands

During December 2006 and January 2007 Amateur Radio operators will have the unique opportunity to work the second rarest DXCC Entity. If all goes as planned members of the Amateur Radio Society of India (ARSI) will be QRV as VU7LD (Lakshadweep Islands) during the entire month of December 2006. Full details can be seen on their Web page at **www.arsi.info/VU7/index.html**. Also in January members of the National Institute of Amateur Radio (NIAR) will be QRV. Although as of press time the exact dates have not been confirmed, looks most likely it will be January 15-25. They have a Web site at **www.vu7.in**.

XT — Burkina Faso

Members of the F6KOP Provins ARS are heading up a multinational DXpedition team to Burkina Faso in January. The Bukinabe authorities have authorized the group the call sign XT2C. Team members will include Bob, N6OX/XT2CI; Bill, N2WB/XT2CJ; Gerard, F2JD/XT2JD; Gerard, F2VX/XT2CA; Alain, F5LMJ/XT2CE; Franck, F5TVG/XT2CD; Dieter, OE8KDK/XT2CK; Bernard, F9IE/XT2IE; Jean-Paul, F4AJQ/XT2CC; and Frank, F4AJQ/XT2CC. Look for activity on 6 through 160 meters on CW, SSB, RTTY, PSK, SSTV and possibly WSJT for 6 meters. They will have six rigs, two amps and multiple antennas. Activity is expected January 6-20. Plans are to have a Web page. QSL via F9IE, Bernard Chereau, PO Box 211, F-85330 Noirmoutier en L'ile, France.

YT1AD — Heading for Pacific

YT1AD, Hrane, is making his plans for a Pacific trip in January in preparation for his upcoming multi-national team DXpedition to Swains Island in April. He will be traveling to American Samoa where he plans to be on as KH8/N9YU February 1-5. QSL via YT1AD.

ZD9 — Tristan da Cunha & Gough Islands

Brian, ZD9BCB, is expected to be QRV from Gough Island (AF-030) until September 2007. Over on Tristan da Cunha (AF-029) Andy, ZD9BV, is expecting to be more active now. Watch for him starting around 1730Z on the following frequencies: 14185, 14220, 18140, 21240 and 21265. QSL via his CBA. QST

W1GHZ

MICROWAVELENGTHS

Directional Couplers

Directional couplers are useful microwave devices, both for determining what is happening on transmission lines and as microwave circuit elements. While many surplus varieties are available, it is also possible to roll your own. We shall also see how to use some of them successfully for ham bands outside their designated operating range.

A small capacitance connected to a transmission line — a probe inserted inside a coaxial line or waveguide — can be used to detect relative voltage at that point on the line, but we would like more information. Usually, we would like to know the Virtual SWR (VSWR) on the line or the amount of power being transmitted.

If an antenna is not perfectly matched, some transmitted power will be reflected and flow back down the transmission line toward the transmitter. A directional coupler samples the power flowing in one direction while ignoring the power flowing in the other, so that we can determine the VSWR by comparing the power flowing in the two directions. The difference in dB between the reflected power and the forward (transmitted) power is called Return Loss (RL). Then the VSWR may be calculated:

$$VSWR = \frac{10\frac{RL}{20}+1}{10\frac{RL}{20}-1}$$

But most microwave engineers find it easier to work directly in Return Loss instead.

How does the directional coupler perform this magical feat? One type samples the transmission line in two locations, and then connects the two samples so that the phases of the samples traveling in one direction add, while in the other direction the phases cancel. In waveguide, the sampling is done through holes between parallel guides. In coax and stripline, the most common form of directional coupler achieves the same result by adding a second conductor in parallel with the center conductor for a quarter-wavelength, as shown in Figure 1. Power may flow in both directions in the second conductor, but one end is normally terminated in a matched load to absorb the unwanted direction. The spacing between

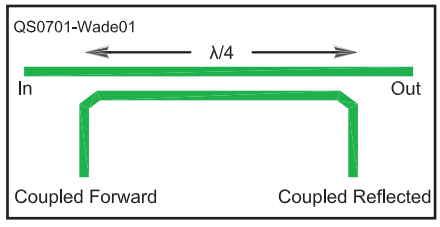


Figure 1 — A sketch of basic directional coupler.

the conductors determines the coupling, the amount of power that is sampled compared to the power flowing in the transmission line. Typical couplings are −20 dB or −30 dB, but may range from −3 dB to −60 dB. For power measurement, −30 dB samples 1 mW for each watt flowing, making calculations easy for measurements — many microwave power meters have a 10 mW maximum. For higher powers, −40 dB samples one mW for each 10 W and −50 dB samples one mW for each 100 W, or 1 kW full scale. I've not had to worry about even higher powers.

In addition to coupling, we must consider directivity. In any real coupler, some power flowing in the undesired direction leaks through, so the separation between directions is not perfect. Directivity is the difference in dB between the desired and undesired coupling. It can be a problem when measuring Return Loss — for example, if the directivity were only 15 dB, then the indicated Return Loss would be only 15 dB (VSWR=1.43), even with a perfectly matched load or antenna. Good directional couplers have directivity well over 20 dB.

To measure Return Loss, the coupler may be reversed, or a dual directional coupler may be used, one that has a third quarter-wave long conductor so that both directions may be sampled simultaneously. Since the direction of the single coupler matters, it is important to get the direction right; to confuse matters, waveguide and coax couplers work in opposite directions, as illustrated in Figure 2.

Homebrewing a Directional Coupler

The basic form of the directional coupler is as shown in Figure 1. Physically, a good way to make one would be in Tri-plate stripline, with round or rectangular conductors centered vertically between two flat plates like the ones in Figure 3. The spacing between the plates may be calculated to make the characteristic impedance of the transmission line near 50 . The exact characteristic impedance needed is a function of coupling, but for coupling levels of −30 dB or weaker, it is very close to 50 (in a 50 transmission line, of course). The best dielectric surrounding the conductor is air, but other good

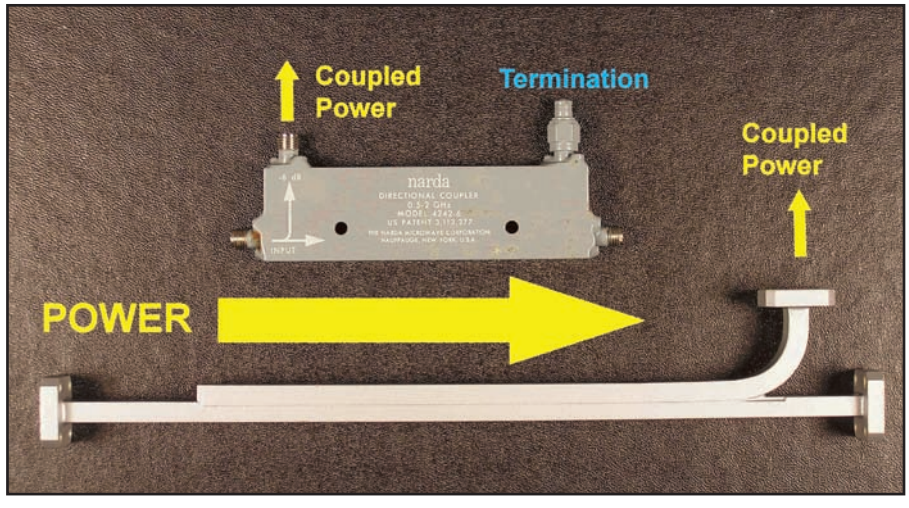


Figure 2 — Coupling direction: in coaxial couplers, the coupled port is closer to the input port, while in waveguide couplers, the coupled port is closer to the output port.

Paul Wade, W1GHZ ♦ 161 Center Rd, Shirley, MA 01464 ♦ w1ghz@arrl.org

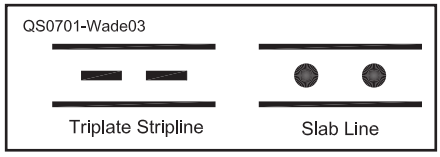


Figure 3 — Common cross-section geometries for directional couplers.

dielectrics may be used as long as they surround the conductors uniformly. To provide support and hold the conductors in place, Styrofoam may be used — at microwave frequencies, it acts just like air.

Calculating the spacing is a bit more complicated. The coupled lines have two characteristic impedances, the even mode, Zoe, when they are excited in parallel, and the odd mode, Zoo, when they excited in opposite phases, both of which depend on the spacing.

Then the coupling may be calculated[1]

$$\text{Coupling} = -20\log\left[\frac{Zoe/Zoo - 1}{Zoe/Zoo + 1}\right]$$

To be matched to the characteristic impedance Zo, usually 50 ,

$$Zo = \sqrt{Zoe * Zoo}$$

must be true as well.

I calculate Zoe and Zoo, coupling, and corresponding physical dimensions for rectangular conductors, with the free *Ansoft Designer SV* software,[2] using the TRL wizard. For instance, if Zoe=51 and Zoo=49, then Zo=50 and Coupling= −34 dB. For round conductors, formulas are given in Note 1.

It would be convenient to make directional couplers in microstrip lines, on printed-circuit boards with dielectric below and air above, but microstrip couplers have very poor directivity. The problem is that electromagnetic waves propagate at different speeds in air and dielectric, so it is difficult to achieve phase cancellation for the undesired direction. I simulated some microstrip couplers using the *Ansoft Designer SV* software and the calculated directivity was only around 10 dB.

At UHF frequencies, a simple way to make a coupler is to slip a thin wire under the braid of a section of coax, with the length under the braid about ¼ λ times the velocity factor of the coax. I did this by carefully slitting the outer jacket of some RG-58 coax, removing the jacket, then pushing the braid from both ends to make it fatter (like the "Chinese handcuffs" toy). After slipping some thin hookup wire through, the braid is pulled tight again, and SMA connectors soldered to one end of the hookup wire and braid for the coupled power. The other end of the wire is terminated to the braid with a 51 resistor. I measured about −22 dB coupling with 20 dB or so directivity — good enough for a QRP rig.

Dick Turrin, W2IMU (SK), made some directional couplers with semi-rigid coax by cutting away a section of the outer jacket on one side of two pieces, flattening the open sides, and soldering the two pieces together[3].

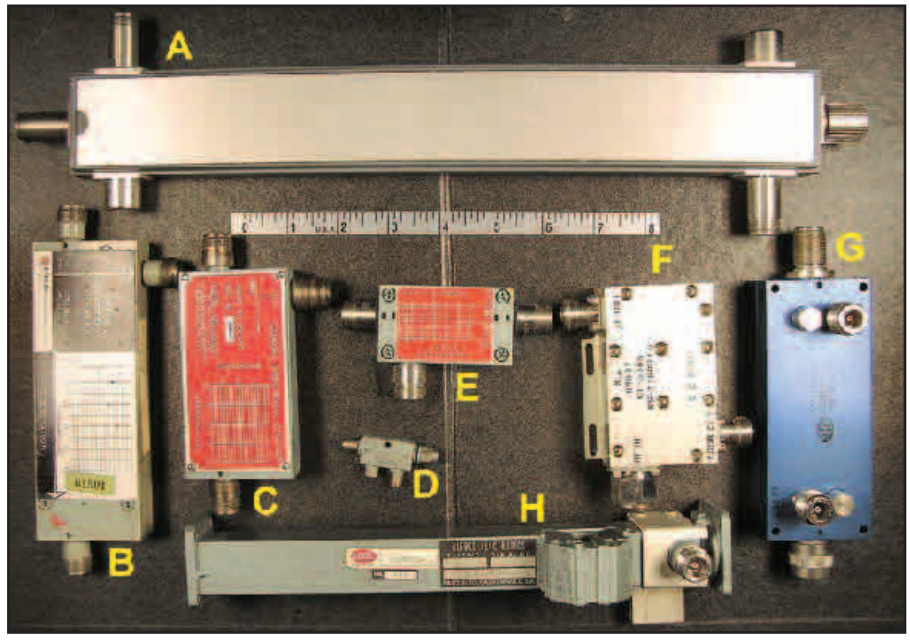


Figure 4 — Directional coupler surplus potpourri: A — from HP instrumentation, dual −20 dB, ~100 to 1500 MHz; B — PRD −20 dB, 4 to 8 GHz; C — Narda, −30 dB, 0.95 to 2 GHz; D — Omni-Spectra, −30 dB, 7 to 12.4 GHz; E — Narda, −20 dB, 7 to 13 GHz; F — from cell site, −50 dB, ~700 to 1300 MHz; G — Meca, dual −50 and −40 dB, ~700 to 1300 MHz; H — Alfred, −10 dB, WR-90 waveguide (8 to 12.4 GHz).

Surplus Directional Couplers

A selection of couplers from my junk box, acquired at various hamfests, is shown in Figure 4. Many are marked with coupling and frequency range, while the frequency range of others may be estimated by size comparison. Some even have individual calibration charts attached. The couplers on the right (items F and G) are probably from cell towers operating around 900 MHz, and have excellent performance at 902 and 1296 MHz. Couplers like the one at the top (item A) were removed from HP test equipment and are excellent performers over a wide frequency range — this one covers from below 2 meters to >1300 MHz with 40 dB directivity. Some similar models cover 2-18 GHz. Typical coupling for these is around −22 dB.

Most commercial directional couplers have pretty good directivity over the specified operating range and can be used for checking Return Loss, even if the coupling is not known. Even better, at frequencies below the operating range, the coupling decreases but the directivity is usually still good, so the coupler can be very useful. For instance, I have a coupler (item C) specified for a nominal −30 dB over 1 to 2 GHz, but the coupling measures −41.8 dB at 222 MHz and −46.5 dB at 144 MHz. Similarly, a small −30 dB X-band coaxial unit (item D) is useful at all lower microwave bands, with the coupling falling off to around −40 dB at 1 GHz.

For accurate power measurement with a directional coupler, good calibration is necessary. This can be done with a known power flowing through the coupler, or with a network analyzer. These expensive instruments are often available to make measurements at VHF conferences and microwave meetings, but not many hams take advantage to calibrate things like directional couplers and attenuators. There isn't much to drift in a directional coupler, so once calibrated, they may be used for reasonably accurate measurements back home. We will discuss power measurement in the next column.

3 dB Couplers

With coupling of −3 dB, half the power is extracted through the coupled port, leaving the other half to continue straight through. One obvious use is as a power splitter; turned around, it becomes a power combiner. Another common use is in balanced mixers and balanced amplifiers. A future column will look at various types of mixers, another essential part of a transverter. QST

[1]G. L. Matthaei, L. Young, E. M. T. Jones, *Microwave Filters, Impedance-matching Networks, and Coupling Structures*, Artech House, 1980, pp 775-780.

[2]**www.ansoft.com**

[3]R. Turrin, W2IMU, "UHF Directional Couplers," *QST*, Sep 1970, p 26.

AB1FM

EXAM INFO

QPC Releases General Class Question Pool

A revised General class question pool will take effect for all Element 3 General class license written exams on July 1, 2007. The new question pool, released to the public in December 2006 by the Question Pool Committee (QPC) of the National Conference of Volunteer Examiners, does not contain significant changes. It has been updated for content; any content that has become less relevant over time or technically inaccurate has been deleted. The QPC also has to incorporate the changes needed to comply with the FCC Report and Order (R&O) for WT Docket No. 04-140 in all current question pools.

Members of the QPC are Chairman Jim Wiley, KL7CC (Anchorage Amateur Radio Club VEC); Roland Anders, K3RA (Laurel Amateur Radio Club, Inc VEC); Perry Green, WY1O (ARRL VEC), and Larry Pollock, NB5X (W5YI VEC). The group can be reached via e-mail at **qpcinput@ncvec.org**.

With the General class exams changing July 1, 2007, the ARRL VEC will be supplying all its (near 1000) Field Stocked VE teams with new test booklet designs about the third week in June. Current ARRL VEC-supplied General class test booklets versions are valid until June 30, 2007. The ARRL VEC *ExamWin* Software will get updated, as well, and will be available about mid-June 2007.

Amateur Radio Question Pools can be viewed, downloaded or printed from the ARRL Web site at **www.arrl.org/arrlvec/pools.html**. For $4, the ARRL VEC will supply a hard copy of any one question pool. To receive the printed question pool copy by mail, send your request and $4 to the ARRL VEC, 225 Main St, Newington, CT 06111. Additional copies or additional pools can be obtained at $4 per pool. Please remember to specify which pool (or pools) you are requesting.

FCC Report and Order Contains Changes to VEC Testing Program

The FCC's Report and Order FCC 06-149 in WT Docket 04-140, which becomes effective December 15, 2006, includes changes that will affect the VEC Testing Program. The 04-140 R&O does *not* include action on the Commission's proposal to eliminate the Morse code requirement for all license classes. A Report and Order in that proceeding, WT Docket 05-235, is still pending.

As of December 15, the FCC no longer requires VECs to make public announcements in advance of test sessions; however, individual VECs may continue to do so as a condition of coordinating an exam session if they so choose. The ARRL VEC would like to maintain the highest degree of service and integrity by asking our VE teams for their continued cooperation with registering test dates in advance of the session. We have observed that most candidates refer to the ARRL VEC for help with finding exam opportunities in their local community. The information we post on our ARRL Exam Session Search Web page (**www.arrl.org/arrlvec/examsearch.phtml**) helps candidates find you!

The FCC removed the requirement that a VEC forward applications to the Commission within a 10 day time period. VECs may still require VE teams to submit exam session materials back to the VEC within a specified period of time as a condition for coordinating the session, however. The ARRL VEC will continue to adhere to the 10 day window to uphold our excellent customer service record. We ask our VE teams to also continue to be sensitive to the 10 day window.

Proof of an expired General, Advanced or Extra class license may be used for Element 1 examination credit (5 WPM) when presented at a VE test session.

FCC Rule 97.505 for Element credit was amended to allow expired FCC-granted General, Advanced or Amateur Extra class license documents to be utilized for Element 1 credit.

For information on the 04-140 R&O, see Happenings, elsewhere in this issue, or visit the ARRL 04-140 FAQ page at **www.arrl.org/wt04-140faq**. QST

2007 Test Fee

The ARRL VEC Test Fee for 2007 will remain at $14. Remember: A $14 fee is charged to every person seeking a new license or upgrade as listed on your ARRL VEC Candidate Roster. This one fee pays for one attempt at each of the four exam Elements. If an applicant retests an exam Element that was failed moments earlier, another $14 fee is charged (and another Roster entry is created).

2007 ARRL National Exam Day Weekends

ARRL-sponsored National Exam Day weekends are held annually on the last full weekends of April and September. The spring National Exam Day weekend is April 28-29, 2007, while fall's National Exam Day weekend is scheduled for September 29-30, 2007. The ARRL VEC thanks you for your support of these events.

Question Pool Schedule

- Technician class (Element 2) Pool released July 1, 2006 is valid until June 30, 2010.
- General class (Element 3) released December 2006 will become effective July 1, 2007.
- The current General pool is valid only through June 30, 2007.
- The Amateur Extra class (Element 4) pool will be released December 2007 and will become effective July 1, 2008.
- The current Amateur Extra pool is valid only through June 30, 2008.

Strays

DAVE WAGNER, K3LGM

Where's the complaint department?: **Dave Wagner, K3LGM, of Springtown, Texas, writes: "Have been driving past this sign every evening for a couple of years, and finally decided I just had to share it. It's on Hwy 199 about 5 miles northwest of downtown Fort Worth."**

Maria Somma, AB1FM ♦ ARRL VEC Manager ♦ msomma@arrl.org

K2TQN

OLD RADIO

The 1926 Grebe CR-18

My first introduction to the Grebe Company and their radios was reading the advertisements in the early *QST* and *Radio News* magazines. (This was in the mid-1990s.) I saw an advertisement and read a review for the Grebe CR-18 in the June 1926 issue of *QST*. I knew right away I wanted one. It was a sharp looking radio. There was something about those coils mounted on top that looked so "ham radio."

Asking around I soon found out that they are hard to find, especially at (what I thought) a reasonable cost. I was told that if I really wanted to find one, I should join the Antique Wireless Association, the AWA, and go to their big meet and auction at the end of summer in Rochester, New York. Checking the classifieds in the current *QST* I soon found the AWA advertisement and sent off a check.

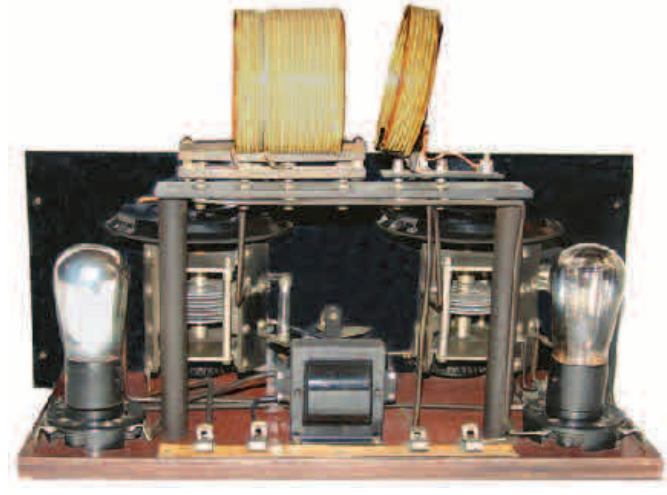
Ironically one of the first AWA publications I received was the February 1995 issue of *The Old Timer's Bulletin*. That issue had an article about the CR-18 by Bruce Kelley, W2ICE, the founder of the AWA. Kelley said in the beginning of the article that this set was, "rare and highly collectable." I also found a full-page advertisement in there for the annual AWA meet later that summer.

Some of my collector friends were planning to attend the big AWA Conference, so I made reservations, bought my tickets, and made arrangements to meet them there. I started to put aside some money to take with me and I scheduled some vacation time from work, as it was a 3-day affair. Everyone told me to expect to have a great time.

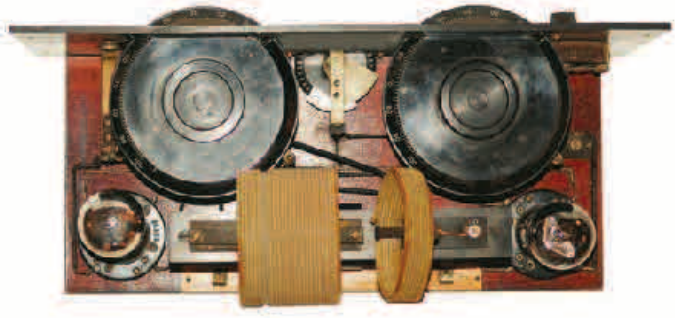
The AWA Conference and Museum

I went and came home that year without a Grebe, but I was able to spend all my money on other early ham radio items I found there. The highlight of the meet for me, though, was an evening side trip to the AWA Museum about 10 miles away. The

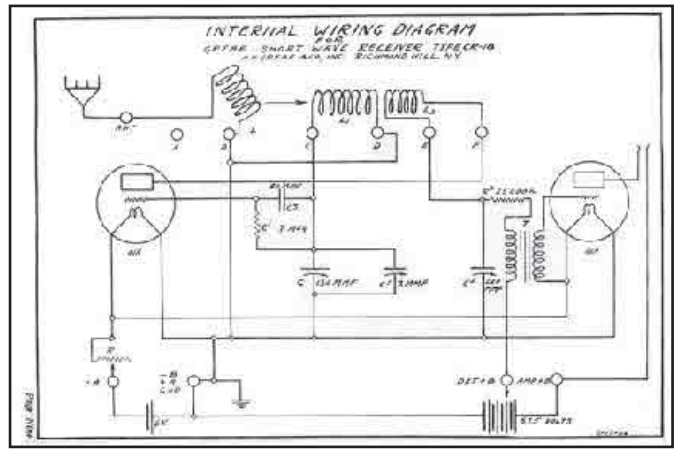
Front view.



Rear view.

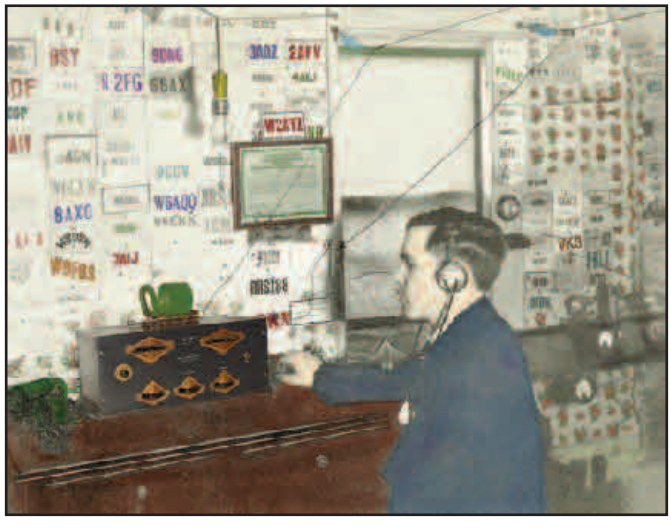


Top view.



John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

A late 1920s station owned by Roger W. Barrington, W3KW. If you look closely at the center of the set, you will see he replaced the small fine-tuning capacitor and dial with a larger dial and probably a larger capacitor. This would allow him fine-tuning over a much greater range. Also note the small metal box at the right end of the desk. I will have a column about this important ham station accessory in the near future. Do you know its purpose?



Eric Palmer, W2ATZ, using his CR-18 on 80 meters.

AWA had rented some small busses and transported about 60 of us from the hotel to the museum.

What I saw there took my breath away. It was wall-to-wall radios. Not just any radios but what seemed like hundreds of ham radios, of all kinds and ages. From the earliest home-brew types, right up to highly collectable manufactured sets from the 1960s and 1970s. There were also microphones, Morse keys, electronic tubes, and anything and everything radio related.

Walking up and down the aisles enjoying all the radios, I turned the corner and then I saw it. I couldn't believe my eyes. There was a Grebe CR-18 on display. It was more beautiful than the photos. The AWA Museum must have had every model that Grebe made. I'll bet I stayed in that area for an hour, comparing them, taking photos and talking to everyone I could about these radios.

It would be quite a few years until I decided to spend what one was worth, and a little longer until I found the one I wanted. I followed my own advice. That is, once in a while if you want a high-end radio, treat yourself. (See my column about the Estes auction, where I bought it, in the July 2006 issue of *QST*.)

A. H. Grebe

Alfred H. Grebe (pronounced "greebie") was born in 1895. His father died when he was about 10 years old. Grebe had been interested in radio for some time and had built his own crystal detector radio with loose coupler coils. Making some more, he made a few bucks selling crystal sets to his neighbors. His backyard radio shack became the neighborhood hangout for his friends, many of whom would later work at the Grebe Company.

After he quit high school, his mother enrolled him in the Marconi Institute of America in New York City. Upon graduation he went to sea, first as an Assistant, then as Chief on vessels of Panama Railroad Steamship Company, Clyde Lines and other ships in the coastal trade. When he was home on leave, he would work on new designs with his friends. They developed the "Improved Detector." This led to his earning $15 per week in his spare time. He decided to leave the sea and try his hand at building radios.

Grebe was a ham operator from his earliest days in radio and held several calls during this time. The earliest I could find was "2PV" in the 1915 call book, "2ZV" in the 1919 call book and "2XE" in 1926. Some of these calls were associated with his company I believe, as the 2ZV and 2XE were mentioned in his advertisement in the June 1926 *QST*.

Much has been written about Al Grebe and the Grebe Company, so I won't repeat it here. For more information, check my Web site, **www.k2tqn.com**. I'll have references and links for you to follow. I'll also have additional photos of my CR-18 and a copy of the original manual and coil data in case you want to build a replica, which should be easy to do. The CR-18 is a 2-tube set using 01A tubes.

There is a model CR-18 Special and a CR-19 that came out in 1928. Both sets look similar, but are improved versions. The CR-18 Special had an additional audio stage and the CR-19 has two additional tubes, a screen-grid tube as an RF amplifier and an additional stage of audio amplification.

Any Grebe radio would be a nice addition to your collection. I'm looking forward to finding some more for mine. I have enclosed photos of my CR-18 so you can see how nice a radio it is. — *K2TQN* QST

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

K1EAX **Syriac**, J. B., Ludlow, MA
W1GFB **Malley**, Edmund J., North Easton, MA
W1HH **Wallace**, Robert A., Chelmsford, MA
KB1JVJ **Smith**, Kathleen A., Westfield, MA
W1PPR **Goldwin**, Melvin H., Memphis, TN
W1YEG **Zeitler**, Henry C., N Dartmouth, MA
WB2AFE **LaMay**, Robert F. Jr, Oswego, NY
WA2CKM **Rotunno**, Joseph J., Bronx, NY
KB2EJY **Leah**, Ben F. Sr, Totowa, NJ
W2FHY **Dohner**, Carol J., Pennsville, NJ
AA2FT **Doty**, Walter C., Fort Edward, NY
W2IB **Inness Brown**, Hugh A., Ogdensburg, NY
WB2KOG **Christman**, James, Claverack, NY
N2LHD **Laterra**, Charles, Westfield, NJ
K2QQF **Morgenweck**, Raymond L., Egg Harbor City, NJ
KB2TMW **Shoemaker**, Kevin P., Minoa, NY
KE2ZJ **Orth**, Robert B., Moorestown, NJ
W3BBB **Spencer**, Clinton R. Jr, Telford, PA
W3BDR **Farthing**, John, Blandon, PA
♦ KA3DRD **Kabak**, Edward J., Royersford, PA
♦ K3HWL **Myers**, Robert E., Meadville, PA
KB3MD **Cook**, Donald F., Englewood, TN
K3PCH **Toth**, Charles, West Mifflin, PA
W3UVG **Cooper**, Horace E., Washington, PA
W4BNE **Murphy**, Raymond, Watauga, TN
♦ N4BX **Thomas**, Bob, Charlotte, NC
W4CBB **Blevins**, Carl B. Jr, Leeds, AL
K4FHB **Baldwin**, Edwin G., Burlington, NC
KF4JAI **Johnsen**, Judy D., Milledgeville, GA
♦ K4JO **Valentine**, Ellicott, Winston-Salem, NC
K4JWP **Bardenwerper**, Hulburt W., Louisville, KY
K4KAM **Warne**, John W., Gainesville, FL
KA4KHJ **Miner**, Dolly M., Gray Court, SC
WB4LZM **Elder**, Virgil M., Spring Hill, FL
♦ W4MC **McFarlane**, Edgar D., Bristol, VA
KU4MF **Leonard**, Earnest L., Bristol, VA
AF4OM **Conroy**, Edward J., Tampa, FL
K4ORC **Jolly**, Robert L., Bowling Green, KY
KC4QMC **Stewart**, Ronald, Winston-Salem, NC
AA4QY **Hagaman**, Boynton G., Falls Church, VA
W4RAG **Harrington**, George A., Cheraw, SC
KF4SB **Westervelt**, Chester R., Columbus, GA
KA4SQC **Herman**, Arthur H., Lexington, KY
W4YBW **Wedge**, James E., Morrow, GA
W4YF **Fulmer**, John A., Ponte Vedra Beach, FL
W4YPM **Granberry**, John A., Atlanta, GA
K5AMT **Stinnett**, J. B., Owasso, OK
♦ K5BGG **Morgan**, Leonard Tool, Sierra Vista, AZ
K5ELH **Honeycutt**, Eddy L., Southaven, MS
♦ W5IBE **Landress**, John B., Richardson, TX
WB5ILY **Merritt**, Betty H., Many, LA
WB5JIO **Donahue**, Howard, Tulsa, OK
N5LRR **Taylor**, Andrew L., Woodward, OK
N5LX **Jacobs**, John Jr, Tulsa, OK
KE5TE **Hauck**, Kenneth A., N Little Rock, AR
W5UJO **Parsons**, J. F., Duncan, OK
KD5VIR **Thompson**, Floren III, Portales, NM
W5WDN **Sluder**, Jerald L., Inola, OK
W6AIM **Dromgold**, Raymond K., Long Beach, CA
KA6AQK **Gullickson**, Dale L., Lomita, CA
WH6AYI **Sisson**, John S. III, Honolulu, HI
WN6DLX **Hopper**, Victor G., McMinnville, OR
WA6FWQ **Webster**, Alexander A., Elk Grove, CA
W6GCM **Bush**, Clarence F., Yuba City, CA
W6JGY **Naylor**, Graham C., Glendora, CA
W6KNF **Baird**, Vern L., La Verne, CA
KE6PXR **Hill**, Charles, Richmond, CA
WA6UTQ **Ruegseger**, Larry R., Chula Vista, CA
KE6ZQ **Wejmar**, Douglas A., Turlock, CA
WB6ZZB **Johnson**, Charles R., Malibu, CA
♦ N7AM **Riggs**, J. D., Bremerton, WA
KA7AXF **Boyd**, Ruth E., Orcas, WA
♦ W7BMI **Sloate**, Robert A., Billings, MT
K7BRR **Rawls**, Noel B., Corvallis, OR
K7KAK **Day**, Marie D., Bainbridge Island, WA
W7KBL **Stewart**, David M., Walla Walla, WA
KC7LZE **Forney**, Nanette G., Eugene, OR
WA7NOQ **Ahlstrom**, John M., Kent, WA
KA7NVY **Gauntt**, Steven B., Jensen Beach, FL
KC7RVG **Barlow**, Kingsley H., Saint George, UT
W7TYX **Dolan**, William M., Carson City, NV
♦ AL7Z **Etheredge**, Donald R., Fairbanks, AK
KC7ZK **Barish**, Carl, Bellevue, WA
K8DOU **Reynolds**, Leighton B., Reynoldsburg, OH
W8LMP **Olds**, Burleigh L., Flint, MI
N8MOD **Parker**, James R., Ashland, OH
WA8MUC **Nolder**, Harold W., Lynchburg, OH
W8NL **Hilfer**, Trevor C., Hiram, OH
K8OOO **Fischer**, Thomas H., Spring Lake, MI
WA8OTH **Neumann**, Harry A. Sr, Manistique, MI
♦ K8UTY **Nobes**, Charles J., Columbus, GA
KC8WIG **Stevens**, Zach T., Gaylord, MI
♦ KF8Y **Miller**, Carl L., Fenton, MI
N9AQ **Johnston**, C. J., Naperville, IL
K9DCQ **Briggs**, Bert O., Peoria, IL
WB9JXT **Swenson**, Keith E., Westby, WI
N9QCD **McFarland**, David A., Martinsville, IN
KB9QNJ **Richardson**, George A., Bath, IL
WB9USB **Hicok**, Charles W., Peoria, IL
W9VHN **Widdows**, Dennis N., Tucson, AZ
KA9YSD **Gugliemelli**, Lewis A., Pekin, IL
WDØCGZ **Hawkins**, Benjamin C., Fulton, MO
WØHJQ **Logan**, Carter M., Independence, MO
WAØHKF **Miller**, William J., Troy, MO
WØHVF **Lofstedt**, Eldon E., Mesa, AZ
WØHYQ **Vosika**, Marvin A., Rapid City, SD
WØJQP **Kellogg**, Byrne V., La Grange, KY
KØLUB **Finesilver**, Sherman G., Denver, CO
♦ KØLVB **Miller**, Gregg D., Marshalltown, IA
WØNL **Poepsel**, John F., Jefferson City, MO
WØNUN **Dmitruk**, Henry, Cedar Rapids, IA
WAØOEW **Wilson**, Clarence J., Davenport, IA
KAØSZY **Carpenter**, R. D., Kansas City, MO
NØTNC **Bakkum**, Gordon A., Saint Charles, MN
KØUEG **Wanous**, Ed, Wrenshall, MN
NAØV **Connolly**, Minako S., Waynesville, MO
NFØX **Brundridge**, Harry L., Hermitage, MO
VE1LN **Mckay**, Bernard P., Yarmouth, NS
VE3NI **Goodier**, Edward A., Picton, ON
LA7SP **Holand**, Torfinn, Tomasjord, Norway
VU2HSN **Singh**, Hari, Jaipur, India

♦ 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

Amy Hurtado, KB1NXO ♦ Silent Keys Administrator ♦ sk@arrl.org

Strays

A NEW LAW = NEW GIVING OPTIONS!

◊In August 2006 *The Pension Protection Act (PPA) of 2006* went into effect. Among other details, this legislation offers individuals new but short-term opportunities for charitable giving to support the non-profit organizations they value — and that includes your ARRL.

Here's how it works:

To encourage charitable giving by individuals, the PPA allows individuals age 70½ to designate IRA assets to a qualified 501(c)(3) organization during both 2006 and 2007.

This legislation permits contributions of up to $100,000 from traditional IRAs or Roth IRAs to be excluded from income calculations of the donor. To qualify, these contributions must be made *directly* to the qualified charitable organizations.

This provision applies for a limited time — contributions must be made before December 31, 2006 for 2006 and before December 31, 2007 for 2007.

Gifts from IRAs to ARRL can be designated for current activities such as Spectrum Defense, The Education & Technology Program or for the ARRL Diamond Club (unrestricted support), or may be directed to the ARRL Endowment Fund to provide for the future.

Other Options

If you don't own an IRA or qualify under the Pension Protection Act's new provisions, there are other options to consider.

Once you have provided for your loved ones, a bequest or other planned gift to ARRL will build The ARRL Endowment. Your contribution will be invested to create a "savings account" for ARRL to fund operations, capital needs and vital programs in the future…and you will be welcomed into the *ARRL Legacy Circle*.

You may direct your contribution to the ARRL Endowment Fund for future general operating support of ARRL or you can designate it for a particular purpose you would like to support.

Currently, the Endowment Fund includes the following special purpose funds:

- Spectrum Defense: Research and Technology
- W1AW: Historical Preservation
- Youth and Education: Antenna Defense Fund

Important note: The American Radio Relay League, Inc, is a non-profit corporation headquartered in Newington, Connecticut (Federal ID # 06-6000004).

As always, be sure to work with your financial and legal advisors as you consider new ways that you can support the work of ARRL on behalf of Amateur Radio and ARRL.

If you need more information on giving through IRAs under the provisions of the Pension Protection Act of 2006 or for more information on planned giving and the ARRL Legacy Circle, contact Mary M. Hobart, K1MMH, ARRL Chief Development Officer, 225 Main St, Newington, CT 06111-1494, tel 860-594-0397; e-mail **mhobart@arrl.org**.

75, 50, AND 25 YEARS AGO

January 1932

• The cover photo shows the sad sight of a ham who has just dropped his high-power final tube on his tile floor.

• The editorial discusses "just supposing," looking at both the past and the future of ham radio.

• Associate Editor Ross Hull discusses "Selectivity in Radiotelegraph Reception" in the issue's 8-page lead article.

• A "Stray" announces the new "government callbook," with the price remaining at only 35¢, because of the Great Depression.

• "The Japs Move" reports that the Japanese government has reassigned "a whole flock of high-power Japanese commercial stations" to frequencies outside the ham bands.

• In "Madrid, 1932" K. B. Warner reports on the amateur radio recommendations that will be made at the forthcoming international radio convention.

• J. B. Dow, of the U.S. Navy Bureau of Engineering, discusses "Electron-Coupled Oscillator Circuits."

• E. L. Battey reports on "Navy Day—1931."

• "56-Mc. Band Marching Ahead" reports that "beginners and old-timers alike report wide success."

• "International Goodwill Tests" announces the new DX competition to be held February 21-26 and March 11-16. There will first be listening periods to log calls heard, and then the last three days will be used for attempts at two-way communication with the DX stations.

January 1957

• The cover photo shows W1TRF's mobile rig, described in this issue.

• The editorial looks at 1956 and notes, among other things, the recent sunspot activity's helping hams set a number of new DX records on 6 meters, plus 513 new DXCC members on HF.

• By Goodman, W1DX, asks, "What's Wrong with Our Present Receivers?" describing a modern 1957 approach to receiver design.

• Bob Resconsin, W1TRF, presents "The Mobile Single-Bander," a neat little transmitter for the mobile crowd.

• "A Cool California Kilowatt," a photo feature, shows the husky and well-engineered all-band HF power amplifier built by Ray Rinaudo, W6KEV.

• Lew McCoy, W1ICP, presents "6L6GBs in a 2-Stage Novice Rig," which describes a band-switching 80, 40, and 15 meter transmitter for the Novice.

• Mason Southworth, W1VLH, tells, in a seven-page article, about "A High-Power 50-Mc. Transmitter" that features operating convenience and TVI prevention measures.

• "W2LEZ/VE1" relates the tale of the DXpedition trip Phil Boardman, W3LEZ, took to Prince Edward Island. The portable shack features an HRO-60 receiver, a DB-22A preselector, a Viking Ranger, and a small beam antenna for HF.

• Because Conelrad monitoring is now required by the FCC, "Hints and Kinks" describes some of the ways hams can do it inexpensively.

January 1982

• The cover photo shows a modern version of the well-known Beverage antenna that was pioneered in 1922 by H. H. Beverage and R. B. Bourne.

• The editorial reminds the readers of the existence and importance of the Wouff Hong to Amateur Radio.

• H. H. Beverage, ex-W2BML, and Doug DeMaw, W1FB, look at the timeless nature of past ham work in "The Classic Beverage Antenna, Revisited." The Beverage antenna is of great value as a low-noise receiving antenna for 160 and 80 meters.

• Earl Bray, VE3EB, describes how a "handful of parts and a couple of hours" work will add new bands to a classic receiver, in "WARC Bands and 160 Meters on the 75S-1."

• Thomas Kneisel, K4GFG, tells how to look for DX paths using "Ionospheric Scatter by Field-Aligned Irregularities at 144 MHz."

• Whether you use the Moon for EME communication or observe it with your telescope, Art Barber, KC2BO, tells us how to use "A Simplified Procedure for Locating and Tracking the Moon."

• George Collins, KC1V, presents Part 2 of "Some Basics for Equipment Servicing," this time telling us how to build a simple high-impedance voltmeter.

• Gerald Boyd, WA6CUP, gives us "An Amateur's Guide to Assisting Public Safety Agencies."

Al Brogdon, W1AB ♦ Contributing Editor

W1AW SCHEDULE

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US Time + 4 hours. For the rest of the year, UTC = Eastern US Time + 5 hours.

♦ **Morse code transmissions:** Frequencies are 1.8175, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13 and 15 WPM.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 WPM.

Code bulletins are sent at 18 WPM.

W1AW qualifying runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted on approximately 3.590 MHz by K6YR. See "Contest Corral" in this issue. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. Fees: $10 for a certificate, $7.50 for endorsements.

♦ **Digital transmissions:** Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent at 45.45-baud Baudot and 100-baud AMTOR, FEC Mode B. 110-baud ASCII will be sent only as time allows.

On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:** Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **Notes:** On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

During 2007, Headquarters and W1AW are closed on New Year's Day (Jan 1), Presidents' Day (Feb 19), Good Friday (Apr 6), Memorial Day (May 28), Independence Day (Jul 4), Labor Day (Sep 3), Thanksgiving and the following Friday (Nov 22-23), and Christmas Eve Day and Christmas Day (Dec 24-25).

For more information, see **www.arrl.org/w1aw.html**.

PACIFIC	MTN	CENT	EAST	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	DIGITAL BULLETIN				
6^{45} PM	7^{45} PM	8^{45} PM	9^{45} PM	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	CODE BULLETIN				

COMING CONVENTIONS

SWOH DIGITAL AND TECHNICAL SYMPOSIUM

January 13, Middletown, Ohio

The Southwest Ohio Digital and Technical Symposium (21st Annual Symposium), sponsored by the Dial ARC, will be held at Miami University, Thesken Hall, Middletown Campus, 4200 E University Blvd. Doors are open at 7:30 AM and presentations start at 8 AM and continue to 4 PM. Features include presentations on technical subjects of interest to the active ham, ARRL forum and active demos. There will be no flea market — this is a technical conference/seminar only. Talk-in on 146.61. Admission: Free. Contact Jay Slough, K4ZLE, 8183 Woodward Dr, West Chester, OH 45069; 513-779-1747; **k4zle@arrl.net**; **www.swohdigi.org**.

MISSISSIPPI STATE CONVENTION

February 2-3, Jackson

F D V

The Mississippi State Convention (Capital City Hamfest 2007), sponsored by the Jackson ARC, will be held at the Mississippi State Fairgrounds Trade Mart Building, I-55 and High Street. Doors are open Friday 5-8 PM, Saturday 8 AM-4 PM. Features include flea market, dealers, forums, VE sessions (Saturday, 8 AM; all classes of FCC license at the Trade Mart in Room 3), Mississippi hospitality, RV camper space available on fairgrounds with full hookups ($15 per day; first-come, first-served basis). Talk-in on 146.76. Admission: $6, under 13 free with paying adult (good both days). Tables: $15 (flea market), $25 (dealer tables). Contact Lew King, W5LEW, c/o Capital City Hamfest 2007, Box 55643, Jackson, MS 39296-5643; 601-924-6535 or 601-372-3156; fax 601-372-3165; **w5lew@arrl.net** or **hamfest@msham.org**; **www.msham.org/**.

SOUTH CAROLINA STATE CONVENTION

February 3, Ladson

F D V

The South Carolina State Convention (34th Annual and Original Charleston Hamfest and Computer Show), sponsored by the Charleston ARS, will be held at the Exchange Park Fairgrounds, 9850 Hwy 78. Doors are open for setup Friday 5-9 PM, Saturday 6:30 AM; public 8 AM-3 PM. Features include tailgating ($8 per space plus admission), dealers, forums (ARRL, natural disasters and more), VE sessions (on site at 1 PM, walk-in basis only; Doc, W4MUR, 843-884-5614; **w4mur@arrl.net**), campsites available with full hookups ($20 per night; call 843-572-3160 to reserve), acres of free parking, light breakfast and world famous CARS Dogs and BBQ sandwiches for lunch. Talk-in on 146.79, 145.25, 147.045. Admission: $5, under 12 free. Tables: $10 in advance (by Jan 19) for 1st table and $8 for each additional table; $12 at the door (for as long as they last). Contact Jenny Myers, WA4NGV, 2630 Dellwood Ave, N Charleston, SC 29405-6814; 843-747-2324; **brycemyers@aol.com** or **wa4usn@amsat.org**; **www.wa4usn.org**.

January 7
New York City/Long Island Section, Bethpage, New York*

February 18
Virginia State, Richmond

March 10
West Texas Section, Midland

March 10-11
North Carolina Section, Charlotte

*See December *QST* for details.

SOUTHEASTERN DIVISION CONVENTION

February 9-11, Orlando, Florida

F D H V

The Southeastern Division Convention (61st Orlando HamCation and Computer Show), sponsored by the Orlando ARC, will be held at the Central Florida Fairgrounds, 4603 W Colonial Dr (SR 50). Doors are open Friday noon-7 PM for Commercial 2 and 3 only, swaps, and tailgating; Saturday 9 AM-6 PM and Sunday 9 AM-2 PM for all areas. The theme for the 2007 Orlando HamCation is "Fun and Fellowship in Amateur Radio." Features include swap tables, commercial booths ($275), major vendors, tailgating ($30 for the weekend; plus admission), "Bring and Buy" area (only radio items permitted), RV camping with water and limited electricity ($22 per night, no reserved spaces), VE sessions (2 sessions on Saturday, pre-registered only; Joe, N4UMB, 407-884-9588), forums on various subjects of interest, foxhunt, Special Event Station, QSL card checking, handicapped parking, free parking. Talk-in on 146.76, 147.015 (103.5 Hz). Admission: $8 in advance (by Jan 25), $10 at the door (good for the entire 3 days); under 12 free with paid adult. Swap tables: $40 (per 8-ft table for the entire weekend). Contact Cindy Radice, KD4NLV, c/o 2007 Orlando HamCation, Box 547811, Orlando, FL 32854-7811; 407-273-1406; **hamcation@oarc.org**; **www.hamcation.com** or **www.oarc.org**.

F = FLEA MARKET
D = DEALERS / VENDORS
H = HANDICAP ACCESS
V = VE SESSIONS

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance.

HAMFEST CALENDAR

***Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission**

Alabama (Greenville) — Jan 27. Jerry McCullough, KE4ERO, 334-382-7644 or 334-301-5007; **ke4ero@greenlynk.com**.

Arizona (Glendale) Jan 13 **D**
6 AM-Noon. *Spr:* Thunderbird ARC. Glendale Community College, 5900 W Olive Ave. *TI:* 146.7 (162.2 Hz), 446.15 (100 Hz). *Adm:* $2. Tables: $5. Steve Grouse, W1ADW, 7523 W Ironwood Dr, Peoria, AZ 85345; 623-521-1036; **w1adw@cox.net**; **www.w7tbc.org**.

Arizona (Sun City) — Feb 5. Ken Solheim, WN7DRX, 623-544-2827; **hamauction2007@cox.net**; **www.qsl.net/wvarc** (auction).

Colorado (Fort Collins) Jan 20 **DV**
Set up 6 AM; public 8 AM-1 PM. *Spr:* Northern Colorado ARC. The Lincoln Center, 417 W Magnolia. New facility, commercial exhibitors, radio and computer gear, VE sessions (9 AM prompt), refreshments. *TI:* 145.115 (–100 Hz); 146.52. *Adm:* $5. Tables: $5 each, includes 1 admission. Willis Whatley, WA5VRL, c/o NCARC, Box 272956, Fort Collins, CO 80527-2956; 970-407-6599; fax 970-407-1413 (call first); **willis.whatley@AEI.com**; **www.ncarc.us**.

Florida (Arcadia) Jan 27 **D**
Daylight-1 PM. *Spr:* DeSoto ARC. Turner Civic Center Exhibit Hall, 2160 NE Roan St. Hot breakfast served on site. *TI:* 147.075. *Adm:* $5. Tables: $10. Doug Christ, KN4YT, 1593 NE Livingston St, Arcadia, FL 34266; 863-491-0618; fax 863-993-4840; **kn4yt@yahoo.com**; **www.desotoarc.org/**.

Florida (Fort Myers) Jan 20 **FDH**
Set up Friday 4-9 PM, Saturday 6-8 AM; public 9 AM-3 PM. *Spr:* Fort Myers ARC. Araba Shrine Auditorium, 2010 Hanson St. Hamfest/Computer Show, vendors, tailgating ($10 for first space, includes 1 admission;

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

$5 for each additional space), free parking, handicapped parking, refreshments. *TI:* 146.88 (136.5 Hz). *Adm:* $5, under 17 free with paying adult (all children must be supervised). Tables: $15 (plus admission). Earl Spencer, K4FQU, 1735 Hanson St, Ft Myers, FL 33901; 239-332-1503; fax 239-334-9362; **k4fqu@juno.com**; **www.fmarc.net**.

Florida (Orlando) — Feb 9-11, Southeastern Division Convention. See "Coming Conventions."

Georgia (Lawrenceville) Jan 13 F
8 AM-2 PM. *Spr:* Gwinnett ARS. St Marguerite D'Youville Church, 85 Gloster Rd NW. 9th Annual Tech-Fest and Chili Cookoff ("Introducing Non-Hams to Ham Radio"), demonstrations, tailgating, free coffee, lunch provided. *TI:* 147.075 (82.5 Hz). *Adm:* Free. Norman Schklar, WA4ZXV, 480 N Peachtree St, Norcross, GA 30071; 770-840-9664; 770-755-5411; **wa4zxv@wa4zxv.com**; **www.gars.org**.

Illinois (Collinsville) Jan 27 D
8 AM-3 PM. *Spr:* St Louis and Suburban RC. Gateway Convention Center, One Gateway Center. Winterfest 2007. *TI:* 146.97, 146.94. *Adm:* advance $6, door $7. Tables: $22. Jim Glasscock, WØFF, 8300 Whiskey Creek Rd, Union, MO 63084-2715; 636-584-8888; **foxfoxdxer@gmail.com**; **www.slsrc.org**.

Illinois (St Charles) Jan 28 DV
8 AM-1 PM. *Spr:* Wheaton Community Radio Amateurs. DuPage Expo, 4050 E Main St. WCRA Mid-Winter Hamfest, VE sessions, free parking. *TI:* 145.39 (103.5 Hz). *Adm:* advance $7, door $9. Tables: $25. John Faber, WT9Y, c/o WCRA, Box QSL, Wheaton, IL 60189; **info@wheatonhamfest.org**; **www.wheatonhamfest.org**.

Kansas (LaCygne) Feb 3 D
9 AM-1 PM. *Spr:* Mine Creek ARC. LaCygne Community Building, Broadway St. Small town atmosphere conducive to eyeball QSOs. *TI:* 147.285. *Adm:* Free. Tables: $10. Ron Cowan, KBØDTI, Box 36, LaCygne, KS 66040; 913-757-3758; **kb0dti@arrl.net**.

Louisiana (Hammond) Jan 20 FDV
8 AM-3 PM. *Spr:* Southeast Louisiana ARC. University Center, 800 W University Ave. 26th Annual Hamfest, commercial dealers ($20 for 1st table, $10 for each additional table), swap tables, vendors, electronics, forums, VE sessions, free parking. *TI:* 147.0. *Adm:* Free. Tables: swap $15; commercial dealers $20 for 1st table, $10 for each additional table (Tyrone Burns, N5XES, 985-351-8315; **tyke1954@yahoo.com**). Robert Priez, WB5FBS, c/o SELARC Hamfest, Box 1324, Hammond, LA 70404; 985-542-1470; fax 985-345-4410; **wb5fbs@arrl.net**; **www.selarc.org/selarchamfest.htm**.

Maryland (Odenton) Jan 28 DV
7:30 AM-Noon. *Spr:* Maryland Mobileers ARC. Odenton Volunteer Fire Department Hall, 1425 Annapolis Rd (Rte 175). VE sessions (pre-registration requested, testing promptly at 9 AM; **wb4ogp@arrl.net**). *TI:* 146.805. *Adm:* $5. Tables: $12. Frank Winner, N3SEO, 283 Oak Ct, Severna Park, MD 21146; 410-765-0447; **n3seo@aol.com**; **www.qth.com/mobileers/**.

Michigan (Burton) Jan 20 FV
8 AM-Noon. *Spr:* Genesee County ARES. Bentley Middle School, 1180 N Belsay Rd. ARAY Swap, ATV demo, VE sessions. *TI:* 147.1 (100 Hz). *Adm:* $5. Tables: $10. Clayton Hewitt, KF8UI, 1109 Ossington Ave, Flint, MI 48507; 810-233-7889; fax 989-871-5594; **kf8ui@arrl.net**; **www.gcares.org**.

Michigan (Hazel Park) Jan 21 FDV
8 AM-Noon. *Spr:* Hazel Park ARC. Hazel Park High School, 23400 Hughes St. 41st Annual Swap and Shop, VE sessions, guest speaker ARRL Michigan Section Manager Dale Williams. *TI:* 146.64 (100 Hz). *Adm:* $5. Tables: $8. Sean Fleming, K8KHZ, 27120 Barrington St, Madison Heights, MI 48071; 248-632-3062; **k8khz@yahoo.com**; **www.hparc.org**.

Michigan (Negaunee) Feb 3 FD
9 AM-1 PM. *Spr:* Hiawatha ARA. Negaunee Township Hall, 42 Hwy M-35. Swap and Shop, refreshments. *TI:* 147.27 (100 Hz). *Adm:* $4. Tables: $6. Robert Serfas, N8PKN, 1600 Bayview Dr, Marquette, MI 49855; 906-225-6773; **n8pkn@aol.com**; **www.qsl.net/k8lod/**.

Minnesota (St Cloud) Feb 10 DV
9 AM-2 PM. *Spr:* St Cloud ARC. National Guard Armory, 1710 8th St N. Vendors, VE sessions, refreshments. *TI:* 147.015. *Adm:* $5. Tables: $10. Scott Hall, NØUV, 3001 8th St N, St Cloud, MN 56303; 320-252-4498; **n0uv@arrl.net**; **www.w0sv.org**.

Mississippi (Jackson) — Feb 2-3, Mississippi State Convention. See "Coming Conventions."

New Mexico (Albuquerque) Jan 27 FD
Sunrise-2 PM. *Spr:* 146.580 Simplex Group. Del Norte High School, San Mateo and Montgomery Blvd. Tailgate Swapfest. *TI:* 146.9 (67 Hz), 146.94 (100 Hz). *Adm:* Free. Tables: Free. Tom Ellis, K5TEE, 912 Lomas Ct NE, Albuquerque, NM 87112-5515; 505-291-8122; **k5tee@arrl.net**.

New York (Lockport) Jan 27 D
Set up 7 AM; public 8 AM-Noon. *Spr:* Lockport ARA. South Lockport Firehall, S Transit Rd (Rte 78). Large indoor Winter Hamfest, vendors, refreshments. *TI:* 146.82 (107.2 Hz). *Adm:* $5. Tables: $5 (8-ft). Dan Caswell, N2OBX, 29 Hoover Pkwy, Lockport, NY 14094; 716-434-6946; **caswelld@verizon.net**; **lara.hamgate.net**.

New York (Marathon) Jan 13 DV
7 AM-1 PM. *Spr:* Skyline ARC. Marathon Civic Center, Peck and Brink Sts. Winterfest, dealers, ham fellowship, VE sessions, refreshments. *TI:* 147.18. *Adm:* $3. Tables: $5. Patrick Dunn, KC2BQZ, 1302 Rams Gulch Rd, Jamesville, NY 13078; 315-488-3499 (phone and fax); **kc2bqz@verizon.net**; **www.skylineradioclub.org**.

North Dakota (Grand Forks) Feb 3 FDV
9 AM-2 PM. *Sprs:* Forx ARC and Sioux ARC. UND Memorial Union Bldg Ballroom, 2901 University Ave. Swapmeet, vendors, learning seminars, VE sessions. *TI:* 146.94. *Adm:* $5. Tables: $5 (includes admission). Karen Noss, NØTKP, 1113 4th Ave N, Grand Forks, ND 58203; 701-775-7781; **klnoss@gra.midco.net**; **www.qsl.net/wa0jxt**.

Ohio (Middletown) — Jan 13, SWOH Digital and Technical Symposium. See "Coming Conventions."

Ohio (Nelsonville) Jan 14 DV
Set up 7 AM; public 8 AM-2 PM. *Spr:* Sunday Creek AR Federation. Tri-County Career Center, 15676 State Rte 691. 11th Annual Hamfest, AR and electronics equipment, vendors, VE sessions, special guest ARRL Assistant Section Manager Connie Hamilton, refreshments. *TI:* 147.15. *Adm:* $6. Tables: $7 (per table in advance or as available on site). Jeramy Duncan, KC8QDQ, 5000 Angel Ridge Rd, Athens, OH 45701; 740-593-3451; **kc8qdq@hughes.net**; **www.scarfclub.org**.

Ohio (Strasburg) Jan 28 D
Set up 6 AM; public 8 AM. *Spr:* Tusco ARC. Wallick Auction House, 965 N Wooster Ave. 17th Annual Hamfest, dealers, free parking. *TI:* 146.73 (71.9 Hz). *Adm:* $5. Tables: $11 (plus admission; advance reservations required and paid by Jan 15; bring your own extension cords). Gary Green, K8WFN, 32210 Norris Rd, Tippecanoe, OH 44699; 740-922-4454; **tuscofest07@hotmail.com**; **noard.com/tuscoarc.htm**.

Oklahoma (Ada) Feb 10 DV
8 AM. *Spr:* Ada ARC. Pontotoc County Agri-Plex Auditorium, 1700 N Broadway. Slide show from the Gulf Coast, VE sessions. *TI:* 147.285 (114.8 Hz). *Adm:* $5. Tables: $10. Charles Etier, KC5TGA, 15766 CR 1574, Ada, OK 74820; 580-436-4425; **kc5tga@arrl.net**; **www.adacomp.net/~jewell/**.

South Carolina (Greenwood) Jan 13 FDV
9 AM-2 PM. *Spr:* Greenwood ARS. Greenwood Civic Center, 1610 Highway 72 E. Flea market, new dealers, ARRL forum, VE sessions, refreshments. *TI:* 147.165 (107.2 Hz). *Adm:* $6. Tables: $10. Darrell Manning, KI4BST, 719 Darlington St, Calhoun Falls, SC 29628-8969; 864-418-8969 or 864-379-4226; **dbmaning@wctel.net**; **www.w4gwd.org**.

South Carolina (Ladson) — Feb 3, South Carolina State Convention. See "Coming Conventions."

Tennessee (Morristown) Jan 6 V
8 AM-3 PM. *Spr:* Lakeway ARC. VFW Post 5266, 2503 E Andrew Johnson Hwy. VE sessions. *TI:* 147.03. *Adm:* $5. Tables: $10. Chris Brown, K4MGY, 340 E Economy Rd, Box 160, Morristown, TN 37814; **k4mgy@hotmail.com**; **www.lakewayarc.org**.

Texas (Georgetown) Feb 4 FDV
Set up 7 AM; public 8 AM-2 PM. *Spr:* Williamson County ARC. Williamson County Show Barn, E Morrow St. Swapmeet, vendors, inside tailgate only ($10 per vehicle, electricity included; bring your own extension cord and table), VE sessions (8:30 AM). *TI:* 146.64 (162.2 Hz). *Adm:* Free. Rick Trommer, W5NR, 302 Rio Bravo Rd, Georgetown, TX 78628; 512-863-2428; **w5nr@arrl.net**; **www.wcarc.com**.

Texas (San Antonio) Jan 13 FDV
Set up Friday 6:30-9:30 PM, Saturday 6:30 AM; public 8 AM-3 PM. *Spr:* San Antonio RC. Little Joe's Country Gold, 7405 Old Pearsall Rd. Swapfest, vendors, VE sessions, ARRL forum, refreshments. *TI:* 146.94 (179.9 Hz), 444.1 (179.9 Hz). *Adm:* advance $3, door $4. Tables: advance $7, door $8 (dealer tables $12). J C Smith, N5RXS, Box 34263, San Antonio, TX 78265-4263; 210-522-6167; **n5rxs@satx.rr.com**; **www.w5sc.org/**.

F = FLEA MARKET
D = DEALERS / VENDORS
H = HANDICAP ACCESS
V= VE SESSIONS

Attention: The deadline for receipt of items for this column is the 1st of the second month preceding publication date. For example, your information must arrive at HQ by **January 1** to be listed in the **March** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For detailed directions to the event, see the event Web site or contact sponsor. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Dec 10, 1400Z-2200Z, Brainerd, MN. Brainerd Area Amateur Radio Club, WØUJ. Winter Wonderland — The Brainerd Lakes Area. 28.450 21.350 14.250. QSL. Brainerd Area Amateur Radio Club, PO Box 189, Ironton, MN 56455-0189. **www.brainerdham.org**.

Dec 24-Jan 8, 0501Z-0500Z, Atkinson, NH. Atkinson Amateur Radio, K1D. Kid's Day and Amateur Radio Awareness. 21.273 14.273 7.257. QSL. Peter Schipelliti, W1DAD, 7 Dearborn Ridge Rd, Atkinson, NH 03811.

Jan 5-Jan 7, 1600Z-1600Z, Blairstown, NJ. Eastern PA QRP Club, N2P. Polar Bear Camp-Run-a-MOC. 14.260 14.060 10.116 7.260 7.040 3.910 3.506. QSL. Camp-Run-a-MOC, WA3WSJ, 775 Moonflower Ave, Reading, PA 19606-3447. **www.wa3wsj.com/files/polarbear2006.html**.

Jan 6-Jan 7, 1200Z-2359Z, Bethpage, NY. Ham Radio University Committee, W2V. Ham Radio University 2007 — 8th annual day of education. 21.273 14.273 7.273. QSL. Phil Lewis, N2MUN, 22 Belle Terre W, Lindenhurst, NY 11757. **www.HamRadioUniversity.org**.

Jan 11-Jan 17, 0100Z-2359Z, St Croix, USVI. Family Radio Club, KU9UUU. 513th Anniversary of the Discovery of the US Virgin Islands. Day 14.332 14.260 Eve 7.235 7.046 — all 3905 Century Club Nets SSB and CW. QSL. J. M. Zacher, 39W345 Central Dr, Elgin, IL 60124.

Jan 13, 1300Z-1900Z, Phoenix, AZ. Thunderbird Amateur Radio Club, W7W. 10th Anniversary of WestFest Hamfest. 21.370 14.270 7.270. QSL. TBARC WestFest, 16772 W Bell Rd, Ste 110 - #421, Surprise, AZ 85735. **www.w7tbc.org**.

Jan 13-Jan 14, 1500Z-1800Z, Marcell, MN. Northern Lakes Amateur Radio Club, KØGPZ. White Oak Sled Dog Classic. 14.225 14.070 7.165 7.070. QSL. NLARC, PO Box 525, Grand Rapids, MN 55744. **northernlakesarc.tripod.com/nlarc.html**.

Jan 13-Jan 15, 1500Z-2100Z, Atlantic City, NJ. Southern Counties Amateur Radio Association, K2BR. Absecon Lighthouse (ARLHS # USA-001)150th Birthday. 21.260 18.160 14.260 7.260. QSL. SCARA, PO Box 121, Linwood, NJ 08221. *CW contacts on request*. **mysite.verizon.net/vzepb0rn**.

Jan 14-Jan 15, 1400Z-0000Z, Wall Township, NJ. Ocean Monmouth Amateur Radio Club, N2MO. From the Amateur Radio/MARS station at the historic Diana Site, to commemorate "Project Diana," the first ever successful moonbounce experiment. Gen and Nov/Tech subbands 80, 40, 20, 15 and 10 m. Certificate and QSL.* OMARC Inc, PO Box 267, Oakhurst, NJ 07755. **www.omarc.org**.

Jan 15-Jan 24, 0700Z-2400Z, Denver, CO. Castle Rock Repeater Group, K1D. Elementary School Demonstration. 14.265 7.265. QSL. Johnny Lee, 21530 E Stoll Pl, Denver, CO 80249. **www.crrg.org**.

Jan 20, 1300Z-2300Z, Spring Hill, FL. Spring Hill Amateur Radio Club, W4B. 27 Annual Brooksville Raid — Largest Florida Civil War Reenactment. 14.260 18.130. Certificate. SHARC-BR, PO Box 6083, Spring Hill, FL 34611. **www.kf4ixu.org**.

Jan 27, 1500Z-2200Z, Zolfo Springs, FL. The Whole Ham Family Radio Club, KI4RDM. Peace River Refuge And Ranch On The Air. 14.260. QSL. The Whole Ham Family Radio Club, c/o Cartlidge, 4288 Bell Ave, Sarasota, FL 34231. **www.geocities.com/KI4RDM/SpecialEvents.html**.

Jan 27-Jan 28, 2000Z-2000Z, Jefferson City, MO. Mid-MO Amateur Radio Club, W9C. 90th anniversary of the first transcontinental relay of formal message traffic by Willis Corwin, 9ABD. CW 14.035 10.113 7.035 3.535. Certificate. Kent W. Trimble, K9ZTV, 2210 Heartland Rdg, Jefferson City, MO 65109. **www.mmccs.com/mmarc**.

Jan 27-Jan 29, 1400Z-0200Z, Wilsona Gardens, CA. BioRem Radio Amateur Club (Edwards AFB), AL7LS. 40th anniversary of the movie "Hot Rods to Hell," released January 27, 1967. 14.315 7.273 pkt 14.105 7.105. QSL. Bruce Rossi, 2127 Sierra Stone Ln, Las Vegas,

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, you must be an Amateur Radio club, and use the ARRL Special Events Listing Form. Copies of this form are available via Internet (**info@arrl.org**), or for an SASE (send to Special Requests, ARRL, 225 Main St, Newington, CT 06111, and write "Special Events Form" in the lower left-hand corner). You can also submit your special event information on-line at **www.arrl.org/contests/spevform.html**. Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; that is, a special event listing for **Mar** *QST* would have to be received by **Jan 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

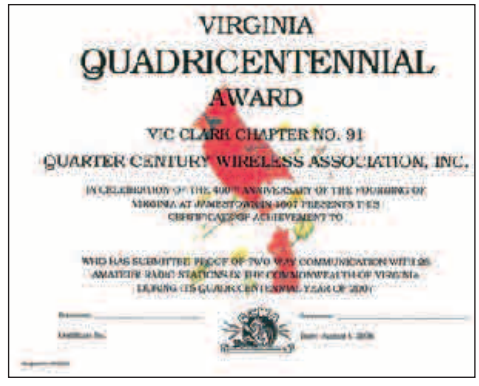
Strays

THE VIRGINIA QUADRICENTENNIAL COMMEMORATIVE AWARD

◊ During 2007, the Commonwealth of Virginia will be celebrating the 400th anniversary of the founding of Jamestown, the first permanent English settlement in the New World. The Vic Clark Chapter 91 of Quarter Century Wireless Association is joining in that celebration by offering the Virginia Quadricentennial Award to all licensed radio amateurs for completing 25 two-way contacts with Virginia stations during 2007.

A colorful 8½ × 11 inch certificate will be available to all amateurs satisfying the following requirements:

The award will be issued for two-way contacts with 25 different stations in Virginia during the quadricentennial year of 2007. Contacts must be made between 0000 UTC January 1, 2007 and 2400 UTC December 31, 2007. Certificates will be serially numbered and signed by the chapter president and treasurer. Contacts may be made on any frequency authorized for amateur use. Contacts through a repeater will not be creditable. Any mode that is legal on the frequency used will be acceptable.


VIRGINIA
QUADRICENTENNIAL
AWARD
VIC CLARK CHAPTER NO. 91
QUARTER CENTURY WIRELESS ASSOCIATION, INC.

Applicants must submit a list of contacts claimed, including call sign of each Virginia station worked, date and time (UTC), band/frequency, mode, QTH and name of operator. Applications must be sent by mail, and not electronically (do not submit logs via e-mail). Do not send QSL cards. Each application must include a signed log certifying the list to be accurate, and include your name, call and return mailing address. See our Web site, **homepage.mac.com/rrucker/qcwa/chapter91.html** or e-mail **k6zr@arrl.net** for more details.

The Virginia QSO Party (see **www.qsl.net/sterling/uf1.htm**), to be held March 17-18, 2007, is an excellent event for contacting stations in Virginia.

There is a fee of $2 for applicants in North America to cover printing and shipping of the Quadricentennial Award. (Check, cash, or money order only. No credit cards or stamps accepted.) Certificates will be sent at no charge to stations outside North America but donations will be accepted. Mail your application to QCWA Vic Clark Chapter 91, PO Box 4112, Merrifield, VA 22116-4112, by July 1, 2008. — *Ray Johnson, K5RJ*

CONTEST CORRAL

W1AW Qualifying Runs are 10 PM EST Friday, Jan 5 (0300 UTC Jan 6) (10-35 WPM), and 9 AM Thursday, Jan 18 EST (1400 UTC Jan 18) (35-10 WPM). The K6YR West Coast Qualifying Run will be at 9 PM PST Wednesday, Jan 10 (0500 UTC Jan 11) (40-10 WPM). Unless otherwise indicated, code speeds are from 10-35 WPM. Check the W1AW schedule elsewhere in this issue for more details.

Abbreviations

SO — Single-Op; M2 — Multiop, 2 Transmitters; MO — Multi-Op; MS — Multi-Op, Single Transmitter; MM — Multi-Op, Multiple Transmitters; AB — All Band; SB — Single Band; S/P/C — State/Province/DXCC Entity; HP — High Power (>100 W); LP — Low Power; QRP — 5 W or less; Entity — DXCC Entity.

No contest activity on 30, 17 or 12 meters. Refer to the contest Web sites for information about awards. Unless stated otherwise, regional contests only count QSOs with stations in the region. Publication deadline for Contest Corral listings is the first of the second month prior to publication. For updates and additional contests, see the Contest Corral Web page at **www.arrl.org/contests**.

Jan 1

A number of entertaining short contests celebrate the New Year. For more information, view the sponsor's Web sites.

ARRL Straight Key Night — see page 98 of December 2006 *QST* or **www.arrl.org/contests/rules**.

New Years Snowball Contest — sponsored by the Activity Group of Belarus (AGB) — **www.qsl.net/eu1eu/index_e.htm**.

SARTG New Year RTTY Contest — sponsored by the Scandinavian Amateur Radio Teleprinter Group (SARTG) — **www.sartg.com/contest/nyrules.htm**

AGCW Happy New Year Contest — sponsored by the Arbeitsgemeinschaft CW — **www.agcw.de**.

Jan 6-7

What better way to encourage young operators? Get on the air and tune in the future of Amateur Radio! Then take time to try out some of the new RTTY software in the big RTTY contest.

ARRL RTTY Roundup — 1800Z Jan 6-2400Z Jan 7 (see Dec 2006 *QST*, p 99, or **www.arrl.org/contests**).

Kid's Day — Phone, sponsored by the ARRL and the Boring Amateur Radio Club from 1800Z to 2400Z Jan 7 (see Dec 2006 *QST*, p 45, or **www.arrl.org/FandES/ead/kd-rules.html**).

DARC 10 Meter Contest — CW/SSB, sponsored by the Deutscher Amateur Radio Club, from 0900Z-1059Z Jan 7. Frequencies: CW 28.000-28.200 MHz, SSB 28.300-28.700 MHz, work stations once only. Categories: SO-Mixed Mode and SO-CW. Exchange: RS(T) and serial number, DL stations add DOK code. QSO points: 1 pt/QSO. Score: QSOs × WAE and DXCC entities + DOK codes. For more information: **www.darc.de/referate/dx/fedcz.htm**. Logs due Jan 22 to **10m-contest@dxhf.darc.de** or Frank Steinke, DL8WAA, PO Box 1188, D-56238 Selters, Germany.

EUCW 160 Meter Contest — CW, sponsored by the Union Francaise des Telegraphistes from 2000Z-2300Z Jan 6 and 0400-0700Z Jan 7. Categories: EU (HP, LP, QRP), non-EU, SWL. Exchange: RST, serial number, club name, member number or NM. QSO points: own entity — 1 pt; different entity — 2 pts; diff. continent — 5 pts. Score: QSO points × clubs. For more information: **www.uft.net/articles.php?lng=fr&pg=22**. Logs due Feb 15 in Cabrillo format to **f6cel@wanadoo.fr** or F6CEL — Ghislain, Barbason 5 Rue d'Ecluse, 02190 Pignicourt, France.

Jan 13-18

The NAQP contests are just right to break in the New Year. They're 10 hours long, you may work stations on all bands and are low power only.

North American QSO Party — CW, sponsored by the National Contest Journal from 1800Z Jan 13-0600Z Jan 14. Frequencies: 160-10 meters. Categories: SOAB and M2, 100 W power limit, operate a maximum of 10 hours (off times must be at least 30 min and M2 entries may operate the entire contest). Exchange: Name and S/P/C. Score: QSOs × States + Province + NA DXCC countries (count each once per band). For information: **www.ncjweb.com/naqprules.php**. Logs due Jan 28 via Web entry form at **www.ncjweb.com/naqplogsubmit.php**, to **cwnaqp@ncjweb.com** or Bruce Horn, WA7BNM, 4225 Farmdale Ave, Studio City, CA 91604.

NAQCC Monthly Straight Key Sprint — sponsored by the North American QRP CW Club from 0130Z-0330Z Jan 18. Frequencies (MHz): 3.560, 7.040, 14.060. Exchange: RST, S/P/C and NAQCC member number (pwr for non-members). QSO points: member — 2 pts, non-member — 1 pt. Score: QSO points × S/P/C, multiply by 2 if all straight key or by 1.5 if all bug. For more information and the yearly contest schedule: **www.arm-tek.net/~yoel**. Logs due Jan 24 to **naqcc33@alltel.net** or Tom Mitchell, KB3LFC, RD6 Box 122A, Kittanning, PA 16201.

Winter Field Day — all modes, sponsored by the Society for the Preservation of Amateur Radio (SPAR) from local noon Jan 13 to local noon Jan 14. Frequencies: 160-10 meters. Categories: SO, Two Op, Multi, Indoor, Outdoor, Home. Exchange: call sign, RS(T), category, local outside temperature. QSO points: 1 pt/QSO. Score: QSO points × modes operated on each band. For more information and bonus points: **www.spar-hams.org/contests/winterfd/index.php**. Logs due Feb 15 to **winterfd@spar-hams.org**.

Midwinter Contest — CW/SSB, sponsored by the Dutch YL Committee, CW from 1400Z-1800Z Jan 13, SSB from 1000Z-1400Z Jan 14. Frequencies: 80-10-meters, SSB 3.600-3.650, 7.080-7.090, 14.270-14.300, 21.270-21.300, 28.470-28.500 MHz. Categories: YL-SSB, YL-CW, OM-SSB, OM-CW, SWL. Exchange: RS(T) and serial number, OMs start with 001 and YLs start with 2001. QSO points: YL — 5 pts, OM — 3 pts. Score: QSO points × DXCC entities counted once per mode. For more information: **www.qsl.net/pi4ylc/Engels/midwinter%20contest.htm**. Logs due Feb 15 to **jckoekkoek@home.nl** or PA3GQG — Contestmanager Midwintercontest, Keulenheide 1, 6373 AP Landgraaf, The Netherlands.

Hunting Lions in the Air — CW/Phone, sponsored by the South African District 410B of the Int'l Association of Lions Clubs from 0000Z Jan 13-2400Z Jan 14. Frequencies: 80-10 meters, work stations once per band regardless of mode. Categories: SOAB, MS. Exchange: RST and serial number, Lion club members also sign /L or LION and send name, district and club name. The Midrand Lions station ZS6LCM/L will act as the Melvin Jones Memorial club this year. QSO points: non-Lion station — 1 pt; with Lions — 5 pts; 25 points with ZS6LCM/L. Score: QSO points × number of Lions clubs worked (count only once). For more information: **www.sarl.org.za/public/contests/contestrules.asp**. Logs due Feb 28 to **rad.handfield-jones@pixie.co.za** or to Lion Rad Handfield-Jones, ZS6RAD, Lions Club of Midrand, PO Box 1548, Halfway House, 1685, South Africa.

070 PSKFest — sponsored by the Penn-Ohio DX Society (PODXS) from 0000Z-2400Z Jan 13. Frequencies: 80-10m. Categories: SOSB and SOAB (QRP, MP <50 W, HP <100 W). Exchange: RST and S/P/C. QSO points: 1 pt/QSO. Score: QSO points × S/P/C (counted only once). For more information: **www.podxs.com/html/pskfest.html**. Logs due Feb 14 to **jbudzowski@peoplepc.com** or Jay Budzowski, N3DQU, 109 S Northview Ave, New Castle, PA 16102.

Jan 20-22

This is a great contest to give that all-band, all-mode radio a workout on CW and SSB. All it takes is a simple horizontal dipole to join in.

ARRL January VHF Sweepstakes — 1900Z Jan 20-0400Z Jan 22 (see Dec 2006 *QST*, p 98, or **www.arrl.org/contests**).

North American QSO Party — Phone, 1800Z Jan 20-0600Z Jan 21 (see Jan 13-14). Logs due Feb 4 to **ssbnaqp@ncjweb.com** or Bruce Horn, WA7BNM, 4225 Farmdale Ave, Studio City, CA 91604.

HA DX Contest — CW, sponsored by the Hungarian DX Club from 1200Z Jan 2-1200Z Jan 21. Frequencies: 160-10 meters. Categories: SOAB, SOSB, MS, MM, SWL. Exchange: RST and serial number, HA stations send county or HADXC member number. QSO points: Own DXCC entity — 1 pt; same continent — 1 pt; different cont — 3 pts; HA stations — 6 pts. Score: QSO points × HA counties and members on each band. For more information: **www.mrasz.hu**. Logs due 30 days after the contest to **contest@enternet.hu** or MTTOSZ, Gyôr Városi Rádióclub, PO Box 79, 9200 Gyôr, Hungary.

LZ Open Championship — CW, sponsored by the LZ Open Contest Club from 0400Z-1200Z Jan 20. Frequencies: 3.5 and 7 MHz. Categories: MS, SO, SO-QRP. Exchange: 6 digits, serial number and serial number received in previous QSO (e.g., the first QSO exchange is 001 000). A station can be worked once every 30 minutes. QSO points: same entity — 1 pt; different entity — 2 pts. Score: total QSO points. For more information: **www.linkove.com/lz-open-contest/rules/rules.**

H. Ward Silver, NØAX ♦ PO Box 927, Vashon, WA 98070 ♦ n0ax@arrl.org

htm. Logs in Cabrillo format due 30 days after the contest to **lz1gl@yahoo.com** or PO Box 830, Sofia 1000, Bulgaria.

International United Teenager Contest — CW/SSB, sponsored by Radio-TLUM Ukraine, from 0600Z-1400Z Jan 20 for operators under 18 years of age. Frequencies: 80-10 meters. Categories: SOSB, SOMB, MO, RT (veterans). Exchange: RS(T) and age or RS(T) and RT for veterans. For scoring and other information: **www.sk3bg.se/contest/utcont.htm**. Logs due 30 days after the contest to CQ UT Contest, Radio-TLUM, PO Box 5000, Vinnytsa, 21018 Ukraine.

UK DX RTTY Contest — sponsored by the Scottish-Russian ARS from 1200Z Jan 20-1200Z Jan 21. Frequencies: 80-10 meters. Categories: SOAB (HP, LP <100 W), MS. Exchange: RST and serial number, UK stations send UK region code. QSO points: own DXCC entity — 1 pt; same continent — 2 pts; different cont — 3 pts; UK stations — 5 pts. Score: QSO points × UK regions + DXCC entities on each band. For more information: **www.ukdx.scotham.net**. Logs in Cabrillo format due 30 days after the contest to **ukdxc@scotham.net** or UK DX RTTY Contest Committee, PO Box 7469, Glasgow, G42 0YD, Scotland, UK.

Jan 27-28

The biggest 160 meter contest of all means the Big Guns will be listening for you, so load up the bedsprings and give Top Band a try.

CQ WW 160 Meter Contest — CW, sponsored by *CQ Magazine* from 0000Z Jan 27-2359Z Jan 28 (Phone is Feb 24-25). Exchange: RST and S/P/C. Categories: SO-QRP (<5 W), LP (<150 W), HP, MO categories. Enter as MO if packet or spotting nets are used. QSO points: own entity — 2 pts; same continent — 5 pts; diff cont — 10 pts; /MM stations count 5 points, but no multiplier. Score: QSO points × states + VE call areas + DXCC entities (KH6 and KL7 count as DXCC only). For more information: **www.cq-amateur-radio.com/index.html**. Logs due by Feb 28 to **160cw@kkn.net** (Cabrillo format only) or CQ 160 Contest, 25 Newbridge Rd, Hicksville, NY 11801.

BARTG RTTY Sprint — sponsored by the British Amateur Radio Teletype Group from 1200Z Jan 27-1200Z Jan 28. Frequencies: 80-10-meters. Categories: SO-Expert, SOAB, MO, SWL. Operators with a Top Ten log in the past three years must enter as an Expert. Exchange: serial number only. QSO points: 1 pt/QSO. Score: QSO points × DXCC entities + W/VE/JA/VK call areas × continents counted only once. For more information: **www.bartg.demon.co.uk**. Logs in Cabrillo format due Mar 1 to **ska@bartg.demon.co.uk**. See Web site for e-mailing instructions.

REF French Contest — CW, sponsored by the Reseau des Emetteurs Francais from 0600Z Jan 27-1800Z Jan 28 (Phone is Feb 24-25). Contact French stations including Corsica, Overseas Territories and EU Council station TP2CE. Frequencies: 80-10 meters. Categories: SOAB, MS, SWL. Exchange: non-French stations send RST and serial number, French send RST and department number or prefix. QSO points: different continent — 3 pts; 1 pt otherwise. Score: QSO points × departments and prefixes counted once per band. For more information: **www.ref-union.org/concours**. Logs are due Mar 15 (CW) or Apr 15 (SSB) to **cdfcw@ref-union.org** (SSB to **cdfssb@ref-union.org**) or Reseau des Emetteurs Francais, REF Contest, BP 7429, 37074 Tours Cedex, France.

UBA Contest — Phone, sponsored by the Royal Union of Belgian Amateur Radio from 1300Z Jan 27-1300Z Jan 28 (CW is Feb 24-25). Frequencies: 80-10 meters, according to the IARU band plan. Categories: SOAB and SOSB (QRP, LP, HP), MS, SWL, packet is allowed for all classes. Exchange: RST and serial number, ON stations add their province abbr. QSO points: QSOs with ON stations — 10 pts; with other EU — 3 pts, outside EU — 1 pt. Score: QSO points × ON provinces + ON prefixes + European Union DXCC entities counted once per band. For more information and a list of EU entities: **www.uba.be**. Logs due 30 days after the contest to **ubassb@uba.be** (**ubacw@uba.be** for CW) in Cabrillo format to UBA Contest, Marc Domen, ON7SS, Ferdinand Coosemansstraat 32, B-2600 Antwerpen, Belgium. QST

AT THE FOUNDATION

More Foundation Scholarships to be Awarded in 2007!

Time is short for applicants who wish to apply for one of the many ARRL Foundation Scholarships. The *application deadline is February 1, 2007* when the Foundation will begin review of applications and transcripts for scholarships that will be awarded in the spring. With the addition of new scholarships this year — The Richard W. Bendicksen Memorial Scholarship ($1000), The Gary Wagner, K3OMI Scholarship ($1000) and The Zachary Taylor Stevens Memorial Scholarship ($750), more scholarships will be awarded than ever before.

Students applying for scholarships must include a recent transcript when sending their application. Applicants for the four-year William R. Goldfarb Memorial Scholarship should complete the separate application for that award, which requires a Free Application for Federal Student Aid (FAFSA) as well as a transcript.

Complete information on available scholarships, application instructions and forms are only found on the Web at **www.arrl.org/arrlf/scholgen**. QST

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

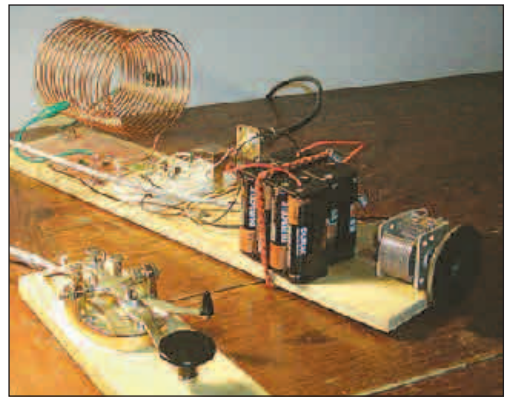
Strays

HOW LOW CAN HE GO?

Doug Vander Clute, KB1MGL

♢I built an 80 meter transmitter after building the 40 meter Hartley oscillator Ward Silver recently featured in Hands-On Radio [Nov 2006, pp 66-67]. It was a fun project and a great way to learn radio. At first I was only able to put out ⅛ W, which was not enough to make contact with a local station. After putting up an 80 meter dipole cut for the CW portion of the band, doubling the battery voltage and adjusting the emitter resistance on the matching stage of the amp, I was putting out ¼ W.

It doesn't sound like much but it was enough make contact with four stations in my home state of New Hampshire, 1 station in Vermont, 1 in Maine and 1 in Massachusetts. Jim, W1PID, who does a lot of QRP work, was a big help.



Doug, KB1MGL, put this basic QRP station together and was able to make contacts in neigh-boring states when he adjusted his power upward….to 0.25 W!

Results, 2006 ARRL UHF Contest

"Rumors of the death of the UHF Contest appear to be greatly exaggerated…"

John (JK) Kalenowsky, K9JK
hamk9jk@ameritech.net

The first weekend of August 2006 brought another opportunity for UHF and Microwave radio enthusiasts to exercise their equipment, antenna arrays and listening skills (*for the weak ones!*) in the 2006 ARRL UHF Contest. The trend of increased entry count from the previous year continued for a third straight year, suggesting that rumors of the death of this event appear to be greatly exaggerated.

The Numbers…

Single Operator, Low Power continues to attract the greatest number of logs, with 86, as compared to 80 in 2005. The 53 entries in Single Operator, High Power for 2006 match the count from 2005. Rover is the next most popular entry category, bringing in 34 logs this year (an increase of 2 from last year's 32) with those rovers reporting contacts from 137 grids (which was actually down from the 150 grids that were reported by rovers in 2005). This year's count of 17 Multi-operator entries is down 1 from the 18 in 2005.

The total count of QSO in all logs submitted for 2006 exceeded 12,000 and the total points broke the 4 million "barrier" which has not happened since 2002 when the point total was just shy of 4.3 million with 10,216 QSOs reported. To compare to 2005, just over 3.5 million points and just shy of 11,000 QSO were in last year's logs. More contradiction to those rumors.

Tables 1 and 2 compare activity between 2005 and 2006, Table 1 showing number of QSOs and stations active by band and Table 2 summarizing the count of stations by how many bands their submitted logs showed contacts had been completed on.

It's interesting to note the increase in activity through 24 GHz, while no one reported any contacts on 47 or 75 GHz in 2006. Another interesting item for 2006 is that, of 190 logs submitted, all but 1 reported a contact on 432 MHz.

Enough with the Numbers… Who were the Winners?

First of all, everyone who participated was a winner and I hope everyone had fun. From reading soapbox comments, both from the logs and in the online area, **www.arrl.org/contests/soapbox/**, there were a number of stations who tried the UHF Contest for the first time, or added a new band, or operated from areas where the activity was quite sparse. While we might have hoped that everyone's "buddy" Edsel Murphy was taking his vacation over that first weekend of August, it appears he *was* busy…thankfully nothing catastrophic for anyone he visited, just the typical broken antenna or rover having to end a trip early; probably the worst was a rover who visited three grids and did not make a single contact.

The big story for 2006 is the incredibly close finish in Single Operator, High Power, between **Mike, KMØT**, who finished narrowly ahead of **Don, WW8M**, with less than 1% difference in their final scores. This was close enough that one more multiplier by **Don** or one fewer by **Mike** would have changed the finish. With higher band QSOs being worth 12 points, a change of just one there could have made a similar difference. Congratulations to both **Mike** and **Don** for their efforts. Not too far behind in this category was **Jeff, K1TEO**, with his 3rd place score for 2006. It's interesting also, that this is the third consecutive year that **Mike**, **Don** and **Jeff** have finished first, 2nd and 3rd in this category.

Table 1
Activity by Band, 2006 vs 2005

Band	2006 QSOs	2006 Stations	2005 QSOs	2005 Stations
222 MHz	3229	152	3136	144
432 MHz	4618	189	4228	175
902 MHz	1037	90	827	81
1.2 GHz	1613	131	1427	116
2.3 GHz	585	67	425	54
3.4 GHz	337	49	261	38
5.7 GHz	222	36	170	29
10 GHz	389	56	306	51
24 GHz	38	14	47	16
47 GHz	0	0	3	3
75 GHz	0	0	1	1
Light	1	1	10	6

Table 2
Participation by Number of Bands, 2006 vs 2005

Bands	2006 Logs	2005 Logs
1	26	30
2	32	34
3	40	31
4	25	34
5	8	12
6	18	8
7	12	7
8	19	16
9	10	9
10	0	2

K2KIB looks ready to rove but used this setup "fixed" from High Point State Park in Northern New Jersey to set a new Hudson Division Record.

Another "repeater" is **Bob, K2DRH,** finishing 1st in the Single Operator, Low Power category for the 4th consecutive year. **Bob** was fewer than 4000 points shy of topping his 2004 effort, which is the current Top Score for the "A" category. **Roger, W3SZ**, and **Russ, KB8U**, closed out the top three in Low Power with their respective 2nd and 3rd place scores.

Still another familiar call tops the Multi-operator category…13 operators of the **Mount Greylock Expeditionary Force** piloted the **W2SZ** call sign to the top of that category, which they have done for what seems like forever. **Dave, K1WHS**, invited a few operators over to his shack for what ended up being the 2nd place finish among Multi-ops followed by the **Mountain Group, N2PA,** in 3rd place.

Not to be outdone in familiarity, **Jon, WØZQ**, piloted his 8 band "rover-mobile" through 7 different grid squares to produce another 1st place finish in the Rover category for a third consecutive year. The club call of the **Mt Airy VHF Packrats, W3CCX**, was pressed into rover service by **Rick, K1DS**, through 4 grid squares with 9 bands. Third place in the Rover category was claimed by **Bruce, W9FZ**, with his visit to 8 grid squares and making contacts on 5 bands.

New Divisional Records

While the general consensus about conditions is they were "normal" or slightly below that, this year's entrants managed to update a number of divisional records.

In Single Operator, Low Power, the previously mentioned national 2nd and 3rd place finishes by **Roger, W3SZ**, and **Russ, KB8U**, were new records for their Atlantic and Great

Table 3

Regional Leaders

(A = Single Op Low, B = Single Op High, M = Multioperator, R = Rover)

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)			Southeast Region (Delta, Roanoke and Southeastern Divisions)			Central Region (Central and Great Lakes Divisions; Ontario Section)			Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)			West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)		
W3SZ	114,210	A	KN4SM	3,870	A	K2DRH	170,382	A	NØKP	94,000	A	KI7JA	4,347	A
K2KIB	41,607	A	K4FJW	2,193	A	KB8U	95,811	A	NØVZJ	5,856	A	W7RV	3,240	A
AF1T	24,288	A	WA4QYK	2,091	A	KC9BQA	68,110	A	NØUGY	3,834	A	W6OMF	1,920	A
WB2SIH	20,160	A	N4AK	1,440	A	KB9TLV	18,228	A	W5ROK (WA8ZBT, op)	2,160	A	KK6KE	1,080	A
W1PM	13,505	A	WA4YRK	1,053	A	N9TZL	15,675	A	WØRT	2,070	A	N7IR	648	A
K1TEO	241,956	B	W4ZRZ	30,378	B	WW8M	269,616	B	KMØT	271,026	B	N7EPD	23,754	B
K3TUF	134,895	B	K4QI	27,216	B	K8MD	70,272	B	WØGHZ	119,892	B	K6TSK	6,048	B
K1RZ	49,464	B	W4WA	21,420	B	K2YAZ	51,578	B	KFØQ	57,708	B	WA7TZY	2,592	B
K1JCL (K1GX, op)	40,320	B	KE2N	17,280	B	K3SIW	44,992	B	WB5ZDP	19,280	B	KC6ZWT	2,352	B
KA1LMR	21,824	B	K4XR	13,818	B	WA8RJF	30,745	B	K5LLL	6,588	B	WB7BST	2,295	B
W2SZ	390,544	M	K4RF	15,300	M	N2BJ	19,894	M	K5QE	42,545	M	KI6BEW	609	M
K1WHS	121,788	M	AG4V	12,393	M	W9CDL	1,122	M	WØEEA	4,200	M	K7HSJ	189	M
N2PA	103,320	M	N4JQQ	1,680	M				K5CCC	810	M			
N3EMF	79,722	M												
W3KWH	20,703	M												
W3CCX	86,496	R				W9FZ	77,946	R	WØZQ	179,478	R	K6NKC	1,560	R
WA3PTV	44,892	R				VE3SMA	29,097	R	WAØVPJ	12,215	R			
W3HMS	37,206	R				KF8QL	25,917	R	WBØLJC/R	11,736	R			
KE3HT	26,529	R				WB8BZK	24,288	R	KCØP	7,524	R			
N3LJK	21,168	R				VE3CRU/R	9,720	R	NØHZO	7,458	R			

Table 4

Top 10 Scorers

The table shows bands activated, total QSOs and multipliers.

Band Key: C = 222, D = 432, 9 = 902, E = 1296, F = 2304, G = 3456, H = 5760, I = 10 GHz, J = 24 GHz, K = 47 GHz, L = 75 GHz, P = Light

Call	*Score*	*Bands*	*QSOs*	*Multipliers*
Single Operator Low Power				
K2DRH	170,382	CD9EFG	232	146
W3SZ	114,210	CD9EFGHIJ	188	90
KB8U	95,811	CD9EFGI	187	109
NØKP	94,000	CD9EFGHI	154	94
KC9BQA	68,110	CD9EF	160	98
K2KIB	41,607	CD9EFGI	130	69
AF1T	24,288	CD9EFGHIP	107	44
WB2SIH	20,160	CD9E	112	48
KB9TLV	18,228	CDE	117	49
N9TZL	15,675	CD	95	55
Single Operator High Power				
KMØT	271,026	CD9EFGHIJ	228	162
WW8M	269,616	CD9EFGHI	329	164
K1TEO	241,956	CD9EFGHI	321	141
K3TUF	134,895	CD9EFGHI	232	115
WØGHZ	119,892	CD9EFGHI	193	97
K8MD	70,272	CD9EFG	151	96
KFØQ	57,708	CD9EFGHI	117	84
K2YAZ	51,578	CD9EFGHI	118	82
K1RZ	49,464	CD9EFGHI	117	72
K3SIW	44,992	CD9EFGH	115	76
Multioperator				
W2SZ	390,544	CD9EFGHIJ	383	154
K1WHS	121,788	CD9EFGHI	225	102
N2PA	103,320	CD9EFH	204	120
N3EMF	79,722	CD9EFGHIJ	160	86
K5QE	42,545	CD9EFG	139	67
W3KWH	20,703	CD9E	81	67
N2BJ	19,894	CD9E	104	49
K4RF	15,300	CD9EFI	68	50
AG4V	12,393	CD9EF	57	51
KB1JDX	9,588	CD9EFI	68	34
Rover				
WØZQ	179,478	CD9EFGHI	340	78
W3CCX	86,496	CD9EFGHIJ	207	68
W9FZ	77,946	CD9FI	251	66
WA3PTV	44,892	CDEFGHI	126	58
W3HMS	37,206	CD9EFGHI	113	54
VE3SMA	29,097	CD9EFGIJ	97	53
KE3HT	26,529	CD9EFGH	107	37
KF8QL	25,917	CD9EFI	115	53
WB8BZK	24,288	CDE	148	46
N3LJK	21,168	CD9EF	94	48

Lakes Divisions, respectively. **Roger** shattered a record that had been set in 2002 and **Russ** broke his own record set in 2005 (and with a bit of margin as well). **Jim, K2KIB**, also set a new top score for the Hudson Division in the "A" category.

Two divisional records were "reset" in the "B" category and, in both cases, the "resetter" was the previous record holder. **Lynn, N7EPD**, bettered his 2002 effort in the Northwestern Division and **Jimmy, W4ZRZ**, "high-powered" his way to top the Southeastern Division, replacing the record he had just claimed in 2005.

Among Rovers, **Jon, WØZQ**, now claims top divisional scores in *two* divisions. His effort in 2004 remains the best for the Midwest division but his efforts in 2006 bettered the previous best for the Dakota Division. This year's **W3CCX/R** is a new best for rovers in the Atlantic Division…the operator, **Rick, K1DS**, actually topped the record he had set in 2002.

Regional Highlights

Forty-nine logs were received from the Northeast Region, with **W3SZ** leading the 24 SOLP entries and **K1TEO** finishing tops among the 8 SOHP entries. **W2SZ** was first within the 7 Multi-op entries from the Northeast (in addition to having the top Multi-op score nationally) and **W3CCX** was best among the 10 rovers in that region.

The Southeast Region produced 27 entries, with **KN4SM** and **W4ZRZ** achieving the highest scores from 12 logs in each of their respective "A" and "B" classes. **K4RF** finished atop the three Multi-op entries from the Southeast.

From the Central Region, 44 logs were submitted. **K2DRH's** top national finish naturally leads the 22 Single Operator, Low Power entries from the region. The other category bests in Central were **WW8M** (among 11 High Power Single-ops), **N2BJ** (among 2 Multi-ops) and **W9FZ** (among 9 Rovers).

The Midwest Region's 45 entries included the national top scorers in the "B" and "R" classes, those being **KMØT** (among 15 SOHP entrants) and **WØZQ** (from a group of 14 Rovers who submitted logs from the region). **NØKP** scored best among 13 SOLP entries and **K5QE** topped the 3 Multi-op submissions from the region.

Twenty-five logs were submitted from the Western Region with 15 of those in Single-Op, Low Power, lead by **KI7JA**. **N7EPD's** score was best among 7 Single-Op, High Power entrants from the region. The team at **KI6BEW** was the top finisher among 2 Western Region Multi-op entries, not bad for their first ARRL UHF Contest. **K6NKC** was the top (and, unfortunately, the only) Rover who submitted a log from the region.

So…What about Future ARRL UHF Contests?

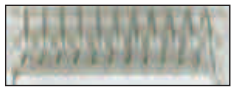
It *is* on the ARRL Contest Calendar for 2007, August 4-5. Can "we" keep it going and growing? I've already heard that there will be a *Rover Mania IV* so there should be a *lot* of Rover activity, at least in the Midwest Region…hopefully *Rover Mania* will spread through more of the country. "We" also have the opportunity to suggest some possible changes or enhancements to this contest (as well as all the other ARRL sponsored VHF & Up Contests) through the special "Contest focused" VHF-UHF Advisory Committee that was formed earlier in 2006. Might "Club Competition" be an asset to this contest? I'm sure there are other ideas and I encourage everyone to contact the VUAC Member for their region to share their thoughts on what might be done to enhance and improve this and *all* ARRL VHF & Up contests.

So…let's remember to keep finding our enjoyment (ie, the "fun") in these contests, and to always *listen for the weak ones*. See you in 2007.

HAMSPEAK

The following are brief descriptions of some Amateur Radio related terms found in articles from this month's issue. More information on most can be found in *The ARRL Handbook* or other specialized ARRL publications. See also **www.arrl.org/qst/glossary.html**.

A TWO ELEMENT "WONDER BAR" BEAM FOR 17 METERS

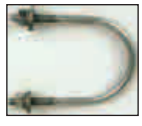


B&W Miniductor — trade name for a line of air wound coil stock popular from the '50s on, for use in Amateur Radio projects. Other similar products are known as AirDux. See **www.bwantennas.com/coils/mini.htm**.

Full sized beam — multielement, often rotatable, directional antenna in which the elements are all approximately half a wavelength long at the operating frequency. See **www.cebik.com/yagi/3l.html**.

PL-258 coax coupler — coaxial fitting designed to accept two male UHF coaxial plugs (PL-259) and thus splice two cables. Sometimes it is known as a *barrel* connector, because of its appearance. See **www.premiere-electronics.net/store/pl258.html**.

Ring terminals — connection device designed to allow a wire to be solidly connected under a screw terminal. They are typically crimped or soldered to the end of a wire. See **www.waytekwire.com/ring-terminal.htm**.



U bolt — bolt in the shape of the letter U often used to secure antenna tubing to supports. See **www.dxengineering.com**.

Windom antenna — wire antenna fed with a transmission line, or a single wire, at about ⅓ of the distance from one end. It is intended to operate reasonably well on even harmonic (multiples) bands of its half wave frequency. For example, a 130 foot Windom will work on 80, 40, 20 and 10 meters. See **www.smeter.net/antennas/windom2.php**.

HIGH SENSITIVITY CRYSTAL SET

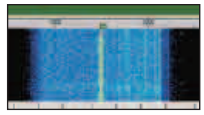
FET — field effect transistor. A transistor in which the current flow is regulated based on an electric field instead of a current, as in the usual *bipolar* transistor. Particular constructions include the junction field effect transistor (JFET) and metal oxide semiconductor field effect transistor (MOSFET). See **www.arrl.org/tis/info/HTML/Hands-On-Radio/**; look for Experiment #12.

LC resonator — combined inductor-capacitor circuit designed to have equal reactances at a particular frequency for use in selecting signals. Also known as a tuned circuit.

Selectivity — ability of a receiver to separate stations that are transmitting on frequencies close together.

THE DOCTOR IS IN

Balun — BALanced to UNbalanced transformer, used to transform signals between balanced antennas or transmission lines to coaxial cable. See **www.arrl.org/tis/info/pdf/7902015.pdf**.



Digipan — popular PC software used to decode digital transmissions using the PSK-31 format. It appears as a "waterfall" showing signals across the receiver bandwidth as a function of time. See **www.digipan.net** for more information or to download the software.

Ground plane — antenna in which the primary element is a λ/4 vertical monopole located above an artificial ground of typically three or four λ/4 horizontal radials. See **www.arrl.org/tis/info/pdf/ab18-16.pdf**.

Invisible antenna —antenna design implemented with fine wire, or otherwise hidden, so as not to cause concern of neighbors or family members. See **www.arrl.org/tis/info/limited.html**.[1]

Open wire transmission line — pair of conductors used to carry energy between locations, such as between a transmitter and antenna. Open wire line has two constant spaced conductors with air in between. In contrast, coaxial cable is *concentric* line with one conductor surrounding the other. See **www.arrl.org/tis/info/pdf/128320.pdf**.

SWR — standing wave ratio, a measure of how well a load, such as an antenna, is matched to the design impedance of a transmission line. An SWR of 1:1 indicates a perfect match. See **www.arrl.org/tis/info/pdf/49470.pdf**.

A SIMPLE ADD-ON RF STAGE FOR REGENERATIVE RECEIVERS

Air variable tuning capacitor — adjustable capacitor in which the two terminals are connected to metal plates that either rotate or compress to change the capacitance. See **www.arrl.org/tis/info/pdf/8404037.pdf**.

Antenna rod — rod antennas are an antenna type often used in broadcast radios from the '50s on. They consist of a powdered metal core (ferrite) wound with many turns of fine wire. Also a whip type antenna.

Gimmick capacitor — small value capacitor in which the electrodes are two wires wrapped together.

Regenerative receiver — type of radio receiver, especially popular during the 1930s, using an oscillating detector to provide additional sensitivity and selectivity compared to other receivers of the period. See **www.techlib.com/electronics/regen.html**.

SPDT — single pole double throw. Switch configuration in which a single circuit can be switched between two different terminals.

SIMPLE AUDIO COMPUTER TO TRANSMITTER MORSE KEYER

BASIC — computer programming language popular with early personal computer users. See **www.fys.ruu.nl/~bergmann/history.html**.

QRP — strictly speaking, an operating shorthand for "I am sending with low power." In common use it refers to low power, typically under 5 W output, operation viewed as a special challenge by many amateurs. See **www.arrl.org/tis/info/qrpwhtwy.html**.

USB Port — universal serial bus port. Increasingly popular connection arrangement designed to allow computers to interface with peripheral equipment. See **www.howstuffworks.com/usb.htm**.

RF ACTIVATED TIMER

Light emitting diode (LED) — diode from which light is emitted when current flows. Originally used in place of incandescent bulbs as indicator lights, now are used in place of larger light bulbs and to form the basis of some display screens. See **hyperphysics.phy-astr.gsu.edu/hbase/electronic/leds.html**.

Potentiometer — three terminal variable resistor with the center terminal generally adjustable from one end to the other.

OLD AMPLIFIERS

Bias supply — power supply used to provide a dc input to a tube or transistor to set the no-signal-current level and thus establish operating conditions.

CW — continuous wave, or more properly *interrupted* continuous wave. This is the method generally used to send Morse telegraphy over radio.

Decibel (dB) — way of expressing signal ratios. Decibels are based on logarithms so that gains and losses can be added. For example a power ratio of 1 is 0 dB, 2 is 3 dB, 10 is 10 dB, 20 is 13 dB, 100 is 20 dB, etc. Mathematically, $dB = 10 \times \text{Log}_{10}$ (P2/P1).

Diode — two element vacuum tube or semiconductor that conducts in only one direction when its anode is positive, and does not conduct when it's negative.

Electrolytic — kind of capacitor in which the insulation is a form of electrolyte. Usually found in polarized high value capacitors.

Heathkit — electronic kit made by the Heath Company of Benton Harbor, Michigan. Heathkits were a popular source of Amateur Radio equipment, test instruments, high-fidelity sound kits and even televisions and airplanes for a time. They were popular with hams from shortly after WWII to around 1990. See **www.heathkit-museum.com**.

Linear amplifier — amplifier that provides an output that is a larger copy of the input signal. This may be used to amplify any type of signal. In contrast, a "class C" amplifier is a *non-linear* amplifier that can only properly amplify CW or FM signals. See **www.dxzone.com/cgi-bin/dir/jump2.cgi?ID=4304**.

Parasitic suppressors — parasitic oscillations are signals at unwanted frequencies generally generated in an amplifier. A suppressor is a small circuit designed to absorb energy at the unwanted frequency and thus eliminate the unwanted oscillation. See **www.w8ji.com/vhf_stability.htm**.

Rectifier — circuit, consisting of one or more diodes, designed to convert alternating current (ac) into direct current (dc), typically for the operation of radio equipment. See **www.allaboutcircuits.com/vol_3/chpt_3/4.html**.

Zener diode — diode that conducts in the backward direction after a certain specified voltage is exceeded. Used for voltage regulation. See **hyperphysics.phy-astr.gsu.edu/hbase/solids/zener.html**.

[1]*Low Profile Amateur Radio,* 2nd Edition, is available from your local dealer or the ARRL Bookstore at telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

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- CW trainer built-in

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2M Handheld

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- Direct Keypad Entry
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Ultra compact HF, VHF, UHF

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- 50w 2m, 40w on 440mHz
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FT-2000 HF + 6M tcvr

- 100 W w/ auto tuner • built-in Power supply
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- SSB, CW, AM, FM, WFM
- 32mb digital recorder
- 1,000 memories
- VSC • 100 ch/sec. scanning

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- 1250 memories
- Alphanumeric labels
- DMS scan
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- 500 kHz - 2.45 GHz*
- 450 Alphanumeric Memories
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- 4 Level Attenuator
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*816-901.995 MHz blocked; unblocked versions available to FCC approved users. FM video range for the IC-R3 is 900-1300 MHz & 2250-2450 MHz

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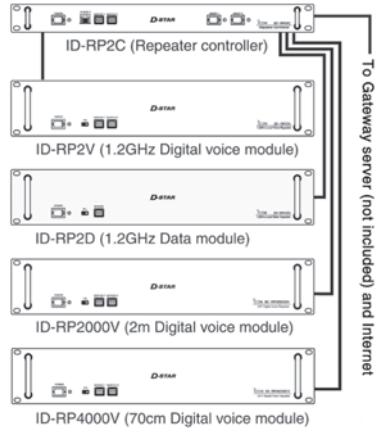

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• 0.01 - 3300 MHz* • AM, FM, WFM, SSB, CW • "Unlimited" memory channels • Multiple PC operating screens to choose from • Simple USB connection • Record and save .WAV files • Windows® software • Also available: IC-PCR2500, with dual receivers, dual watch software and optional D-STAR, optional P25

R1500 R2500

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• Remote control head plugs into "black box" • Shares most specs with IC-PCR1500 • Also available as IC-R2500, which shares most of same specs with IC-PCR2500

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IC-7000

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2M @ 7W • Optional D-STAR format digital operation features include callsign calling, up to 20 character text message, & position exchange*3 • CTCSS/DTCS encode/decode w/tone scan • Also available in a sport version and a 70CM version (IC-U82)

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- 200 Mems., CTCSS
- VC-H1 Messaging Control

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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, the FT-897 includes operation on the SSB, CW, AM, FM, and Digital modes.

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The six outputs are organized in three groups of two. Each pair is internally regulated to 12 vdc, thermal protected and short-limited; a short circuit just shuts down the regulator and turns off that output. So, with the Multi-DC, you can easily and safely power your LDG tuners and accessories (with more coming, by the way!).

LDG ELECTRONICS 2 YEAR WARRANTY

List Price $49

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The "Talking" Watt Meter

The TW-1 Talking Wattmeter provides an aural spoken indication of power and SWR using a digitally recorded voice. It is ideal for the vision-impaired, for those of us in the "bi-focal set", or just for those times when you need to be looking somewhere else. At the press of a button, the TW-1 speaks the forward power, reverse power or SWR. Three languages are available: English, Spanish and German. It includes its own internal speaker; no external audio hookups are needed. Also available the TW-2 for UHF/VHF.

List Price $149

Your Eye Strain Problems — Solved!

Yaesu's popular FT-857 and FT-897 transceivers are wonders of compact efficiency. These do-anything, go-anywhere transceivers were science fiction just a few years ago, but ham's today are using them in shacks, mobiles and on expeditions from the back yard to the top of the world.

The 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.

LDG ELECTRONICS 2 YEAR WARRANTY

Each function is selectable from the radio's menu.

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The FT-Meter comes fully assembled and ready to go; just plug it into the radio and you're in the picture like never before.

List Price $49

Your Cable Problems—Solved!

RCA-14 is a breakout box for the accessory jacks on most popular transceivers. It comes with cables with the right DIN plugs, and all the outputs are blessedly simple RCA jacks. You simply plug the RCA-14 into your radio's accessory jacks, and all your ports are right there at your fingertips; just plug and play, one function or all of them, makes no difference. And, you can changes things around as often as you like; it's as simple as swapping out an RCA plug.

The RCA-14 comes with a DIN 13 cable, a mini DIN 6 and a mini Din 8. The DIN 13 cable breaks out the functions to RCA jacks 1 - 13, while the mini DIN 6 goes to RCA 1 - 6, and the mini DIN 8 goes to RCA 7 - 14.
You can use the DIN 13 or the mini DIN 6 and/or 8, depending on your radio.

The RCA-14 is compatible with: Icom 703, 706, 718, 746, 756, 7000 and 7800, Yaesu 817, 857, 897 and 840, Kenwood 480, 570, 2000 Ten Tec Orion and many more radios.

List price $59

The DTS Series

Antenna Switches

Tired of that tangled mess of coax and pigtails in your shack? Always worrying about whether you set the ground switch on your antenna before you left your snack? LDG's new DTS Series antenna switches are for you. Instantly switch your rig between 4 or 6 antennas with the press of a button. Auto-grounding when you shut your rig down. Purchase the additional remote control and put the DTS Series switch anywhere indoors and operate it from your desk. They handle up to 1500 watts of RF power on HF (250W on 6M), and can be used with any coax-fed antenna.

List Price DTS-4 $79, remote $39
DTS-6 $99, remote $49

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. We even added the ability to mount the "feet" on the side of the tuner so when you are transporting your rig by the handle, you can safely set it down and not worry about scratching the case. The AT-897 takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so if you are using another CAT device, hooking it up couldn't be easier.

List Price $199

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Z-11Pro

The Return of a Legend.

The original portable Z-11 was one of LDG's most popular tuners, accompanying adventurous hams to their backyards, or to the ends of the earth. Now 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.

With 8,000 memories in LDG's exclusive "3-D Memory" array, 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. ***Ready to go right out of the box! No extra cable to buy.***

List Price $179

AT-200Pro

The first auto tuner specifically designed for today's high-powered transceivers.

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 MH **(including 6 meters)**.

Ready to go right out of the box! No extra cable to buy.

List Price $249

LDG ELECTRONICS **2 YEAR WARRANTY**

AT-7000

The Hottest Radio in the Industry! Now with It's Own Autotuner!

The AT-7000 is the ideal tuner for IC-7000 & other ICOM Radios: Covers all frequencies from 1.8–54 MHz **(including 6 meters),** and will automatically match your antenna in a flash. Requires just 0.1 W for operation, but will handle up to 125 W (100 W on 6 m), making it suitable for everything from QRP (IC- 703Plus) to a typical 100 W ICOM transceiver.

Ready to go right out of the box! No extra cable to buy.

Tune with the AT-7000 or use your radio. Includes over 2,000 memories, uses latching relays, tuning range is 4-800 ohms, powered by your radio. Includes ICOM interface cable.

List Price $169

AT-200PC

The First Automatic Tuner Designed Specifically for PC Rig Control

Now you can have a state-of-the-art, high performance automatic tuner and still run your whole station right from your keyboard and mouse. LDG's AT-200PC is a special version of the popular AT-200Pro, designed for PC control. All of its functions are controlled entirely by a program running on your PC. The tuner itself can be installed out of the way, on the floor or even in another room, interfacing to your PC via a serial or USB cable.

List Price $259

AT-100Pro

Automatic Antenna Tuner

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. The AT-100Pro includes over 2,000 memories for each antenna, automatically storing tuning configurations for each frequency and band as you use them.

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AT-1000

An Autotuner for use with your amplifier!

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Z-100

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The Z-100 will tune with 0.1 to 125 watts (50 watts on 6 meters), making it an excellent choice for almost any radio or operating style. Backpackers and QRP operators will appreciate the latching relays. Power can be removed from the tuner once you have tuned. Additionally, when the tuner is not tuning, it draws nearly zero amps. ***Ready to go right out of the box! No extra cable to buy.***

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D-STAR HANDHELDS

D-Star Capable


IC-91A/AD

IC-V82 *2M High Power Digital Capable Handheld*
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D-Star Capable


IC-V82/U82

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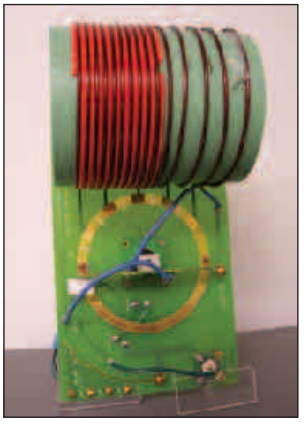

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VHF/UHF HANDHELDS

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VX-150 *(left)* **2M Ultra-Rugged FM Handheld** – 5W output on 2M; 140–174 MHz RX; 144–148 MHz TX; 209 memories; Wide/Narrow Deviation Selection.
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VHF/UHF MOBILES

FT-2800M **2M FM Transceiver** – Covers: 144-148 MHz TX with 137-174 MHz RX and WX Alert; Power: 65/25/10/5W; CTCSS & DCS Encode/Decode; WIRES™ capability. © **$159.99**

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Free Separation Kit!

Free Separation Kit!

(FT-8900R shown)

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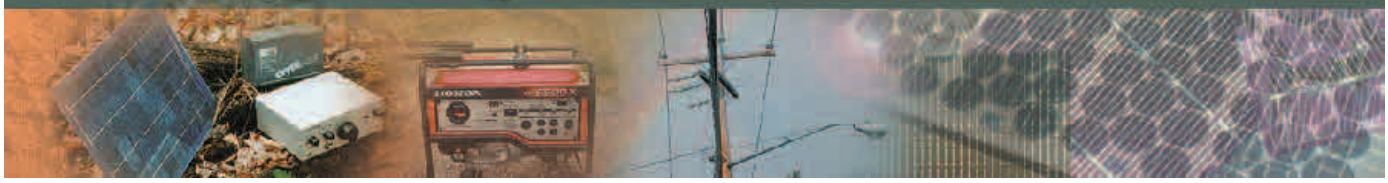

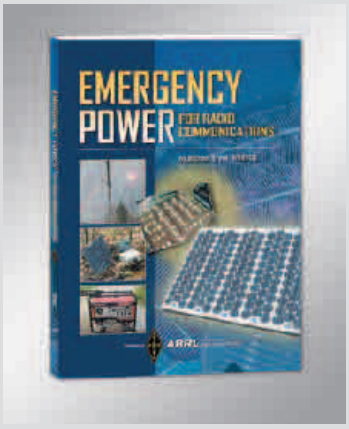

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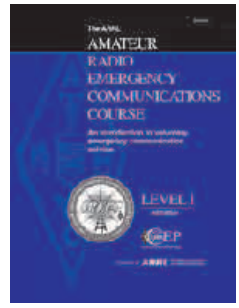

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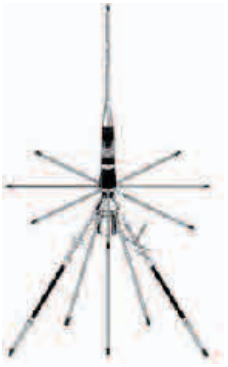

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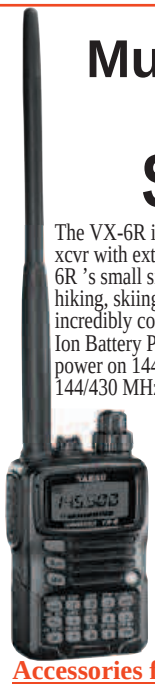

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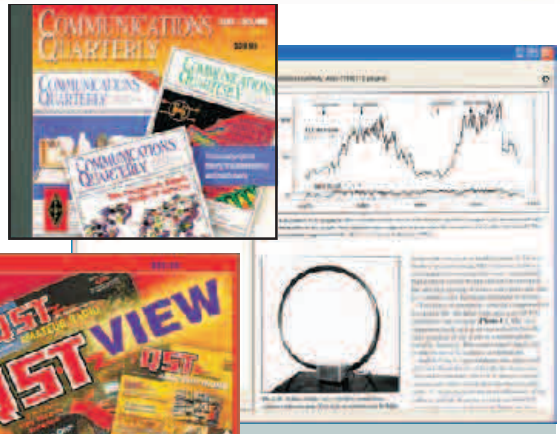

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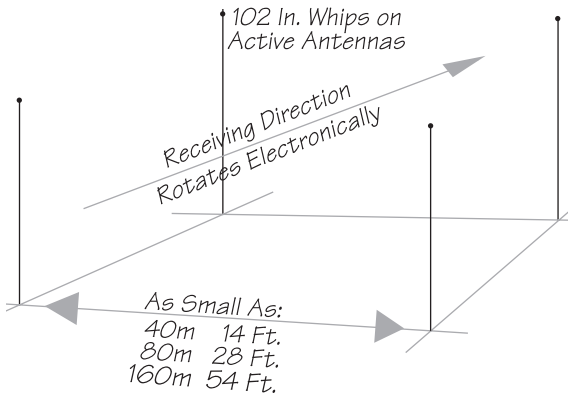

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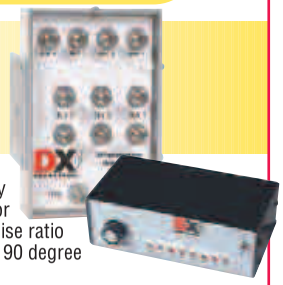

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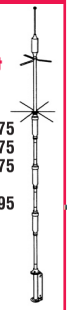

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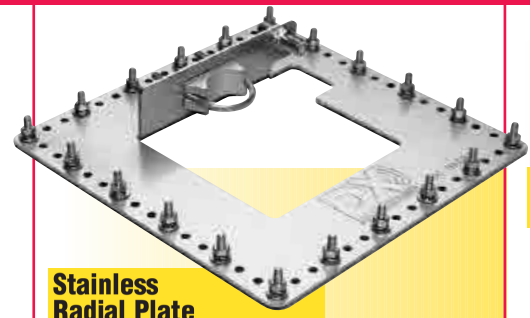

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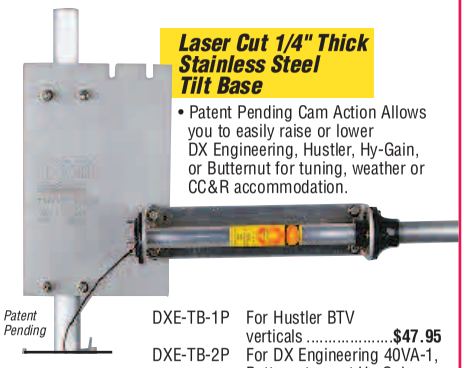

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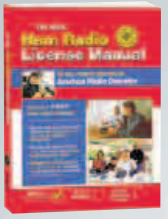

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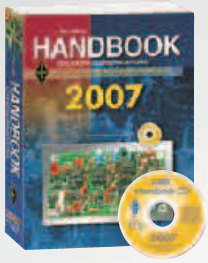

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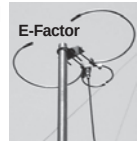

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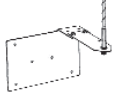

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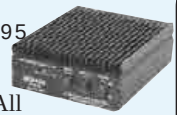

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Stainless Steel Bonding Plate

6-Band ***Rotatable*** mini-Dipole for 40,20,15,10,6,2 M

Low profile 14 ft . . . 7 ft. turning radius . . . 1.5 kW . . . Directivity focuses signal, reduces QRM/noise . . .

You can hardly see this mini 14 foot rotatable dipole from across the street!

Tiny 7-foot turning radius fits the smallest roof -- perfect for houses, apartments/condos.

The low-profile MFJ-1775 is not much bigger than a TV antenna and nicely blends into the sky. It's easily turned by a lightweight TV rotator.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction that you want -- so you can work some *real* DX.

Operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters. Run *full 1500 Watts* SSB/CW on all HF bands!

Its entire length radiates. Each HF band uses a separate, highly-efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire with capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $239.95. WARC band version for 12, 17, 30, 60 Meters only.

80/40/20 Meter Rotatable Dipole

MFJ-1785, $359.95. DX the *low bands* on 80, 40, and 20 Meters with an efficient full 33 foot *rotatable* dipole! Handles a full 1500 Watts. Balun included. 6063 T-6 aircraft strength aluminum tubing with a solid center fiberglass insulator. Requires a medium-duty rotator such as Hy-gain's AR-40.

Compact SWR/Wattmeter

MFJ-822
MFJ-842
$59.95
New!

Compact SWR/Wattmeter has huge 3 inch *lighted* Cross-Needle Meter, easily viewable from across shack. Read forward/reflected power, SWR *simultaneously*. 3¹/4Wx3¹/4Hx3¹/4D in. **MFJ-822** for 1.8-200 MHz, 30/300 Watts. **MFJ-842** for 140-525 MHz, 15/150 Watts.

16-Element 2.4 GHz WiFi Yagi

MFJ-1800 $29.95

16-element WiFi Yagi antenna greatly extends range of 2.4 GHz, 802.11b/g WiFi signals. Turns slow/no connection into fast, solid connection. Highly directional -- minimizes interference. N-female connector. Tripod screw-mount. Wall/desk/shelf mounts. Use vertically or horizontally. 18Wx2³/4Hx 1¹/4D in. 2.9 oz.

MFJ-5606SR, $24.95. Cable connects MFJ-1800/WiFi antennas to computer. Reverse-SMA male to N-male, 6 ft. RG-174.

MFJ-5606TR, $24.95. Same as MFJ-5606SR but Reverse-TNC male to N-male.

Glazed *Ceramic* Insulators

MFJ-16C06, $4.56, package of 6 authentic glazed *ceramic* antenna insulators. Extra-strong -- long antennas will not break, will not arc over or melt under full legal power. Extra-long ridges prevent high-voltage breakdown. Smooth wire holes prevent wire damage.

2-Position *Remote* Ant. Switch

MFJ-4712 $79.95

Switch any two antennas remotely! *Single* coax feeds two antennas, DC power, control signals -- *no extra cable needed.* Use 1.8-150 MHz antennas. 1500 Watts. 50-75 Ohms. 4W x2⁵/8Hx1¹/2D in. fully enclosed, *weather protected* outside switch box has stainless steel bracket for 1¹/2 in. mast. 3 *Teflon*® SO-239s.

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MFJ *Switching* Power Supplies

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these new 25 or 45 Amp MFJ MightyLite™ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's new adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's *MightyLites*™ are so light and small you can carry them in the palm of your hand! Take them with you anywhere.

No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

MFJ's 25 Amp *MightyLite*™ weighs just 3.7 lbs. -- that's *5 times lighter* than an equivalent conventional power supply. MFJ's 45 Amp is even more dramatic -- *8 times lighter* and weighs just 5.5 pounds!

No RF hash!

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either!

Some competing switching power supplies generate objectionable RF hash in your transmitted and received signal.

These super clean MFJ *MightyLites*™ meet all FCC Class B regulations.

Low Ripple . . . Highly Regulated

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

Fully Protected

You won't burn up our power supplies!

MFJ-4225MV
25 Amp
$149.95 plus s&h

MFJ-4245MV
45 Amp
$199.95 plus s&h

No RF Hash! ***No RF Hash!***

They are fully protected with Over Voltage and Over Current protection circuits.

Worldwide Versatility

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

MightyLites™ . . . Mighty Features

Front-panel control lets you vary output from 9 to 15 Volts DC.

Front-panel has easy access five-way binding posts for heavy duty use and cigarette lighter socket for mobile accessories. MFJ-4245MV has two sets of quick-connects on the rear for accessories.

Brightly illuminated 3 inch meters let you monitor load voltage and current.

A whisper quiet internal fan efficiently cools your power supply for long life.

Two models to choose from . . .

MFJ-4225MV, $149.95. 25 Amps maximum or 22 Amps continuous. Weighs 3.7 pounds. Measures 5¾Wx4½Hx6D in.

MFJ-4245MV, $199.95. 45 Amps maximum or 40 Amps continuous. Weighs 5.5 pounds. Measures 7½Wx4¾Hx9D in.

New! **MFJ-4175, $359.95.** 75 Amps *continuous*. 13.8-14.2 VDC. 7.8 pounds. 6½Wx3½Hx10D inches.108-132 VAC. *No RF hash!*

NEW! 25 Amp *MightyLite*™

MFJ-4125
25 Amp
$109.95 plus s&h

Super light, super compact switching power supply delivers 25 Amps maximum/22 Amps continuous at 13.8 Volts DC. Low ripple, highly regulated. ***No RF Hash!*** Five-way binding posts for high current. Quick connects for accessories. Over voltage/current protection. 110 or 220 VAC operation. Meets FCC Class B regs. 2.86 lbs. 5¾Wx3Hx5¾D inches.

MFJ 35/30 Amp Adjustable Regulated DC Power Supply

Massive 19.2 pound transformer . . . No RF hash . . . Adjustable 1 to 14 VDC . . .

MFJ's heavy duty conventional power supply is excellent for powering HF or 2 Meter/440 MHz transceiver/accessories.

A massive 19.2 pound transformer makes this power supply super heavy duty! It delivers 35 amps maximum and 30 amps continuous without even flexing its muscles. Plugs into any 110 VAC wall outlet.

It's highly regulated with load regulation better than 1%. Ripple voltage is less than 30 mV. *No RF hash* -- it's super clean!

Fully protected -- has over voltage protection, fold back short circuit protection and over-temperature protection.

MFJ-4035MV
$149.95

You get front panel adjustable voltage from 1 to 14 VDC with a convenient detent set at 13.8 VDC. A pair of front-panel meters let you monitor voltage and current.

Three sets of output terminals include a pair of heavy duty five-way binding posts for HF/VHF radios, two pairs of quick-connects for accessories and a covered cigarette lighter socket for mobile accessories.

A front-panel fuse holder makes fuse replacement easy. Whisper quiet fan speed increases as load current increases -- keeps components cool. 9½Wx6Hx9¾D inches.

MFJ *High Current* Multiple DC Power Outlets

Power two HF/VHF transceivers and six or more accessories from your 12 VDC power supply

MFJ-1118
$79.95 plus s&h

MFJ-1116
$54.95 plus s&h

MFJ-1112
$39.95 plus s&h

MFJ-1117
$59.95 plus s&h

MFJ-1118, $79.95. This is MFJ's most versatile and highest current *Deluxe Multiple DC Power Outlet*. Lets you power two HF and/or VHF transceivers and six or more accessories from your transceiver's main 12 VDC supply.

Two pairs of super heavy duty 30 amp 5-way binding posts connect your transceivers. Each pair is fused and RF bypassed. Handles 35 Amps total.Six pairs of heavy duty, RF bypassed 5-way binding posts let you power your accessories. They handle 15 Amps total, are protected by a master fuse and have an ON/OFF switch with "ON" LED indicator.

Built-in 0-25 VDC voltmeter. Six feet super heavy duty eight gauge color-coded cable with ring tongue terminals. Binding posts are spaced for standard dual banana plugs. Heavy duty aluminum construction. 12½x2¾x2½ in.

MFJ-1116, $54.95. Similar to MFJ-1118. No 30 amp posts. Has "ON" LED and 0-25 VDC voltmeter. 15 amps total.

MFJ-1112, $39.95. Similar to MFJ-1116. No on/off switch, LED, meter, fuse.

MFJ-1117, $59.95. For powering four HF /VHF radios (two at 35 Amps each and two at 35 Amps combined) simultaneously. Tiny 8x2x3 inches.

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The ARRL is suing the FCC!

With one stroke of the pen, the rights of FCC licensees have been subordinated to those of spectrum polluters.

The **FCC ignored technical information** provided by ARRL and others.

The FCC rules for BPL in 2004 were bad, but the rules adopted in 2006 are **intolerable**.

We must fight to challenge bad rules which will lead to even worse rules later.

ARRL has only one course of action: Appeal in federal court!

The Amateur Radio is a priceless asset —and it must be protected!

Your financial support of the ARRL Spectrum Defense Fund is vital to fund this expensive and important legal challenge.

Thank you for your generous contribution today by phone, mail or on the web at **www.arrl.org/defense**.

For more information, contact:

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MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$179.95

"What did you say?" ***Can you hear but . . . just can't always understand everything people are saying?***

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $21.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $69.80. *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434B
$189.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and playback 5 natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed. Use your mic or its built-in mic for recording.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434B is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

New! **It's** easy to use -- just plug in your 8 pin round or modular mic plug, set the internal jumpers for your transceiver and plug in the appropriate (included) cable for your rig.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2½Hx6½D in.

MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null *wipes out* noise and interference

MFJ-1026
$189.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network.* You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½x1½x6¼ in.

MFJ-1025, $169.95. Like MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ *tunable* Super DSP filter

MFJ-784B
$269.95

Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you can customize. **Automatic** notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.

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MFJ *Pocket size* Morse Code Reader™

Hold near your receiver -- it instantly displays CW in English!

Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . .

MFJ-461
$89.95

Is your CW rusty?

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you miss-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

Automatic Speed Tracking

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW.

Four Display Modes

1. Bottom line scrolls and fills with text, then that entire line is displayed on top line until bottom line refills -- makes reading text extra easy! Automatically displays speed in WPM.

2. Same as **1**, without speed display -- gives you maximum text display.

3. Top line scrolls, bottom line displays speed in Words-Per-Minute.

4. Both top and bottom lines scroll.

Two-line LCD display has 32 large 1/4 inch high-contrast characters.

MFJ Instant Replay

The last 140 characters can be instantly replayed. This lets you re-read or check your copy if you're copying along side the MFJ-461.

High Performance Modem

Consistently get solid copy from MFJ's high performance *PLL* (*phase-lock loop*) modem. Digs out weak signals. Even tracks slightly drifting signals.

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

Computer Interface

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

More Features

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable.

Battery saving feature puts MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery (not included).

True Pocket Size

Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny $2^{1}/_{4}$x$3^{1}/_{4}$x1 in. $5^{1}/_{2}$ ounces.

No Instruction Manual needed!

Super easy-to-use! Just turn it on -- it starts copying instantly!

Accessories

MFJ-26B, $9.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $14.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $7.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ-5163, $10.95. Cable lets you use external speaker when MFJ-461 is plugged into radio speaker jack. 3.5 mm.

MFJ *Pocket* Morse Tutor

MFJ-418
$89.95

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

MFJ Code Oscillator

MFJ-557
$39.95

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. $8^{1}/_{2}$x$2^{1}/_{4}$x$3^{3}/_{4}$ inches.

MFJ *Pocket* CW Keyer

MFJ-403P
$79.95

Built-in Iambic Paddle. Thumbwheel speed control. Adjustable weight. Adjustable sidetone with speaker. Iambic modes A or B. Fully automatic or semi-auto "bug" mode. Reversable paddle. Tune mode. RF-proof. Battery Saver. Tiny $2^{1}/_{4}$Wx$3^{1}/_{4}$H x1D inches.

MFJ *miniature* Travel Iambic Paddle

MFJ-561, $24.95. $1^{3}/_{4}$W$x1^{3}/_{4}$D$x^{3}/_{4}$H in. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

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MFJ-259B *1.8-170 MHz* SWR Analyzer

World's most popular SWR analyzer is super easy-to-use

Reads SWR . . . Complex RF Impedance: Resistance(R) and Reactance(X) or Magnitude(Z) and Phase(degrees) . . . Coax cable loss(dB) . . . Coax cable length and Distance to fault . . . Return Loss . . . Reflection Coefficient . . . Inductance . . . Capacitance . . . Battery Voltage. LCD digital readout . . . frequency counter . . . side-by-side meters . . . Battery charger . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . .

World's most popular SWR analyzer! The famous MFJ-259B gives you a complete picture of your antenna's performance. You can read your antenna's SWR and Complex Impedance from 1.8 to 170 MHz.

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

You can determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously.

You can read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

It has built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Here's what you can do

Find your antenna's true resonant frequency. Trim dipoles and verticals.

Adjust your Yagi, quad, loop and other antennas, change antenna spacing and height and watch SWR, resistance and reactance change instantly. You'll know exactly what to do by simply watching the display.

Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance from HF to VHF -- 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

Take the guesswork out of building and adjusting matching networks and baluns.

Accurately measure distance to a short or open in a failed coax. Measure length of a roll of coax, coax loss, velocity factor and impedance.

Measure inductance and capacitance. Troubleshoot and measure resonant frequency and Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

Call your favorite dealer for your best price!

MFJ-259B $279.95

Adjust your antenna tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance and Reactance Analyzer, Coax Analyzer, Capacitance and Inductance Meter and more!

Free Manual: call, write or download

MFJ's comprehensive instruction manual is packed with useful applications -- all explained in simple language you can understand.

Take it anywhere

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. It uses 10 AA or Ni-Cad batteries (not included) or 110 VAC with MFJ-1312D, $15.95. Its rugged all metal cabinet is a compact 4x2x6¾ in.

How good is the MFJ-259B?

MFJ *SWR Analyzers*™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Used worldwide by professionals everywhere.

More MFJ SWR Analyzers™

MFJ-249B, $259.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

MFJ-209, $149.95. Like MFJ-249B but SWR meter only. No LCD/frequency counter.

MFJ-219B, $119.95. UHF *SWR Analyzer* covers 420-450 MHz. External frequency counter jack. 7½x2½ x2¼ in. *Free* "N" to SO-239 adapter.

SWR Analyzer Accessories

Dip Meter Adapter

MFJ-66, $24.95. Plug a dip meter coupling coil into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate bandswitched dip meter. Takes guesswork out of winding coils and determining resonant frequency of tuned circuits and Q of coils. Set of two coils cover 1.8-170 MHz depending on your *SWR Analyzer*.

Genuine MFJ Carrying Case

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric -- cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors so you can use your MFJ *SWR Analyzer*™ without taking it out of your case.

MFJ-99, $60.85. Accessory Package for MFJ-259/B/249/B/209. Includes MFJ-29C carrying case, MFJ-66 dip meter adapter, MFJ-1312D 110VAC adapter. ***Save $5!***

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MFJ-269 $379.95

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MFJ Compact 200 Watt *IntelliTuners*™

Automatically tunes any unbalanced antenna . . . Ultra fast . . . 20,000 VirtualAntenna™ Memories . . . Antenna Switch . . . Efficient L-network . . . Matches 6-1600 Ohms at 200 Watts . . . 1.8-30 MHz . . . Digital SWR/Wattmeter . . . Audio SWR meter . . . Radio interface . . .

New!

MFJ-929
$219.95

The MFJ-929 *IntelliTuner-Compact*™ lets you *automatically* tune any coax fed or random wire antenna 1.8-30 MHz at full 200 Watts SSB/CW. It can match 6-1600 Ohms (SWR up to 32:1) - - that's a 50% wider matching range at a higher power level than lesser competing products.

You get a *digital* SWR/Wattmeter with backlit LCD, antenna switch for 2 antennas, built-in radio interface and built-in internal BiasTee for remote tuner operation.

MFJ's exclusive *IntelliTune*™, *Adaptive Search*™ and *InstantRecall*™ algorithms give you ultra-fast automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

MFJ VirtualAntenna™ Memory

MFJ new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 antenna connectors. You can select up to 4 antennas on each antenna connector. Each antenna has 2500 memories.

4 Times the Solutions!

MFJ-929 gives you 256 values each of capacitance and inductances for 131,072 matching solutions. That's *4 times* the 32,768 matching solutions of competing products with only 128 L/C values each!

Highly intelligent, ultra-fast tuning!

Don't be fooled by competing products claiming fast search times -- if you have a *quarter* of the matching solutions, of course, it takes less time to search but it's *not* faster.

MFJ's much faster speed comes from advanced technology and software algorithms *not* from fewer matching solutions.

MFJ's *IntelliTuner-Compact*™ actually *measures* complex impedance -- *R* and *X* -- of your antenna, computes the L-network values needed and snaps in those components to give you an *instant* match.

If the load is out of measurement range, *AdaptiveSearch*™ determines the *smaller* subset from all solutions that can match a safe load -- and then searches *only* that subset -- others search through far more solutions.

Digital LCD SWR/Wattmeter

An easy-to-read, two-line, 16-character backlit LCD displays SWR, peak or average forward/reflected power, frequency, antenna 1 or 2, L/C tuner values, on/off indicators and other info. They are selected from easy-to-understand menus -- *not* complex combinations of buttons you can't remember.

A fast-response, high-resolution bargraph gives you an auto-ranging 20/200 Watt power meter. You get 60 segments each for forward and reflected power and 36 segments for SWR -- *try that with an 8 segment bargraph that makes you change power ranges and doesn't even give you reflected power!*

You can read inductance and capacitance *directly* in uH and pF. This turns you into an expert *L-network designer!* Match your load, read the resulting L/C values, then use them to build your fixed L-network.

Or, knowing the L/C values you can determine R and X of the load impedance.

Plus Much More!

***StickyTune*™** mode gives you one-hand tuning by locking the TUNE button -- just transmit to tune regardless of SWR.

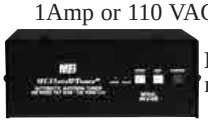
Has audio SWR meter and audio feed back. Competing products don't.

Built-in 50 MHz frequency counter.

Its built-in radio interface lets you use a simple wire cable to compatible rigs. Others require a cable with expensive electronics.

Binding post for random wire. Self-test.

Highly efficient L-network. 10 Amp/1000V relays, RF duty silver mica capacitors. 6½ Wx2¾Hx7½D in. 2.4 lbs. 12-15 VDC/1Amp or 110 VAC with MFJ-1316, $21.95.



MFJ-928, $199.95. **Like** MFJ-929, less LCD, manual tune buttons.

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Desktop/Remote Antenna and Antenna/Transceiver Switches

MFJ-4716
$89.95
6-position *Antenna* Switch

New!

MFJ-4726
$159.95
6-position *Antenna/Transceiver* Switch

Place these MFJ antenna or antenna/transceiver switches on your *desk* or use them *remotely*. You can place them out-of-the-way under your desk, in your garage or closet -- saves cable, eliminates cable mess.

Super easy-to-use rotary switches -- no complicated computer buttons to learn or microprocessors to fail or generate RFI that covers up rare DX.

Select 1 of 6 antennas and/or 1 of 6 transceivers in any combination. All unused inputs are grounded. Automatically grounds all inputs when you turn off your transceiver -- simply connect a sense line to your transceiver. When rotary switches are in OFF position, all inputs are grounded or control is transferred to the optional remote control.

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Antenna Switches - - 6 and 4 positions

• MFJ-4716, $89.95, *6-positions*; **• MFJ-4714, $79.95,** *4-positions*. 8Wx2¾Hx4¼D in.

Remote Controls:

• MFJ-4716RC, $39.95, *6-positions*; **• MFJ-4714RC, $39.95,** *4-positions*. 2¾Wx3¾Hx1D inches.

Antenna/Transceiver Switches - - 6 and 4 positions

Select one of 6 antennas *and* one of 6 transceivers in any combination with just two easy-to-use rotary switches.

Plug in antenna tuner, SWR/Wattmeter or other into its common ports, so it's always connected to the antenna and radio selected.

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New high voltage *current balun* lets you tune balanced lines at high power with no worries.

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New cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

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MFJ-986 Two knob *Differential-T*™

MFJ-986 $339.95

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 $279.95

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 $199.95

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3^{1}/_{2}$Hx$10^{1}/_{2}$Wx$9^{1}/_{2}$D inches.

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MFJ-949E $169.95

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. $3^{1}/_{2}$Hx$10^{5}/_{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E $129.95

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 $119.95

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 $109.95

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 $89.95

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MFJ-902 *Tiny Travel* Tuner

MFJ-902 $89.95

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, $139.95. 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 $59.95

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 $89.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $59.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921/924 $79.95

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 $99.95

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, $199.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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MFJ 2500 Watts *ContinuousCarrier*™ Tuner

Silver plated Edge-Wound Roller Inductor . . .1000/500 pF Variable Capacitors . . . Antenna Switch . . . 4-Core Balun . . . true Peak Cross-Needle SWR/Wattmeter . . . Dummy Load . . . Extremely Wide Matching Range . . . Patent Pending . . .

The MFJ-9982 ContinuousCarrier™ antenna tuner handles 2500 Watts continuous carrier output on all modes and all HF bands into most unbalanced antennas -- even on 160 Meters where even the best antenna tuners fail!

The MFJ-9982 gives you every feature you'll ever want in a high power tuner -- wide matching range, 1.8 to 30 MHz coverage, 6-position antenna switch, 4-core balun, dummy load, true peak/average lighted SWR/Wattmeter, 6:1 reduction drives with detailed logging scales, 3-digit turns counter, extra large knobs.

New!

MFJ-9982

$699.95

New Components, New Technologies

The *Heart and Soul* of the MFJ-9982 is its roller inductor and variable capacitors.

MFJ's high power, high-Q *continuous current AirCore*™ roller inductor is no ordinary roller inductor! It's edge wound from thick .06-inch *silver-plated* solid copper strap.

It can carry huge circulating RF currents and withstand tremendous heat that'll melt or burn up ordinary roller inductors.

Self-insulating construction reduces stray capacitance -- keeps self-resonant frequencies high and out-of-the-way. Dual, *silver-plated* compression wheels give ultra low-resistance contacts. New fast-tune crank knob.

High-current, *high-capacitance* 1000 pF and 500 pF air variable capacitors have low minimum capacitance and are self-insulating.

These newly developed air variable capacitors give you *very high efficiency* on 160/80 Meters *and* MFJ's patent pending innovation gives you *extremely wide matching range* on 10/12/15 Meters at 2500 Watts -- a feat *only* the MFJ-9982 has achieved.

Hi-Voltage/Current Antenna Switch

The antenna switch is completely isolated to handle high-voltage, high impedance antennas. High-current, low impedance antennas are handled by parallel sets of high-current contacts of *two* ceramic switches.

New 4-Core Balun

Powerful balun -- Four 2½ inch cores, 12-gauge *Teflon*™ wire. Run balanced lines at full 2500 Watts SSB/CW continuous, 24/7.

New Balanced Line Feed-Thru Insulator

Allows massive transmitter currents to flow directly to the antenna without passing through lossy screws or bolts.

TrueActive™ Peak Reading Circuit

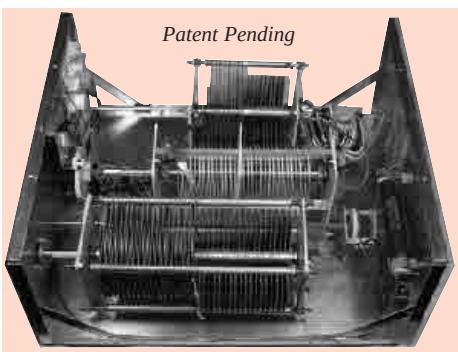
New *TrueActive*™ circuit reads *true* peak or average power on all modes. *Cross-Needle* meter reads SWR/forward/reflected power.

1500 Watt Dummy Load

1500 Watt air-cooled non-inductive 50 Ohm resistor. 100W/10 min., 1.5kW/10 sec.

New Cabinet maintains high Q

New roomy cabinet maintains high Q. Vent holes. Heavy gauge, .08 inch aluminum braced chassis. Vinyl cover, non-stripping PEM nuts, heavy 10-gauge and copper strap wiring throughout. 13¾Wx7Dx16¼D inches. 15 pounds.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MFJ 1500 Watt *Fully Balanced* Antenna Tuner

Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

New!

MFJ-976

$499.95

The MFJ-976 is a 1500Watt full Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

Four separate 500 pF in two gangs gives you a total of 2000 pF for highly efficient low loss operation on 160 Meters.

You get excellent 10 Meter performance because of MFJ's low minimum capacitance and exclusive *Self-Resonance Killer*™ high-Q *AirCore*™ roller inductor with silver plated contacts.

Heavy duty 1:1 current balun gives you *superb balance* and stays cool even at 1.5kW.

True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

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- Bar antenna for receiving AM broadcasts
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[1]Note that certain frequencies are unavailable. [2]5W output

TH-F6A

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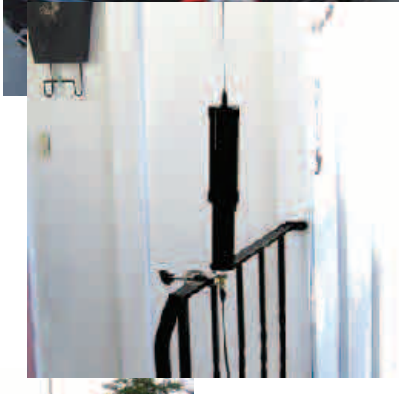

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MFJ tiny Travel Tuner

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
$89.95

Tiny Travel Tuner with 4:1 Balun

MFJ-902H
$109.95

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
$119.95

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
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ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

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$22.95
10 Feet

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$29.95
12 Feet

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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
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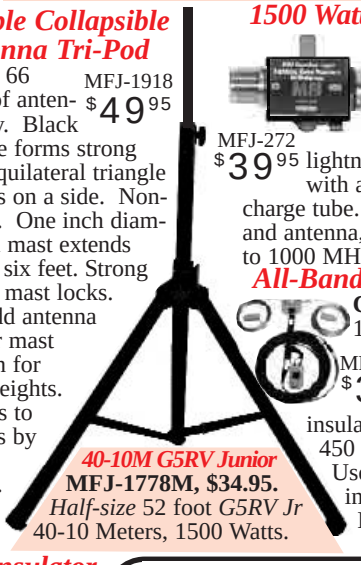

Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.

40-10M G5RV Junior
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Half-size 52 foot *G5RV Jr* 40-10 Meters, 1500 Watts.

1500 Watt Lightning Surge Protector

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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
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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.

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MFJ-16C06
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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.

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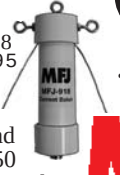

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True *1:1 Current Balun/Center Insulator* forces equal currents into dipole halves to reduce coax feedline radiation and field pattern distortion. Reduces TVI, RFI and RF hot spots in your shack. 50 ferrite beads on *Teflon*(R)coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

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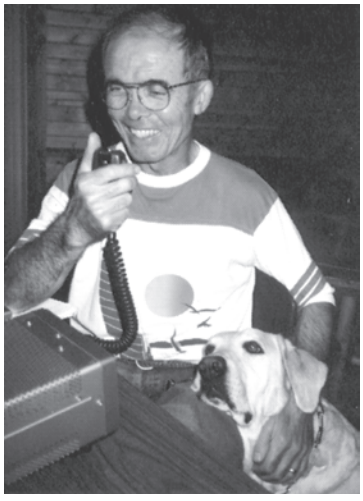

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• Just as on the FT DX 9000, the most important operational switches are arrayed around the Main Tuning Knob.
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HF/50 MHz Transceiver

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