QST

Official Journal of ARRL The national association for AMATEUR RADIO

Devoted entirely to **Amateur Radio**

www.arrl.org

June 2007

Field Day is June 23-24

QST reviews:

ICOM IC-V85 2 Meter Handheld Transceiver

National RF Vector-Finder VHF Direction Finding System

Battery Powered Soldering Tools

Inside:

A Field Day Logging Alternative

Tune Your Antenna System Audibly

Special 8-Page Field Day Section Inside!

$4.99 US $6.99 can.

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D-STAR MOBILES

Dual display

Diversity reception with band scope

Select your favorite display color, adjustable from amber to green

DIGITAL

D-STAR optional

NEW IC-2820H

D-STAR UPGRADEABLE 2m & 70cm

50/15/5W RF Output Levels • Right Band RX: 118-173.99, 375-549.99, 810-999.99MHz*; Left Band RX: 118-549.99MHz* • Analog/Digital Voice with GPS (Optional UT-123) • 500 Alpha-numeric Memories • Diversity Receive Capable

GEE, I WISH MY OWNER WOULD GET ME A...

UT-123

GPS MODULE AND ANTENNA

ID-1

GO DIGITAL ON 1.2GHz

10 Watt • High Speed Digital Data, Digital Voice, Analog Voice (FM) • Wireless Internet/Network Capable • PC Control via USB Port • Digital Callsign & Digital Code Squelch

ID-800H

GO DIGITAL ON 2m & 70cm

55 Watt VHF/50 Watt UHF • Wide RX: 118-173, 230-549, 810.999 MHz* • Analog/Digital Voice & Data • Callsign Squelch • CTCSS & DTCS Encode/Decode w/Tone Scan

D-STAR optional

IC-2200H

DIGITAL UPGRADEABLE FOR 2m

65 Watt • 207 Alphanumeric Memories • Digital Voice & Data w/Optional UT-118 • Optional Callsign Squelch • CTCSS & DTCS Encode/Decode w/Tone Scan • Weather Alert

AMATEUR | AVIONICS | LAND MOBILE | MARINE | RECEIVERS | SYSTEMS

ICOM®

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

Expanding your possibilities for the ultimate mission.

Introducing Icom's IC-R9500 Wide Band Receiver*

We've raised the bar with our super performance, multiple function wide band "measuring" receiver. The IC-R9500 has normal and wide spectrum scope functions. With five roofing filters before the first amp, two independent 32 bit floating point DSP processors, and 7-inch wide color TFT LCD, this is something to get excited about!

Features:

- 0.005 - 3335.000 MHz*
- USB, LSB, CW, FSK, FM, WFM, AM
- 1020 Alphanumeric Memories
- P25 (Option UT-122)
- Five Roofing Filters
- Dual DSP
- Digital IF Filter
- Multi-function Spectrum Scope
- 7-inch TFT LCD Display
- Noise Blanker
- Noise Reduction
- Multi-scan Functions
- Voice Synthesizer
- Digital Voice Recorder
- USB Connector
- Receive Assist Functions

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ICOM®

hy-gain® ROTATORS

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

HAM-IV

HAM-IV
$559.95

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

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

TAILTWISTER SERIES II

T-2X
$649.95

T-2XD
$1079.95
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!*

ROTATOR OPTIONS

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

AR-40

AR-40
$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.**

Digital Automatic Controller

DCU-1
$699.95

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

AR-35 Rotator/Controller

AR-35
$79.95

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

RBD-5
$34.95

NEW! Automatic Rotator Brake Delay

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

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MINI COOPER SHOWN WITH CP-5M UNIVERSAL LIP MOUNT AND COAX CABLE COMBINATION. NO HOLES TO DRILL!

MODEL	ANT CONN / COAX CONN
CP-5M	SO-239 / PL-259
CP-5NMO	NMO / PL-259
CP-5 3/8-24	3/8-24 / PL-259

Heavy-duty adjustable lip mount bracket with 16' 6" deluxe cable assy includes 18" mini RG-188A/U type coax for weather seal entry.

Max antenna 70" Attaches to trunk side/ van door/SUV door/ truck doors etc..

COMET BNC-24 DUAL-BAND 2M/70CM HT ANTENNA RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: BNC Super flexible featherweight whip

COMET SMA-24 DUAL-BAND 2M/70CM HT ANTENNA RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: SMA Super flexible featherweight whip

COMET SMA-503 DUAL-BAND 2M/70CM HT ANTENNA RX range: 100-1200MHz
• Length: 8.75" • Conn: SMA

Maldol MH-209 *(BNC Conn)* **MH-209SMA** *(SMA Conn)* **2M/70CM DUAL-BAND HT ANTENNAS**
3" length, soft rubber cover. Good performance in a small package!

COMET NEW! CSB750A DUAL-BAND 2M/440MHZ W/FOLD-OVER
Wavelength: 2M 1/2 wave, 70cm 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 42" • Conn: PL-259 • Max Pwr: 150W

COMET NEW! CSB770A DUAL-BAND 2M/440MHZ W/FOLD-OVER
Wavelength: 2M 5/8 wave center load, 70cm 5/8 wave x 2 center load • VSWR: 1.5:1 or less • Length: 51" • Conn: PL-259 • Max Pwr: 150W

COMET NEW! CSB790A DUAL-BAND 2M/440MHZ W/FOLD-OVER
Wavelength: 2M 7/8 wave center load, 70cm 5/8 wave x 3 center load • VSWR: 1.5:1 or less • Length: 62" • Conn: PL-259 • Max Pwr: 150W

Maldol AX-50 DUAL-BAND 2M/440MHz
Wavelength: 2M 1/4 wave • 70cm 9/8 wave • Length: 21" • Conn: PL-259 • Max Power: 60W

Maldol AX-75 DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 30" • Conn: PL-259 • Max Power: 60W

Maldol AX-95 DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 2M 1/2 wave • 70cm 5/8 wave x 2 • Length: 38" • Conn: PL-259 • Max Power: 60W

COMET B-10 / B-10NMO DUAL-BAND 2M/440MHz
Wavelength: 146MHz 1/4 wave • 446MHz 1/2 wave • Length: 12"
• Conn: B-10 PL-259 ,B-10NMO - NMO style • Max Pwr: 50W

COMET SBB-2 / SBB-2NMO DUAL-BAND 2M/440MHz
Wavelength: 146MHz 1/4 wave • 446MHz 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18"
• Conn: SBB-2 PL-259 • SBB-2NMO NMO style • Max Pwr: 60W

Maldol EX-107RB / EX-107RBNMO DUAL-BAND 2M/440MHz
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less • Length:29"
• Conn: EX-107RB PL-259 • Ex-107RBNMO NMO style • Max Pwr: 100W

COMET SBB-5 / SBB-5NMO DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • Length: 39"
• Conn: SBB-5 PL-259, SBB-5NMO - NMO style • Max Pwr: 120W

COMET SBB-7 / SBB-7NMO DUAL-BAND 2M/440MHz W/FOLD-OVER
Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58"
• Conn: SBB-7 PL-259, SBB-7NMO - NMO style • Max Pwr: 70W

COMET and Maldol Mobile

For a complete catalog, call or visit your local dealer.
Or contact NCG Company.1275 N. Grove Street, Anaheim, CA 92806
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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
Oh, what a beautiful morning! Darrell Schreiner, K9AIH, of Eau Claire, Wisconsin, gets ready for Chippewa Valley VHF Contesters, K9CVC, final push of a successful Field Day 2005 (photo by Chris Lantz, W9CDL). Inset photos, counterclockwise from top: Members of the Boeing Employees Amateur Radio Society, K7NWS, Seattle, Washington, prove CW works just as well on Field Day as it does in the shack; The Roanoke Valley Amateur Radio Club, W4CA, Troutville, Virginia, work together to raise an antenna and carry a beam to its Field Day home. Are you ready for Field Day 2007? Be sure to check out the *ARRL Field Day Cookbook* 8-page section following page 48 of this issue.

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Conquer the Elements!

IPX7

5 W Heavy Duty Submersible
2 m/70 cm Dual Band FM Hand held (220 MHz: 1.5 W)
VX-6R

5 W Ultra-Rugged,
Submersible 6 m/2 m/70 cm
Tri-Band FM Hand held
VX-7R/VX-7RB
(220 MHz: 300 mW)

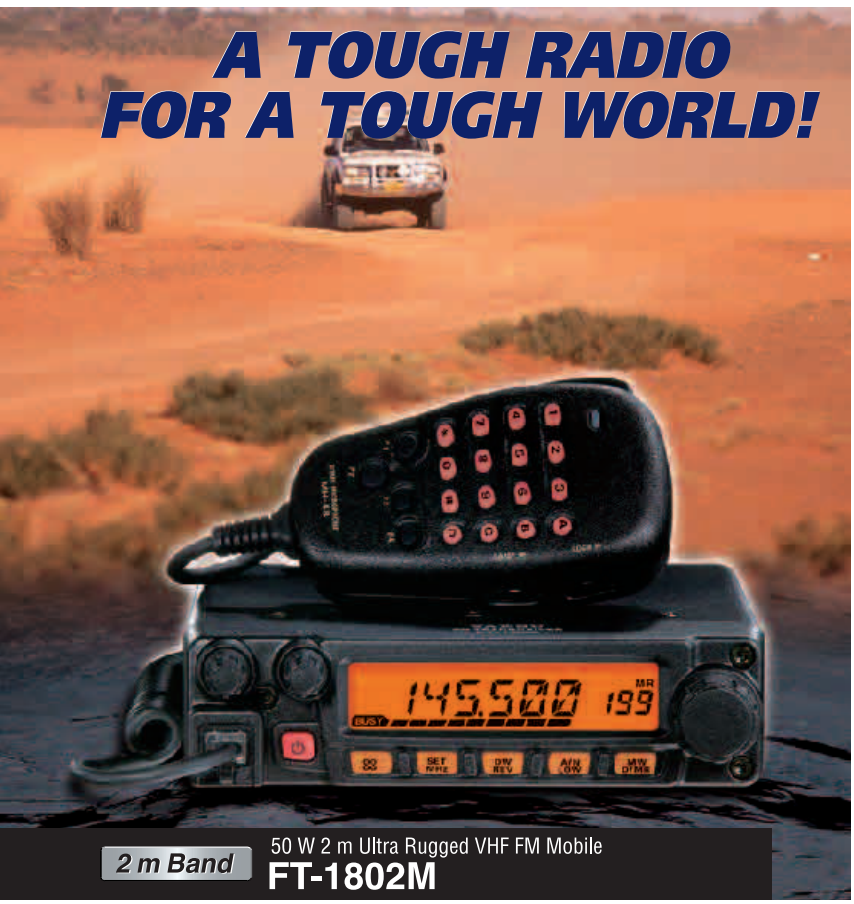
5 W Heavy Duty
2 m/70 cm Dual Band
FM Hand held
FT-60R

1.5 W Ultra Compact
2 m/70 cm Dual Band
FM Hand held
VX-2R

5 W Heavy Duty Submersible
2 m FM Mono Band Hand Helds
VX-120 VX-127 2 m Mono Band
70 cm FM Mono Band Hand Helds
VX-170 VX-177 70 cm Mono Band

Ultra-Rugged
5 W Full Featured
2 m FM Hand helds
VX-150/VX-110

A TOUGH RADIO FOR A TOUGH WORLD!



2 m Band

50 W 2 m Ultra Rugged VHF FM Mobile
FT-1802M

50 W 10 m/6 m/2 m/70 cm*
Quad Band FM Mobile
FT-8900R
*70 cm 35 W

50 W 2 m/70 cm*
Dual Band FM Mobile
FT-8800R *70 cm 35 W

50 W 2 m/70 cm*
Dual Band FM Mobile
FT-7800R
*70 cm 35 W

65 W 2 m Rugged FM Mobile
FT-2800M 2 m Band

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Great new features to support outdoor motor sports activities
Mobile Transceiver... Great appearance ...Easy to Operate

Actual Size

144/430 MHz FM DUAL BAND TRANSCEIVER
(144 MHz 50 W/ 430 MHz 40 W)

FTM-10R

■ **Compact Version (main body and front panel may be separated)**
144MHz 10W/ 430MHz 7W

FTM-10RS (available May, 2007)

- **The keys and indicators are illuminated with high brightness LEDs. The bright ocean blue negative type LCD display is easy on the eyes and adjustable for day or nighttime viewing.**
- **The Front panel meets the IP57 standard. (Waterproof at 3 feet for 30 minutes, and protection against dust)**
- **The main body of FTM-10R is a solid die-cast aluminum sandwich structure. The compact size is: 4.48" W x 1.50" H x 7.12" D, Including the detachable front panel (The Panel is only 1.64" D.)**
- **The microphone and PTT button are built into the front panel. No external microphone is needed for operation.**
- **Completely hands free operation is possible using the optional wireless Bluetooth function and a headset.**
- **It is Equipped with a high power 8-watt audio amplifier and a PA function. When combined with the moisture and dust protected MLS-200-M10 optional loudspeaker, there is plenty of loud audio for a noisy outdoor environment.**
- **AM/FM radio is built in. Listen to your favorite AM or FM stereo station, and at the same time monitor the amateur band.**
- **Loaded with many functions for your convenience at outdoor motor sports activities.**

●Includes event timer stopwatch, with an interval function ●With the intercom, you can communicate with a fellow passenger ●Tone Control ●Automatic Volume Control can adjust the speaker volume compared to nearby noisy environment ●External audio input is available to connect your iPod® ●Wireless cloning allows transfer of memory information without any cable ●The Control Head may be separated from the main body with the 10 feet cable and attached with a magnetic mount to a flat metal surface. Quickly put the radio in your vehicle or take it out with one touch release ●The simple hanger type bracket may be attached to the top or bottom, and the front may be tilted up or down 20 degrees with an adaptor bracket ●The message function can transmit alphanumeric messages you have entered beforehand ●The VOX function includes automatic audio delay on transmit, so the start of your message is not missing

The detachable Control Panel is shown here mounted on a motorcycle handlebar using the optional MMB-M11 multi-angle bracket.
The body section is not a waterproof structure (FTM10R).
The FTM-10RS compact Version (front panel and body) meets IP57 waterproofing standards.

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

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

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NEW COMPACT HF TRANSCEIVER WITH IF DSP

A superb, compact HF/50 MHz radio with state-of-the-art IF DSP technology configured to provide YAESU World-Class Performance in an easy to operate package.
New licensees, casual operators, DX chasers, contesters, portable/field enthusiasts, and emergency service providers - *YAESU FT-450…This Radio is for YOU!*

HF/50 MHz 100 W All Mode Transceiver

FT-450 Automatic Antenna Tuner ATU-450 optional

■ **FT-450AT With Built-in ATU-450 Automatic Antenna Tuner**

Compact size : 9" X 3.3" x 8.5" and Light weight : 7.9 lb

■ Large informative Front Panel Display, convenient Control knobs and Switches

■ The IF DSP guarantees quiet and enjoyable highperformance HF/50 MHz operation

Handy Front Panel Control of Important Features including:

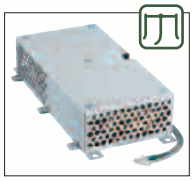
- **CONTOUR Control Operation**
  The Contour filtering system provides a gentle shaping of the filter passband.
- **Manual NOTCH**
  Highly-effective system that can remove an interfering beat tone/signal.
- **Digital Noise Reduction (DNR)**
  Dramatically reduces random noise found on the HF and 50 MHz bands.
- **IF WIDTH**
  The DSP IF WIDTH tuning system provides selectable IF passband width to fight QRM.
  SSB - 1.8/2.4/3.0 kHz , CW - 0.5/1.8/2.4 kHz
- **Digital Microphone Equalizer**
  Custom set your rig to match your voice characteristics for maximum power and punch on the band.
- **Fast IF SHIFT Control**
  Vary the IF SHIFT higher or lower for effective interference reduction / elimination.

■ The rugged FT-450 aluminum die-cast chassis, with its quiet, thermostatically controlled cooling fan provides a solid foundation for the power amplifier during long hours of field or home contesting use.

MOS FET RD100HHF1

The rugged aluminum die-cast chassis with cooling fan

■ Operate anywhere using optional internal or external antenna tuning systems



Internal Automatic Antenna Tuner ATU-450
Covering 160 m to 6 m Amateur Bands Dipole or Yagi antennas
(The ATU-450 Antenna Tuner is included in the FT-450AT)

External Automatic Antenna Tuner FC-40
Covering 160 m to 6 m Amateur Bands (with 65+ ft end fed wire)

Active Tuning Antenna System ATAS-120A
Covering 40 m to 6 m Amateur Bands
(For mobile)

More features to support your HF operation

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The Field Day Bug

"Field Day 2007 should be one for the record books! Sunspots may not be cooperating, but every other indicator points toward an outstanding, memorable event. If you have never participated in an ARRL Field Day — or if it's been a few years since your last outing — make this the year you join the fun."

Field Day (FD) always falls on the fourth full weekend of June, which makes it the 23rd and 24th this year. Explaining FD brings to mind the old story of the blind men and the elephant; their description varies widely, depending on what part of the beast they touch. If you experience FD with a group of serious competitors who set out to maximize their score, you will think it is a contest. If you go out with your local general-interest radio club, you might think it's a picnic with a bit of radio operating and public relations thrown in. If you are new to Amateur Radio you're likely to view it as a great learning experience, and if you're an old-timer as an opportunity to renew acquaintances and share memories.

For all of us, Field Day is an opportunity to pack a lot of Amateur Radio into one weekend — an opportunity that has become more valuable as our world has gotten busier and operating from home has become more difficult, either for lack or time or because of antenna limitations. FD gives us a chance literally to "head for the hills," preferably as part of a group; it's more fun to share the experience with others, and more rewarding to learn antenna and operating lore from one another. The operating format is to make quick contacts, exchanging your number of transmitters, operating category and ARRL section with other stations. Each station can be contacted once per band (except 60, 30, 17 and 12 meters, which are off limits) and mode (CW, phone, and digital). CW and digital contacts are worth twice as many points as phone, so there is an incentive to be able to do more than just talk (not that good phone operating is easy — picture an Air Traffic Controller at Atlanta Airport!).

While the FD focus is on setting up temporary portable stations operating on emergency power, stay-at-homes and mobiles also can participate. Since 2003 there has been a special category for stations operating from established Emergency Operations Centers. The goal is to show that we can communicate with one another, *no matter what*, without the need for *any* infrastructure. This is a capability that we tend to take for granted, but that is increasingly rare — and increasingly valuable — as the world becomes ever more dependent on complex telecommunications systems to cope with daily life. Cell phones are ubiquitous these days, and it's natural to rely on them — but what do we do when they don't work? Most people have no answer to that question. As radio amateurs, we do — but only if we keep our batteries charged, our equipment ready, and our operating skills honed.

This year's theme for Field Day is "Bitten by the Bug!" It's all too common to be bitten by all manner of insects at an FD site, but the "bug" we have in mind is simply enthusiasm. For many amateurs, this year's event will be the first where they can be the control operator of an HF station. Newly minted General and Extra licensees will be on all bands, and Technicians will be able to operate on 10-meter SSB and RTTY.

By the way, if you think that the lack of sunspots means there's no point setting up for 10 meters this year, think again. June is prime time for sporadic-E, and it's a rare FD that doesn't reward preparation and patience with a spate of 1000-mile contacts. You may be surprised, too, at how reliably 10 meters works for "local" QSOs out to 200 miles or so, especially if you're in a quiet location that's in the clear.

Are you getting bitten by the bug? A good next step is to *read the rules* — even if you're a loyal FD regular, since there are some changes this year. A summary appeared in last month's *QST* on page 98. The complete, official rules are at **www.arrl.org/contests/rules/2007/fd.html**. Don't know what ARRL section you're in? If you know your county, just go to **www.arrl.org/FandES/field/org/secinfo.html**. There is a link from that page to a list of standard abbreviations.

The biggest change in the rules is that it will be easier this year to earn Get-On-The-Air (GOTA) bonus points. The purpose of the GOTA station is to encourage Novices, Technicians and prospective hams under the direct supervision of a properly licensed control operator, as well as inactive hams, to get acquainted or reacquainted with HF operating. Up to 500 QSOs can be counted from this station, plus 20 bonus points for each 20 contacts made by an eligible operator (up to a maximum of 100 per operator). The bonus points double if your group provides a full-time "GOTA Coach"; see the official rules for details.

Field Day is *not* about taking risks. A need for improvisation is likely to crop up at the most carefully planned event, but safety always comes first — especially when erecting antennas and operating generators. Always be mindful of the safety not only of your participants, but of any visitors to your site as well.

Have fun on Field Day, and may the only bugs you encounter be friendly ones!

David Sumner, K1ZZ
ARRL Chief Executive Officer

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

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

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

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

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

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

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

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For just $369.95 you can greatly increase your effective radiated power and hear far better!

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

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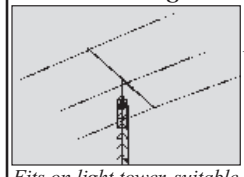

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TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$869.95**
TH-5MK2	5			1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$759.95
TH-3MK4	**3**			**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$469.95**
TH-3JRS	3			600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$359.95
TH-2MK3	**2**			**1500**	**10, 15, 20**	**3.25**	**80**	**6**	**27.3**	**14.25**	**20**	**1.9-2.5**	**CD-45II**	**$369.95**
EXP-14	4			1500	10,15,20 opt. 30/40	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM IV	$599.95

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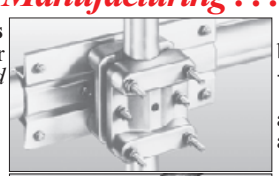
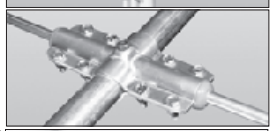
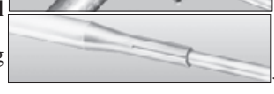


2. ***Tooled*** *Boom-to-Element Clamp*



3. **Thick-wall** *swaged* aluminum tubing



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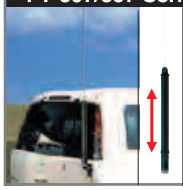

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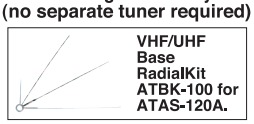

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This Just In

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

In Brief

- The ARRL has been working with the US Department of Defense to develop a plan to mitigate alleged interference from 70 cm ham radio repeaters to military radar systems.
- Position available: ARRL HQ is looking for an Assistant Editor. For more information on this and other available positions, see www.arrl.org/announce/jobs/.
- Four CubeSats containing payloads operating on Amateur Radio frequencies were among several spacecraft launched successfully April 17 from Baikonur Cosmodrome, Kazakhstan.
- ARRL General Counsel Chris Imlay, W3KD, and Chief Technology Officer Paul Rinaldo, W4RI, met March 20 with officials of the American Red Cross to clarify ARC requirements regarding background checks.
- President George W. Bush has honored ARRL member Randy Hatfield, AG6RH, of Victorville, California, with the President's Volunteer Service Award.
- The FCC has invited opposition comments ("oppositions") to two petitions for reconsideration filed in the wake of the Commission's Report & Order (R&O) in WT Docket 05-235.
- Andrea Hartlage, KG4IUM, of Grayson, Georgia, is the winner of the prestigious William R. Goldfarb Memorial Scholarship for 2007.
- On April 18, the International Amateur Radio Union and its member-societies representing more than 150 countries around the world celebrated World Amateur Radio Day 2007.
- Civilian space traveler Charles Simonyi, KE7KDP/HA5SIK, started making contacts with the earthbound ham radio community from the International Space Station soon after he arrived.
- Several Amateur Radio special event operations marked the 95th anniversary of the sinking of the RMS *Titanic*.
- The FCC has levied a $10,000 fine on a Florida construction company for "willful and repeated violation" of the Communications Act of 1934 for operating radio transmitting equipment on 2 meters without a license.
- The winner of the *QST* Cover Plaque Award for March is Ed Fong, WB6IQN, for the article "The DBJ-2: A Portable VHF-UHF Roll-Up J-Pole Antenna for Public Service."
- The ARRL alerted members — and especially users of the ARRL E-Mail Forwarding Service — about bogus e-mails that claim to be from the "arrl.net user support team." There is no such entity.
- A bill in the Maine Legislature that would have required credentials for Amateur Radio emergency communications volunteers has died in the legislature.
- ARRL again sponsored a display at the National Association of Broadcasters Convention April 14-19 in Las Vegas.
- An Amateur Radio display entitled "Amateur Radio — a European Resource" was unveiled at the European Parliament in Brussels, Belgium in March.
- The ARRL granted Colvin awards to the N8S Swains Island DXpedition and the 2007 Scarborough Reef (BS7H) DXpedition.
- NASA Space shuttle veteran and International Space Station Expedition 12 commander Bill McArthur, KC5ACR, will be the League's guest at Dayton Hamvention 2007.
- The ARRL and the National Public Safety Telecommunications Council (NPSTC) signed a Memorandum of Agreement.
- The ARRL DXCC Desk has approved these operations for DXCC credit: DXØJP (Spratly Islands, 2007 operation), 9M4SDX (Spratly Islands, 2007 operation), 9U9Z (Burundi, 2007 operation), YWØDX (Aves Island, 2007 operation) and 1A4A (Sovereign Military Order Of Malta, 2007 operation).

Media Hits

Allen Pitts, W1AGP

As the code requirement change faded from the news headings, you might have expected that there would be a drop in the number of major articles promoting Amateur Radio. But that did not happen. The PIOs work through March and April continued to generate a lot of positive press.

- One of the highlights of the period was the presentation of the President's Volunteer Service Award to Randy Hatfield, AG6RH, of Victorville, CA. This was first reported in *The Daily Independent* (Ridgecrest, CA) on April 5 and carried in many other outlets.
- With the memories of Katrina fresh in the minds of many people, KVUE-TV's (New Orleans) article and coverage of "Coast Guard partners with ham radio operators" on April 3 was more than a minor plug. Sandra Gonzalez did an excellent presentation of how the organizations work cooperatively in crises.
- The March 28 edition of *Radio World* carried a full page article by James Careless titled, "ARRL Is Robust as It Nears 100." Starting with the events of 1914, it showed the continued role of Amateur Radio in providing critical services.
- Other full page hits included, "Reaching out with Radio" by C. Alcorn in the March 5 *Sandusky Register* (Sandusky, OH) and "It's Not Too Late To Reach Out and Touch Someone With Ham Radio" by M. Dispirito in the *Prime Time Journal* (Rutland, VT).
- Ham radio action was reported by KOB-TV in Albuquerque, NM on March 16 with "Hikers plucked from Sandias" by R. Upton and again on March 15 when the City of Modesto, CA, police issued a special press release praising hams for aid in finding an 82 year old man with dementia.
- The past of Amateur Radio could be found in many articles about the *Titanic*'s 95th Anniversary and the Branson, MO hams' role in the celebrations, while the future was evident in articles about students and ham activities. Among them were: "Amateur radio lets students talk to the world" (March 11 *Tribune Review*, Pittsburgh, PA), "Orbiting astronaut talks to local students" (March 8 *Ledger-Sentinel*, Oswego, IL), "California Students learn Emergency Radio" (March 8, Voice of America), "Fairborn students talk with man orbiting earth" (April 13 *Dayton Daily News*, Dayton, OH).

HAROLD KRAMER, WJ1B

ARRL COO Harold Kramer, WJ1B, gave the keynote address at this year's Communications Academy, held March 31-April 1 at Seattle Pacific University (top). From the left in the bottom photo: Western Washington Section Manager Ed Bruette, N7NVP; Northwestern Division Director Jim Fenstermaker, K9JF, and Idaho SM Doug Rich, W7DVR.

A Whale of an Event in Arkansas

COURTESY N3HOW

Razorback is a nickname for the Finback Whale. The Razorback is also the name of a submarine, the USS *Razorback* (SS-394), to be precise. It is the premier artifact on display at the Arkansas Inland Maritime Museum in North Little Rock, Arkansas.

The *Razorback* will be the site of the US Power Squadrons Amateur Radio Net's special event station this year (**www.usps.org**). The event is part of the National Safe Boating Committee's National Safe Boating Week campaign. The station will be operating June 2-3 with the special call sign N5R. The frequencies will be 7.267, 14.267, 21.367, and 28.367 MHz. Special thanks to Lt Ian Campbell, WA5OFT, for coordinating this event. — *Don Stark, N3HOW*

The radio room of the USS *Razorback*, site of this year's US Power Squadrons special event station, N5R.

Inside HQ

Field Day is June 23-24 — Enjoy!

It time for Field Day 2007. Here's what happens inside HQ when Field Day rolls around.

Based on FD reports received each year, more than 35,000 people participate in FD including entries from over 1,300 ARRL Affiliated clubs. It is an event where families, kids and old friends get together and new friends are made. If you do participate, we urge you to submit your entry form at **www.b4h.net/cabforms/**. Even if you operate from your home station and make only a few contacts, these entries help us gauge participation levels, determine the effectiveness of the various bonus point programs and identify operating trends for future Field Days. A verified record of FD participants demonstrates our emergency preparedness, capabilities and response. Our ability to quickly mobilize and get on the air under adverse conditions creates a powerful argument for our Advocacy efforts.

Here at HQ, we will be operating W1AW on Field Day. Like many of you we will be operating as Class F — with emergency power available although we do not use it for the full period because of W1AW's location in a residential neighborhood. Since Katrina, we have learned to pay more attention to our own state of readiness and FD is our most extensive emergency preparedness test of the year here in Newington. We intend to give W1AW a rigorous workout to see how well it performs on backup power and on multiple bands for 24 straight hours (including multiple transmissions of the W1AW Field Day bulletin on standard W1AW bulletin frequencies). Along with the equipment evaluation, we will be training many of our newly licensed and upgraded staff members in emergency preparedness and on-air operations.

Just for fun, our Membership Manager, Katie Breen, W1KRB, will be running a Field Day Blog on our Web site. We will also be producing some new *youtube* videos that will be located at **www.youtube.com**. To find them, along with some of our previous videos, simply type "ARRL" into *youtube*'s search engine.

In this issue of *QST*, we have prepared a special Field Day eight page tear-out insert. Managing Editor Joel Kleinman, N1BKE, and Assistant Production Supervisor Jodi Morin, KA1JPA, led this effort at taking a serious — and not so serious — view of Field Day. Here's what's in it:

- A breezy survey of antennas — what has worked for FD groups and what doesn't work as well
- Field Day fare — a humorous take on feeding your FD group, complete with a couple of tried and true recipes
- How to make FD satellite contacts
- All the different ways to earn bonus points including GOTA stations
- Powering up — tips and techniques for supplying electricity at your remote FD location
- Our latest chart of the US Amateur Radio Bands

Other FD-related articles and reference material appear on pages 9, 42, 44 and 96.

We also have expanded our line of FD products adding a Field Day Survival Kit and FD Water Bottles to the ever popular Field Day shirts and pins.

I hope that you get to participate in this year's Field Day activities and have some fun!

73,

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

Guide to ARRL Member Services

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Ameritron's *toughest* Amp

with Eimac(R) 3CX1200A7 toughest tube

AL-1200

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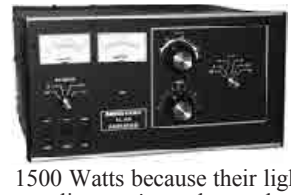
Get ham radio's *toughest* tube with AL-1200. The *Eimac*(R) 3CX1200A7 has a 50 Watt control grid dissipation and the lowest history of field replacement of any modern transmitting tube that we use. 90 Watts in gives you full power out. All HF bands, all modes. 76 pounds, 17Wx18½Dx10H in.

Ameritron's *classic* Amp

with 2 graphite plate classic (R) 3-500G tubes



AL-82

$2645

Suggested Retail

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Most linears using 3-500Gs *can't* give you 1500 Watts because their lightweight power supplies *can't* use these tubes to their full potential. AL-82 is ham radio's *only* super 3-500G amp! 100 Watts in gives you full power out. All HF bands, all modes. Hefty 76 pounds, 17Wx10Hx18½D inches.

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3rd Order IM: <-30 dBc
SWR tolerance: 2.5:1
Drive power: 50 to 55 watts nominal
Tube: 2x 4CX800 Svetlana Tetrodes
Cooling: Forced air
Antenna output: SO-239 connector
Input: SO-239 connector
Tuning/Band switching: Manual band switching & tuning
Power: 100, 120, 200, 220, 240 V ac, 50/60 Hz
Power tap selection: Manual
Interface: USB port for remote monitoring and performance data logging
Protection: Protected against all common faults
Display: LED bar graphs
T/R switching: Vacuum relays; QSK (full break-in)
Bypass capability: 150 watts

ALPHA 9500

Frequency coverage: All amateur frequencies from 1.8-29.7 MHz
Power output: 1500 watts minimum
Harmonic Output: Better than 50 dB below rated output.
3rd Order IM: <-30 dBc
SWR tolerance: 3:1
Drive power: 65 watts nominal
Tube: Eimac 8877
Antenna outputs: 4xSO-239 connectors
Antenna selection: 1 or 2 outputs per band/segment
Input: SO-239 connector
Tuning/Band switching: Automatic. Manual override possible
Power: 100, 120, 200, 220, 240 V ac, 50/60 Hz
Power tap selection: Automatic
Interface: USB. Full remote control capability
Protection: Protected against all common faults
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Up Front in QST

Field Day 2007

Since the first Field Day in 1933, hams (and those they can convince to join them) have enjoyed making contacts with other FD stations from the great outdoors. 2007 promises to be a year to remember, as several rules changes promise more FD fun. A special 8 page section elsewhere in this issue explores just a few of the ways hams and their guests can make this Field Day weekend (June 23-24) memorable. Check it out!

STEVE GALCHUTT, NØTU

"Goat-a" station: **Steve Galchutt, NØTU, took to the hills (well, mountains, since we're talking Colorado here) last FD, accompanied by his two pack goats, Peanut and Rooster. He writes: "Today thanks to QRP, lightweight batteries and solar technology it's possible to sit on a mountaintop somewhere off the grid and join the Field Day fun far from the crowd and still be connected. Thanks to all those ops with great ears! Field Day...it's all about getting outdoors, setting up an antenna, making sure it plays with the radio, and making contacts and sharing in the *fun* of sharpening our emergency preparedness skills for the good of mankind."**

WEB WILLIAMS, KR4WM

Ham jersey: **While eating at a restaurant near Saginaw, Michigan, Web Williams, KR4WM, of Myrtle Beach, South Carolina, discovered this framed football jersey on a wall. "I'm not a sports fan," he writes, "but I felt the combination of '59' and 'HAM' was pretty interesting!" Football fans will recognize the jersey of former Pittsburgh Steelers All-Pro outside linebacker Jack Ham, who came in "59" on opposition quarterbacks and other unfortunate ball carriers during a notable 12 year NFL career.**

Kids Learn Morse Code at Dutch Military Aviation Museum

Hans Coelers, PA0AAJ

I am a volunteer at the Dutch Military Aviation Museum, at Soesterberg, The Netherlands. We have a vintage radio shack in a mock-up of a B-25 Mitchell WWII-era bomber. I operate mainly CW, on 80-40-20 meters; the call sign is PI9MLM.

The museum is giving workshops for children age 8 to 12 years on jet engines, flying and Morse code. On arrival the kids receive a booklet with all the information about Samuel Morse, the code and instructions on how to assemble the "sounder." The cost is about $5 per child.

Then there's an explanation of Morse code history and a demonstration with station PI9MLM. The "sounder kit" consists of a pre-drilled wooden base, screws, buzzer, battery holder, plus batteries and keyer, made from a strip of PC board and a doorknob. (The kids can keep the sounder and take it home.) Assembly takes about 20 minutes.

After the assembly of the "sounder" they start to practice Morse, trying to key their name. On a laptop with a CW program they can check if the dot-dash ratio is okay.

The Morse workshop takes about 90 minutes, and is very successful — the kids like the "secret code" and they also start writing in dots and dashes.

HANS FRANSE

A 40 year ARRL member, Hans, PA0AAJ, helps teach Morse code to youngsters at a Dutch military museum.

It's the 2nd Annual Photo Contest!

Have you ever wanted to see a photo of yours in *QST,* the annual ARRL Amateur Radio Calendar or another ARRL publication? Well, here's your chance!

Not only will your photographic skill be propagated far and wide, but we're offering a $100 prize to the winning entry. The winning photo and three runners-up will be published in *QST*. All submitted photos will also be considered for the 2008 ARRL Calendar.

Deadline: Photos must be received at ARRL HQ by June 30, 2007.

Subject: Must be related to Amateur Radio, and be in good taste. Photos will be judged on overall quality and composition.

Requirements: Digital images or color prints accepted. If digital, images should be high resolution. A digital image up to 3 MB can be e-mailed to **upfront@arrl.org**, subject line "2007 Photo Contest." An image may also be burned to a CD and mailed to ARRL Photo Contest, 225 Main St, Newington, CT 06111. All entries must include caption information describing where the photo was taken, along with the names and call signs of any persons shown. If you entered last year's contest, please do not resend the same photo for this year's contest.

PT2TD

A winner: **This photo of the picturesque TH7-DX triband beam at PT2TD near Brasilia, Brazil, was one of the winning entries in the 2006 ARRL Photo Contest. The deadline for this year's contest is June 30.**

Miscellaneous: All submitted photos become the exclusive property of the ARRL, and decisions of the judges (*QST* editorial and production staff) are final. One entry per person.

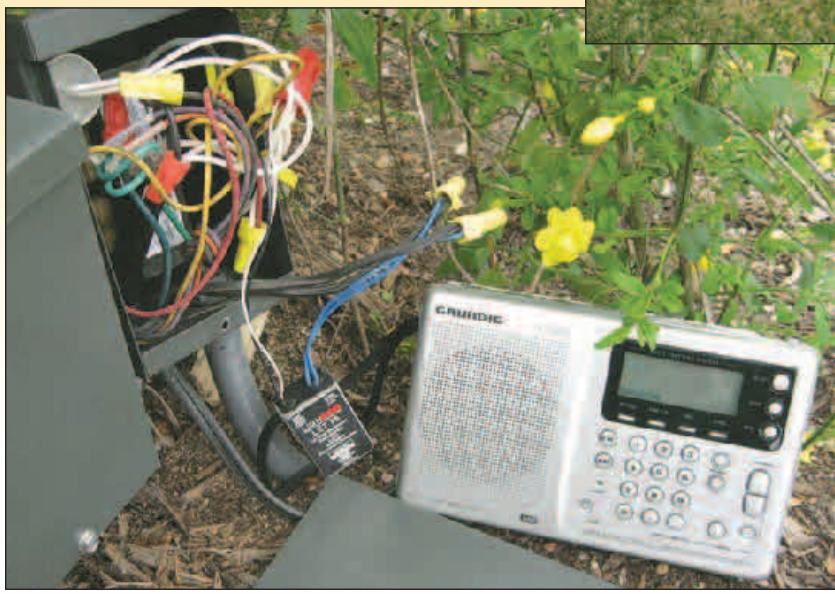
Thank you, and good luck in the 2007 ARRL Photo Contest!

No More Noise

My neighbor installed 12 V lighting that made S9 noise on my receiver on 40-17 meters. I met with him and after working for a couple of hours on locating the source, we finally found it. It was a very small switching power supply.

The noise was S9 before the chokes were installed. After the chokes were installed the noise is still there but it's low, just a little above the daytime background noise. My neighbor will use the lights at night when the noise on the band is so high I will not hear the noise at all — case closed. My neighbor was very cooperative.

The chokes I used are Amidon 2.4 inch toroids. See **www.amidoncorp.com/aai_specifications.htm** and look under ferrites for RFI.
— *Gene Preston, K5GP*



Good chokes make good neighbors: **The small 120/12 V, 75 W power supply next to the radio was the source of my noise problem.** ***Inset:*** **The QRN solution — 22 turns of 14 gauge wire wrapped around an Amidon Associates toroid.**

S. KHRYSTYNE KEANE, K1SFA

Morse gets "thru": **This sign is in Becket, Massachusetts.**

Have a Photo for UpFront?

We're always looking for unusual photos for Up Front in QST, so if you have one, send it our way (along with caption information and a photo credit), and you might just find it in an upcoming issue. Digital images (high-resolution only, please) can be e-mailed to upfront@arrl.org, and prints can be mailed to: Up Front in QST, c/o ARRL HQ.

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TEN-TEC

CORRESPONDENCE

ARISS QSO OUT OF THIS WORLD

♦ Thank you for the terrific story about Boulder Hill's ARISS contact ["The Next Gen Hams: It's Elementary," May 2007]. I'm still receiving letters about it, as well as notes and things from the school board, village officials and parents. I really had no idea that this contact would mean so much to the kids and adults; the kids are still wearing their ARISS T shirts at school. I gave a recap of the QSO at our ham club meeting, and all the adults who were watching told me the same thing — when Suni Williams', KD5PLB, voice came through the static, they had tears running down their faces! The ARISS contacts are great for the kids, the adults and for others listening or participating, as well. I hope all hams, the astronauts and NASA know how much this program means to people.

JOHN SPASOJEVICH, K9COE
Montgomery, Illinois

CONTESTING INCREDULITY

♦ In his letter "Share the Bands" ["Correspondence," May 2007], John E. Gercken, AA9UF, highlights the chaos that results during the many RTTY contests that now occupy the HF bands at weekends. He observes that such events often result in RTTY stations operating "all over the place," causing much frustration to CW experimenters and ragchewers.

Increasingly, it is the lack of respect for international band plans and a disregard for other users of the amateur service that now characterizes the modern amateur radio contester. Contesters are adopting a more aggressive approach and becoming more obsessive in their desire to maximize their contest score. The victims of modern contesting are the 90% of amateurs who are denied reasonable access to the popular HF bands at weekends.

In relation to the similar situation that often happens during CW contests, Mr Gercken writes: "... CW operators have no room to complain when they are guilty of the same thing." Sir, this is a misleading assertion. Such a comment reflects the commonly held belief that those inconvenienced by one group of contesters will inevitably "settle old scores" in the next contest.

Thankfully, there are still many amateurs who want to do more than exchange call signs with robots. But unless national societies meet the needs of the 90 percent, these amateurs will continue to leave the hobby to follow more worthwhile activities.

STEVE RAWLINGS, GW4ALG
ARRL Life Member
Chepstow, Wales

AN IDEA WITH MERIT

♦ Through a friend of mine who is a Scoutmaster for one of the local Boy Scout troops. I was invited to become a Merit Badge Counselor and teach Radio Merit Badge classes. To complete all the requirements, Scouts chose to focus on Amateur Radio, broadcast radio or shortwave listening; of the three Scouts who earned their badge in my class, two of them decided to go for the Amateur Radio option. I had a little apprehension about teaching the class, but once in the middle of the action, sharing my passion for radio, seeing the sparkle of interest in the eyes of those boys, listening to their answers when they proudly demonstrated what they had learned, it made all the efforts worth it.

I encourage my fellow Amateur Radio operators to get involved with the local BSA Council and become Counselors for the Radio or Electronics Merit Badge. Let's do our part to touch the lives of our younger generations. If you want to give back for all the good that radio has brought into your life (an exciting hobby, friends, a career, maybe even a spouse!) and contribute to bring young and brilliant minds into our ranks, I can not think of a more worthy endeavor.

PAOLO BATTEZZATO, N1XOI
Westford, Massachusetts

[*Editor's Note: To find out more about the ARRL's program for both Girl and Boy Scouts, please see* **www.arrl.org/FandES/ead/scouthbk/**].

QUESTIONING THE POOL

♦ This is a reply to David Kruzek, N6AZA ["Correspondence," May 2007]. David asked if it was a fair trade-off to add more questions too the question pool of all class grades since Morse code is no longer a testing element (I will use some of last month's correspondence articles to help me with this reply). No, David, it is not fair to add more questions. You see *dit* and *dah* did not teach me what a repeater split is. *Dit* and *dah* did not teach me to wait and listen to a frequency I wanted to work, and then ask if the frequency was in use before calling CQ. *Dit* and *dah* did not teach me that I should not piggy-back onto other callers when chasing a hard DX. I learned this information by studying the material and retaining the material learned.

I will offer this: Instead of adding more questions, let's take away some of the easy questions and replace them with questions like "What is a repeater split?"

BRUCE BORELLO, KI4KFW
Fort Walton Beach, Florida

HIGH FREQUENCY EQUALS HIGH PRICE?

♦ I've been a Technician since March of last year. I have gotten involved in Emergency Communications groups, as well as a SKYWARN spotter. I am also a Net control station for SKYWARN and a VHF traffic net. To say that I thoroughly enjoy the hobby is an understatement. It was always my goal to upgrade to General, Morse code status notwithstanding. CW is another mode of operation, and one that I think is vital to amateur operation.

What is making me hesitate about upgrading to General is the cost of HF equipment, new or used. I think the manufacturers should look at producing a true entry-level HF rig. I think a great entry-level HF rig would be one that put out 100 W, had the 10, 20 and 40 meter bands in it, a power supply and an antenna tuner; the buyer only has to buy an antenna separately. I'd love to think that a radio like this would be able to be priced around $500. I'd have to save up for it, but I also know I'd be on the air a lot sooner than I can be now.

Is it a case of wanting instant gratification? Yes, that is absolutely part of it. Why upgrade if I can't utilize my new privileges immediately? Unlike the VHF/UHF rigs, HF rigs, new or used, are just too far out of reach for me. Maybe I'm a poor man in a rich man's hobby, I don't know. I do know this — it's probably going to be a long time before I upgrade my license.

JOE PICA, KC2PJL
Wanaque, New Jersey

Your opinions count! Send your letters to "Correspondence," ARRL, 225 Main St, Newington, CT 06111. You can also submit letters by fax at 860-594-0259, or via e-mail to: **qst@arrl.org**. We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and to fit the available page space. Of course, the publishers of *QST* assume no responsibility for statements made by correspondents.

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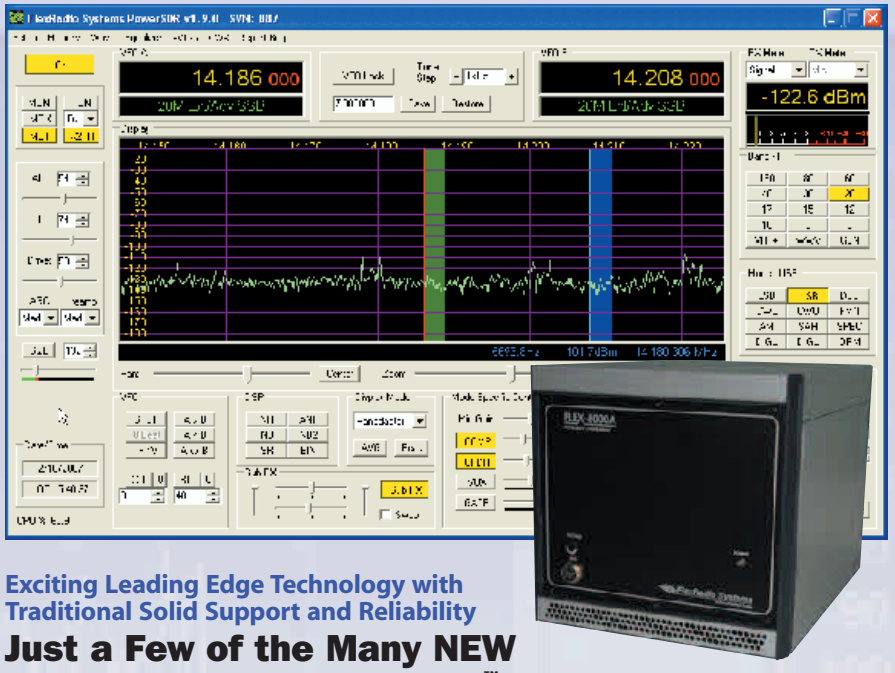
Mike, KM0T – I had always dreamed about a radio and interface like this; but never thought it would ever happen. I sometimes catch myself staring at the screen showing the microwave band frequencies thinking "Man this is awesome!" Seems every time I turn around, there is something new coming down the pipe to make the whole setup better.



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- Great for desktop or DXpedition!

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Frequency:
1.8 ~ 28MHz all amateur bands including WARC bands and 50MHz

Mode:
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RF Drive:
85W typ. (100W max.)

Output Power:
HF 1kW PEP max.
50MHz 650W PEP max.

Matching Transceivers for Auto Band Decoder:
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Drain Voltage:
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ESD Control for the Radio Amateur

Give those pricey solid-state devices a fighting chance!

Bill Reese, W8WER

Did you ever walk across a carpeted floor and get a shock when you reached for the door knob? Have you heard the clothes crackle as they are removed from the dryer? Sure, static electricity — everyone knows about that, right? *Static* implies "at rest" so static electricity refers to the difference in potential between your finger and the door knob. The spark you feel is actually called electrostatic discharge or ESD. That same spark that jumps to the door knob can destroy electronic components if applied to them instead of the door knob. You do not have to see or feel a spark to damage a component, either. The lowest level of ESD that most people can feel is about 2000 V while voltages as low as 20 V can damage sensitive components.

Do I Need to Worry?

Different components have different levels of sensitivity. Passive devices such as resistors and capacitors are not ESD sensitive at all; neither are zener diodes. Bipolar transistors and diode rectifiers can be nonsensitive or mildly sensitive. All metal oxide semiconductor (MOS) devices are ESD sensitive. Microprocessors and memory chips, with very close spaced features, are especially sensitive.

Static charge usually builds up due to friction, scuffing your shoes across the carpet, the tumbling of the clothes against each other in the dryer — even the movement of the clothes you are wearing can cause static buildup. When you scuff your shoes across the carpet, you and the carpet take on opposite charges, but why does a spark (current) flow to the door knob? As you bring your charged finger near the knob, like charge in the knob is displaced away from your finger and opposite charge is attracted. When the gap between your finger and the knob gets small enough, a spark jumps the gap. You do not have to rub the door knob to generate a static field; in fact this would not work since the knob is metal. If you become charged by any means, ESD can occur to the knob. The same is true with electronic components; if you become charged by some means, ESD can occur to the component even if it is not charged initially.

You say you have never experienced an ESD-related component failure? How about that project that mysteriously failed after 6 months or a year of operation? You probably blamed the failure on bad parts or that lightning storm the month before. Possible, but it also might have been the result of an ESD event during construction. ESD events do not have to destroy a device immediately, but may weaken it and cause premature failure months after the event.

How They Do It in Industry

ESD control is taken very seriously in industrial electronic assembly areas. The goal is to make sure that all materials (including the human bodies) at each assembly station are always at the same potential. Figure 1 shows a typical ESD-safe industrial work station. The bench has a special static dissipative surface and is grounded via a 1 MΩ resistor. Static dissipative materials have the unique and desirable characteristic of allowing charge to flow, but at a controlled rate, so the charge can be bled off without a damaging current surge. The operator is wearing a wrist strap that is connected, also via a 1 MΩ resistor, to the same ground point. She is also wearing a smock made from static dissipative material that prevents the buildup of static from her clothes. The floor is painted with a special static dissipative paint. The paint works in conjunction with conductive heel straps to ground operators who are standing or walking and are not grounded through wrist straps.

In addition, there are other procedures to control what materials are allowed at the workstation. Her soldering iron has a grounded tip and is ESD safe. All parts containers are made of static dissipative material. No common plastics are allowed. Paper is placed in static dissipative sleeves; notebooks have special static dissipative plastic covers. Even the hand lotion is special! There is also a wrist strap test set to make sure the strap is working and a tester to ensure that the surface of the bench remains dissipative.

ESD Control Light — For Your Workbench

While the electronics experimenter could assemble a completely equipped ESD-safe work area, the cost of doing so is prohibitively high. So, what can you do to ensure that your

Figure 1 — Ora Remmer at a typical industrial ESD workstation showing the various ESD safeguards (see text).

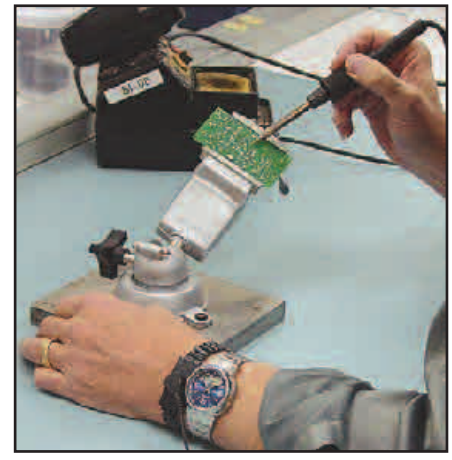
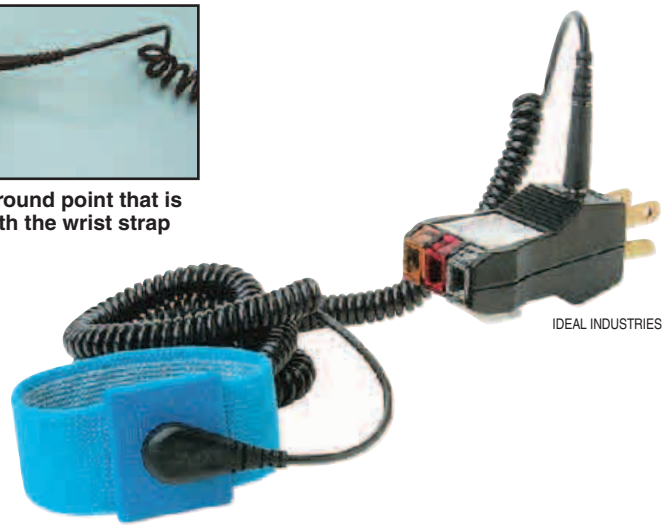


Figure 2 — An ESD-safe work mat and wrist strap. This is the setup I use to develop prototype electronics at work.

Figure 3 — Common ground point that is a part of the 3M mat with the wrist strap attached.



IDEAL INDUSTRIES

Figure 4 — Ideal Industries 61-046 Stat-Gard ESD Grounding Kit, a handy way to ground a mat and wrist strap temporarily.

home work area is ESD safe? Figure 2 shows a work area you can duplicate that will go a long way toward ensuring you and your work are at the same potential. The bench is constructed of common materials, in this case wood, but the work surface is a static dissipative mat. The one in the photograph is made by 3M and costs about $70.[1] Similar ones are available from DESCO.[2] I am also using a grounding wrist strap. [You can choose elastic or expansion types; I use an expansion type, but it is a matter of personal preference — both types work equally well.] This one is from DESCO and costs about $30. The soldering iron is an Edsyn Model 951SX, ESD-safe. Similar models are also available from Weller.[3,4] All these items are available from sources such as Digi-Key, Mouser or Contact East/Jensen.[5,6,7]

Proper Grounding is Critical

It is important to ground the mat and wrist strap properly for both ESD and safety reasons. You want to be sure that you have not created a shock hazard by putting on the wrist strap. The wrist strap and mat should have 1 MΩ series resistors built in. Check to be sure. These resistors limit the current to protect both the electronic devices and you. Both the wrist strap and mat should be connected to a common ground point. Most mats are available with a common ground point attached (see Figure 3). There are a number of ways to establish the needed ground. If you have a grounded outlet with a metal cover plate, you can connect the bench ground to the cover plate screw. Ideal Industries makes a device that plugs into a grounded outlet, indicates that the outlet is correctly wired and provides a banana jack for connection of the mat and wrist strap (see Figure 4).[8] The Ideal 61-046 is available from Contact East/Jensen by itself for $31 or with a wrist strap for $10 more. This device is especially handy if your electronics workbench is also the kitchen table or if you just do not want to leave the mat connected all the time. Grounding the mat and wrist strap to a ground other than the power line ground can cause an unsafe condition. DESCO's Technical Bulletin TB-2007, *Safe Grounding of Static-Controlled Workstations*, provides more detail on this subject and is available on their Web site.

Don't Make it into an Electric Chair

Another important safety consideration: wrist straps are for use while building electronic circuits or while working on powered low voltage equipment. If you are going to work on energized line voltage powered equipment, take the strap off to avoid a potentially deadly shock hazard!

Details Matter

Just as important as the wrist strap and mat is how you arrange your work area and what you wear. If some of your parts came in plain plastic bags, take them out of the bags before moving them to your work area (ESD-safe plastic bags are a dark, smoked gray color and are labeled as ESD safe). If you are working from diagrams printed on paper, in magazines or in books, make sure the paper products are kept away from your work. Wear clothing made of cotton. Cotton is naturally static-dissipative unlike wool or synthetic materials, which should be avoided. Avoid loose clothing that can drape down onto your work. Wear short sleeves. Keep family members and pets away from your work; cats generate huge amounts of static electricity. An ESD-safe soldering iron is also desirable. If you are in the market for new tools, look for ones with ESD-safe plastic handle cushions. You might also want to invest in some ESD-safe bags to store your projects between work sessions.

My own electronics bench, shown in Figure 5, consists of a couple of surplus commercial ESD benches, so I do not need a mat. The bench tops and wrist strap are connected directly to the service entrance ground wire that passes directly above the bench. The Edsyn soldering iron can be seen in the background.

Do you really need to worry about ESD? The answer depends on what you do at your electronics bench. If your projects use resistors, capacitors and bipolar transistors, the answer is probably not, although it can't hurt. If, on the other hand, you work with MOSFET transistors, microprocessors and memory chips or if you plan to open up that state-of-the-art rig, proper ESD control is a must.

Figure 5 — The author at his electronics bench, two surplus commercial ESD workstations. His wrist strap and ESD-safe soldering iron are visible.

Acknowledgments

I would like to thank Robin Franklin of Ideal Industries for supplying the photo of their Stat-Gard ESD Grounding Kit; Greg Ryshen, ESD Coordinator at Tyco Electronics/Hartman, for checking this article for technical accuracy, and Ora Remmer for allowing me to invade her space and take her picture.

Notes
[1]**www.3m.com**.
[2]**www.desco.com**.
[3]**www.edsyn.com**.
[4]**www.cooperhandtools.com/brands/weller**.
[5]**www.digikey.com**.
[6]**www.mouser.com**.
[7]**www.stanleysupplyservices.com**.
[8]**www.idealindustries.com**

William Reese, W8WER, was first licensed in 1976 as WB8ZRN and now holds an Amateur Extra class license. He obtained a BEE degree from The Ohio State University in 1968 and is a registered professional engineer. Bill is a Senior Project Engineer for Tyco Electronics/Hartman, where he designs electromechanical high power contactors and electronic power monitors for the aerospace industry. He is active in the Intercity Amateur Radio Club and is currently the chairman of the Technical Committee and licensee of one of the club repeaters. You can reach Bill at 2651 Bell Rd, Mansfield, OH 44904 or at **w8wer@arrl.net**.

The Audible Antenna Bridge

WA3ENK describes a tone generating SWR box that is useful for both blind and sighted hams.

Rod Kreuter, WA3ENK

Recently I had the privilege of working with a blind student. Through him I have begun to look at problems in a different way. When I attended a conference of the National Federation of the Blind (NFB) with him, it started me thinking about ways I could help as a circuit designer. I went to Dallas to talk to the NFB about my current projects. One of the committees I talked with was the ham radio committee headed up by D. Curtis Willoughby, KAØVBA. Committee attendance was not large but the enthusiasm was. These are hams who want to do things — many things. I have written other articles. In them I have said, "Get out your soldering iron and build something for yourself." In this article I would like to add, "or build something for someone else."

Introducing the Audible Antenna Bridge

Don't get me wrong — although the audible antenna bridge (AAB) would be great for a visually impaired ham, sighted hams will also find it very useful. How about tuning that screwdriver antenna while you're driving without looking at a traditional SWR meter? The AAB is more rugged than an analog meter and it's easier to use, both in the harsh light of day and in the dark of night. It's also inexpensive to build. What more could you ask?

An absorptive type of SWR meter, the AAB is used to indicate how close the match is between your transmitter and your antenna. Its output is a tone whose pitch is proportional to SWR. And for those of you who want to know just what your SWR really is, it also sends the value in Morse code.

Unlike most SWR meters on the market, this one actually absorbs power from your transmitter while you're tuning. Who needs that? You do — if you want to protect your transmitter during tune-up, that is. Many transmitters have SWR foldback capability and will decrease the output power if the antenna match is poor. But then again, some do not.

By absorbing power in the AAB, no matter what you do at the antenna port, the transmitter never sees a SWR greater than 2:1. Of course, everything has a price, and the price of this insurance is that 75% of your transmitter power ends up as heat in the bridge — unless you simply switch out the AAB after you have tuned your antenna.

Figure 1 — Front view of the audible antenna bridge.

Theory of Operation

The AAB works on a principle taken right from *The ARRL Antenna Book*.[1] The bridge consists of four impedances, or *arms*. See Figure 2. If three of the arms are 50 Ω resistors and the fourth is an antenna (or an antenna and tuner combination), then the bridge will be balanced when the antenna port is also 50 Ω. Diodes D1 and D2 sample the forward and reverse voltages, respectively. A peripheral interface controller (PIC) with a 10 bit analog to digital converter (A/D) digitizes these voltages and calculates the SWR using the following equation:

$$SWR = \frac{V_{forward} + V_{reverse}}{V_{forward} - V_{reverse}}$$

The SWR is used in two different ways. The first use is to control a hardware pulse width modulator that produces the output tone. The SWR is also used by the Morse code routine to send the actual value of SWR, at 15 WPM with 5 WPM spacing using the Farnsworth method.

The power that the AAB can handle during tune-up is a function of the resistors used in the three reference arms of the bridge. I used 30 W noninductive resistors. These resistors are made by a number of companies, but be warned — they are not cheap.

We all know that antenna tuning should be done with the least amount of power necessary to do the job. The AAB will work down to about 1 W. The 30 W resistors that I used will allow you to do tune-ups with about 60 W or perhaps a 100 W for a short time.

Now why in the world would someone use 30 W resistors in a bridge that should be run at a few watts? Well, let's put it this way — Have you ever forgotten to turn down your power before tuning up? If you *always* remember to do this, and you tune up quickly, the bridge resistors could be low power. Perhaps 5 W for normal rigs and 1 W for QRP rigs.

The other restriction on the bridge resistors is that they be noninductive. Do not try to use wire wound resistors! They're cheap, but that's about the only good thing you can say about them in this application.

Building the AAB

A printed circuit board is a nice way to build the AAB, but you could easily construct such a simple circuit using ugly construction. Keep the wires short in the RF section. See Figure 3.

You should use a heat sink for the non-inductive resistors. Like many power devices, the power rating depends on getting the heat out! See Figure 4. A little heat

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

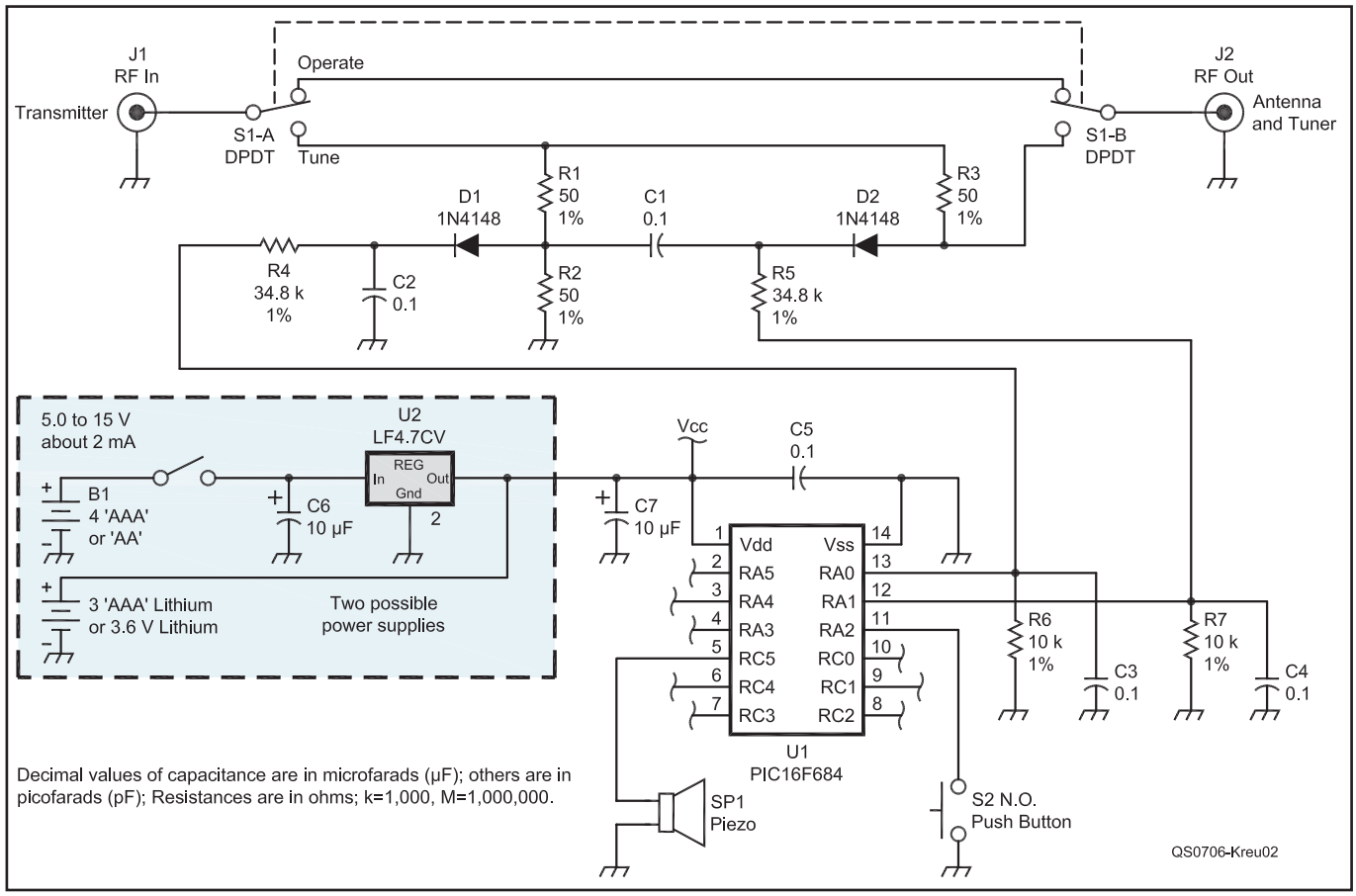


Figure 2 — Schematic and parts list of the AAB. Resistors are ¼ W, 5%.

C1-C5 — Capacitor, ceramic 0.1 µF.
C6, C7 — Capacitor, electrolytic, 10 µF, 25 V.
D1, D2 — Diode, 1N4148.
J1, J2 — SO-239 UHF coaxial socket.
R1-R3 — Resistor, 50 Ω 1% 30 W Caddock noninductive (Mouser 684-MP930-50).
R4, R5 — Resistor, 34.8 kΩ, 1%.
R6, R7 — Resistor, 10 kΩ, 1%.
S1 — Switch, DPDT (Digi-Key SW333-ND).
S2 — Switch, momentary contact (Mouser 612-TL1105LF250Q).
SP1 — Piezoelectric buzzer EFB-RD24C411 (Digi-Key P9924-ND).
U1 — PIC16F684 (Digi-Key PIC16F684-I/P-ND).
U2 — Regulator, LF4.7CV (Mouser 511-LF47CV).

sink compound goes a long way to help. Do yourself a favor and give yourself plenty of room and plenty of time. These resistors get really hot running at 10 or 20 W. Use a big heat sink and put holes in the cabinet to let the heat escape. Although my first prototype looked pretty good, it was too small and there was no way for the heat to get out. I've run it for 10 minutes at 10 W but the heatsink gets too hot.

I used two switches in the AAB. One chooses TUNE/OPERATE and the INQUIRE button is used to report on various conditions, such as the SWR value in Morse code. You can eliminate the TUNE/OPERATE switch if you would like. Simply remember to remove the AAB from your feed line after tuning up.

If you wish to use the AAB in a QRP station, you may want to reduce resistors R4 and R5. They are sized so that a 25 W transmitter will not saturate the analog to digital converter (ADC) on the PIC when using fresh batteries — more on this later. A good value for a 5 W transmitter would be about

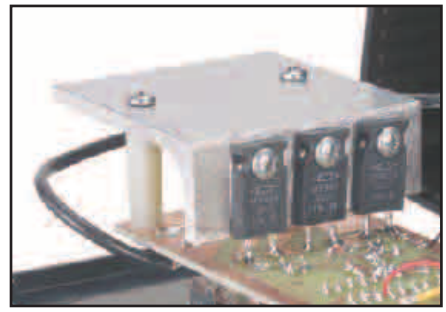


Figure 3 — Close-up view of three Caddock TO-220 style bridge resistors mounted on the heat sink.

20 kΩ. So long as the voltages at pin 12 and pin 13 of the PIC are below the battery voltage, the system will work fine.

Powering the AAB

Powering the AAB is about as simple or as complex as you would like to make it. One of the reviewers, and I won't embarrass Tom by mentioning his name, said he would like not to have an ON/OFF switch.

To save power the AAB uses a sleep mode. If you haven't pushed the INQUIRE button for about 5 minutes, the AAB will get bored and go to sleep. It will let you know by sending the letter N for "night night." During sleep the current draw is about 2 µA. Pushing the switch while it's sleeping will wake up the AAB and it will send the letter U to tell you it's "up."

In the first four prototypes of the AAB I used four AAA batteries and a low drop out 4.7 V regulator. This made for a nice stiff supply and very good battery life, with only one problem. Even though the PIC uses less than 2 µA during sleep, the regulator uses 500 µA. Battery data says that alkaline AA batteries will last 6 months at this level and AAA batteries about half that long. That was not long enough for me. I recommend an ON/OFF switch if you go this route.

The other option is to use batteries without a regulator. Normally you couldn't get away with this without providing a separate voltage reference for the ADC in the PIC. In

this case it doesn't matter as much because SWR is a *ratio* of two voltages.

What does matter is the battery voltage with respect to the voltage produced by the RF signal. Diodes D1 and D2 rectify the RF and produce a dc voltage proportional to RF power. This voltage is divided by resistors R4, R6 and R5, R7. The voltage at the ADC inputs of the PIC, pins 12 and 13, must be less than the power supply voltage. With a regulated supply this isn't much of a problem and if you're careful it can also work with unregulated batteries.

Microchip recommends that these parts be run on 2.5 to 5.5 V if you need the 10 bit ADC to be accurate. Many battery combinations will provide this, but if you go this route, consider lithium batteries instead of alkaline. The voltage from an alkaline battery begins to fall very early in its life and continues at a downward slope until it is exhausted. A lithium battery, on the other hand, provides a nearly constant voltage throughout its useful life. A 3.6 V AA size lithium should last a few years but with the lower output voltage, you may want to reduce R4 and R5. My final prototype used three AAA lithium batteries (each about 1.7 V when new), with no regulator or ON/OFF switch, which I hope will last at least two years.

The PIC's ADC converter will saturate at some level. With new batteries, let's say this level is 25 W when the power supply is 4.5 V. When the power supply has fallen to 3.5 V, the RF level that will saturate the converter will be 15 W. So if you find that the output of your rig, which used to be fine, is now saturating the ADC, it's time to change batteries.

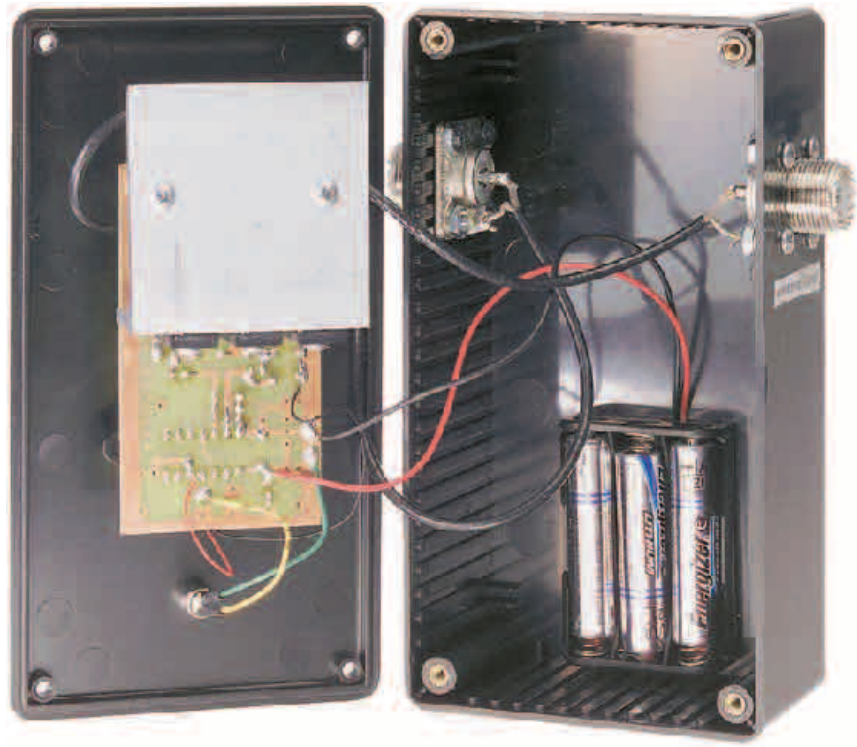


Figure 4 — Interior view of the AAB, showing the battery pack at the bottom of the enclosure.

Using the AAB

Using the AAB is very simple. Simply connect your transmitter to the INPUT and your antenna/tuner to the OUTPUT. Turn your transmit power down to 5 or 10 W and put the TUNE/OPERATE switch, in the TUNE position. Wake the AAB up by pushing the INQUIRE button. Key up your transmitter in CW, AM or FM mode so that you will have some carrier power. The AAB should start to produce a steady tone. Tune your tuner or antenna for the lowest tone pitch. Press the INQUIRE button for the numeric value of your SWR.

When the AAB is operating normally, it produces a tone proportional to SWR. The tone ranges from 250 Hz at an SWR of 1.0:1, rising to 4450 Hz at an SWR of about 15:1. Errors can occur and at times the AAB can't really make a measurement. For example, if there is no RF energy present you can't really talk about SWR. If an error occurs, either a high pitched tone or no tone is produced. Pushing the INQUIRE button will give you more information. Five different conditions can occur:

- Normal operation — A tone proportional to SWR is produced. INQUIRE button — a two digit SWR value is sent separated by the letter R (Morse for the decimal point character).
- Error 1 — The forward power is too low for a reliable measurement. No tone is produced. INQUIRE button sends letter L (low).
- Error 2 — Forward power is too high (almost saturating the ADC). A pulsing tone proportional to SWR is produced. However, if the ADC is saturated this value might be meaningless. INQUIRE button sends letter S (saturated).
- Error 3 — SWR is greater than 9.9:1. A tone proportional to SWR is produced. INQUIRE button sends letter H (high).
- Error 4 — The reverse voltage is greater than the forward voltage. Two things can cause this error. You might be near a high power transmitter, or you connected the transmitter to the OUTPUT port. No tone is produced. INQUIRE button sends letter F (fault).

More

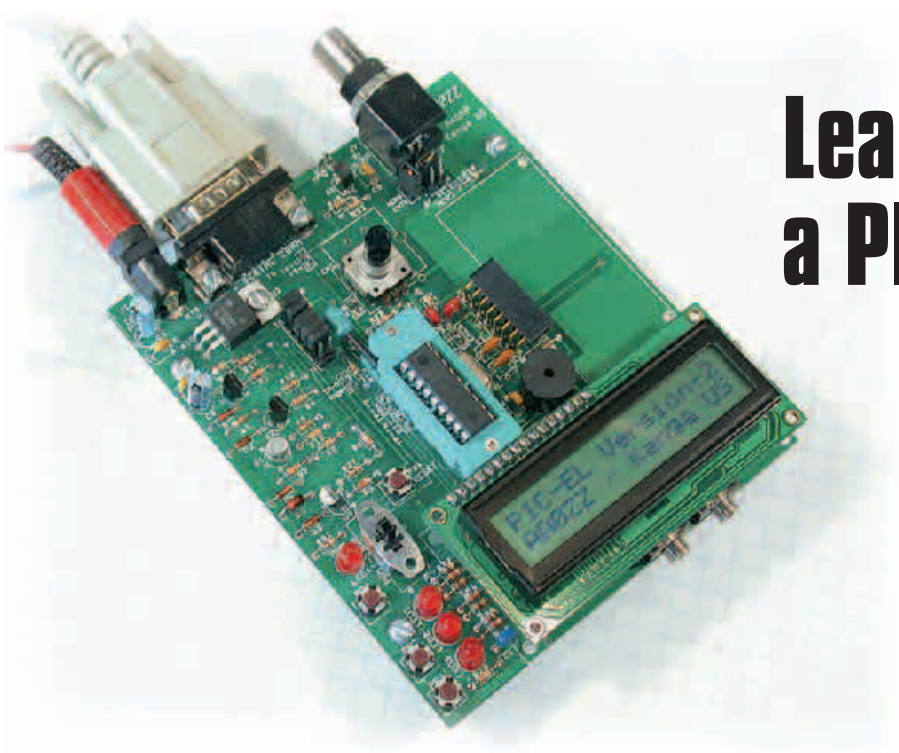
Some have asked whether the PIC used in this design could be used in a more standard SWR meter, such as those with a transformer type sensor. The simple answer is, yes it can. As long as the meter produces a forward and reverse voltage that you can scale to be from 0 to 3 up to 5 V (depending on your power supply choice), it will work just fine. However, there is one restriction — the driving impedance of the voltage must be 10 kΩ or less.

A kit of parts including a printed circuit board (PCB) is available from Q-Sat, 319 McBath St, State College, PA 16801. The price is currently $30, postpaid. PCBs are available for $7 postpaid and a programmed PIC is available for $6 postpaid. Source code for an unprogrammed PIC is available on the ARRLWeb site as *aabpic2.hex* at **www.arrl.org/files/qst-binaries/kreuter0607.hex**.

Thanks

I would like to thank the Ham Radio Committee of the NFB for inspiration. A special thanks goes to Tom Fowle, WA6IVG, and Bill Gerrey, WA6NPC, of the Smith-Kettlewell Research Institute. They tested prototypes 2 and 4 and gave encouraging advice.

Rod Kreuter, WA3ENK, earned his Technician class license at age 15 and now holds an Amateur Extra class ticket. Rod's interest in Amateur Radio led to a career in electrical engineering. He holds a BSEET from the Pennsylvania State University and is Director of Research Instruments for Penn State's Chemistry Department. Rod enjoys biking, backpacking, tinkering and ragchewing. You can contact him at 319 McBath St, State College, PA 16801 or **rak10@psu.edu**.



Learning to PIC with a PIC-EL — *Part 2*

This easy to duplicate PIC proto board will make learning how to use these useful components easy!

Craig Johnson, AAØZZ

Last month I described the PIC-EL board that I developed for use as a companion board for an online course to teach beginners how to use peripheral interface controllers (PICs).[1] The course is written by John McDonough, WB8RCR, and additional lessons are still being developed. This article is intended to show how easy it is to understand how to use a PIC microcontroller. By looking at the various PIC-EL hardware components and the sample code or the Elmer-160 lessons, the amateur can learn how to use microcontrollers in many interesting applications.[2] The rewards are great.

PIC-EL Hardware

We looked at the PIC-EL computer interface last time and we also took a preliminary look at the various hardware components attached to the PIC microcontroller in the PIC-EL. Now we will take a closer look and show how you can make use of these components in your own projects. The project and demonstration portion of the PIC-EL board was designed to allow the experimenter to understand how a PIC microcontroller can be used in a variety of applications. It allows a person to progress from controlling very basic components to more advanced components and projects. PIC experimenters have an opportunity to use and understand the following hardware functions:

- An 18-pin PIC microcontroller (such as a 16F84/A, 16F628/A or 16F88).
- A 4 MHz crystal controlled clock.
- A two line (16 characters each) LCD display.
- A rotary encoder.
- Three general-purpose push buttons.
- A dedicated push button for master clear or reset of the PIC microcontroller.
- Three light emitting diodes (LEDs).
- A speaker with a transistor driver.
- All connections necessary to drive the NJQRP DDS daughtercard.[2]
- A stereo jack for connection to CW paddles.
- A stereo jack with transistor driver for transmitter keying.
- A transistor signal conditioner for converting low-level signals to levels required for PIC input detection.
- A multi-purpose BNC connector, jumper selectable to allow DDS output or signal input.
- A 2 × 6 pin header block to allow attachment of a foreign programmer.

What's Inside?

The PIC-EL schematic (see Figure 1 in Part 1) may look quite complicated because many of the PIC pins have multiple usages.[3] However, we can break down the schematic into its core pieces to understand the individual functions. This will also show how to use these basic components in other projects.

Last time we discussed the computer programming interface (the left side of the schematic). Now let's take a look at the various hardware components that are attached to the PIC and see how they work.

PIC System Clock

The system clock is generated by a 4 MHz crystal coupled with two 22 pF capacitors. A simple RC oscillator or the 16F628's internal oscillator could have been used instead. Since we are going to be experimenting with several timing-sensitive

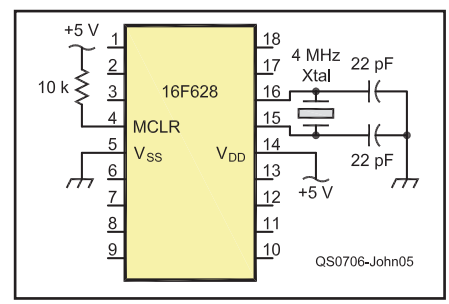


Figure 5 — The basic components necessary to run a PIC.

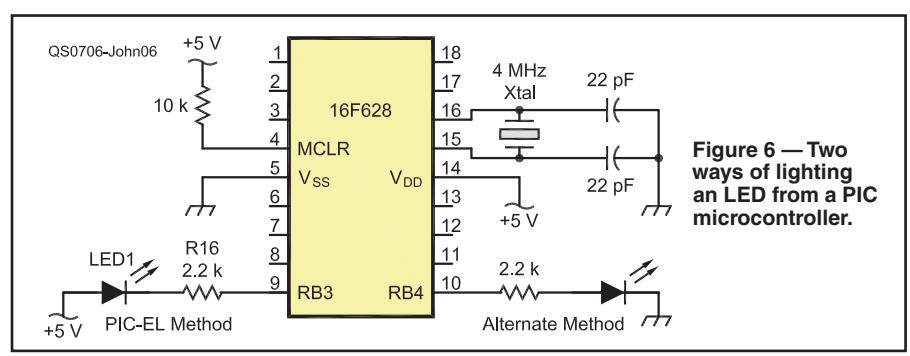


Figure 6 — Two ways of lighting an LED from a PIC microcontroller.

[1]Notes appear on page 36.

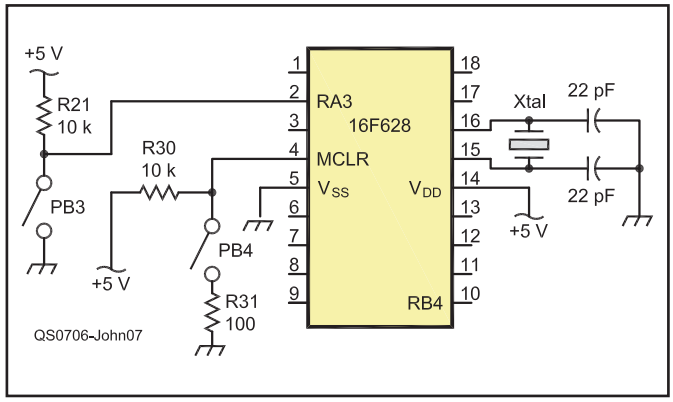


Figure 7 — The manner in which switches are used with a PIC and how PB3 is implemented in the PIC-EL.

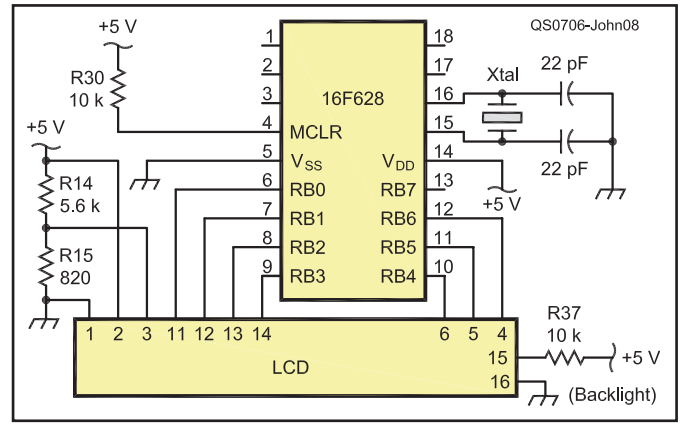


Figure 8 — Implementation of an LCD with the PIC-EL board.

projects such as frequency counters, an accurate clock is essential so a crystal was used.

The basic components necessary to run a PIC are shown in Figure 5. As you can see, it's really very simple.

LEDs

Two direct ways of lighting an LED from a PIC microcontroller are illustrated in Figure 6. The first is to connect a PIC output pin to a resistor and then to the anode of the LED with the cathode grounded. To light the PIC, the program needs to assert a logical high (+5 V nominal) on the output PIC pin. The PIC then provides the current to light the LED.

The other way is to connect a PIC output pin to a resistor and then to the cathode of the LED with the anode connected to +5 V. In this case, to illuminate an LED from the PIC, the PIC pin needs to be brought to a low level. The PIC is a current "sink." One minor drawback of this method is that the PIC programmer must remember that the logic is reversed. In this case the LED is illuminated when the PIC pin is set to a logical low, and it is dark when the PIC pin is at a logical high.

The method used in the PIC-EL board is to "sink" current with a PIC rather than to "source" the current.

Ideally, to illuminate an LED, the current flow through it should be between 1 mA and 20 mA. In this design the current flow is determined by the size of the series resistors. The series resistors (R16, R17 and R18) are each 2.2 kΩ. These values were selected in order to keep the circuit loading to a minimum, since the PIC pins to which they are connected are used for multiple functions. Since the voltage drop across each LED is about 1.8 V, the voltage drop across the 2.2 kΩ resistors is about 3.2 V. This means the current through the resistors and these LEDs is about 1.4 mA. This amount of current illuminates the LEDs sufficiently. In some cases you may want to increase this current for brighter illumination. You could use a 1 kΩ resistor (3.2 mA), for example.

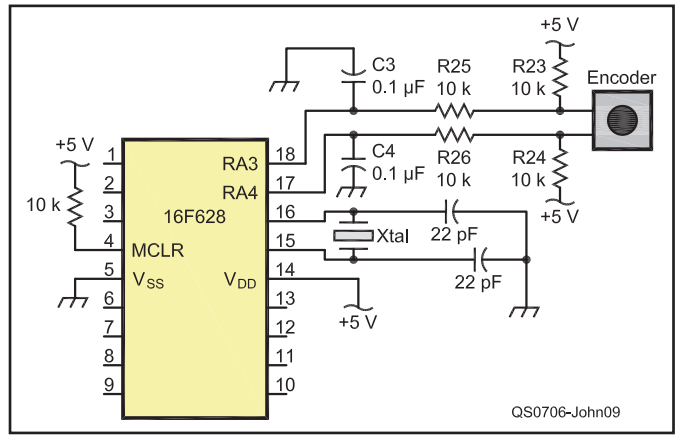


Figure 9 — A mechanical rotary encoder is attached to two PIC pins.

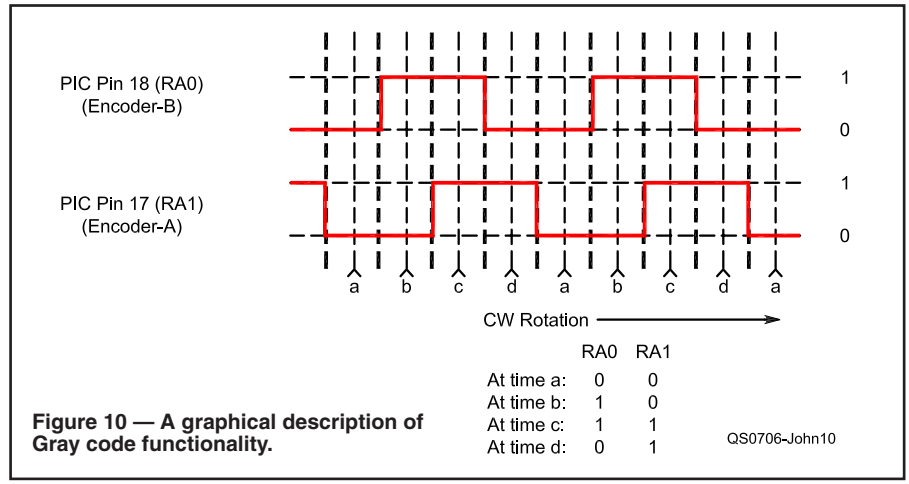


Figure 10 — A graphical description of Gray code functionality.

Push Buttons

Figure 7 shows how these switches are used in a PIC and how push button PB3 is implemented in the PIC-EL. Three stand alone normally open SPST push buttons (PB1, PB2 and PB3) are connected to PIC pins RA4, RA3 and RA2 in the PIC-EL. They can be used for any type of control functions that the programmer wants to use them. One other normally open SPST push button (PB4) is connected to the PIC's MASTER CLEAR pin and is used to reset the PIC program (make it start over). The three PIC pins that have general-purpose push buttons (PB1, PB2 and PB3) also have 10 kΩ pull-up resistors (R22, R21 and R34 respectively) attached to V_{DD}

(+5 V). In general, using pull-up resistors is a good design principle and provides a good "stiff" pull-up. In some cases, no pull-up resistor is used because some PIC pins (Port B in a 16F628) can have internal weak pull-ups activated via PIC software instructions. (This is done by executing a PIC instruction that clears bit 7 of the PIC's OPTION register.) In this mode, the PIC in effect puts a 50 kΩ resistor between each of these pins and +5 V. This means the PIC is able to source 0.1 mA of current on each of those pins. This is sufficient for a simple push button operation.

Note that the PIC's MASTER CLEAR pin (pin 4) has a 10 kΩ pull-up resistor (R30) to +5 V and is switched via a normally open SPST push button (PB5) to "near" ground. This is also illustrated in Figure 8. The pull-up resistor is essential here, since the PIC needs +5 V on MCLR for normal PIC operation. The 10 kΩ resistor is sufficient here, since the MASTER CLEAR pin draws very little current. Push button PB4 also has a 100 Ω resistor to prevent voltage transients from locking up the PIC.

Liquid Crystal Display (LCD)

The LCD panel used in the PIC-EL demonstration board has two rows of 16 characters each. It is a standard 5 × 10 dot matrix LCD that uses a Hitachi 44780 controller. It is attached in such a way that it minimizes interaction with other functions of the PIC-EL. In particular, the PIC programmer (also using PIC pins 12 and 13 — RB6 and RB7) still works properly when the LCD is connected in this manner.

The values of the voltage divider resistors (R14, R15) were selected to put the proper voltage on the LCD's contrast pin (pin 3). Also, the LCD backlight is activated with the resistor to +5 V connected to LCD pin 15 along with the ground connection to LCD pin 16. The backlight of the 2 × 16 LCD used in the PIC-EL kit draws about 75 mA. If an LCD with a different level of backlight current is used, the size of this resistor must be adjusted. Figure 8 shows how the LCD is implemented in the PIC-EL board.

Rotary Encoder

A mechanical rotary encoder is attached to two PIC pins, RA3 and RA4, as shown in Figure 9. R23 and R24 are typical pull-up resistors, since the rotary encoder is essentially just a pair of switches that open and close as the shaft rotates. Capacitors C3 and C4 are filters for removing noise that comes from contact bounce. The series resistors, R25 and R26, help in the signal filtering. Without the noise filtering, operation could be erratic.

For the mechanical encoder included in the PIC-EL kit, each of the signal lines produce 24 pulses per revolution, so a total of 96 up or down voltage transitions per revolution are generated that can be detected by the PIC microcontroller. The pulses of the two data lines are encoded in an overlapping Gray code such that an algorithm allows the PIC program to determine which direction the shaft is being turned. Figure 10 provides a simple explanation of how Gray code works. Table 1 illustrates one way to determine the rotation direction.

Speaker

A miniature speaker (SPKR-1) is attached to a PIC pin by way of a simple transistor (Q5) driver, as shown in Figure 11. The transistor driver gives more "punch" to the speaker than could be attained by directly attaching it to the PIC speaker output pin. The capacitor and diode in the path to the base of the driver transistor would be optional in most PIC speaker applications but are very important in the PIC-EL board because they prevent the speaker from being inadvertently left "on" if the PIC-EL application happens to leave that pin in a high state. Q5 acts as a switch, allowing current to flow through the speaker when Q5 is turned on and not flow when Q5 is turned off.

Pulses are generated by the PIC software and pass through capacitor C11 to turn Q5 on and off. The PIC program produces different tones by changing the frequency of the pulses it generates. Since audio tones are relatively low frequency and the PIC executes an instruction every microsecond, accurate delay loops can be designed to produce pulses with the desired frequencies.

Signal Generation with the NJQRP DDS Daughtercard

The AmQRP DDS daughtercard can be plugged into the PIC-EL board by way of socket J6. Appropriate connections are made to the PIC and the required +12 V is also supplied to the daughtercard socket. Details of how the daughtercard operates can be found on the AmQRP Web page at **www.amqrp.org/kits/dds60/**. The PIC connections to the DDS daughtercard are illustrated on the bottom of Figure 11.

The output of the daughtercard is supplied back to pin 6 of socket J6. The PIC microcontroller can drive the DDS daughtercard to produce an amplitude of approximately 600 mV with a frequency within the range of 0 to 30 MHz or 60 MHz, depending on which version of the DDS daughtercard you have.

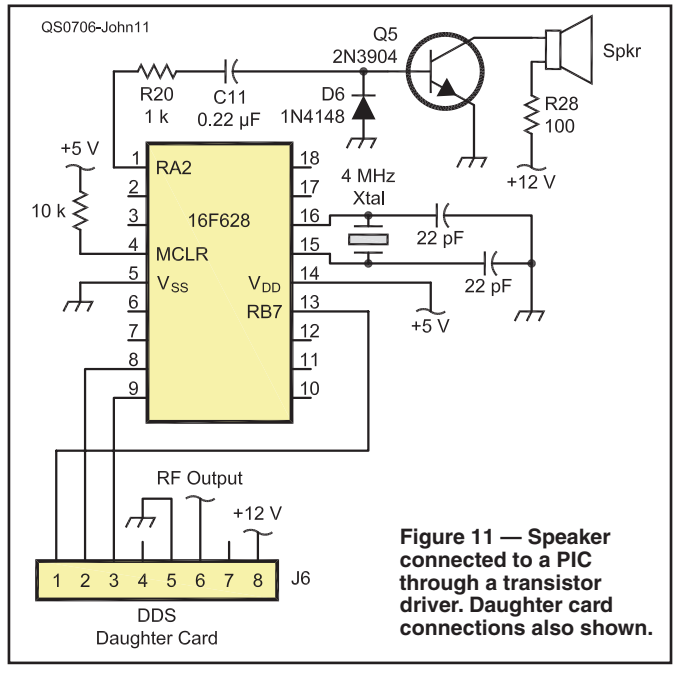


Figure 11 — Speaker connected to a PIC through a transistor driver. Daughter card connections also shown.

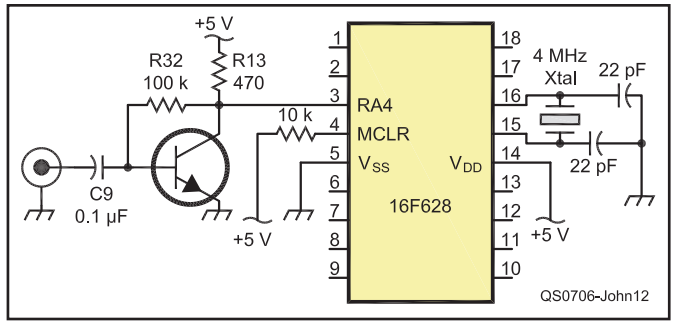


Figure 12 — Signal conditioner to increase small amplitude signals to voltage levels detectable by the PIC.

Signal Conditioner

A signal conditioner, shown in Figure 13, is provided to increase small amplitude signals to voltage levels detectable by the PIC. The output amplitude of the DDS daughtercard is too low to be fed directly back into a PIC pin for the demonstration of frequency counting. To make this work, the amplitude is increased by the signal conditioner circuitry. Notice that this conditioner is not a linear amplifier in that it does not attempt

to keep a distortion-free sinewave output. For purposes of frequency measurement, a square wave is just as good as a sine wave.

Note that header HDR2 is used to select the source of the signal that goes into the conditioner. In one position, the output of the DDS daughtercard is fed into the conditioner while in another configuration a signal from an external source can be brought into the PIC-EL board via BNC connector J7 and routed through the conditioner before going to the PIC.

CW Paddle Input Via a Stereo Jack

CW paddles can be attached to the PIC by way of a ⅛ inch stereo jack as shown in Figure 13. The jack connects one of the paddle connections to the stereo plug's tip and the other to the ring. Both pins have pull-up resistors (R21 and R22) connected to +5 V. The PIC is then able to detect the paddle closures just as if they were two SPST switches. A demonstration example of a CW keyer is available on my Web site or the FILES section of the PIC-EL YAHOO group.

Transmitter Keying Via a Stereo Jack

Figure 14 shows how to key a transmitter with the output of the demonstration keyer. Another ⅛ inch stereo jack is provided for this purpose. The output of a PIC pin goes to a transistor driver which then goes to the tip connection of the stereo jack. When keyed, the transistor driver drives the voltage at the tip connection from approximately 5 V to ground potential. When the PIC pin is not keyed the tip-to-ground connection looks like an open circuit so the tip remains at approximately 5 V. This keying mechanism will work for most modern rigs because they employ positive keyed transmitters. Some early transmitters (tube type in particular) used negative keying. Modern positive keyed transmitters have approximately +3 to +5 V on the tip connection with the radio keyed by connecting this pin to ground. Negative keying transmitters often have something on the order of –30 V on the tip connection. This keying circuit is for positive keying only, but if your radio requires a negative keying scheme, or uses high voltage cathode vacuum tube keying, a relay or driver circuitry will be required.

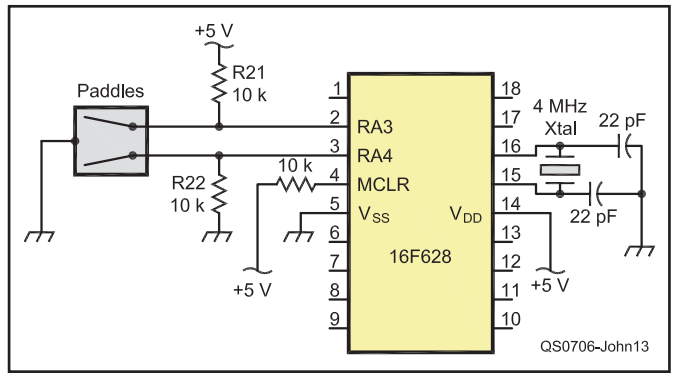


Figure 13 — CW paddles attached to the PIC by way of a ⅛ inch stereo jack.

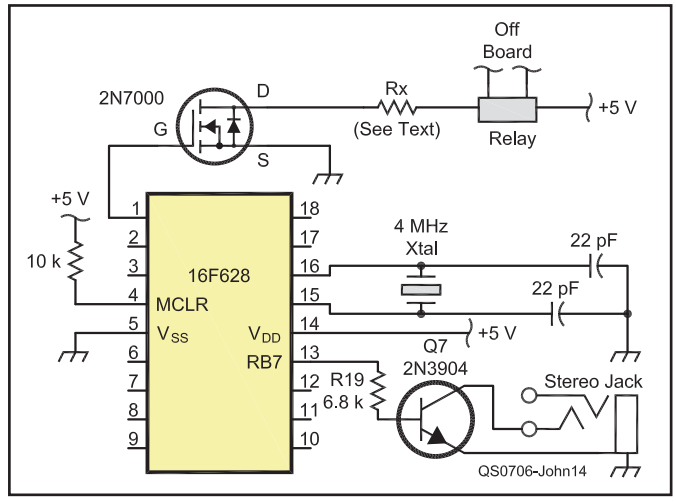


Figure 14 — Keying a transmitter with the output of the demonstration keyer. Relay driver also shown.

Table 1

A Method to Determine the Direction of Rotation of a Rotary Encoder

Going UP, the sequence is a,b,c,d,a,b,c,d,a, etc, so the sequence is:

00, 10, 11, 01, 00, 10, 11, 01, 00….

Going DOWN, the sequence is a,d,c,b,a,d,c,b,a, etc, so the sequence is:

00, 01, 11, 10, 00, 01, 11, 10, 00….

To determine if the sequence is UP or DOWN:

1) Take the "right-bit" of any pair.
2) XOR it with the "left-bit" of the next pair in the sequence.
3) If the result is 1, it is UP; if the result is 0, it is DOWN.

Frequency Counter

A frequency counter can be implemented in the PIC-EL by using the signal conditioner, described earlier. The conditioner feeds its output into PIC pin 3 (RA4/T0CKI). This PIC pin may be configured to be a general purpose input/output pin, but also has the unique characteristic of being configured as a counter input to PIC register TMR0. The TMR0 register is used by frequency counter applications.

How to Drive a Relay from a PIC

The PIC-EL is not set up to demonstrate relay control. In order to drive a device that requires more current than the 20 mA or so a PIC pin can deliver, a driver circuit is required. The top of Figure 14 shows an example of how it can be done. Resistor R_x in series with the relay coil must be sized to pass the proper amount of current. The 2N7000 MOSFET is a good general purpose device but in some applications, such as for driving relays or LCD backlight activation, an IRLML2502 is an even better choice, since its drain to source resistance when turned on is about 0.045 Ω. In contrast, the on R_{DS} of a 2N7000 is between 2 and 5 Ω.

Questions, Support?

For up-to-date details and documentation regarding this project, please see my Web page, **www.cbjohns.com/aa0zz**, the YAHOO group PIC-EL or e-mail me directly at **aa0zz@cbjohns.com**.

Conclusion

I hope you can see that getting started with PIC programming is not terribly difficult and that there are many useful things you can do with them. We have only scratched the surface, of course. The PIC-EL is a very convenient platform for experimenting but after that, it's up to you to develop your own projects with the components. Now it's time for you to try it!

Notes

[1]C. Johnson, AAØZZ, "Learning to PIC with a PIC-EL — Part 1," *QST*, May 2007, pp 37-42. Available on the ARRLWeb at **www.arrl.org/files/qst-binaries/Johnson0507.pdf**.
[2]**www.amqrp.org/elmer160**.
[3]See Note 1.
[4]**www.njqrp.org/**.

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Add a 30 and 40 Meter Dipole to Your SteppIR Yagi

Add this dipole to your SteppIR Yagi for approximately $60. Some of the ideas presented in this article may also be applicable to other types of Yagis.

Rick Dwight, KL7CW

When I ordered my new 6 through 20 meter 3 element SteppIR Yagi three years ago, I immediately began to think about antenna possibilities for 30 and 40 meters. The usual ham solution is to install an inverted V dipole with its apex located just below the Yagi. I was reluctant to risk distorting the excellent radiation pattern of my new Yagi with an inverted V. (See page 61 of the April 2006 issue of *QST* for an analysis of this problem.)

The apex of the inverted V needs to be down at least 20 feet below the Yagi to avoid most interaction. I also hoped for better performance since the broadside gain of an inverted V is less than that of a horizontal dipole. The low angle DX performance off the ends of an inverted V dipole is poor.

I considered installing a commercial rotary dipole above my Yagi; however, this would have cost several hundred dollars and added a considerable amount of wind and ice load to my installation. Here in Palmer, Alaska, we often have winds of over 50 and occasionally even 100 mph.

During my 52 years as a ham, I have used top loaded verticals and end loaded dipoles. Some of these antennas have performance nearly equal to that of full size antennas. The thought occurred to me that possibly I could construct a short dipole just above and parallel to the boom of my Yagi (see Figure 1). The far end of one 8 foot dipole leg would connect to the center of the director, and the far end of the other 8 foot dipole leg to the center of the reflector. The director and reflector serve only to end load the dipole legs and do not radiate.

The SteppIR director and reflector are insulated from the 16 foot boom. All three elements of the SteppIR Yagi are constructed with hollow fiberglass tubes. At the center of each element is a housing, which contains a motor and two copper strips on reels. The control box in the shack controls the extension of these copper strips into the fiberglass tubes. There are several preprogrammed Yagi designs for each band from 6 through 20 meters. With a few button pushes on the control box, you can either modify or create new antennas in software.

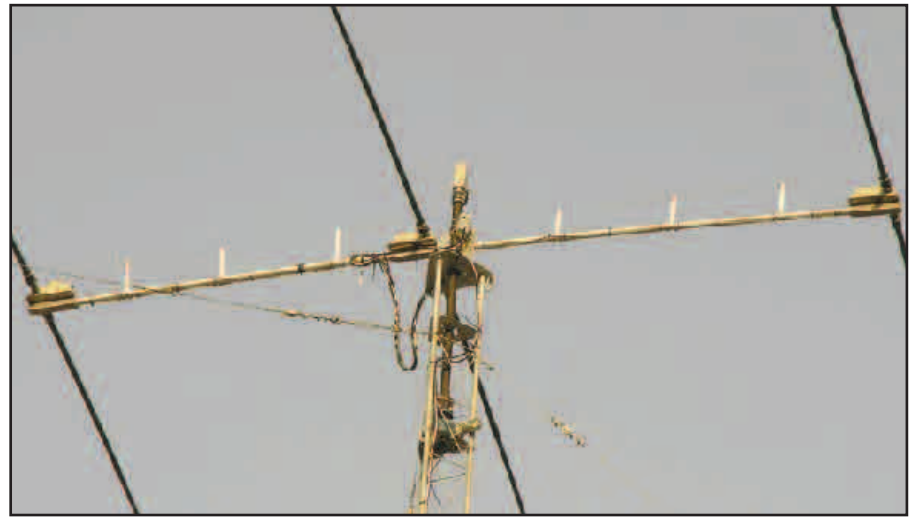


Figure 1 — Yagi with the dipole 8 inches above the boom on six white standoff insulators. The PVC balun and loading coil enclosure is at the top of the mast.

Antenna Modeling Predictions

I used Nittany Scientific's *NEC-Win Plus+* antenna modeling software to investigate this idea. My models predict the following:

- With the director and reflector fully extended to 35 feet, acting as end loads for the 16 foot dipole, resonance is near 7 MHz.
- The feed-point impedance of the dipole is near 12 Ω on both 7 and 10 MHz.
- The gain, which is *broadside* to the boom, is within 1 dB of a full size dipole.
- At an elevation angle of 20°, the azimuth pattern is similar to that of a full size dipole, but with a half power beamwidth of 98° instead of 80°.
- The performance at 10 MHz is at least equal to the performance at 7 MHz.
- There is negligible interaction between the dipole and the boom if the dipole is 8 inches above the metal boom.
- A dipole constructed with #10 wire will have nearly the same performance as larger aluminum tubes. The wire has less wind resistance and is less likely to break than a rigid tube since the boom jumps around quite a bit in windstorms.
- The most important result of my modeling is that the dipole will not degrade the performance of the Yagi.

When I actually built the dipole, it was resonant in the 40 meter phone band with the SteppIR director and reflector fully extended. I put a 0.3 µH inductor in series with each leg of the dipole to bring the resonant frequency of the dipole down to just below 7 MHz with the reflector and director elements fully extended. Modeling shows the losses in these inductors to be negligible on both 7 and 10 MHz. Since the inductance is so small there is no reason to use linear loading, to move the inductors out away from the center of the dipole, or to switch them out of the circuit on 10 MHz. For convenience, I located the small inductors inside the same weatherproof enclosure as the 4:1 balun.

SteppIR Modification

Before installing the SteppIR on the tower, you must bring the director and

Figure 2 — PVC standoff insulators on boom.

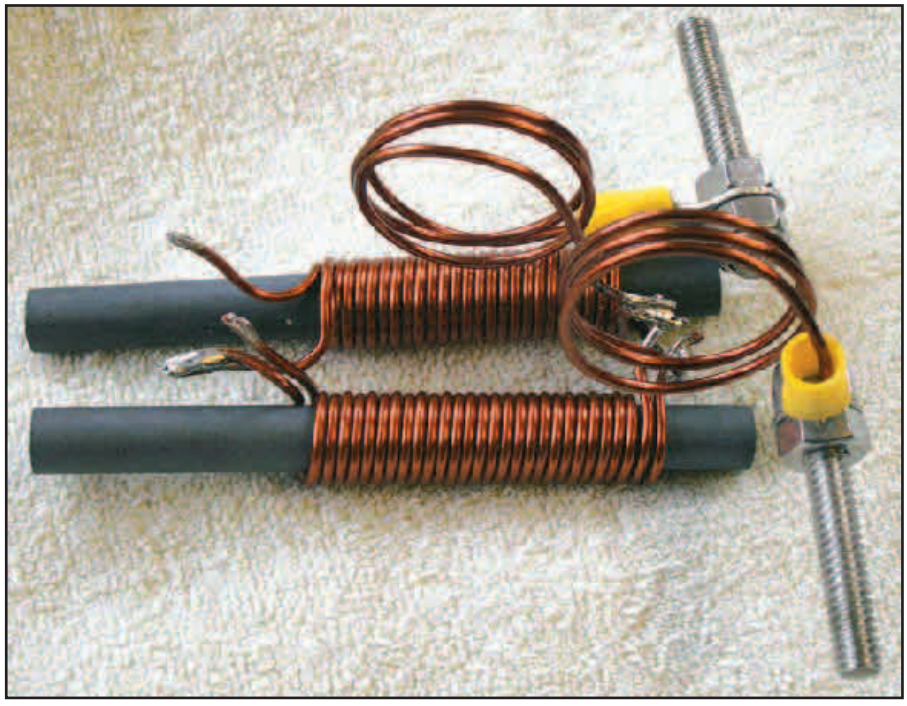


Figure 4 — Balun and loading coils.

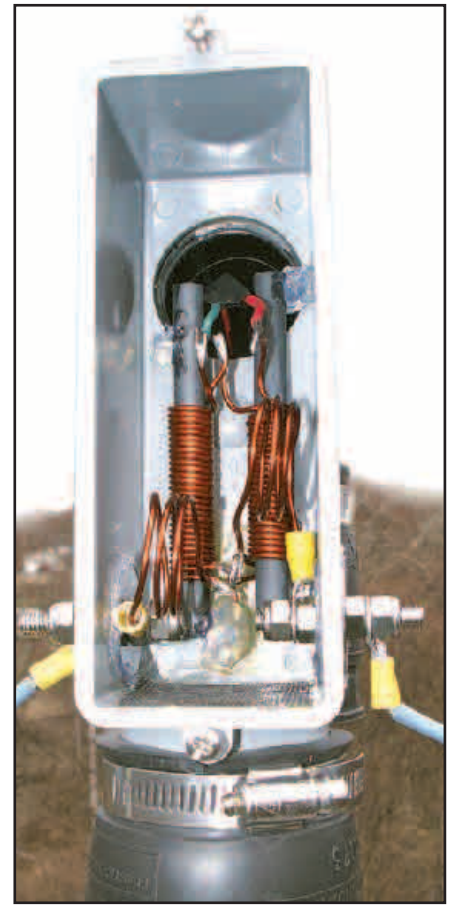


Figure 3 — PVC enclosure with balun and loading coils on top of mast.

reflector center connections out of their housings. Remove the bottom cover plate from the director housing. Fabricate two #18 jumper wires. Attach a small ring lug to one end of each jumper. These lugs go under the two 4-40 nuts that hold the brushes. I used 4-40 nylon insert lock nuts since I did not want anything to vibrate loose. A drop of Loctite on the threads or a second nut will also work. Solder large ring lugs to the other ends of these jumpers. These lugs both go under the large nut on the bottom of the element, which is on the end of the large bolt that goes down through the center of the element and holds it to the top of the housing.

Solder a large ring lug on one end of a 10 foot piece of #10 flexible wire. I used Arctic Ultra Flex insulated wire, although any highly flexible wire can be used. Weatherproof this connection. Scotchkote Electrical Coating covered with a piece of heat shrink tubing is one way to accomplish this. This lug goes under the large bolt head on the *top* of the housing. This bolt passes through the center of the element. As you tighten the bolt, make sure the lug on the #10 wire faces toward the Yagi mast. Replace the bottom cover of the housing. Repeat these same steps for the reflector housing.

Standoff Insulators

Construct six PVC standoff insulators (see Figure 2). Cement an 8 inch piece of ½ inch PVC pipe into a ½ inch PVC T. With a hacksaw cut away the bottom portion of the T, leaving only a strip approximately ⅞ inches wide. Use either a hot glue gun or epoxy to fill the top inch of each standoff insulator. Drill a hole near the top of the PVC pipe, parallel to the T, and just large enough for the #10 dipole wire. When you attach the director and reflector housings to the boom, also attach each of the PVC standoff insulators to the top of the boom with two stainless steel hose clamps. Thread the #10 dipole wires through the standoff holes back toward the mast. I used small black tie wraps on the dipole wire on each side of every standoff.

Be sure to leave just a little slack in the dipole wire between each standoff insulator. Route the director and reflector motor control cables on the *underside* of the boom. I was able to assemble my Yagi with this 30/40 meter dipole by myself at the top of my 60 foot (Rohn 25G) tower using the SteppIR "BoomSlide" tower assembly fixture. The fixture cost me $69.95, but saved me the cost of renting a boom truck or the requirement to feed an antenna crew. The installation was easy for this senior citizen with only average strength.

Balun

I built a 4:1 balun, which match the 12.5 Ω balanced dipole to the 50 Ω un-balanced coax. I used the W2FMI-4:1 HB50 design, which Jerry Sevick, W2FMI, describes in his book *Transmission Line Transformers Handbook, 48 Improved Designs*. This book is available from Amidon Associates at **www. amidoncorp.com**. W2FMI states that a conservative power rating for this balun is 1 kW continuous and 2 kW peak power. A commercial version of this balun, "BAL-12.5," is available from CWS ByteMark.

I built my balun in a 32 cubic inch PVC access box (Figures 3, 4 and 6). This type of box is used for electrical connections and is found in the electrical supply section of most building supply stores. Cement a piece of small mesh screen on the inside of the box to cover the bottom hole.

Next, cement the male end of a 1½ inch, 90°, ABS street elbow into the rear hole of the box. The elbow is made of black ABS plastic and is available in the plumbing section of building supply stores. Cut a circular disc out of PVC just large enough to fit into the female end of the street elbow (Figure 6). I cut my disc out of a 4 inch square PVC blank electrical box cover. Solder a 1 foot piece of #18 insulated wire to the center pin of an SO-239 coax receptacle and another 1 foot piece of #18 wire to its shell. Run the two wires parallel and close together, but not touching. Use several pieces of electrical tape to maintain the spacing. Mount the SO-239 in the center of the PVC disc, route the wires through the elbow into the box, and cement the disc into the female end of the elbow. See Figure 5 for the balun and loading coil schematic.

When you wind the ferrite rods, *do not* try to wind both wires at the same time. Wind 14½ close spaced turns onto a ferrite rod. The second winding is 14½ turns squeezed between the turns of the first winding. This will result in very tight windings, which are necessary for the proper operation of the balun. Be sure to use only the Formvar wire specified since this insulation thickness is needed for proper balun operation. The 0.3 µH loading coils are each 3 turns, 1 inch inside diameter and approximately 8 turns per inch.

Offset the coils as shown in Figure 3 so they are not on the same axis. Do not worry if the loading coils are not perfect. They just need to lower the resonant frequency of the dipole about 200 kHz. You adjust the dipole to resonance on any 30 or 40 meter frequency with the SteppIR control box.

Test the balun before you hook it up to the loading coils. For my 12.5 Ω load, I used eight 100 Ω carbon film resistors in parallel. Hook up an antenna analyzer or low power transmitter to the 50 Ω port on the balun. There will be some SWR showing, since the balun has some residual inductive reactance. This does not degrade the performance of the dipole but simply lowers its resonant frequency, and the SteppIR tuning adjustment will compensate for that. For testing purposes I was able to cancel out most the inductive reactance by paralleling a 1000 pF capacitor across the 12.5 Ω load. I measured a 1.1:1 SWR with the above test setup. Don't forget to remove the capacitor and dummy load when you're finished testing the balun.

I used ¼ inch stainless steel studs, washers, fender washers, nuts and nylon-insert locknuts to bring the antenna connections through the sides of the weatherproof balun box. Although nylon-insert locknuts will not come loose due to vibration, they are somewhat difficult to work with. When you turn a locknut the stud tends to rotate and can twist the wires inside the box. Use silicon caulking around the stainless steel washers on the outside of the box. Wire up the balun and loading coils according to the schematic in Figure 5.

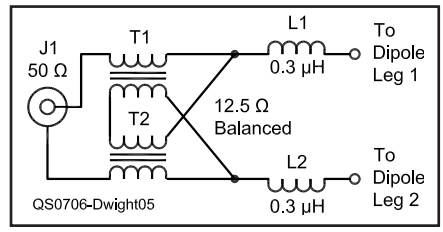


Figure 5 — Schematic diagram and parts list for balun and loading coil assembly.

J1 — SO-239 coax panel connector.
L1, L2 — 3 turns of #14 Formvar wire, wound on a 1″ form, 8 tpi. Order 15′ of wire for the entire project. Available from www.cwsbytemark.com.
T1, T2 — 14½ turns bifilar wound #14 Formvar wire wound side by side on ⅜″ diameter × 4″ long ferrite (permeability = 125) rods (CWS ByteMark part no. R-037400-61).
Access box, PVC (Home Depot: Carlon E986HR).
4″ square cover plate, PVC (Home Depot: Carlon A400R-CAR4).
Six ½″ PVC T fittings.
4′ schedule 40 ½″ PVC pipe.
12 each stainless steel 2″ (size 24) hose clamps (Ace Hardware: # 41146).
90° 1½″ ABS street elbow (Home Depot: Mueller # 02880).
Two 2″ rubber couplings (Ace Hardware: #44610).
Four 4-40 nylon insert lock nuts. These may be hard to find so do a Google search to find a supplier.
Two 10′ rolls #10 Arctic Flex stranded wire, www.polarwire.com.
Oatley #30818 all purpose cement (for PVC, ABS, etc), from Ace Hardware.
Scotchkote (3M) electrical coating, from electrical supply stores and some electronics outlets.
Loctite, from automotive supply stores.
Assorted ¼″ stainless steel studs, nuts, nylon insert locknuts, washers and fender washers to bring the dipole connection through the balun box, from Ace Hardware.
Assorted ring lugs, from Ace Hardware.

Install the balun/loading coil assembly in the weatherproof box. Before you solder the SO-239 leads to the balun be sure to cut off the excess lead length (these are the red and green wires at the top of Figure 5). Tack the ferrite rods down to the box with several dabs of silicon caulking. Keep the caulk off wire connections to avoid corrosion.

Installation

Since I have a short mast extending only slightly above my Yagi, I simply mounted my balun box on top of that mast with a 2 inch rubber coupling. One end of the coupling goes over the top of the mast and the other end over the flange, which protrudes from the bottom of the box. The bottom of my mast is open, so any moisture that accumulates in the balun box will simply drain out through the bottom and run down through the mast. It is important that your dipole be close to horizontal if you are interested in maximum gain and want to preserve the nulls off the end of the antenna. If your mast extends much more than a foot above your Yagi, you can strap the balun box to the side of the mast so that the dipole elements are horizontal.

Trim the length of each of the dipole wires so that after you solder a ¼ inch ring lug on the end, it will reach its connection point on the box with just a little slack (see Figure 3). Be sure to weatherproof the lugs' solder connections. Slip a 2 inch rubber coupling over the coax feed line and screw its PL-259 connector into the SO-239. Slide the rubber coupling up over the end of the 90° elbow and tighten the hose clamp.

Testing

Consult the SteppIR instruction manual for the following steps. You can download a copy from **www.steppir.com**. From the control box, select 6 meter antenna #1. You are going to modify this Yagi for testing the dipole on 40 meters. *You will not ruin anything!* You can easily restore the system to the factory defaults at any time.

Modify the director and reflector of this antenna so that they are in their fully extended position of 426.2 inches. Modify the driver length so it is in its fully retracted position of 4.5 inches. The dipole should now be resonant slightly below 7 MHz. Next, shorten the director and reflector to 405 inches. With these settings, my dipole is resonant at 7.060 MHz and the SWR in my radio shack, at the end of 150 feet of coax (0.6 dB loss), is 1.15:1.

Adjust the director and reflector lengths so the antenna is resonant in your favorite part of the band and save these settings. Select

6 meter antenna #2. Modify this antenna for director and reflector lengths of 174 inches and a driver length of 4.5 inches. This makes my antenna resonant at 10.120 MHz, with an SWR of 1.2:1. Adjust the director and reflector so the antenna is resonant in your favorite part of the 30 meter band and again save these settings. I selected these two antennas to modify since I do not currently operate on 6 meters. However, you can modify any of the ham band antennas and construct multiple antennas for 30 and 40 meters.

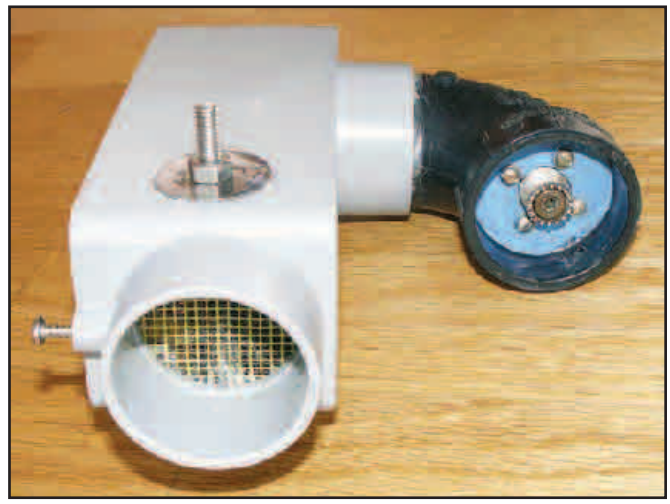


Figure 6 — PVC balun and loading coil enclosure.

If you need to operate the Yagi on a segment of a band where you've modified that Yagi design for dipole use, select an adjacent Yagi and use the up or down arrows to scroll to a frequency near to, *but not the same as*, the modified Yagi. I suspect most of us can find several preprogrammed Yagis on segments of bands we seldom use. It is also possible to modify the 180° and bidirectional Yagis.

Another option is to select Yagi designs from the general coverage portion of the menu to act as end loads for your 30 and 40 meter dipoles. One dipole is needed for 40 meter phone, one for 40 meter CW and one for the 30 meter band. Occasionally you should calibrate the SteppIR. This only requires a few button pushes. I do this before an important contest or if I see a change in SWR on either the Yagi or one of the dipoles.

Some More Thoughts on This Dipole

The SteppIR Yagi is rated at 2000 W PEP. When I modeled the 40 meter dipole, I determined that the voltage between the boom and the parasitic elements is approximately the same as the voltage in Yagi operation between the boom and driven element. All three element housings use similar insulation and construction methods. Although I have only tested the dipole with 100 W, I believe it can handle full legal power.

If you anticipate running high power, please do your own investigation. The balun and loading coils are in a small PVC box. At the 100 W power level, there is no detectable heating after several minutes of solid carrier operation. With full legal power, heat could possibly be a problem. If so, use a larger box, and/or move the loading coils outside of the box. Remember that SteppIR recommends that you do not transmit with over 200 W while the antenna is in the process of changing frequencies.

When I operate 40 meter CW, there are some very weak birdies generated by the SteppIR power supply. Occasionally I need to unplug the power supply if a birdie happens to be on top of a very weak signal I'm trying to work. This is an easy fix for a momentary problem.

If you use a CWS balun, be sure to weatherproof the enclosure and put a screened weep hole in the bottom of the box. Probably it would be easiest to use external loading coils with the CWS balun.

Although my antenna modeling indicated that the dipole modification should not affect the operation of the Yagi, I made some tests to satisfy myself that this prediction was in fact true. I temporarily installed relays, which I could use to disconnect the dipole wires while evaluating Yagi performance. I set up a test transmitter on a horizontally polarized dipole several hundred feet from my Yagi. I didn't find any difference in the received signal strength when I operated these relays. I did spot checks on a number of different bands and several beam headings. There was also no change in the SWR when I operated the relays.

I do not claim that these unscientific tests prove that the dipole will not degrade Yagi performance. However, I did satisfy myself that if there is any decrease in Yagi performance it must be very small!

The folks at SteppIR say that under some atmospheric conditions, the received noise level is decreased if the parasitic elements are not grounded. I do not know if hooking up the dipole wires is equivalent to grounding the elements. In my limited tests, however, I never found a difference in noise levels with the dipole wires disconnected by my relay system. If this is a concern, there is unused space in the parasitic element housings for vacuum relays to disconnect the ends of the dipole wires from the parasitic elements.

It takes approximately 20 seconds to change from the Yagi to dipole mode. If the driven element of a modified Yagi is set to 264 inches, instead of 4.5 inches, the average time for a Yagi to dipole change decreases to less than 10 seconds. Models and measurements indicate that the performance of the dipole will not be degraded. Please make your own measurements if you choose not to fully retract the driven element.

Possibilities for Use with Other SteppIR Yagis

It should be possible to use these same ideas with the 40 through 6 meter larger SteppIR Yagi. Dipole operation on 60, 75 and 80 meters should then be possible. The 4:1 balun will work on these bands. The loading coil inductance would need to be increased. Probably the same 8 inch standoff insulator height would still be okay, but if you are unable to do your own modeling, you could increase it to something like 12 inches just to have some extra margin. I have not seen one of these element housings, so a different method of bringing out the element center connections might be required.

The 4 element, 6 through 20 meter SteppIR Yagi on a 32 foot boom should also work with a 30 and 40 meter dipole. I constructed some rough models with this Yagi. No loading coils were required. Possibly the boom truss wires could serve as dipole legs. I believe the dipole's performance would be nearly equivalent to a full size 30 or 40 meter dipole. The feed point impedance would be approximately 50 Ω on both bands, so a 1:1 balun would work fine.

The RF voltage between the boom and parasitic elements will be higher than with the shorter boom Yagi, so there is the possibility that there could be trouble if you run more than a few hundred watts. When you model the antenna, estimate the RF voltage at these points. Perhaps the folks at SteppIR have some data about the boom-to-element breakdown voltage.

There is also the possibility that an 80 meter dipole would work with this larger SteppIR Yagi. You would need to model this antenna, make measurements, and then design and construct the loading coils, choosing an appropriate balun. It would require large high Q loading coils and possibly an unusual impedance transformation ratio. The RF voltage at the ends of the dipole wires will be even higher with this 80 meter dipole, so consider this before running high power.

I did some modeling with my 3 element SteppIR on its 16 foot boom, and also a short 40 meter beam on its 24 foot boom, to see

if either would work as an 80 meter dipole. Both models had unacceptable losses. If the boom length of a Yagi is much shorter than ⅛ of a wavelength I doubt that this dipole scheme can be used to build an efficient antenna. Possibly one of these higher loss antennas would be good for receiving only.

A 40 meter dipole could be attached to a conventional 3 element 20 meter mono band beam. You would need to insulate the director and reflector from the boom (several *QST* advertisers have hardware for this). If the dipole resonates slightly below 7 MHz, a small amount of capacitive reactance in series with the dipole wires would move resonance up into the 40 meter band. If it is resonant above 40 meters, use small loading coils.

On a long boom Yagi, use some capacitive reactance between the dipole ends and the parasitic elements to raise the resonant frequency to the vicinity of 40 meters. Make final adjustments at the center of the antenna by adding a small amount of inductive or capacitive reactance.

Another idea would be to construct a 15 or 20 meter dipole on a 10 meter Yagi. There are many other possibilities. Some of these would require something other than a 4:1 balun. If the dipole is only going to operate on a single band, a quarter-wave transformer made with coax is an option. Two quarter-wavelength pieces of 50 Ω coax in parallel will transform 12.5 Ω unbalanced to 50 Ω. Roll this coax into approximately an 8 inch diameter coil, and you have a choke balun too.

Two quarter-wavelength pieces of 75 Ω coax in parallel will match 25 Ω to 50 Ω. A quarter-wavelength piece of 75 Ω coax in parallel with quarter-wavelength piece of 50 Ω coax will match 17 Ω to 50 Ω. Another possibility is to design a series-section transformer, which can match nearly any impedance. If possible, use an antenna analyzer when you cut these pieces of coax. See *The ARRL Antenna Book* and your antenna analyzer manual for more information on the above topics.[1]

If you build your own balun, consider using a larger box so you can include a relay to switch a single coax run between the Yagi and the dipole. If your dipole design requires a significant amount of inductance, especially if you run high power, consider using linear loading instead of coils. Use longer PVC standoff insulators with multiple holes and thread a single piece of wire back and forth through the insulators to act as linear loading elements. Mechanically these PVC standoff insulators are very strong.

The above possibilities are untried ideas, except I did build a 12.5 to 50 Ω quarter-wave transformer for 40 meters. Dipole performance was identical with either the ferrite rod balun or the coax transformer.

Performance

I have been very pleased with both the electrical and mechanical performance of this antenna. On the air comparisons and my impromptu antenna range measurements confirm the modeled results. It has survived wind, ice and snow for 3 years. Most of my operating during this time has been with my Elecraft KX1 running between 1 and 4 W. I regularly work stations all over North America, and sometimes further, on 40 meters with less than 5 W.

If you build this antenna, please remember that the maximum radiation is *broadside* to the boom of the Yagi. The 40 meter pattern is quite broad; however, the nulls off the ends of the dipole are a measured 15 dB. I forgot this during the WPX Contest and tried, without success, to work a strong (long path) ZS station in South Africa for over 30 minutes. It turns out he was in this null. I was only running 4 W, so the 15 dB handicap was too much to overcome! Perhaps my next project will be a separate rotator display for the dipole, which will automatically make this 90° correction.

The author will provide information on his modeled results, including predicted azimuth pattern, to anyone requesting it via e-mail to his address below.

Rick Dwight, KL7CW, received his license in 1954 as KN6JBV. He has been an ARRL member for over 50 years. Rick graduated from the University of Southern California with a degree in physics and taught high school physics, math and electronics. He later worked for AT&T Alascom until he retired in 2001. His ham radio interests are building and designing QRP equipment, antenna experimentation, operating contests and CW. He has had two previous articles published in QST. *Rick is also interested in skiing, hiking, camping and bicycling. Rick lives in Palmer, Alaska, with his wife, Carolyn. They have 2 children and 6 grandchildren. You can reach Rick at PO Box 298, Palmer, AK 99645 or* **kl7cw@arrl.net**.

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

Strays

QST congratulates...

◊ ARRL Life Member John W. Meredith, WØPQI, of Colorado Springs, Colorado, who is serving as President of IEEE-USA.

◊ Roland H Patnode, W2WIZ, of Saranac Lake, New York, who has been named 2007 Volunteer of the Year for his many years of providing volunteer communications services to his community.

◊ Manny Hanowell, K7GVE, recognized by Mayor Greg Nickels after 50 years of continuous service as an engineer at Seattle City Light, the city's publicly owned electric utility. — *Tad Cook, K7RA*

◊ Nancy R. Williams, NR4RR, of Robbinsville, North Carolina, whose ham radio suspense novel, *A Matter of Destiny*, is available through **www.nlwilliamswriter.com**.

◊ Terry Graham, KD4QPB, who was recognized as Policeman of the Year in Rainbow City, Alabama. Officer Graham has served more than 20 years on the Rainbow City force. — *J. Harley Davidson, K4JHD*

AARA 1, Murphy 0: Our *Linux* Logging Program at Field Day

Club members meet the challenge to improve their logging efficiency.

Walt Legowski, WA1KKM

"*Linux? KB?* Walt, are you sure it will work at Field Day?" That was the reaction some skeptical club members expressed at the pre-Field Day meeting of the Albany Amateur Radio Association (AARA). Our Field Day Chairman, Ernie Popp, K2EP, announced that for 2006, our club would use *KB*, my homebrew contest logging program, instead of the commercially available *Windows*-based program we have used in past years.

It must have worked, as we broke a club record using *KB*.

The Operating System

So, what is *Linux*? *Linux* is an open-source, *UNIX*-like computer operating system that is stable (system crashes are rare), provides easy access to the computer's hardware (programmer-friendly) and runs on a PC, Mac or just about anything else with a microprocessor in it. *Linux* (*UNIX*) is preferred by scientific and technical programmers. The operating system on Cray supercomputers uses a flavor of *UNIX*; I was fortunate to spend part of my career on scientific programming with those cutting-edge machines. This experience facilitated the creation of my contest logging program, and ultimately, became a resource for our club.

The Computer Program

So, what is *KB*? *KB* is my contest logging computer program based on an idea originated by my friend Tom Owens, K7RI. It runs on the *Linux* operating system using the *Gnome* desktop. *KB* is written in the *C* programming language (with a little assembler thrown in). It is a complex multi-process, multi-threaded program that implements the *GTK+* graphical user interface. By keeping the complexity in the source code and away from the user, *KB* provides the operator with a program that is both intuitive and simple to use. This is a must, since an entire club of first-time users, as well as several guest operators, wouldn't get to touch it until Field Day.

Although still under development, *KB* already does a lot of what you would expect a contest logging program to do. On-the-fly dupe checking, CW and voice message keying, super check partial, packet and networking are among the currently available features.

KB generates CW in a technologically unique manner. A data stream representing the CW message is sent to the serial/USB port. A few small components then convert the data to the actual CW that keys the radio.

KB doesn't crash. Field Day 2006 was the first time in AARA club history that the computer network would stay up without a glitch for the entire duration of the event.

ERNIE POPP, K2EP

AARA president George Wilner, K2ONP, racks up an impressive QSO total at the CW station on Field Day last year.

ERNIE POPP, K2EP

Walt, WA1KKM; Sue, N2LBR, and Mike, WD2AJS (l-r), take down the homebrew 20 meter vertical after a successful Field Day.

Implementation and Preparation

So now you know what the program is about. But how we got from developing computer software to actually using it at Field Day is a case study in teamwork. AARA president George Wilner, K2ONP, is a *Linux* user. He has listened intently to my program development stories at each of the monthly club meetings for the past year. When I told him at that pre-Field Day meeting in May that *KB* was ready for Field Day, Ernie made the announcement at the meeting.

"Can you put on a demo at the June meeting?"

"Sure, no problem. By the way, each of the computers for Field Day will need a minimum of 128 MB of RAM, a 4 GB hard disk and a 350 MHz processor to install *Linux*."

"What?!" Suddenly, we needed computers. John Pritt, N1JP, donated one. Will Liporace, NA2NA (a computer specialist for the State of New York, and the one who got me set up on Linux in the first place), managed to obtain six more (including a Mac and several high-powered Pentium IIIs), plus all the keyboards, mice and cables. Barry Gross, N1EU, donated two monitors to the cause, and Guy Hoose, WK2H, got the club monitors, the network hub, CAT-5 cables and the power cords.

The club's June meeting was two weeks before Field Day. After the usual business meeting and the final Field Day planning

session, it was time for my presentation. I rapidly gained the interest of the attendees as I demonstrated the capabilities of the program, including the CW keyer and digital voice keyer. By the end of the demo I could see that I have won over at least some of the skeptics. I'm satisfied, the membership seems satisfied, and most importantly my wife Sue is smiling.

You see, it was her birthday, but instead of me taking her out to dinner, she watched me give a talk. What makes Sue so understanding? Well, for one, she happens to be N2LBR, and her prior experience with the Cray supercomputers has made her invaluable in helping me to debug *KB*. She is also the only other person who will be at Field Day who has actually used the program in other contests (Sue and I do multi-single efforts in the major contests). As such, Sue will be in charge of the training/demo computer that we planned to set up at the site.

The two weeks leading up to Field Day were a blur. *Linux* installations, *KB* installations, network setup, system testing — all problems must be found and corrected now or Murphy will pay us a visit. I decided the Mac would be the training/demo machine, as well as a backup should one of the PCs go up in smoke.

The Big Day!

Field Day morning, Sue and I arrive at our reserved site at the John Boyd Thacher State Park, in New Scotland, New York. It's a beautiful location, high in the hills overlooking Albany. Our crack tower crew (Nathaniel Greenman, KB2HPX; Dave Patti, KB2HPW, and Scott Eutermarks, N2MQQ) already have the towers and Yagis up, ready to go. Guy brought all of the computer equipment that he had picked up from me the day before. It was now time to set everything up.

After lunch, the station managers finish setting up the three HF stations (two phone and one CW) and the VHF station. The tower crew starts up the generator; the rigs come to life, and the computers boot up.

I boot up *KB* on each of the station computers and on the network server. I type SERVER and the *KB* server started up. I then type CLIENT on each of the computers, and one by one they connect to the network. The network is up and running. So far, so good. Meanwhile, Sue gives everyone a crash course in *KB* on the training/demo machine set up near the dining area.

In just minutes, Field Day will officially start. The phone ops take their positions at the two phone stations, and I get ready at the CW station. I wonder if it would really work. *KB* had never been used for a Field Day before. I've never had more than two computers to network before. Yes, it tested out okay at home, but will Murphy find a problem I didn't catch? Will everyone find the program easy to use? It's too late to worry about it now, but I double check everything, and then — *go*!

Field Day starts! Contacts are made, lots of contacts. The rate meter went higher than I've ever seen it — 200, 300, 400 contacts per hour! It's working! After about four hours, George tells me everyone is having fun, *KB* was working great and that by now the *Windows* program would have crashed five times! And yes, the remaining skeptics are becoming less skeptical.

After dinner, Sue and I get ready to go home for the night. We planned to return early the next morning, but the night crew will be going solo with *KB*. I left them an instruction sheet on how to restart the system, if necessary. They also have my phone number.

Sunday Morning

It's 5:30 AM and I can't sleep any more. I don't receive a phone call, so maybe everything is still going okay. By 8:30, Sue and I are back at the site. The *KB* network is still going strong. I look at the contact total — we have already beaten last year's score!

George told me that he found *KB*'s CW keying to be absolutely flawless, with perfect weighting and perfect spacing, and none of the timing issues that he had experienced with the *Windows* programs. George is a former CW traffic handler for the NTS, so he should know. That's why *KB* generates CW in a totally different way from the others — it's better.

Walter J. Legowski, WA1KKM, was first licensed in 1968. He holds an Amateur Extra class license. He received an SB in physics from MIT, where he studied electrical engineering. He also holds a BS in mechanical engineering and an MS in nuclear engineering from the University of Washington, Seattle. Walt was secretary of the MIT Radio Society, president of the University of Washington, Amateur Radio Club and vice president and board member of AARA. An avid contester, he holds an all-time North American record in CQ WPX and a #3 in the World in the CQ World Wide DX contest. All of Walt's antennas and most of his equipment are of his own design. He can be reached at **wa1kkm@k2ct.net**.

For More Information about *KB*

The *KB* program is still under development. New features are always being added and suggestions for improvements, based on the AARA Field Day experience, are being implemented. The current version for *SuSE-Linux* is available for download under the terms of the General Public License (GPL). For more information, go to the AARA Web site (**www.k2ct.net**) and click on the link for *KB*.

Now for the Rest of the Story

George D. Wilner, K2ONP, President, Albany Amateur Radio Association (AARA)

To promote participation in Field Day, each AARA member is encouraged to come up with special projects or ideas that they would like to try out at Field Day. These have usually been special antenna projects, or even different culinary menu items. In Walt's case, being a retired physicist with a background in mainframe computer programming, he decided to attempt something that no one else in the club had tried before: Build a contest logging program from the ground up for use at our Field Day.

In this era when many radio clubs are struggling to stay afloat, where there is widespread doubt as to the viability of our hobby and widespread bemoaning over our failure to attract legions of young people into the fold, our group has discovered that a simple thing like putting on a Field Day celebration seems to totally rejuvenate the Albany club. Whether we realize it or not, we actually spend all year planning for Field Day; as a group, we continually look for ways to improve our equipment, to build better antenna systems.

The reality is that our organization pulling together for Field Day is not a simple thing. It's something we have been doing for many years now, and it appears to have become the glue that holds all of us together. As radio hams, despite our widely divergent interests and experiences, we all share one consuming passion. We are all awed by the mystery and wonder of radio, and in the end this is the source of our unity and strength.

Building a Better Field Day

Getting back to the basics of Field Day lets a dad and his kids share Amateur Radio.

Ed Wright, KB6THO

I have always enjoyed Field Day — working stations that last week end in June is one of my favorite parts of Amateur Radio. In years past I have even gone solo on top of a mountain in my HF/VHF/UHF-equipped recreational vehicle, but I really prefer operating as part of a group. In 2006, our group, the Independent Radio Club, ascended to the Table Mountain Campground in the Angeles National Forest just outside Wrightwood, California.

I considered taking two of our children for their first Field Day, but the Unimog is not well suited to carrying kids over long distances. I was really looking forward to some weak signal work on 2 meters, 1.25 meters and 70 cm — maybe even some 1.2 GHz and satellite work out of the RV. During my prep, however, it became apparent that the truck just wasn't up to a 60-plus mile trip into the mountains this year. Was 2006 going to be a bust?

The Essential Field Day

I was a bit disappointed when I realized that I wouldn't be able to get the Mog ready for Field Day. It looked like Field Day wasn't going to happen for me in the manner I wanted. But is Field Day really about "business as usual"? No, it's about being able to operate in abnormal situations under less than perfect conditions. "Anywhere, anytime" is a good motto for Field Day.

I was also having qualms about passing on this chance to introduce the kids to Field Day. My 10 year old daughter Becky, KI6CRN, received her ticket earlier in the year, and my 8 year old son Daniel was developing an interest in the hobby. In early 2006, their school started an Amateur Radio club. Daniel, the youngest member of the school's club, enjoys attending with Becky. I began feeling that maybe I should make Field Day more about their budding interest in Amateur Radio than doing something that, in all honesty, I had done several times before.

So, "looking outside of the box," I took this as an opportunity to do two things: First, set up a truly portable solar powered HF station, using as much existing equipment as possible, and second, give my kids an enjoyable experience on their first Field Day. Marrying the two proved to be well worth the effort.

Power

A few years back, before the kids came along, I put together a solar power system for my shack. A 50 W solar panel, charging circuit and 12 V deep cycle battery provided the power to keep the packet station on the air. Several Field Days ago, I outfitted the RV for solar operation as well, installing a solar charging circuit. I obtained a second 50 W solar panel and mounted it on a PVC A-frame. With this, the panel can be set up outside the Mog and moved as needed to maximize power output as the sun traverses the sky.

For 2006, the solar charging circuit from the shack was reconfigured into a power distribution assembly (PDA) for portable operation. Anderson Powerpoles connect the panel, deep cycle battery and charger together, making for quick setup. The 75 A Powerpoles and 6 gauge cable run from the battery to the PDA, ensuring maximum current is available at the PDA should it ever be necessary.

I used 30 A Powerpoles for the panel input and 12 V dc output. The connectors for the solar panel are aligned vertically, while those for the battery are horizontal to prevent hooking things up incorrectly. The battery also has a set of 30 A Powerpoles so it can be used without the solar panel. This configuration meets my portable design criteria for quick setup and keeping the battery charged.

Radio

My rig is a Yaesu FT-897D. I don't have the internal batteries yet, so the deep cycle

Becky, KI6CRN, uses her grandfather's SWR-121 to check the match on the Buddipole antenna from the Independent Radio Club 2006 FD site at Table Mountain Campground in Wrightwood, California. This time the match was 1.2:1 — not bad!

Daniel worked 40 meters last year. He had an earbud in his left ear, while I had the other in my right ear. This made helping the kids work Field Day very easy, as we could hear each other and the radio.

battery is my portable power source for the time being. Not something to lug up a hill, but certainly capable of traveling on a camping trip or, incidentally, to Field Day. The advantage of the deep cycle over the internal batteries is power. I can run the '897 at its full 100 W if necessary, with no 20 W limitation. This is a plus for Field Day or emergency operations.

Antenna

A portable multiband HF antenna that works well, and is *really* portable…I certainly didn't have anything like this laying around in the shack. In my research, I came across something that looked quite promising: the Buddipole (**www.buddipole.com**). This antenna can be made resonant on 40 meters up through 2 meters, and can mount on an extendable painter's pole — good enough for my Field Day plans. What really caught my eye were the Buddipole's telescopic end whips; telescopic translates to "easy-tune" for me.

When my father-in-law Bob, K6GLV (or Bapa to the grandkids), became a Silent Key, his shack and everything in it passed to me. In that eclectic collection was a graphical antenna analyzer, the AEA SWR-121. It dawned on me that with the analyzer, the Buddipole could be tuned for a near-perfect SWR, just by adjusting those whips.

A couple of mouse clicks later, and the UPS truck arrived with the Buddipole. The kids and I set up the solar panel, battery, radio and Buddipole in the backyard for a quick try on 20 meters. Texas boomed in at S9+, and with a modest 20 W, we got 56 to 58 reports back. After that quick test gave positive results, it looked like Field Day might work after all.

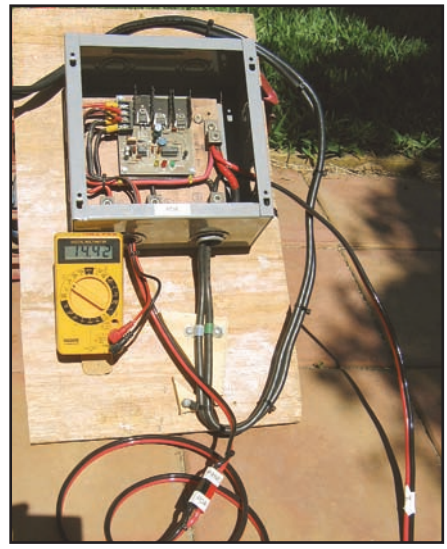
Our family goes camping on the coast north of Santa Barbara just about every summer. Last year was no exception, with the week before Field Day being our allotted time to camp. The Buddipole and '897 were packed, but since space was limited, I decided to leave the solar panel and PDA home. I didn't worry, since I had ample battery capacity for a night of practice with the SWR-121 and Buddipole.

Alligator clips on the battery didn't work all that well, so I added those 30 A Powerpoles to the battery when we got back. The Buddipole consistently tuned to 1.2:1 or better on 20 meters. Running 50 W and with the Buddipole up 12 feet, I contacted G. K. Rieger, VK7GK, down under in Tasmania. With that one contact, I knew Field Day was doable. Becky and Daniel were taking a greater interest as well, and 2006 was now looking very promising indeed.

CQ Field Day from WA6IRC

Field Day morning, Becky, Daniel and I departed with anticipation for the IRC Field Day site at Table Mountain Campground. We arrived about noontime and checked in with the Field Day coordinators. Since Field Day had officially started about an hour earlier, we were glad setup would be quick.

Charging the deep cycle battery with the solar panel. The power distribution assembly (PDA) regulates the charge. The unconnected pigtail is the 12 V dc output from the battery.



The power distribution assembly showing the solar panel input and 12 V dc output.

Our operating area was a large clearing in a stand of tall pines, about 100 feet from the parking area. The three of us ferried our equipment to the clearing and had the panel, battery, PDA, card table and rig ready in about 10 minutes. Daniel, Becky and I then set up the Buddipole on an umbrella stand in short order. We chose 15 meters as a good band to start our first Field Day together — not too crowded, not too sparse. Becky ran Bapa's old SWR-121 with gusto and announced a 1.2:1 match. We were now "good to go."

Becky started calling CQ FIELD DAY with first-rate results, logging stations in our section (LAX), as well as ones from Orange County to our south (over the San Bernardino Mountains) and the San Joaquin Valley (far up the plain to our north). When we heard "NH6JC, 2 ALPHA PACIFIC," I encouraged Becky to stay on frequency and see if we could log this one.

Her persistence paid off when NH6JC asked the pileup to "PLEASE STAND BY FOR THE YL STATION. WHISKEY ALPHA 6 INDIA ROMEO CHARLIE, GO AHEAD." Becky completed the exchange as she logged NH6JC and he responded with, "QSL. YOU'RE 3 ALPHA, LAX, AND GOOD LUCK IN THE CONTEST!" Having my daughter smiling and talking to Hawaii on 15 meters near the bottom of the solar cycle, running just 50 W into a dipole up 12 feet — now that made my Field Day!

Daniel's interest in Amateur Radio is growing to match that of his interest in typical 8 year old boy stuff. He and I took a turn on 40 meters when the band wasn't too crowded. We tuned the Buddipole to 1.6:1 and Daniel began calling CQ. As he worked a couple of stations, I noticed he was quite intrigued by the audio from the '897.

Seeing his fascination at how SSB audio changes during tuning, I let Daniel practice dialing in stations with the occasional reply to a CQ. Later in the day, he took a try at the 20 meter operating position. There were lots of pileups, so he went off with some of the other kids to look for lizards. Again, his smile told me we had succeeded.

Making It Work

Being their first Field Day, an enjoyable experience for the kids was paramount. I had been pondering a couple of potential issues in the time leading up to our big Saturday. The solution to one came as our youngest, Will, asked for some "Magic Blue Tape" to frame his latest bit of art.

Will's preschool uses blue painters' masking tape that he calls "Magic Blue Tape." It is amazing stuff — not only good for masking areas to be painted, it also marks out where to sit on the carpet, where the play area is and it even works as a label. I had my answer and tossed a roll into the Field Day box. When we set up our card table on Saturday, we put down strips of blue tape emblazoned with "CQ Field Day, Whiskey Alpha 6 India Romeo Charlie" and "3 Alpha LAX." With

that, we had eliminated the problem of our identity blowing away in the wind.

Headphones are a great help on Field Day, but I didn't think a traditional set would work well for us. Being able to hear the radio without disturbing our other operators, and being able to help Becky and Daniel work the stations heard, was crucial. Since we would be sitting next to each other, I chose to use a set of earbud headphones. With a change to a mono plug on the end, one earbud in Daniel's ear and the other in mine, we could hear both the radio and each other quite well. This made it very easy to help Becky and Daniel as they worked their first Field Day.

A Field Day Well Spent

What was looking like a bust for Field Day 2006 actually turned out to be one of the best in many ways. I was able to build and field an effective solar powered portable HF station primarily with existing equipment, and most important, I was able to give my kids a chance to experience an enjoyable first Field Day and all that goes with it. Of course, add in the fun of just being up in the mountains with friends from the club, putting faces to call signs, enjoying each other's company and the hobby, and you have a winning day.

Late Saturday, as the sun crept lower in the west and the beginnings of thunderheads began to loom on the horizon and pass overhead, traffic on the talk-in frequency announced that two of our members were traveling up the hill with ribs and chili, signaling that it was now time to pack up and celebrate a successful first half of Field Day. I was especially thankful for the quick cleanup, as that meant I could get my share of the grub, too!

After a time, me and the kids wound our way down the mountain and across the sunset-colored desert for the trip home. I reflected on the changes of fortune that had brought me a most satisfying Field Day: Spending time with my kids, sharing what was now *our* hobby.

"Hey, guys, did you have fun today?"

"Yes, Papa, it was fun! Can we go next year?"

"QSL, guys. QSL!"

All photos by the author.

Ed Wright, KB6THO, holds an Amateur Extra class license and enjoys working with other Independent Radio Club members on enhancing the group's linked repeater system. He has dabbled with digital modes, HF and satellite work over the years, but his favorite is the 1.25 meter band where he got his start. Ed received his Novice ticket in 1987, much to the joy of his father-in-law-to-be. A third generation of Amateur Radio in the family began in 2006 when his daughter Becky, KI6CRN, received her Technician license. Her two brothers are not far behind, with Daniel aspiring to get his General license, then his grandfather's old call. You can reach him at **kb6tho@arrl.net**.

New Products

NIFTY! *MINI-MANUAL* FOR ICOM IC-718

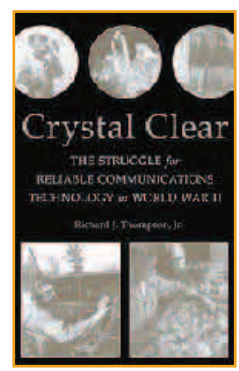
♢ The *IC-718 Mini-Manual* from Nifty! Ham Accessories is a quick reference guide for ICOM's IC-718 entry level HF transceiver. Nifty! *Mini-Manuals* provide abbreviated instructions for a variety of transceivers and are intended to be kept with the radio for quick access to needed information. The 14 page *IC-718 Mini-Manual* includes simplified step-by-step programming and operating instructions for all of the IC-718's controls and setup menus. It measures 4.5 × 8 inches and is laminated for durability and weatherproofing. Price: $16.95. For more information or to order, visit **www.niftyaccessories.com**.

STAINLESS STEEL RF ADAPTERS FROM TIMES MICROWAVE SYSTEMS

♢ TuffGrip precision RF adapters from Times Microwave Systems are intended to complement the SilverLine TuffGrip series of RF test and measurement cables. These stainless steel adapters are said to be more durable than typical nickel-plated brass adapters. They are available in several styles: 7-16 DIN female-to-female, N male-to-male and female-to-female, N male to 7-16 DIN female and N male to 7-16 DIN male. The Type N double male and double female adapters are rated for use to 18 GHz with low VSWR. The 7-16 DIN adapters are laboratory grade but designed to provide long life in field applications. For more information, see **www.timesmicrowave.com** or your favorite wire and cable dealer.

New Books

CRYSTAL CLEAR: THE STRUGGLE FOR RELIABLE COMMUNICATIONS TECHNOLOGY IN WORLD WAR II



♢ *Crystal Clear: The Struggle for Reliable Communications Technology in World War II*, by Richard J. Thompson, Jr, delves more deeply into crystal technology than his *QST* article "…And We Had Crystals" (Jan 2004, pp 43-45). Some of the defining leaps in technology in the 20th Century occurred during World War II, from radar to nuclear energy. Often left out of historical discussions are quartz crystals, which proved to be just as pivotal to the Allied victory — and to post-war development — as other technologies. For the first time, quartz crystals provided the US military with reliable communication on the front lines, becoming the core of some of the most basic devices of the post-war era, from watches, clocks and color televisions, to cell phones and computers.

In *Crystal Clear*, Richard Thompson relates the story of the quartz crystal in World War II, from its early days as a curiosity for Amateur Radio enthusiasts, to its use by the United States Armed Forces. It follows the intrepid group of scientists and engineers from the Office of the Chief Signal Officer of the US Army as they raced to create an effective quartz crystal unit. They had to find a reliable supply of radio-quality quartz, devise methods to reach, mine and transport the quartz, find a way to manufacture quartz crystal oscillators rapidly and then solve the puzzling "aging problem" that plagued the early units. Ultimately, the development of quartz oscillators became the second largest scientific undertaking in World War II after the Manhattan Project.

Bringing to light a little-known aspect of World War II, *Crystal Clear* offers a glimpse inside one of the most significant efforts in the annals of engineering. Published by Wiley-IEEE Press, 2006, 230 pp. $54.95. **www.wiley.com/WileyCDA/Section/id-301635.html**. — *S. Khrystyne Keane, K1SFA*

Unidentified Flying Signals, and What We Can Do About Them

*We want **you** to help guard and protect the amateur bands.*

Chuck Skolaut, KØBOG

When you see words like "Boing Boing," "CODAR," "Yosemite Sam," "Spy numbers stations" and "Firedragon," what do you think of first? You may think of a new science fiction story or even a Saturday morning cartoon show. If you are part of the ARRL Monitoring System/Intruder Watch, or you contribute reception reports of unidentified signals, you know better.

You don't have to be Sherlock Holmes, but it does help if you have a Hardy Boys mentality to aid in sorting out the various reception reports of unidentified signals heard on the amateur bands. Our monitors take part in an exciting world where one day you may be on the lookout for a cartoon character run amuck on the hams bands, to fighting a fire-breathing dragon that spits out music and causes interference the world over on a popular amateur band the next.

The ARRL Intruder Watch is a small group of dedicated amateurs across the country. They spend their available time tuning the amateur bands, looking for signals not originating from amateurs that cause interference to normal operation on the bands. The ARRL Monitoring System/Intruder Watch combines its efforts with the International Amateur Radio Union (IARU) Region 2 (which covers the Americas) Coordinator as part of the worldwide team that includes Regions 1 and 3.

Bill Zellers, WA4FKI, of Fayetteville, North Carolina, is the IARU Region 2 Monitoring System Coordinator. The IARU Monitoring System (IARUMS) is a worldwide service working primarily to identify and initiate the necessary steps to remove any non-Amateur Radio signals causing harmful interference through improper use. Bill joins with coordinators in ITU Regions 1 and 3 in this mission to maintain the amateur bands, keeping them free of outside interference as much as possible.

Boing Boing

"Boing Boing" was the name given to describe an intruder on 12 meters a number

of years ago, because it sounded to some like a squeaky spring. Brennan Price, N4QX, former administrator of the ARRL Monitoring System, received numerous reports from Amateur Radio operators. Brennan asked the FCC for help in locating the source.

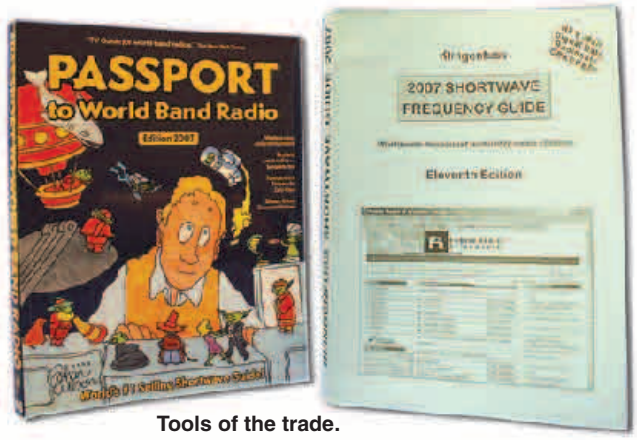
The HF direction-finding facility in Columbia, Maryland quickly found it to be originating from Honduras. It identified the signal as Coastal Ocean Dynamics Applications Radar. CODAR is an ocean current-mapping technology used in meteorological and other commercial applications. Evidently an operator had entered in the wrong frequency, and it was quickly rectified when they were notified.

CODAR Strikes Again

Another report of an intrusion by a CODAR installation surfaced in April 2004. John O'Hara, KF6AVB, from San Diego noted the signal was particularly strong at his location, prompting him to do some detective work. A search of the FCC license database associated the signal with an oceanographic research project off the coast of San Diego and Baja California, conducted by the Scripps Institution of Oceanography at the University of California San Diego. The project involved the use of three separate CODAR sites to monitor ocean currents in the region. Working with the project's director, John determined the CODAR site (located on South Coronado Island in San Diego Bay) was responsible for the intruding signal. An alternate frequency was chosen, eliminating

S. KHRYSTYNE KEANE, K1SFA

As a part of the ARRL Monitoring System/Intruder Watch, you too can patrol the bands and report suspicious signals.



Tools of the trade.

the 12 meter intrusion while allowing the important research to continue without interruption. The project people were extremely cooperative and grateful for Amateur Radio's help in resolving the incident.

O'Hara noted this was similar to the problem caused by the "Boing Boing" intruder (see **www.arrl.org/news/stories/2001/03/14/2** — this includes an audio file of the sound, and **www.arrl.org/news/stories/2001/03/21/4** for more information). ARRL news articles led him to identify the signal as CODAR and set him on the right track.

Several more recent cases of CODAR intrusions on the 12 meter band have been reported. With the aid of the FCC, direction finding abilities were located and resolved, one in the Gulf Coast that was interfering with an RV net and one off the Virginia coast.

Calling all "Varmints"

The Yosemite Sam incident involved a signal that first appeared on December 19, 2004. It was heard on 3.700, 4.300, 6.500 and 10.500 MHz double sideband. A transmission was made on one of the frequencies, and 10 seconds later it was repeated on the next higher frequency. Every 40 seconds, a transmission was made on each frequency, starting with an 800 millisecond data burst and followed by the phrase, "Varmint, I'm a-Gonna Blow Yah ta Smithereens," with the voice of Yosemite Sam of Looney Tunes cartoon fame. An audio clip of the transmission is available at **www.spynumbers.com/ys.wav**.

The signal went silent this past December 23, only to reappear in February. With the aid of the FCC direction finding station, the signal's source was narrowed down to an area west of Albuquerque. Two New Mexico hams finished tracking down the exact site and the FCC resolved the problem.

I Spy

Spy numbers stations refer to shortwave stations of uncertain and mysterious origin. Most of the time they are heard outside of the amateur bands, but they have occasionally been heard on 30 meters. They may consist of 5 letter CW code groups or spoken numbers or letters.

The Internet has a wealth of information about these stations with various explanations for their existence. One article says they have been reported since World War I. If this report is accurate, it would make number stations among the earliest radio broadcasts. It has long been speculated that these stations operate as a simple and foolproof method for government agencies to communicate with spies. More recently, they have perhaps been related to illegal drug smuggling operations.

One of the simplest methods to transmit messages via random numbers is the use of a one time code pad. This is where the sender and the recipient both have identical pads; each sheet of paper in the pad is used only once and then destroyed. It has been said that the CIA has a special type of paper that turns into chewing gum when it contacts saliva. The numbers stations were particularly prolific during the Cold War era, but many are still heard today.

One of the most recent reports of a numbers station operating in the amateur bands stated that at 1740 UTC on September 27, 2006. Dubbed the "Russian Man," he appeared on 10.116 MHz with a call of 201, 201, 201 (an audio file is available at **www.simonmason.karoo.net/page505htm**). From time to time, others report 5 letter or number groups on 10.126 MHz. Most of these are thought to have come from Cuba.

Breathing Fire

"Firedragon" is a fairly recent example of jamming attributed to the People's Republic of China aimed at blocking the *Sound of Hope* broadcasts in Taiwan. Jamming from China was first noted in December 2005 and January 2006 on 18.160 MHz. In July 2006, this music jamming was noted for a short time on 14.230, 14.305, 14.310 and 14.350 MHz, and then it stopped. On August 5, it was back on the air, heard primarily on 14.260 MHz and was nicknamed the Firedragon. Reports flooded the ARRL Monitoring System at ARRL Headquarters, as well as the other ITU region monitoring coordinators. These complaints were forwarded to the various national agencies, asking for help in resolving the interference.

About 10 days later, the jamming moved to the CW portion of 20 meters on 14.050 MHz. Finally, on September 2, it moved to 14.400, and sometimes to 14.600 MHz — both frequencies are outside of the ham band. As of this writing, it has remained out of the 20 meter amateur band. We believe both the cooperation and the large number of complaints from amateurs around the world helped eliminate this interference.

Russian Beacons

One other frequently reported signal is any one of a number of single-letter beacon stations that originate from different areas in Russia on 7.039 MHz; these are thought to be used by the military. These stations identify with a single letter in conventional Morse code. Here is a list of ones reported in the past and their locations: F (Vladivostok), C (Moscow). L (St Petersburg), P (Kaliningrad), R (Ustinov), S (Arkhangelsk) and V (Tashkent).

Safeguard the Bands

The work that the Intruder Watch group does is vital. Their vigilance helps maintain the amateur bands, keeping them free from unwarranted interference from intruders. Today, when all segments of the radio spectrum are increasingly becoming a valuable commodity, we all need to be vigilant while using the bands. One word of caution: Be sure to check the band plans for the other regions when determining if a signal is really an intruder or allowed in the other regions.

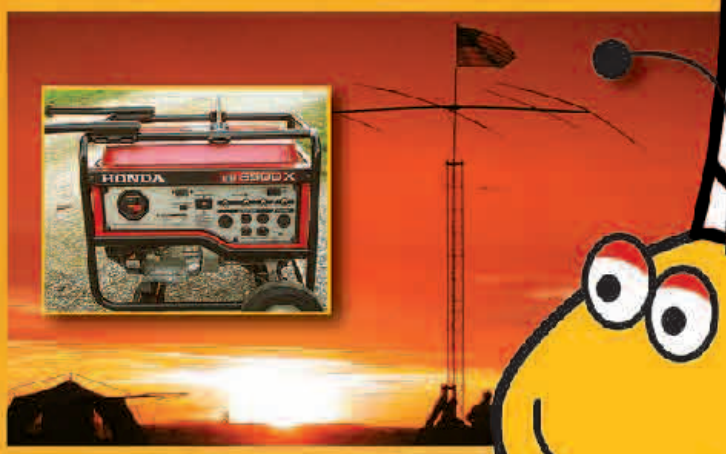
The IARU band plans are available at **www.iaru.org/bandplans.html**. The FCC's *Online Table of Frequency Allocations* is available at **www.fcc.gov/oet/spectrum/table/fcctable.pdf**. To aid in identifying signals you hear, check out **www.kb9ukd.com/digital/**, a popular site for digital signals, as well as **www.iarums-r1.org/iarums/sound/main.html** for sound files from the IARU Region 1 Web site.

When you hear intruders, we invite you to forward reports to us at **cskolaut@arrl.org**. If you have any questions or are interested in becoming a recognized member of our monitoring system, please contact the author.

Chuck Skolaut, KØBOG, is the ARRL Monitoring System Coordinator. He can be reached at **k0bog@arrl.org**.

ARRL Field Day Cookbook

It's no contest—many are convinced that Field Day weekend is the most fun you'll have as a ham. Whether this year's running, June 23-24, is your first FD or your 27th, you'll want to devour the contents of this special insert.



Contents:

ARRL The national association for AMATEUR RADIO

www.arrl.org/fieldday

Of Antennas and Mosquitoes

Geoff Fox, WA1U and Kevin Webster, N1EPU

Field Day groups have been experimenting with temporary antennas since 1933, and there's still no consensus! Several clubs agreed to share their collective antenna wisdom, so you can reach your own conclusions.

Verbal battles have been fought for decades over which part of your station is most important, but many say it's the antenna. That's never more true, these folks say, than on Field Day!

Antennas are transducers. They are the connection between the radio frequency electrical currents your fancy transceiver produces and the electromagnetic waves that freely roam the atmosphere. Transducers are notoriously inefficient.

Simply put, you can't run enough power to make up for a bad antenna. More importantly, for Field Day purposes, a really good antenna can cover the fact you're running low power or operating under less than optimal circumstances.

QRP FD?

"I could run 5 watts and work the world." That makes Mike, K2LEK, a perfect example.

Living in rural New Jersey and operating by himself, Mike made the right choice with a very simple antenna. His extended double Zepp (fancy name, but it's just wire), fed with 450 ohm ladder line, was matched to his transceiver by a small tuner.

Using a crossbow...at this point Mike reminded me just how rural the area was...he shot a line into an 80 foot oak tree. Others use fishing rods, slingshots, or like John, N1OLO, a lightweight tree surgeon's throw line and 14 ounce weight.

Get that antenna as high as you possibly can. The lower the frequency, the higher the antenna needs to be!

Mike took advantage of ladder line's incredibly low loss. Even with a 3:1 SWR on 15 meters, ladder line's loss is 0.3 dB. Use lightweight RG-58 feed line instead and the loss is over 3 dB — more than half your power never gets to the antenna!

The Philmont Mobile Radio Club's FD '06 antenna arsenal included this modest beam.

Most Field Day operations are mounted by clubs or just groups of friends who want to get together for a fun weekend. Operating in a group is a good news bad news situation. The good news is, you've got lots of people. The bad news is, you've got lots of people.

This is where organizational skill takes over. That's a skill I don't personally possess. Luckily, most groups can find that one person who likes making lists...whose lists have lists!

For our last Field Day operation, Harold, WJ1B (now ARRL COO), came to the meetings and the actual Field Day site, with spreadsheets listing everything we'd need, where it would come from, where it would go and who was responsible for it.

I would have dismissed Harold's lists...until we started to use them. Harold sweated the details at home so we wouldn't have to in the field. He was a lifesaver!

Larger clubs, like the Mount Airy VHF Packrats, keep an on-line inventory. Before they head to the field, they make sure nothing has disappeared. When they do go, fluorescent, color coordinated tower sections, rotators and beams simplify the installation.

"Know what your antennas are going to be. Know what your supports are going to be, before you get there." That's the mantra from Mount Airy's president, Rick, K1DS. They go so far as to do a post mortem after each event, looking at photos and deciding what did or did not work.

BOB BULLOCK, K5RWB

The Jackson (MS) ARC got some FD help from the State Health Department's 100 foot tower.

Who Brought the Transceiver, Anyway?

Having one person in charge of each aspect of the operation can streamline your setup. The Meriden Amateur Radio Club in Connecticut, operating in Class 2A, has CW and SSB station leaders who decide all aspects of their individual stations.

Those leaders, taking "ownership" of your antenna concerns, can make a world of difference.

In their first year with an antenna coordinator and team, Maryland's Montgomery Amateur Radio Club doubled their previous score. Mona, NY7P, said even when torrential rain forced their operation from open tents to the inside of a van, and limited them to just one station on-the-air, the antennas saved the day.

By the way, when that torrential rain does come (and it will) make sure any antenna traps are properly mounted with the drain holes facing down...not that I would know from personal experience or anything like that.

In the end your antennas, as so much else in life, will be a compromise.

Some Meriden Amateur Radio Club members questioned the extra effort to fly all those antennas. What's the hassle-to-benefit ratio? That's just one consideration — though a very important one.

How much space do I have? What frequencies do I want to operate? What's the manpower situation? How much will this cost? Most importantly, is this safe? Some of the questions will have mutually exclusive answers!

For years, the Meriden club used a huge V-beam with 480 foot legs. Up 50 feet, and fed with an "old school" open feed line, the "V" was a killer on 80 through 10. It was an antenna they bragged about!

Flexibility Pays Dividends

When developers pushed the club from their hillside pasture to a town park, the V-beam was dropped, replaced with a tri-bander on a 30 foot ladder. It's the kind of compromise clubs make every year.

This year, back in wide open spaces, the V-beam very well might return. Bill, W1KKF, says the space gave his club the luxury to "experiment with all kinds of antennas, and we did!"

On idyllic Nantucket, Massachusetts, the Nantucket Amateur Radio Association operates on the beach or a bluff overlooking the ocean. This is their time to test emergency skills. As three operators assemble and hoist their portable mast, one more is in their emergency van hooking everything up.

To them, it's like a ritual.

Does the coordination work? You be the judge: they can get on the air in a little over an hour after arrival.

VHF antennas tend to be light. Often, more than one beam can be stacked on the same mast. Just remember to separate them vertically by at least a half wavelength. The light weight also opens up the possibility of "Armstrong" rotators! Of course, as one rotates, so does the other.

When you do operate multiple stations side-by-side with antennas in close proximity, you have to worry about generating your own interference. There are simple solutions, like coax stubs, that are well documented. If this is one of your club's headaches, find a contester or two. This is a problem they've probably already faced and usually conquered.

Stay Alive Until Next FD!

Where you should never make antenna compromises is safety. No matter what you do, you've got to avoid the urge to "throw something up" on Field Day. Yes, it's only a temporary installation. Making allowances for that is very different than ditching safety to get the antenna in the air quickly.

With a permanent installation, you need to be conscious of using materials that will survive long term exposure to the weather — like top-grade cable or aircraft cable to support a permanent tower installation.

For Field Day, you're only supporting structures

Field Day at W6SON, with four towers and antennas for 3.5 through 432 MHz, including 4 elements on 40 meters!

Fifteen-year-old Karen, KCØOCH, made all of KAØSWL's 10 meter FD contacts from this unusual mobile station. The group resisted the idea of loading up the large structures in the background.

for two days. Permanent isn't as big an issue.

You can get by with driving the bottom section of the tower into the ground (or burying a few feet if the ground will allow you to dig). You can also use rope for guying the antenna rather than heavy steel cable (although if you have cable cut to length already, that's always a better choice).

Be careful using nylon or other material that stretches. You may find that what looks nice and solid has a lot of play in the guys if you use nylon rope to support it!

Since this is a short-term installation, you probably won't be using tall towers. That will allow you to use less-permanent anchors. Weather conditions and the forecast wind at your site are important considerations. In most cases, trees or metal pipes driven into the ground will work for Field Day, though not for a permanent installation.

In fact, you need to be *more* careful on Field Day when less than optimal materials are being used. In the end, it's only a hobby and never worth putting life, limb or property at risk just for a couple of extra points.

Be Visible

Aside from radiating, there is one more factor to consider when you're erecting your Field Day iron. When you set up in a public location, you are recruiting new hams. Anyone who sees antennas and wonders what's connected to the other end of the wire has the potential to be one of us.

Take the Alameda (CA) County Sheriff's Communications Team. They set up in the San Leandro Marina, a very visible location in the East Bay. When they pull up their van and tilt up the 50 foot tower, they know people will take notice.

"It's about trying to recruit people for ham radio," says Andy, N6AJO. "You want them to see something big!"

That's what was missing when the Alameda group operated from their repeater site, on a less accessible hilltop. "The operating was better, but no one got to see us."

Meteorologist Geoff Fox, WA1U, forecasts the weather on WTNH-TV and WCTX-TV in Connecticut. He can be reached at **www.geofffox.com**.

Field Day Fare for the Discriminating Palate

What is a *Field Day Cookbook* without recipes? These are real recipes that you can prepare yourself. However, please note the following precautions…

- When a recipe calls for "meat," do not substitute animal flesh of uncertain or unsanitary origin. Creatures that have suffered lethal encounters with motor vehicles do not qualify as "meat."
- Do not procure vegetable ingredients from nearby farm fields. Farmers tend to dislike this practice. Some carry firearms.
- Do not attempt to smoke meat or vegetables with exhaust fumes from electric generators.
- Tree bark is not an herb.
- Resist the temptation to use liquid helium or hydrogen for on-site refrigeration. Metallic soft drink containers are likely to superconduct. Hydrogen vapor may react explosively with open flame, provoking cries of "Oh, the humanity!" among those present.
- Obtain the consent of your entire Field Day crew before adding recipe enhancements such as jalapeno peppers, snails, the sensory organs of animals or anchovies. Especially anchovies.

VO1MRC Sunday Breakfast

FD fuel needn't look nasty!

The Skyview Radio Society "Dipole"

Courtesy of Bob Bastone, WC3O

Ingredients:

Foot long hotdog buns
Normal-sized all-beef hotdogs
Canned, crushed pineapple
Yellow onions
Spicy barbeque sauce

Use a strainer to drain the juice from the crushed pineapple. Chop the onion into small pieces and set aside.

Grill the hotdogs until thoroughly cooked. Put a bed of crushed pineapple along the inside of the bun. Place a layer of chopped onions atop the pineapple bed. Put two hotdogs end-to-end on top of the pineapple-onion mix and slather barbeque sauce over everything.

W1AB's Field Day Stew

This hearty dish is designed for slow cooking in a crockpot. Begin preparation the night before or in the early morning and it will be ready to deliver to the Field Day site by evening.

Ingredients:

7 lbs of beef (chuck)
1 lb mushrooms
3 lb carrots
6 medium potatoes
1 can of mixed vegetables
2 can of stewed tomatoes
1 red pepper
1 green pepper
1 red onion
¼ cup A1 Steak Sauce
½ cup Heinz Tomato Ketchup
1 tablespoon seasoned salt
¼ tablespoon black pepper
¼ tablespoon red pepper
3 packages of brown gravy mix
½ cup cornstarch
3 tablespoons of olive oil

Brown the beef in a large frying pan and add it to the crock pot with the pot set to **HIGH**. Do not clean the frying pan until you've sautéed the onions and mushrooms.

Dice the onion and sauté it in the frying pan with just enough olive oil to cover the bottom of the pan. Place the onions in the crockpot. Repeat with the mushrooms.

Add the canned vegetables and stewed tomatoes to the crockpot. Stir well.

Add the salt, black pepper, red pepper, A1 sauce and ketchup to the crockpot.

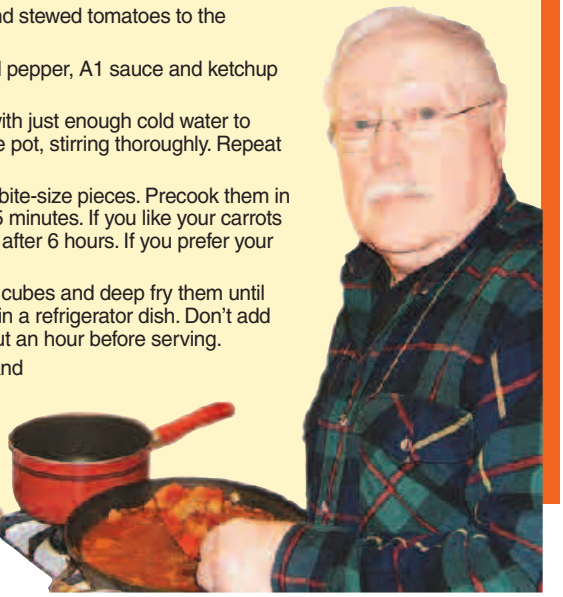
Mix the brown gravy powder with just enough cold water to make a thin paste. Add it to the pot, stirring thoroughly. Repeat this step with the cornstarch.

Peel and slice the carrots into bite-size pieces. Precook them in a microwave oven for about 15 minutes. If you like your carrots firm, add them to the crockpot after 6 hours. If you prefer your carrots soft, add them now.

Cut the potatoes into bite-size cubes and deep fry them until they are medium brown. Cool in a refrigerator dish. Don't add them to the crockpot until about an hour before serving.

Reduce the crockpot to **LOW** and cook for about 12 hours, adding the carrots and potatoes at the desired time.

Deliver to hungry crew!



Al Brogdon, W1AB, whipping up a small portion of his famous Field Day Stew.

MAGGIE BROGDON

The Field Day Space Race

Look to the stars for some of your best contacts!

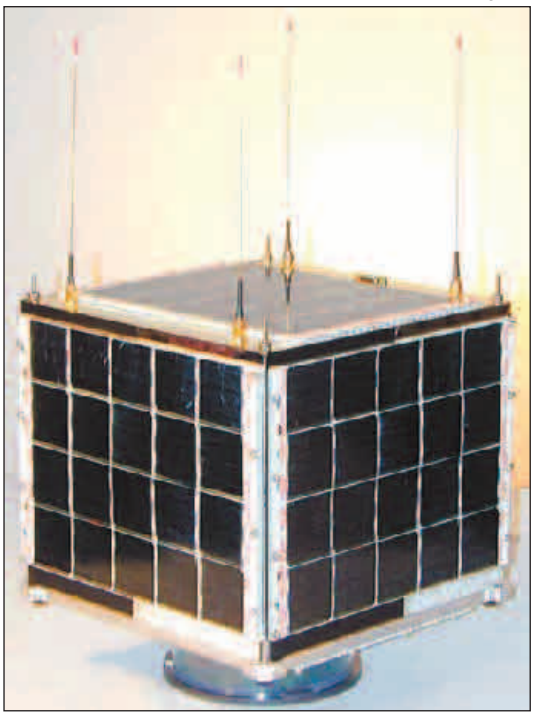
Steve Ford, WB8IMY

As you read these words, dozens of Amateur Radio spacecraft are whizzing around the globe like angry bees. They rise above your local horizon, streak across the sky in about 10 to 20 minutes, and then disappear.

This is common knowledge, and not only among those stationed at Area 51. In fact, hams have been lofting spacecraft into orbit since 1961. These "birds" are often referred to as *OSCARs*: Orbiting Satellites Carrying Amateur Radio. The satellites function as signal relays, allowing VHF/UHF stations on Earth to communicate over hundreds or even thousands of miles.

On Field Day, a contact made through an Amateur Radio satellite can earn you 100 bonus points if you are operating as a Class A (a club/non-club portable operation using battery power), Class B (one or two person portable), or Class F (operating at an Emergency Operations Center). The bonus notwithstanding, each satellite contact counts as a point on its own regardless of class.

AMSAT-NA



This innocuous little cube is one of the most popular Amateur Radio satellites in orbit today: OSCAR 51.

The FM Birds

Do you have a dualband VHF/UHF FM rig that can receive below 437 MHz? Try OSCARs 27 and 51 — the FM repeater satellites. Just use the frequency table to program the radio's memories so that you can quickly compen-sate for frequency drift caused by the Doppler effect. Switch memory channels according to the times shown in the table.

	OSCAR 27		OSCAR 51	
Time	*Transmit*	*Receive*	*Transmit*	*Receive*
AOS (start)	145.860	436.805	145.930	435.310
AOS+3 Minutes	145.855	436.800	145.925	435.305
Zenith (maximum)	145.850	436.795	145.920	435.300
Zenith+1 Minute	145.845	436.790	145.915	435.295
LOS (end)	145.840	436.785	145.910	435.290

The problem with the FM satellites is that they can only repeat one signal at a time, just like repeaters on *terra firma*. On Field Day, hundreds of signals will be blasting skyward and the result on the downlink will sound something like this:

"CQ Field Day from —"

Bzzzzzzt! Screech!

"This is —"

Screech!

Patience and persistence are key. Keep trying until you make contact. Field Day rules allow only one contact for bonus credit on the FM satellites. To ensure success, I'd strongly recommend directional (beam) antennas and plenty of RF muscle on the 2 meter uplink (50 W or more). You don't need a fancy azimuth/elevation antenna rotator to keep the satellites in your crosshairs. Just recruit someone to swat mosquitoes and adjust the aim of the antennas while you work the radio. (Bribe them with a hot dog or a can of their favorite beverage.)

OSCAR 27 is only available during daylight passes, so plan accordingly. OSCAR 51 occasionally operates on other bands and modes. Check the schedule page on the Web at **www.amsat.org/amsat-new/echo/ControlTeam.php** *before* you leave for Field Day! Note also that you must send a 67-Hz CTCSS tone on the uplink frequency to access OSCAR 51.

Another FM opportunity on Field Day is the International Space Station. Last year they switched on their FM repeater during the event. If the astronauts find time to get on the air, you may also be able to work them directly. Check the ARISS Web page (**www.rac.ca/ariss/**) and the ARRLWeb (**www.arrl.org**) for late-breaking details.

SSB/CW Birds

If you can transmit and receive CW or SSB on 2 meters and 70 cm, your satellite horizons will expand tremendously (pun intended!). There are amateur satellites with *linear transponders* that relay many conversations at once. Although they are more complicated from an operational standpoint, you'll have your best odds of success on these birds because your signal won't be butting heads with a hundred others on the same frequency.

VUSat-OSCAR 52

This is an excellent SSB/CW bird and you can work it with a fairly minimal setup. You may even be able to use omnidirectional antennas (ground planes, for example). The tricky aspect is that OSCAR 52 has an *inverting transponder*. If you transmit LSB, the satellite repeats as USB. If you transmit at the high end of the passband (see below), OSCAR 52 will repeat your signal at the low end of the passband. The good news is that you can communicate on any uplink/down-link frequency combination within these passbands. Just find a quiet spot and start calling.

Uplink Passband
435.220-435.280 MHz

Downlink Passband
145.870-145.930 MHz

Fuji-OSCAR 29

This satellite isn't particularly active, even on Field Day, but it has excellent range and solid signals. Like OSCAR 52, it also uses an inverting transponder.

Uplink Passband
145.900-146.000 MHz

Downlink Passband
435.800-435.900 MHz

To operate effectively with either satellite, I recommend using either two separate radios or a single radio with full-duplex satellite capability. That's because it helps to be able to hear your own signal on the downlink *while you are transmitting*. As you start calling, tune your downlink (receive) radio quickly until you find your own signal (wear a set of headphones). Keep adjusting the receiver to keep the signal stable in your headphones as you continue calling, and as you make the contact. Don't change your transmitting frequency. Your partner at the other end will be doing the same (or at least you hope so).

I'd recommend trying these satellites prior to Field Day to get some practice. This type of satellite operating will seem awkward at first, but you'll soon become accustomed to it.

Where and When

To talk to a satellite, you need to know when it will be passing by. One easy way to obtain pass predictions is on the AMSAT Web site at **www.amsat.org/amsat-new/tools/predict/**. Just print the predictions for the satellites you intend to use before you head out to Field Day.

While you are at the AMSAT page, you'll see satellite software for sale. If you plan to have a computer at your Field Day site, consider purchasing one of these programs. They'll give you a detailed picture of what is going on during each pass, and they tend to fascinate the public, too!

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

Bonus Points Will Enhance Your FD Fun

Joel Kleinman, N1BKE

Field Day a competition? *Blasphemy!* Everyone knows we do Field Day to prepare for the Big One — the disaster that will once again bring ham radio to the fore as the most effective provider of emergency communications when power and cell phones are down for the count.

If you lurk about a dark corner of a dark room, however, you might hear someone whisper: "We gotta beat that Podunk club this year; wudda done it last year if it weren't for the [pick one] locusts/flat tire/lack of edible food/Noah's flood."

While it's true that Field Day isn't really a contest, it's still fun to see how your group stacks up against the competition — other stations in your class. Even if your effort lasts but a few hours, you can juice your score with Bonus Points.

Buried among the detritus of the Official Rules are a variety of ways to increase your FD score. For all the gory details, delve into the "Official Rules." A summary appears in May 2007 *QST*, page 98, and the whole shebang is online at **www.arrl.org/contests/rules/2007/fd.html**. Let's start our survey with GOTA.

GOTA

This relative newcomer to the list stands for *Get On The Air* (subtle, no?). How do you enhance your score with a GOTA station?

Have at least 3 people and 2 stations transmitting simultaneously in your FD group? You can be a club or just a bunch of friends (or in-laws, for that matter). You need to be away from a regular station location (Class A), or in an Emergency Operations Center (Class F).

The GOTA station will have a single separate call sign throughout the weekend, and will be operated by Technician and Novice class licensees along with hams described in the rules as "generally inactive." There's a 500 contact limit for GOTA stations.

SERGIO PICADO, KE5CUY

Young GOTA station ops: **Two youngsters seem to be having the time of their lives at the 2006 FD GOTA station of the Arkansas River Valley Amateur Radio Foundation in Russellville.**

How does a GOTA station help the bottom line? Simply enough, points the GOTA station racks up get added to the score of the ROS (regular old station), but has no effect on the class. So, if your group of three or more is out in the field and has three transmitters operating at the same time, including a GOTA station, you're in Class 2A, not 3A. That can make a sizable difference in your ultimate ranking. GOTA stations can help earn BPs in several ways.

Class A and F stations with GOTA stations can earn 20 BPs for each 20 contacts made by the same GOTA op, up to a maximum of 100 BPs per GOTA op. Have five GOTA ops? Each can qualify for 100 BPs, but there's a 500 BP limit.

If a "GOTA Coach" is present at the GOTA station *at all times* to supervise, answer questions and talk the op through contacts, GOTA BPs are doubled. (The Coach doesn't actually make contacts or help with logging.)

Emergency Power

That's what it's all about, right? If you're not operating at home, and all of your transmitters use 100% emergency power (no fair using a half mile long extension cord to the outlet in your garage), you'll earn 100 extra points — *per transmitter*. So if your FD station has 7 transmitters, all on 100% emergency power, you'll earn 700 BPs — not too shabby. Maximum bonus is 2000 points.

Sadly, GOTA stations don't count for this Bonus Point category. But there's good news: You can claim the emergency power bonus if you're Class F (operating from an Emergency Operations Center) as long as there's emergency power at the EOC and it is tested at some point during your FD operation.

Extra VHF Station

Similar to the GOTA bonus, your "out in the field" group of three or more (Class A) or EOC location (Class F) can operate a VHF-only station without it counting in your entry class. This station must have at least two transmitters and must operate only at 50 MHz or above. So: Three transmitters operating simultaneously, including a VHF-only, is in Class 2A (or 2F). GOTA stations don't count.

Media Publicity

Tell the world what you're up to, and you'll be eligible for 100 Bonus Points, regardless of your class. All you need to do is submit a copy of the press release you sent out or the media publicity your FD operation received (newspaper article, TV video or whatever).

Public Location

On the same theme, you'll get 100 BPs for operating from a public place (as long as you're in Class A, B or F — a station set up for FD "in the field" or in a public area associated with an EOC). Shopping center and campus locations are great for catching the interest of passers-by.

Public Information Table

As long as you're trying to attract the attention of the general public, you may as well have some handouts available at the site. You'll need to be Class A, B or F, and you'll need to submit a photo, a copy of the handouts or a visitor's log to earn 100 BPs. Again, Class F stations need to be in a public area.

Send a Message to your Section Manager or SEC

Pass a message in formal National Traffic System (NTS) style to your Section Manager or Section Emergency Coordinator, and you'll grab yourself another 100 BPs. You'll need to submit a copy with your FD report.

Handle Message Traffic

Originate, relay or receive a formal NTS message to or from anyone other than your SM and SEC and you'll have yourself a quick 10 BPs. You're limited to a maximum of 10 such messages, for 100 BPs, and you'll need to include copies of all messages with your report.

Hit a Satellite

Complete at least one satellite contact for another 100 BPs. This one's also available only to Classes A, B and F. And there's more: If you have a station that's used *only* for satellite communication, it won't affect your class (same deal as the GOTA-only and VHF-only stations described earlier).

Have a Portable Windmill?

If you use a form of alternate power, such as wind, water, solar or methane, you can earn more BPs. Groups in Class A, B, E or F who make at least five FD contacts without using commercial mains or a petroleum-driven generator will breathe a bit easier while earning 100 BPs. A tip: You can avoid increasing your class by taking an ROS off the air while you operate a transmitter on alternate power. One more restriction: Contacts made with a station powered by dry cell batteries don't count for this BP category.

Tune in W1AW

Copy the special bulletin transmitted from W1AW (or K6KPH on the West Coast) for another 100 BPs. Just include an accurate copy of the bulletin text with your report.

Try a New Mode

Admit it: You've always wanted to venture into the unknown, and there's no better time than FD weekend to demonstrate the Automatic Position Reporting System (APRS), Amateur Television or Slow-Scan TV. Why? You'll be eligible for 100 BPs for each different qualifying demo, maximum of three for 300 BPs. The digital mode PSK31 doesn't qualify, since it's now mainstream enough to count as regular contact credit. On the other hand, a packet station can qualify — as long as it's a portable node that's completely separate from your local packet infrastructure. If you don't know what all this means, try the next BP opportunity...

Invite a Government Official or Agency Rep

If you can entice an elected government official to visit your FD site, you'll earn another 100 BPs. (Tell 'em the hotdogs are free.)

Likewise, you can earn still another 100 BPs if, as a result of your invitation, your site is graced with the presence of a representative of a community agency served by the Amateur Radio Emergency Service (ARES). Examples: Red Cross, Salvation Army, local Emergency Management and law enforcement personnel. ARRL volunteers (SMs, SECs and so on) don't count.

Submit Your FD Report Electronically

All categories can earn 50 BPs simply by submitting their FD report via the **www.b4h.net/cabforms** Web site.

Grab the Young'uns

Bring along a person 18 or younger who makes at least 1 contact (just tell 'em there's free hotdogs), and you'll have yourself 20 BPs — *for each 18 or under participant*. All classes except Home Stations (Class D) qualify. If you're operating Class B (1 or 2 person portable), the youngsters count, so the total number of participants must still be 1 or 2 (and your BPs are limited to 20 or 40). You can bring along your kid's entire class, but even if all 37 make a contact, you'll qualify only for a maximum of 100 BPs.

Have Fun!

Bonus points will add to your score and make your FD experience more challenging. Put them to good use and you'll have a shot at beating the Podunk club...at long last!

Joel Kleinman, N1BKE, is QST *Managing Editor. He can be reached at* **n1bke@arrl.org**.

More Power to You!

H. Ward Silver, NØAX

Radios, tents, antennas, cables, food — you're all ready for Field Day. Is something missing? Field Day will be over in a hurry without a solid, dependable source of electricity. While this article surveys typical power sources and basic practices, the ARRL's Technical Information Service (**www.arrl.org/tis/info**) and WB8VGE's book *Emergency Power for Radio Communications*[1] have detailed information on many aspects of portable Field Day power.

Generators

The most popular Field Day power source is the gas-powered generator shown in the photos. But all generators are not created equal. Along with the power rating, consider waveform quality and regulation. "Contractor grade" generators for powering tools have poor regulation and distorted waveforms, particularly near full load. Keying a radio can cause large voltage swings, risking damage to a power supply or improper operation. If you can, use a generator intended to power electronic equipment. Poor regulation can be helped by loading the generator with a pair of 100 W light bulbs at all times.

Before, During and After...

Test generators well before Field Day unless you want to learn field generator repair! A generator with old fuel in the tank and carburetor is likely to run poorly, if at all. Generators should be stored with the fuel line and carburetor dry and a stabilizing agent added to stored gasoline. Replace black and dirty oil. Inspect the air filter and muffler for clogging by dust or debris. Some sites may require a spark suppressor, so be sure your generator meets the rules.

Monitor fuel consumption, devising a fueling schedule so the lights don't go out unexpectedly. Your "Generator Czar" should provide additional oil of the proper viscosity, fuel in safety containers away from the exhaust, a fueling funnel, mopping rags, and a flashlight for nighttime maintenance. Review the instructions for each generator, such as those found at **mayberrys.com/honda/generator/html/operation.htm**.

Take generator safety seriously. Never run a generator in an enclosed space — be sure there's plenty of ventilation. Keep flammable materials such as dry grass or cloth clear of the exhaust. Keep a fire extinguisher at each generator. Never fuel a running generator — insist that it be stopped first and try to have two-person crews do the job.

If you operate near homes consider the neighbors! If your generator is noisy, use plywood sheets to make a sound baffle. Try to direct or deflect noise up and away from people trying to sleep.

AC Wiring

Getting electricity to the radios is the next big adventure. Except for short runs, use a 12 AWG three-wire extension cord to minimize the voltage drop. Secure the cords to a stake near the generator and near the radio. Be assured that someone will trip over the cord in the dark, possibly tipping the generator or yanking radios off the operating table! For similar reasons, never run cords where vehicles will run over them. Mark cord locations with safety tape.

Generators should be connected to a ground rod. Use a second ground rod at the operating position if it's a long distance from the generator. Plan for removing the ground rods, too! Cutting them off below ground level is not always a practical idea! Ground rods can help prevent RFI both to and from the generator.

The gas-powered generator is the most popular source of Field Day power. Be safe by storing fuel properly and using proper electrical wiring and grounding.

Now *that's* a generator! Field Day 2006 power from VO1MRC

The sun is up there — why not use it to power your FD station!

Battery Power

Class A and Class B also have a "Battery Power" category. Check the Field Day rules (**www.arrl.org/contests/rules/2007/fd.html**) for complete information on how batteries may be used. Of the different battery types, deep-cycle marine or RV batteries and gel-cells are the best choices for Field Day. Use a voltmeter to measure battery output voltage because many radios do not operate properly at less than 12 V. That means the batteries may need to be charged frequently or continuously, or you may have to use a more tolerant radio!

Protect battery terminals from accidental shorts. Even smaller batteries store a lot of energy. Once again, power cables to radios should be heavy enough to minimize the voltage drop. When recharging batteries, do it in a well-ventilated area.

If you use vehicle batteries, they may be damaged by a deep discharge. Make sure that at least one car can be started to charge weak batteries! Carrying a battery to the nearest service station is an unforgettable experience!

Alternative Power Sources

The most popular alternative power source is solar power. A pair of 100 W panels can run a 100 W radio all day and at least partially charge a battery for nighttime use. Test the panels under load. Cracked cells or corroded connections can severely reduce a solar panel's output current, even if the open-circuit voltage is good.

Human Power from bicycle or hand-cranked generators can be pressed into service for a few QSOs. Small wind generators may be used to take advantage of windy locations. Both of these power sources can be used with a small battery to improve voltage regulation and store excess energy.

H. Ward Silver, NØAX, is a QST *Contributing Editor. He can be reached at* **n0ax@arrl.org**.

[1]Michael Bryce, WB8VGE, *Emergency Power for Radio Communications*, ARRL, 2005.

US Amateur Radio Bands

US AMATEUR POWER LIMITS

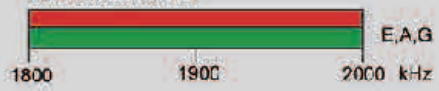
At all times, transmitter power should be kept down to that necessary to carry out the desired communications. Power is rated in watts PEP output. Except where noted, the maximum power output is *1500 Watts*.

Effective Date
February 23, 2007

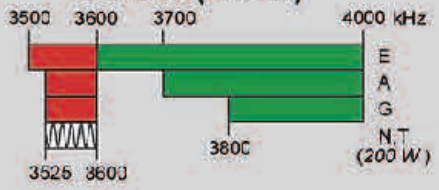
Published by
ARRL The national association for AMATEUR RADIO
www.arrl.org
225 Main Street, Newington, CT USA 06111-1494

160 Meters (1.8 MHz)

Avoid interference to radiolocation operations from 1900 to 2000 kHz



80 Meters (3.5 MHz)



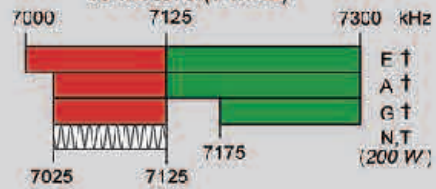
60 Meters (5.3 MHz)

USB *only*
2.8 kHz
E,A,G
(50 Watts)

5330.5 5346.5 5366.5 5371.5 5403.5 kHz

General, Advanced, and Amateur Extra licensees may use the following five channels on a secondary basis with a maximum effective radiated power of 50 W PEP relative to a half wave dipole. Only upper sideband suppressed carrier voice transmissions may be used. The frequencies are 5330.5, 5346.5, 5366.5, 5371.5 and 5403.5 kHz. The occupied bandwidth is limited to 2.8 kHz centered on 5332, 5348, 5368, 5373, and 5405 kHz respectively.

40 Meters (7 MHz)



†Phone and Image modes are permitted between 7075 and 7100 kHz for FCC licensed stations in ITU Regions 1 and 3 and by FCC licensed stations in ITU Region 2 West of 130 degrees West longitude or South of 20 degrees North latitude. See Sections 97.305(c) and 97.307(f)(11). Novice and Technician licensees outside ITU Region 2 may use CW only between 7025 and 7075 kHz. See Section 97.301(e). These exemptions do not apply to stations in the continental US.

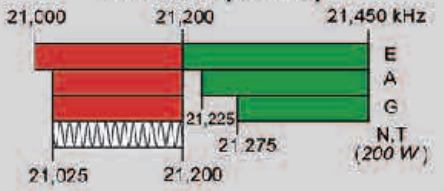
30 Meters (10.1 MHz)

Avoid interference to fixed services outside the US.

20 Meters (14 MHz)

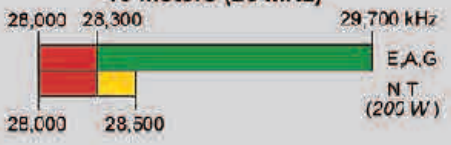
17 Meters (18 MHz)

15 Meters (21 MHz)

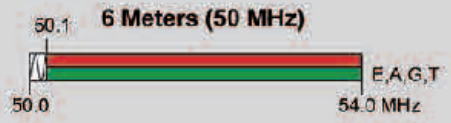


12 Meters (24 MHz)

10 Meters (28 MHz)

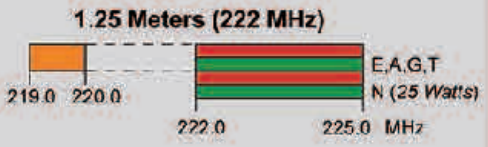


6 Meters (50 MHz)



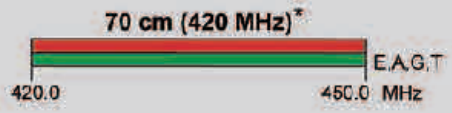
2 Meters (144 MHz)

1.25 Meters (222 MHz)



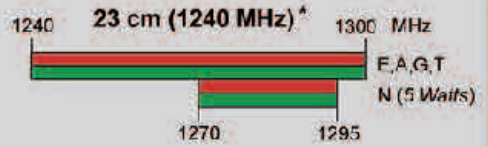
*Geographical and power restrictions may apply to all bands above 420 MHz. See *The ARRL Operating Manual* for information about your area.

70 cm (420 MHz)*



33 cm (902 MHz)*

23 cm (1240 MHz)*



All licensees except Novices are authorized all modes on the following frequencies

2300-2310 MHz	10.0-10.5 GHz	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

KEY

Note:
CW operation is permitted throughout all amateur bands except 60 meters.

MCW is authorized above 50.1 MHz except for 219-220 MHz.

Test transmissions are authorized above 51 MHz except for 219-220 MHz.

= RTTY and data
= phone and image
= CW only
= SSB phone
= USB phone only
= Fixed digital message forwarding systems only

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

See *ARRLWeb* at www.arrl.org for more detailed band plans.

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Kids Day 2007: Way Too Much Fun!

Who ever knew that shouting out your favorite color could be so much fun?

On June 16, kids around the continent will be bitten by the bug! One week before the immensely popular Field Day event, where *everyone* will be "bitten by the bug," youngsters will experience the magic of radio as they make new friends over the air.

With more than 10 years of activity, Kids Day events, created by the Boring Amateur Radio Club (BARC), have gained in popularity year after year. Nearly 500 kids shouted their favorite color into a microphone during the 2006 running of Kids Day!

This year we suggest using the same frequencies that the Scouts use during Jamboree on the Air (JOTA). With propagation conditions that accompany the bottom of the sunspot cycle, we need to spread out to find bands where everyone can participate.

Have Fun? You Bet!

Want some ideas to help you make this event even more enjoyable? Ward Silver, NØAX, provides some great hints:

For the parent ham or host

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

For the radio club host

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

For the kids

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

The Kids Day operating events are the first Sunday in January and the third Saturday in June; this year it is scheduled for June 16. Make that personal connection that could result in a new licensee. You just might find that you are re-infected with the enthusiasm that you once had with ham radio. Don't forget to further the fun and invite the kids to Field Day the next weekend!

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

RON MAJEWSKI, W8RU

Ron Majewski, W8RU, of Commerce Township, Michigan, helps his daughters Caroline, 11, and Julia, 9, get on the air. To prepare, they made up cue cards for calling CQ and making exchanges, learned about the logging software, QSO points and multipliers. Both girls are interested in getting their licenses, and with their dad's help, they have been making their way through the licensing study guide.

Kids Day Rules

Saturday, June 16, 2007

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

Date: Saturday, June 16, 2007.

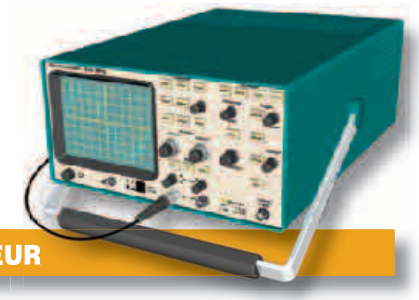
Time: 1800-2400 UTC. No limit on operating time.

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

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

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

The Doctor is IN



PROJECTS AND INFORMATION FOR THE ACTIVE AMATEUR

Q Ed, N5KZW, asks: All of my transmitters are solid state, but I have a couple of instrument racks with tube type test equipment that I use occasionally. I also have a spare Heathkit SB-200 linear that is on a shelf. To maximize the life of this equipment, how often should I be turning it on and how long should I leave it on?

A Ed, for this one, I turned to someone who should know the answer. Ed Gable, K2MP, is the Curator of the Antique Wireless Association (AWA) Museum **www.antiquewireless.org**, and sees more tube gear than most of us ever will! His response: "That's actually a complicated question on the survivability of older tube type equipment over time, especially electrolytic capacitors. The only correct answer is...it depends! It depends largely on the quality of the original parts. I have seen Tektronix scopes turn on after 10 or more years of poor storage and work right away, whereas a cheaply built consumer radio might hum like crazy after a 10th of that time. Tek, HP and other high end manufacturers tended to use good quality OEM parts as their reputation was directly linked to reliability and stable operation for many years. So, I'd be more concerned with equipment of lesser stature (was that a nice way of saying...cheap) than with your better test equipment. I try to turn ON everything in my collection (we're talking a lot of radios here!) at least twice a year. Older items that have been off for many years I typically turn on slowly using a Variac variable voltage transformer. The idea is to save the power transformer in case some capacitor is leaking severely. High power transmitting tubes (see Figure 1) get a few hours of filament time to burn off oxides on the filament and to warm up the remaining getter material to absorb gasses. And yes, throwing switches and turning pots now and again is always a good thing to do.

"*Good luck in keeping that good old stuff running. Try it with 500 museum pieces sometime!*"

Q Mike, K5OSA, asks: How about a rundown on the advantages and disadvantages of various noise reduction technologies? I know that noise can be addressed before it gets into the receiver, in the receiver, and on the way from the receiver to the phones/speaker. Is a combination approach better than depending on just one means of noise reduction?

I live in an apartment in an urban area so the noise sources from the immediate environment are horrendous, but I know there are also noise problems "out there" in the distant ether. My transceivers are pretty low tech and I really don't want to invest in the new high-dollar stuff. I was thinking that a noise canceller such as the MFJ-1026 combined with an audio filter ahead of my phones would allow me to have good filtering at each end of my transceivers.

A I have discussed various noise reduction options in a few places in the past, including the use of the MFJ-1026 and its competitors (Aug 2006, p 46). Noise, and the success of noise reduction techniques, can be tricky to predict since noise can be very different at different locations. This won't keep me from making a few generalizations that will be right at least some of the time. Yes, a combination of devices can be beneficial, particularly since they can help with different kinds of noise.

- Noise cancellers work well against noise that comes from one place and stays about the same during the time you are using it. Otherwise you will be chasing the noise around instead of paying attention to the QSO. That said, they can be effective against not only noise, but also interference, sometimes a real bonus.
- Noise blankers, often found in trans-

ANTIQUE WIRELESS ASSOCIATION

Figure 1 — An extreme example of early vacuum tube equipment: The James Millen memorial station, c 1936, in operation at the AWA museum annex in Holcomb, New York. Millen, W1HRX, was the chief designer of the original National Radio HRO receiver (in left rack, above shelf) and later formed his own company. The transmitter was built by Millen and then *QST* Associate Editor Ross Hull.

ceivers as "standard equipment," are most effective against short duration impulse noise such as from ignition systems. They basically shut down the receiver during the duration of the pulse. They have to occur in the wideband portion of the receiver (ahead of bandwidth setting filters) so that the pulses aren't lengthened. Once the noise duration gets long, they can't work very well.

- Rear end audio digital signal processor (DSP) filters are most effective at reducing the background noise level, although in the process they can also reduce some repetitive noise sources. They often offer other features that make them very handy. These include automatic notch filtering, great for eliminating the operator on channel who is adjusting his antenna tuner or even the carrier of that AM international broadcast station on 40 meters. Not sure if you mostly do phone or CW, but all will work on phone, but some will also notch out a CW station — unnerving if you're trying to copy it! Some also provide additional selectivity for both phone and CW bandwidths. Note that some products can notch out an interfering carrier without wiping out a CW signal — very nice!

Q Dave, K8BBM, asks: I use a horizontal loop, similar to the one in Dave Fisher's 1985 *QST* article.[1] I've been very happy with it at about 35 to 40 feet above ground. I've been wanting to get better DX coverage on 80 meters and was thinking about changing to "A Horizontal Loop for 80 Meter DX,"by John Belrose, VE2CV.[2] In his article, he refers to transmission line loss and the editor makes a suggestion about using a heavy duty open wire feeder. I've always understood that SWR was not a problem when using ladder line and a tuner. So, do I need to be concerned about loss of transmitted or receive signal if I use my usual commercial ladder line (I generally use 450 Ω window line) in the new configuration?

A Good question. We have been taught to believe that with low-loss ladder or window line, the additional loss from a high SWR doesn't matter. Of course there is always some loss. How much it matters is a question with three key parameters:

- How much loss makes you worry?
- How long is the transmission line?
- How high is the SWR?

In our usual "tuned feeder"antennas — dipoles, loops and the like, the SWR on our ladder or window line can easily be 10:1. This value would result in a relatively large loss in coax, but not so much in ladder line, as shown in Table 1. The loss will go up or down in direct proportion to the line length.

Table 1
Loss of 100 Feet of Four Popular Transmission Line Types with a 10:1 SWR

Freq	*RG-8X*	*RG-213*	*450 Ω Window*	*600 Ω Open Wire*
3.8 MHz	2.3 dB	1.4 dB	0.3 dB	0.19 dB
14 MHz	4.0 dB	2.8 dB	0.5 dB	0.33 dB
29 MHz	5.2 dB	3.8 dB	0.8 dB	0.49 dB

Figure 2 — Classic Astatic D-104 microphone. This has been popular with amateurs since the '30s, but is now out of production. There were a lot made and they are often available at reasonable prices at hamfests and swap meets.

The Belrose loop you describe, in common with the popular W8JK antenna (two close spaced dipoles 180° out of phase) works great if you can get power into it. They work by cancelling radiation (and reception) at high angles, leaving just lower angle operation. The combination of close spacing and 180° phase shift result in a mutual impedance that subtracts from the self impedance of each element. The consequence is that the combined impedance is quite low. For example, the '8JK typically has an impedance on the order of 5 Ω, for an SWR of 90:1 with ladder line. Using *TLW*, I found the load impedance of the Belrose antenna to be around 6 $-j358$ Ω for an SWR of 128:1 with 600 Ω line, or 110:1 with 450 Ω line.[3] The resulting losses in 100 feet of 600 Ω line (as determined by *TLW*) are 1.9 and 2.4 dB in 450 Ω window line at 3.75 MHz. The 600 Ω open wire line can be made somewhat lower in loss by using thicker wire than *TLW* assumed.

Alternately, if a matching network (with low loss connections and components) is installed near the feed, as suggested by VE2CV, the transmission line loss can be reduced significantly.

The 2 dB or so of loss is small relative to the low angle gain of the Belrose loop. For receive, the loss should make no difference at all since you are limited by external noise. The noise will drop by an even greater amount since you eliminate that arriving from high angles.

Q Bertholdo, KA5VDU, asks: I received a classic Astatic D-104 microphone from my wife and I would like to use it with my ICOM IC-746PRO transceiver. Is this possible?

A There are two major variations of D-104 microphones (Figure 2). The more recent ones have an amplifier hidden in the base. If so, it should work fine with your radio. Just make sure you adjust the amplifier GAIN control (on the bottom of the base) so it doesn't overdrive your radio. One way is to hook your radio to a dummy load, turn off the speech processor and watch the output meter while you talk into your ICOM mic. Then hook up the D-104 and adjust the mic's amplifier GAIN so the meter swings about the same amount.

The earlier mics don't have a preamp. In this case, the high impedance D-104 element will likely not have enough output to drive a modern low impedance radio. There are at least three solutions. Probably the simplest is to buy an XT-1 matching transformer from Bob Heil at **www.heilsound.com/amateur/parts.htm**. He thinks these are designed to allow his low-Z mics to work with old radios, but you can hook it up the other way. Connect the high-Z side to the mic, low-Z side to the radio and it should work fine.

There have been a number of pre-amps described in *QST* over the years that can also be used to match. A third way is to change to a modern low-Z element. There are a number, but Bob Heil has a way shown on his Web page. I suggest the HC-5 element to sound most like a D-104. See **www.heilsound.com/amateur/heilsketch4keyelements.htm**. QST

[1]D. Fischer, WØMHS, "The Loop Skywire,"*QST*, Nov 1985, pp 20-24. See also **www.arrl.org/members-only/tis/info/pdf/8511020.pdf**.

[2]J. Belrose, VE2CV, "A Horizontal Loop for 80 Meter DX," *QST*, Aug 2002, pp 30-35. See also **www.arrl.org/members-only/tis/info/pdf/0208030.pdf**.

[3]J. Hallas, "I Know What's Happening at the Shack—What's Happening at the Other End of My Feed Line?" *QST*, Feb 2007, p 63.

SHORT TAKES

The (LED) Light Fantastic

Sure as the Sun sets, Field *Day* is followed by Field *Night*. As darkness descends, cables and guy wires become invisible hazards, log sheets become impossible to read and many a knee is lacerated by everything from beverage coolers to generators.

Incandescent and fluorescent lights have defied the gloom for many years, but in recent times a new luminescent player has emerged: the Light Emitting Diode, or LED. This solid-state light source is rapidly coming into favor because of its efficiency and durability. With that in mind, here are three interesting variations on the LED theme that recently came to our attention.

Stanley MaxLife 369 Tripod Flashlight

The MaxLife 369 is an LED flashlight that includes its own tripod. You can carry the MaxLife from place to place like an ordinary flashlight, or quickly deploy its tripod legs when you need a stable, fixed light source. With tripod legs extended, the MaxLife stands 9½ inches tall and sports 6 LEDs in a swivel head. As you press the pushbutton atop the head, the MaxLife switches between 1, 3 and 6 LEDs (think of it as a kind of brightness control). The unit is powered by up to 9 AA batteries that install within the tripod legs. The more LEDs you activate, the higher your current drain. Even so, with 9 batteries installed our MaxLife 369 managed to operate 40 hours continuously with all LEDs lit. With all LEDs burning, the MaxLife doesn't produce brilliant light, but it is adequate for most uses. *Manufacturer: The Stanley Works;* **www.stanleyworks.com**. *Average selling price: $25. Available at hardware and home stores.*

Stanley MaxLife 369 Tripod Flashlight

PowerFlare PF-200 Safety Light

Here's a unique application of LED illumination. The PF-200 is the modern alternative to the old pyrotechnic *fusee* flare. The PowerFlare PF-200 is a ring of bright LEDs encased in a rugged rubberized housing that can withstand a great deal of abuse (watch their Web video of a PF-200 being run over by a fire truck). It's even waterproof to a depth of 80 feet! By pressing the recessed pushbutton you can select up to 9 bright flashing patterns such as double blink, rotation, quad flash or "solid on." An internal lithium battery can power the PF-200 for 8 to 100 hours, depending on the flash pattern (continuous illumination consumes the most power, draining the battery within 8 hours).

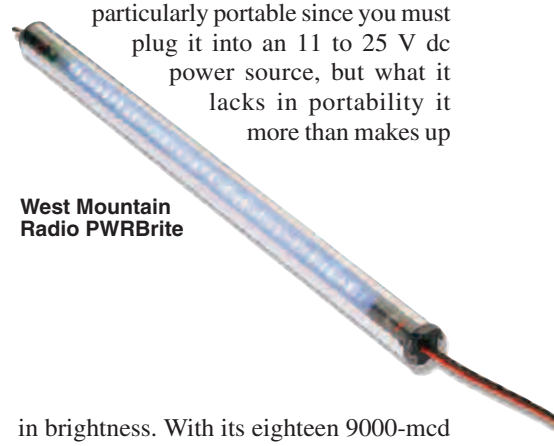
PowerFlare PF-200

The PowerFlare we tested used red LEDs. If you opt for blue, green or white versions, the power consumption will be significantly higher (the performance of lithium batteries can also be affected by temperature). Installing new batteries is relatively simple, but you have to be careful to save and reuse the rubber sleeves on the replacement batteries. Fortunately, the PowerFlare uses common CR123 lithium cells that you can find almost anywhere.

Beyond its obvious emergency applications, the PF-200 would be ideal for marking potential hazards at dark Field Day sites. It gets your attention in a hurry! *Manufacturer: PowerFlare Corporation;* **www.powerflare.com**; *877-256-6907. $49.95.*

West Mountain PWRBrite Light Stick

The West Mountain PWRBrite isn't particularly portable since you must plug it into an 11 to 25 V dc power source, but what it lacks in portability it more than makes up in brightness. With its eighteen 9000-mcd white LEDs, the PWRBrite Light Stick produces an astonishing amount of light—so much so that the PWRBrite was somewhat painful to stare into at a distance of three feet. The PWRBrite draws a maximum of 120 mA. In our test, a 4 Ah battery provided about 30 hours of continuous light. The PWRBrite comes with a 6-foot power cord terminated in Anderson PowerPole connectors. West Mountain also includes adhesive clips that allow you to mount the PWRBrite in any convenient location.



West Mountain Radio PWRBrite

West Mountain thoughtfully included a small toggle switch at the end of the PWRBrite so that you can easily switch it on and off. In my "simulated Field Day tent test," I used the adhesive clips to install the PWRBrite directly above my operating table. Even in the dead of night, I merely had to flip the toggle switch and the area was flooded with blue-white LED light.

Manufacturer: West Mountain Radio; **www.westmountainradio.com**; *tel 203-853-8080. $49.95.* QST

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

Terminating 75 Ω, ⅞ inch Hardline with SO-239

Make good use of readily available low loss cable TV coax.

Bob Locher, W9KNI

At my last two locations, for various reasons the optimum site for the tower was some distance from the house. My run from transmitter to antenna at my last location was 360 feet. At my current location, the distance is on the order of 600 feet.

There are good reasons for this. The most important is that by running that far I get to the top of the hill at the back of our property, good for an extra 45 feet of elevation over the next best site, already 300 feet from the rig. In addition, the remote antenna eliminates family problems. RFI virtually disappears — receive interference from computers, light dimmers and other household sources are greatly reduced or eliminated. RFI problems from the transmitted signal are also minimized. The downside of a remote tower is the attenuation of the RF, both in receive and transmit modes. If I were to use 600 feet of the ubiquitous RG-213 as a feed, I would experience a loss of about 7.8 dB on 10 meters — obviously unacceptable.

Free Low Loss Coax — One Answer

But I got lucky — the local cable TV provider at my last location was wiring in several new neighborhoods. They were kind enough to give me well over 1000 feet of beautiful ⅞ inch outside diameter 75 Ω aluminum hardline roll ends. The cable turned out to be the type with a closed-cell poly foam dielectric. The piece lengths ran from about 75 to 130 feet. The reason they were glad to give it away was that those lengths were economically not worth splicing, so were headed for the recycling bin or the dump. I saved them the trouble, cartage and refuse fees.

But how do you make the 75 Ω hardline work into a 50 Ω antenna installation? Some people use it and simply accept the 1:5:1 SWR penalty. Unfortunately, some radios start reducing power at that SWR. An even greater problem is how to terminate the line with regular coax connectors.

Making the Connections

In trying to figure out some way to mate an SO-239 connector to the hardline, I discovered something interesting — the chassis mounting holes in the SO-239, if held up to a 1⅛ inch piece of aluminum tubing with a 0.058 wall (the standard wall thickness for nesting joints in aluminum antennas), show a partial covering of the hole. It then occurred to me that if I screwed a #4 self tapping screw into each hole, it would force the SO-239 to center over the tubing and pull it up tight. I tried it and it worked. See Figures 1 and 2.

Figure 1 — The screws are started into the aluminum tubing.

Figure 2 — The screws are tightened and the connector is secured to tubing.

Table 1
Materials Needed for Termination of Hardline

Stainless steel Phillips pan head sheet metal screws, #4 × ½″.
SO-239 connector.
Aluminum tubing, 1.125″ diameter, 0.058″ wall, 2¼″ long.
Aluminum tubing, 1″ diameter, 0.058 wall, 3½″ long.
Solid copper wire, 12 or 14 gauge, 4″ long.
Liquid electric tape.
Hot melt glue.

I developed a method of fabricating a connector system based on the above discovery. The best part of the approach is that all tools needed are pretty much standard hand tools plus an electric drill and a hot melt glue gun. The required materials are listed in Table 1.

Having now had some practice in it, I can fabricate a connector assembly in under an hour. Note that both aluminum tubing pieces must have at least one end cut perfectly flat, which is easily done with a standard rotating tubing cutter. Tubing ends must be clean and deburred, and any deforming on the inside surface must be removed with a knife or file.

The stainless steel sheet metal screws seem to be readily available at most hardware stores. The length is not critical — between ⅜ and ¾ inch long — buy whatever is cheapest.

Select your SO-239 connector with care. There are a lot available that are of shoddy construction — make sure you use a quality one, and that it will readily accept solder for the center conductor. Amazingly, not all do.

Step by Step

Begin by making sure that the last 4 inches of the hardline is absolutely straight. This is important. If the coax already has a bit of a curve in it, as it often will from being rolled, you need to straighten it. Probably the best way is to put it in the middle of two right angle pieces of steel and squeeze it. If that is not available you may be able to get the end into a vise and gently straighten out the bend. If you try this, be very sure you do not deform the tubing.

Once the hardline is straight, strip back 4 inches of the plastic insulation. Cut the hardline aluminum jacket ½ inch back from the end using a tubing cutter. When the aluminum jacket is completely separated, use lineman's pliers to twist off the jacket and as much of the dielectric as will readily come away from the center conductor.

Add the Outer Tubing

Take the 1 inch outside diameter (OD) piece of tubing listed in Table 1 and slip it back over the hardline aluminum jacket. If the hardline is absolutely straight it should slip right on — if the hardline is not you will

know it, in which case you need to get it straight. The tube must slide back far enough that the end is at least flush with the end of the aluminum jacket of the hardline. Slip the 1.125 inch OD tubing over the 1 inch OD tubing.

Connecting the Inner Conductor

Now, clean the ¾ inch copper clad aluminum wire sticking out the end of the hardline, being careful to remove all insulation. You should have a bright clean copper surface, plated over the aluminum center conductor. Wrap the solid copper wire tightly several turns around the exposed center conductor, and form it so that it sticks out in front. Using a 40 W or greater soldering iron, solder the wire to the center conductor. Make sure you get the joint hot enough for the solder to flow freely. Cut the end of the wire so that it sticks out about ⅜ inch from the end of the hardline center conductor. Solder the end of the wire to the center terminal of the SO-239 as shown in Figure 3.

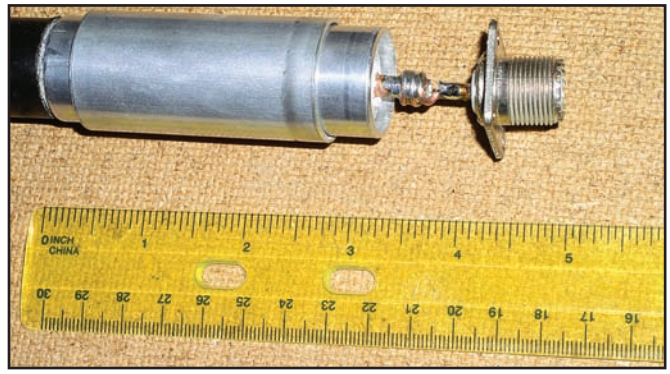


Figure 3 — Detailed view of center conductor connection method.

Figure 4 — The outer tubing sections secured with shortened sheet metal screws.

Bring the 1⅛ inch tubing forward so that it butts up against the SO-239. Insert the #4 stainless steel sheet metal screws into the holes, and rotate them about 2 turns. When everything is centered the SO-239 connector should look like Figure 1. Tighten the screws, turning perhaps two turns on a screw, then to the screw on the opposite corner, then the other corners; continue until all screws are tight. The SO-239 flange will likely deform very slightly — this is okay.

Securing the Outer Tubing

Position the 1 inch tube inside the 1⅛ inch tube so that 2 inches stick out the back. Using a center punch, mark off six holes in a line, three on the 1 inch tube to penetrate the hardline aluminum jacket and three to connect the 1⅛ inch tube to the 1 inch tube, and also through to the hardline aluminum jacket.

Using a 3⁄32 inch bit, drill the six holes. Note that you only want to penetrate through the aluminum hardline jacket, and no deeper. So use some finesse. Note that since aluminum is a relatively soft material you should use a slow drilling speed.

Once the holes are drilled, begin to screw in one of the #4 stainless sheet metal screws through the 1 inch tubing. Once the screw threads are formed, back the screw out. Using lineman's pliers, cut the screw short, so that it is about ¼ inch long. Now, screw it back in, all the way. By doing this you will not penetrate far into the hardline. Repeat with the other screws as shown on Figure 4.

You may well shear one or more screws in doing this — the screws do not seem to be terribly strong. If you shear a screw with enough sticking out, it is usually possible to back it out by gripping it hard with pliers and twisting it out. Then use another shortened screw. If the screw shears at the surface of the tubing, leave it and go to the next hole. This is more likely to happen when you are trying to screw through both layers of tubing and the hardline aluminum jacket.

When you have all six screws in, center punch a new line of 6 holes 120° around the connector assembly and repeat, then finish with a third row.

Now, center punch and drill one last hole ¼ inch in from the flange of the SO-239. You should first drill the hole out to 3⁄32 inch, then open it to 3⁄16 inch. Do so slowly and carefully — you do not want to get any aluminum shavings inside.

Sealing the Fittings

Get the hot melt glue gun good and hot, and begin squirting hot melt glue into the ⅜" hole to fill the cavity at the end of the assembly. Continue squirting in glue until the glue starts coming out at the cracks on the tubing end. Stop, wait a minute, then squirt more glue in, as the shrinking glue opens a void. You may need to do this several times. When finished, wait half an hour, then use a knife to scrape off any glue that is sticking out.

The last step is to paint the whole assembly with the liquid electrical tape. Prior to doing so, mask off the SO-239 threads with masking tape. Make sure all cracks are sealed. You will almost surely need two or three coats to finish the job.

Of course, before you finish, and indeed at several points along the way, use an ohmmeter to confirm continuity where important and confirm that there are no shorts from center conductor to shield. Heat shrink tubing could be used for additional protection, although I haven't used it here.

Using the System

So, now you have a piece of 75 Ω hardline terminated with SO-239s at each end. How do you use it in your antenna system?

I use 4 × 4 inch pressure treated lumber posts set into the ground as terminal points. If a splice is needed, I bring both pieces of the hardline to the post. I use electrical conduit straps to secure the hardline to the post, and interconnect with a short RG-11 coax jumper. Be sure to use RG-11 or the equivalent 75 Ω coax. The use of 50 Ω coax creates an impedance bump that does not go unnoticed on your SWR, especially on the higher HF bands.

Matching Impedances

Most antenna and radio systems are designed for 50 Ω termination. To provide the appropriate match, I use the excellent 50 to 75 Ω transformers, catalog number AS-75:50-1 offered by Array Solutions and WXØB (**www.arraysolutions.com**) at each end of the cable run. These transformers offer a remarkably flat and very low loss conversion from 75 to 50 Ω and vice versa, and are rated for 5 kW. I strap on an assembly of the Array Solutions transformer, a 75 Ω RG-11 jumper and the 50 Ω coax going to the shack to a post. The 4 × 4 post is normally covered by one of the ubiquitous 5 gallon plastic buckets, keeping rain out and birds away.

I have been using this approach for more than 5 years with considerable success and no failures. Note that different vendors' hardline coax may be of somewhat different dimensions than the one I used, but the techniques used should adapt to most any size of common distribution cable.

Bob Locher, W9KNI, was first licensed in 1956 as KNØHGB. Bob's interest has always been HF DX, primarily on CW. Bob is the author of The Complete DX'er*, which has sold 24,000 copies to date. Bob was a co-founder of Bencher, Inc and also is the founder of Idiom Press. He remains active in both firms. Bob is also a private pilot and lives in Grants Pass, Oregon where he is putting up a new antenna farm, of course using 75 Ω TV hardline. You can reach Bob at Box 1985, Grants Pass, OR 97528 or at* **bob@thelochers.net**.

W1ZR

GETTING TO KNOW YOUR RADIO

The Next Step — "Sound Card" Modes

Starting in February of this year, many amateurs upgraded and gained HF voice privileges and many more now will be able to become eligible. While this opens new worlds of opportunities for voice use, it's important to be aware that the same equipment can be used for many other exciting new modes as well! One of the blessings of Amateur Radio is that it has many dimensions. Just when you're about tired of one, there are five new ones you can try. Here's one set that are easy and fun to explore.

It is possible to use that shiny new HF transceiver to transmit not only voice and CW, but also a whole spectrum of digital transmission modes as well as interesting analog modes such as slow-scan TV (SSTV) and facsimile. In years past, each of these exotic modes generally required a special purpose interface unit to process the radio signals and turn them into the language of a dedicated external device, such as a teleprinter or TV monitor, to operate in any of these modes. Fortunately, that's no longer the case. Any amateur with an HF transceiver and a PC can join the fun at low cost and with little effort.

Enter the Sound Card

The key to making it all happen is the sound capability of modern PCs along with some clever PC software. The May 2006 Product Review column had a brief tutorial and performance summary on sound card devices for PCs by *EchoLink* developer Jonathan Taylor, K1RFD.[1] If you haven't yet looked at that review, this would be a great time! If you don't have a May issue at hand, the review can also be found at the ARRL Members' Web page, **www.arrl.org/members-only/prodrev/**.

Amateur Digital Modes

If we don't count Morse telegraphy, arguably a digital mode, the earliest popular digitally encoded traffic over Amateur Radio was radioteletype. RTTY was very popular in the years following WWII as a result of the availability of low cost military surplus teleprinters and terminal units. It didn't hurt that many hams of the era had been military radio operators and were used to working with the equipment.

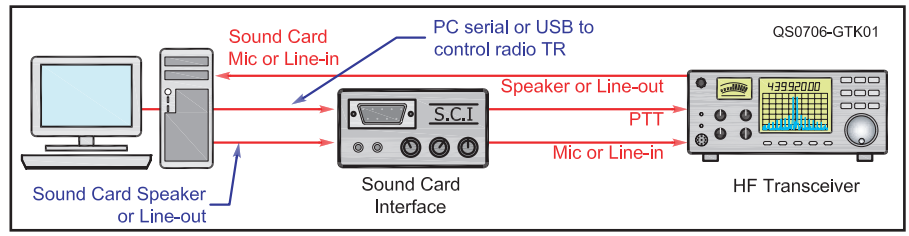


Figure 1 — Typical sound card to radio interconnections.

RTTY uses a Baudot code consisting of five intervals per character, preceded by a START pulse and followed by a STOP interval. While ON/OFF keying, as used in Morse, could be used with RTTY, instead the two signal states traditionally are transmitted by shifting between two radio frequencies. The two distinct states were less prone to misdetection than having one of the states be just OFF, as in Morse. Many transmitters and transceivers have a special jack to allow frequency shifting of the transmit carrier, typically from the carrier (MARK frequency) down to a frequency 170 Hz lower for SPACE.[2] This kind of modulation is called *frequency shift keying* or FSK, a kind of frequency modulation.

So How do I Use My SSB Transceiver to Send FSK?

A properly adjusted SSB transmitter driven by a pure tone instead of voice, emits a signal on a single frequency.[3] If the transmitter is connected to a sound card instead of a microphone, and the sound card sends two tones 750 Hz apart, alternating with RTTY coding, the outgoing signal will look the same as if traditional FSK were employed.

Not surprisingly, an SSB receiver will receive the two tones, sounding the same as if it were from an FSK transmitter. If it sounds the same, it can be processed the same way. This can be through a traditional RTTY terminal unit, or nowadays more likely via a sound card.

What Does the PC Do?

The PC, with its sound card and RTTY emulation software does all the heavy lifting:

- It controls whether the radio is in transmit or receive mode. This is generally accomplished via a dedicated connection to the transceiver push-to-talk (PTT) line, although VOX can sometimes be used.
- On transmit, it provides a user friendly screen that translates keyboard (or memorized) text characters into Baudot-coded signaling for transmission. It forwards the code to the sound card at which point it is converted to shifting tones, 750 Hz apart.
- In receive mode, some form of tuning indicator is usually provided, so that the tones can be set properly for reception. The received tones are filtered by the processing in the sound card and then translated to text characters to be displayed on the computer monitor.

The result is a two-way keyboard-to-keyboard system that operates just like a traditional RTTY system over the air, is compatible with WWII-vintage RTTY gear, but has no moving parts and is as quiet and reliable as a PC.

I'm Convinced, How do I Hook it Up?

Typical connections are shown in Figure 1. Note that the connection from the receiver output to the sound card just needs a cable with the right connectors, so you can start listening (or watching) for an investment

[1] J. Taylor, K1RFD, "Product Review — Computer Sound Cards for Amateur Radio," *QST*, May 2007, pp 63-70.

[2] The terms *mark* and *space* go back to the beginning of telegraphy, before it was found that operators could receive by ear. A paper tape was pulled through a device with an electromagnetically operated pen. When there was current on the line, the pen would be pulled to the paper making a *mark*, and when no current the pen would lift, leaving a *space*. More or less by accident, it was discovered that experienced operators could decode the messages without looking at the tape — just from the sound of the pen hitting the paper. The terms mark and space live on in the RTTY world as a description of the state of current flow in the teleprinter circuit.

[3] Note that improper transmitter adjustment can result in extra signals from the carrier and opposite sideband.

Joel R. Hallas, W1ZR ♦ *QST* Technical Editor ♦ jhallas@arrl.org

of perhaps $2 if you already have a sound-equipped PC in your shack![4]

It would be possible to hook your sound card to your transmitter mic jack in the same way. In fact I've heard of people putting their sound card speaker next to their mic and sending tones via what we used to call "acoustic coupling," in the early days of telephone modems! This becomes illegal as soon as other sounds, perhaps the TV set in the other room, couple in while you're operating in the CW/data band segments, so don't be tempted to try it! At a minimum, invest an additional $3 in a cable and mic connector.

Line Level is Best

While the speaker and mic jacks can be used, many radios also have "line level" inputs and outputs. These are preferable because they are not affected by changes in MIC GAIN or VOLUME control settings. Once you have the computer sound card levels adjusted properly, they won't need to be changed unless you change to a different radio. You also can turn down the sound from the speaker once you have everything set up.

What's That Extra Box?

It is possible to change from receive to transmit using the radios voice operated transmit switching (VOX) function, or even a manual switch. The transmitter input should see tones from the sound card only when it's time to switch to transmit, but will it? If your computer is like mine, there are lots of sounds that happen at other times. You certainly don't want a vacuous voice saying, "You've got mail!" showing up on 40 CW while you're getting ready to operate RTTY!

A better way to perform transmit receive switching is to have positive control that causes the radio's PTT line to switch only when the digital mode software commands the change. This can be accomplished with the addition of a *sound card interface device*. This device shows up under a number of product names, such as "RigBlaster" from West Mountain Radio (**www.westmountainradio.com**), "Sound Card-to-Rig Interfaces" from MFJ (**www.mfjenterprises.com**) and "SignaLinx USB" from Tigertronics (**www.tigertronics.com**). Such a device often has an input for your mic, a connection to the computer serial or USB port and an output to the radio's mic connector. The computer data interface provides transmit-receive switch control, generally to the radio's push-to-talk line, upon software command. There is generally an isolated audio link to go into the radio mic port when transmitting.

[4]A difference in ground systems between the radio and computer can introduce hum into the radio. This can be easily fixed by providing ground isolation. This is described in another article in this issue.

Figure 2 — Screen shot of RTTY reception using *MMTTY* software. Note the spectrum analyzer display in the upper right with the two tones lined up on the two transmit frequencies.

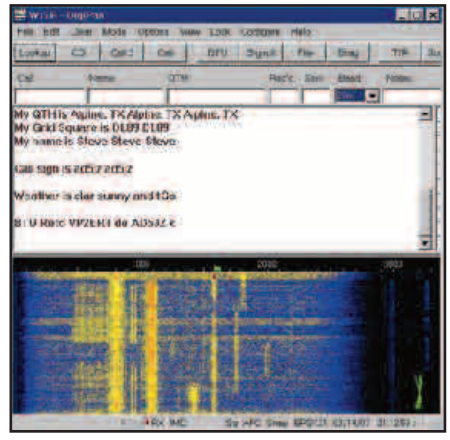


Figure 3 — Screen shot of PSK31 reception using *DigiPan* software. Note the spectral display indicates multiple signals, one with each line. The *DigiPan* filtering allows you to tune a signal with just a click.

Other Sound Card Modes

PC sound card connections really took off around 1999 with the introduction of a digital keyboard mode named *PSK31* to work with free software and a sound card. This mode, developed by Peter Martinez, G3PLX, captured the imagination of many amateurs. This was largely the result of dedicated users providing demonstrations of people chatting via their PC keyboards with other amateurs all over the world using 20 W of transmitter power. It's fair to say that this started the revolution that resulted in sales of interface devices, development of software to allow sound card operation of other modes that previously required dedicated equipment and then a profusion of different digital and analog modes, all usable with the same equipment and yet another free software package.

Software for Digital Mode Operation

While the connections are simple, nothing will happen unless you load the appropriate software on your PC. Software for different modes is available from many sources. If you are just interested in a single mode, you can find both free and commercial software by searching for the mode name on any popular search engine. Some software can operate in multiple modes, although you generally need to tell it which mode you're in. Some choices of multiple mode software are listed below for various PC environments.

- *Windows* — *MixW* shareware on the Web at **mysite.verizon.net/jaffejim/**, or the free *MultiPSK* at **f6cte.free.fr/index_anglais.htm**.
- Macintosh — *Multimode* shareware at **www.blackcatsystems.com/software/multimode.html**, or the free *Cocoamodem* by W7AY at **homepage.mac.com/chen/**.
- *Linux* — *Fldigi* by W1HKJ at **www.w1hkj.com/Fldigi.html**.

Finding and Identifying Digital Mode Signals

A real challenge for the beginner is to find and identify the various digital modes. Although there are no "official" frequencies assigned to different modes, you can often find digital communication in the following frequency ranges.

- 80 meters — 3.580 to 3.600 MHz
- 40 meters — 7.070 to 7.090 MHz
- 20 meters — 14.070 to 14.110 MHz
- 15 meters — 21.070 to 21.099 MHz
- 10 meters — 28.070 to 28.120 MHz

PSK31 signals tend to be at the lower end of the range, except on 10 meters where they are often at the high end. RTTY and the other modes often start about 10 kHz higher. New modes, Olivia and DominoEX, are often at the high end of the range shown on 20 meters. Please be sure to leave some space to avoid interference to the worldwide HF beacons at 14.1 MHz.

Each mode has a distinctive sound that is a bit difficult to describe in text. Fortunately, *QST* Editor and digital mode fan Steve Ford, WB8IMY, has put together a *PowerPoint* presentation with some information and imbedded sound files that you should find helpful. It is available on the ARRLWeb at **www.arrl.org/files/qst-binaries/GTK-Sounds.ppt**.

Even Some Analog Modes

While many modes are of the keyboard to keyboard or file transfer type, there are some other options as well. A few analog modes are in common use, still using the same equipment setup. Hellschreiber is an early analog facsimile mode that is a bit different. One of the more interesting to me is slow-scan television. With SSTV, instead of saying "the rig here is a brandX XYZ transceiver," you can show the station at the other end what your shack, or your dog, or your boat or whatever looks like, rather than just describing it! You'll often find SSTV alternating with voice around 14.23 MHz.

Figures 2 and 3 show the display screens of some of the software in operation at W1ZR. QST

Measure Q with your Antenna Analyzer

Another handy application for that versatile antenna analyzer.

Phil Salas, AD5X

Over the past several years I've been experimenting with a variety of portable antennas. These antennas usually use one or more loading coils in order to keep the antennas relatively compact. Since my loading coils also tend to be physically small, I have found it valuable to measure the Q of the antenna loading coils in order to determine the antenna efficiency.

Determining Inductor Q

At resonance, a tuned circuit has a Q factor equal to the ratio of the inductive or capacitive reactance to the total series loss resistance in the tuned circuit. If one of the elements has a significantly higher Q than the other element, then a majority of the loss resistance can be associated with the lower Q element. Capacitors generally have a much higher Q than inductors. And air variable and mica capacitors typically have a Q well in excess of 1000. Therefore the loss resistance of a tuned circuit using these types of capacitors is essentially that of the inductor.

Measuring inductor Q is not difficult with an antenna analyzer. First, measure the resistance of a fixed resistor with the antenna analyzer. Then place the fixed resistor in series with the inductor to be measured and a high-Q variable capacitor. Tune the variable capacitor for series resonance at your operating frequency giving the circuit's series resonant resistance, which consists primarily of the fixed resistor and the inductor loss resistance. Subtracting the measured fixed resistor value from the series-resonant resistance value gives the loss resistance associated with the inductor. Once you know the inductor loss resistance at resonance, you can determine the coil Q ($Q = 2\pi f L / R$). Or you can use the loss resistance directly to determine antenna efficiency. So, this is easy to describe. But how do you implement the test setup? This article describes the compact and easy to use Q-meter adapter that I came up with.

The Q-Meter Adapter

My Q-meter adapter is shown in Figure 1. I used a 51 Ω metal film reference resistor, since antenna analyzers tend to be pretty accurate as you get closer to 50 Ω. Metal film resistors are surprisingly non-inductive into the VHF range. I used an MFJ Enterprises 6 to 180 pF air variable capacitor with a built-in 8:1 vernier drive. Obviously you can use whatever air variable capacitor you have on hand. A vernier drive, such as that on the MFJ capacitor, does makes accurate tuning much easier. I included the capability to switch in a 180 pF fixed capacitor in parallel with the variable should you need additional capacitance for lower value inductors.

Wiring is not critical over the 1.8-30 MHz frequency range. Everything mounts comfortably in the small aluminum box called out in the parts list. The MFJ variable capacitor has front mounting holes that can easily be tapped for #6 screws. Or you can use #4 screws, nuts

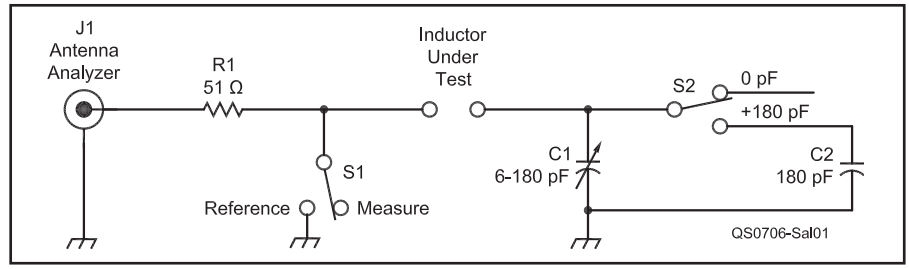


Figure 1 — Schematic diagram and parts list of the Q-meter adapter. MFJ parts are available at www.mfjenterprises.com and Mouser products at www.mouser.com.
C1 — 6-180 pF variable capacitor (MFJ 282-5160).
C2 — 180 pF mica capacitor (Mouser 5982-15-500V180).
J1 — SO-239 UHF jack (MFJ-7721).
R1 — 51 Ω, ½ W film resistor (Mouser 660-CF1/2C-510J).
S1, S2 — DPDT slide switch (MFJ 501-1003).
Aluminum box, 3.25″×2.13″×1.63″ (Mouser 563-CU-3001A).
Double male coax plug (MFJ-7702).
Five-way binding post, red (MFJ 606-0003).
Five-way binding post, black (MFJ 606-0004).
Knob, 1½″ diameter (MFJ 760-0125).

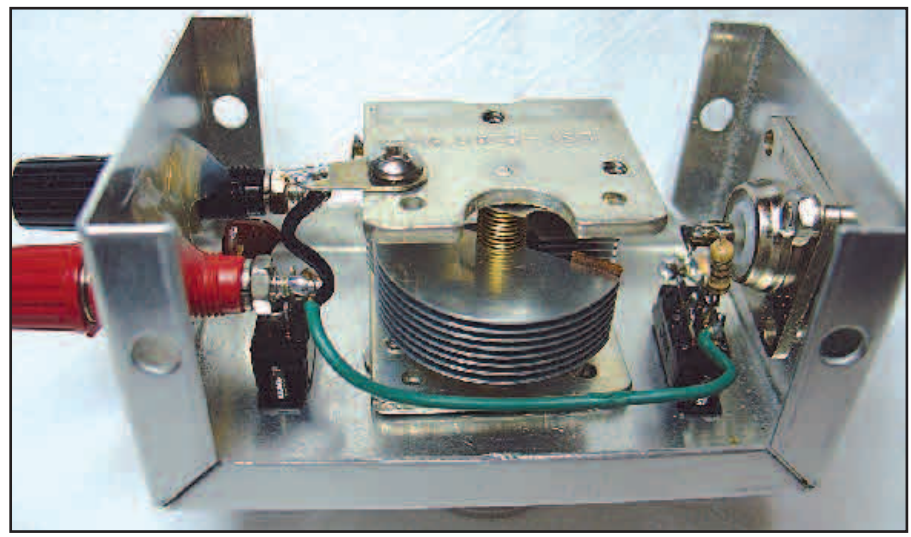


Figure 2 — Internal wiring of the Q-meter adapter.

Metal Working Tools for Home Projects

The Q-meter adapter requires the drilling, punching and filing of an aluminum box. These are skills useful for many radio projects. The right tools can make any fabrication job easier, but be sure to observe all safety precautions. Wear eye protection and always hold the material with a tool, not with your fingers. The following tools are some I recommend to take a lot of the effort out of your metal-based home projects.

- A good cordless drill. I recommend a drill with a ⅜ inch chuck and two battery packs. A ½ inch drill is generally much larger, making it less convenient to use for the typical small projects you need it for.
- A "step" drill bit is often easier and more convenient to use than regular drill bits, for drilling holes, especially when you're trying to work your way into the right-size hole for that odd connector or switch. I like the Harbor Freight 91616-9VGA set of three step drills.
- A Greenlee ⅝ inch circular chassis punch is almost a necessity if you ever mount UHF or type N coax connectors. These are expensive, but they last a long time. I've had my ⅝ inch punch for 40 years. You can get these from Mouser Electronics (part # 585-3803) and other distributors. Sometimes they can be found on Internet auction sites. A less expensive alternative is the Deltron 16.5 mm punch (part # 380-0165).
- A tap and drill set will find frequent use in your metal working projects. I've had several years of use from my Sears Craftsman 9-52068 set.
- For those odd-shaped holes (such as for the slide switches I used here), the Sears Craftsman 9-6757 needle file set is excellent. These files cut through aluminum with minimal effort.
- A nibbling tool is another hand tool that you'll find frequent use for. You can get one from Mouser (part # 524-1806) and other places.
- The most frequently used tool on my workbench is a Harbor Freight 44060-6VGA hand punch. This great tool lets you easily punch 3/32, ⅛, 5/32, 3/16, 7/32, ¼ and 9/32 inch diameter holes in metal. It is safe and easy to use, especially for punching holes in small pieces of metal or small aluminum boxes. I don't know what I'd do without it!

and lock washers, but mounting these may be a bit tricky. The #4 solder lug mounts under one of the SO-239 screws and is used to ground the 51 Ω resistor through one switch. The #6 solder lug mounts on the back of the variable capacitor (a tapped #6 hole is already available there) and grounds the mica capacitor through the second switch.

I used slide switches since I prefer the way they look compared to toggle switches, but there is much more work involved in cutting out the rectangular mounting holes (I use a small metal file to square off the corners). Incidentally, only SPST switches are necessary, but I liked the size and price of the DPDT switches called out. Figure 2 shows an internal view of the unit. Figure 3 shows the Q-meter adapter mounted to an MFJ-259B antenna analyzer with a double male UHF connector. All labeling was done using Casio "black on clear" labeling tape.

Using the Q-Meter Adapter

Set the ADDITIONAL CAPACITANCE switch to 0 pF, and the input switch to 50-OHM REF. Set your antenna analyzer to the desired frequency and record the measured resistor value. This should be close to 50 Ω with little or no reactance. Next, install the inductor to be measured across the five way binding posts. Flip the input switch to Measure R_S and tune the variable capacitor for resonance as indicated by zero reactance and a resistance value relatively close to, but higher than, 50 Ω. Add in the additional 180 pF capacitor if necessary to achieve resonance. Record the resonated series resistance. Now subtract the measured 50 Ω reference value from the resonated resistance. The answer is the loss resistance of the coil.

As an example, my favorite portable antenna is a 20 meter dipole with switches in the antenna wires that disconnect sections of the antenna to make it resonant from 20 to 10 meters. For 40 and 30 meters, the antenna becomes a center-loaded resonant antenna using inductors clipped across the 10 meter open switches. Using the Q-meter adapter, I measured the reference resistor as 51 Ω and the resonant R_s of my 18.5 µH toroid-wound 40 meter loading coil as 60 Ω. This leaves an inductor loss resistance of 9 Ω, so the coil $Q = 2\pi(7.2)(18.5)/9 = 93$. Since the 20 meter antenna is now a λ/4 center loaded antenna on 40 meters, some rough calculations indicate that the antenna radiation resistance should be about 25 Ω. With 9 Ω of loss resistance in each arm of the dipole, the total loss resistance is 18 Ω for the dipole. Therefore the efficiency of this antenna on 40 meters is: $E(\%) = 100 \times 25/(25+18) = 58\%$. Not too bad, especially for compact loading coils.

You can use equations from *The ARRL Antenna Book* or antenna modeling software to determine more accurate values of radiation resistance.

Figure 3 — Measuring the equivalent series resistance of an inductor.

Conclusion

I've described a simple, convenient and relatively inexpensive antenna analyzer adapter that permits you to measure the Q of most inductors used on HF frequencies. Build this adapter to give you more insight into the efficiency of your inductor designs.

Phil Salas, AD5X, has been licensed since 1964 at the age of 15. Because of ham radio he pursued a career in engineering, earning BSEE and MSEE degrees along the way. After 33 years in design engineering, Phil is now retired and splits his time between HF CW operating, and building Amateur Radio related gadgets — all with the understanding and approval of his wife Debbie, N5UPT. He can be reached at **ad5x@arrl.net**.

I Just Wanted to Try Sound Cards, Now I Have Hum!

The interconnect for your sound card modes might add a problem!

Joel R. Hallas, W1ZR

A companion article in this issue provides an introduction on how to start using the many modes that can be accessed via a sound-equipped PC.[1] In a kind of "truth in advertising" disclaimer, I thought I should point out a possible pitfall that awaits some fraction of those who move in that direction. Fortunately, this problem has a simple and inexpensive fix.

Issues that Can Occur while Interconnecting Equipment

Whenever we hook a cable between two systems, we have an expectation that we will pass a set of desired signals between them. We often don't consider the other thing that might happen — we often provide an additional grounding path to allow 60 Hz ac to flow from one equipment's chassis through the cable shield or ground conductor to the other equipment chassis and then to ground.

We generally tie our *radio* station equipment together via a solid low impedance grounding system such as described in a recent article.[2] When we think of our radio equipment, we don't always include our PC, even though it has become a more and more critical element of our station. In most cases we'd be hard pressed to find a ground terminal, especially for that plastic covered laptop model. What happens is that the PC ends up with its own path to ground — typically through the "green wire" of its power plug. Our equipment generally has a much lower impedance path through our single point (or equivalent wide single point — a ground bus) ground system. Any leakage current, from the PC or anything else on the same power circuit, will split — some continuing on the green wire, but most on its newly found low-impedance path through our station equipment to the station ground.

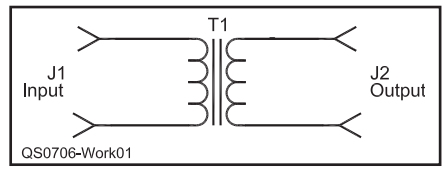


Figure 1 — Schematic diagram of the audio isolating adapter. J1 and J2 to fit your cables, T1 a 1:1 ground isolated low power audio transformer such as a RadioShack 273-1374 ($3.99).

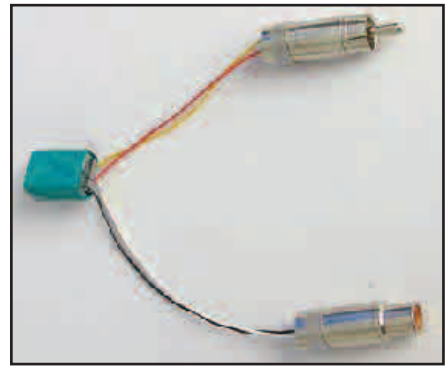


Figure 2 — Photo of the W1ZR isolation adapter.

So What's the Big Deal?

The ground path between the two will be the shield or ground lead of the cable between the two pieces of equipment. Instead of shielding, it will couple onto the signal wire and can drive that hum into your radio. In my case, with the PC on a completely different power system (the house mains) from my dc based uninterruptible system for the radio equipment, I got hum everywhere! Even when not using the PC, I had hum on SSB transmit that didn't stop until I unplugged the audio cable going to the PC sound card.

So How Do You Fix it?

If There's No Problem

Then perhaps you don't need to fix it. On the other hand, there could still be a ground system deficiency that may cause problems if your station is hit by lightning, so read on. If you are using a completely ground isolated laptop, you probably are not at any particular risk.

If You Can Get to the PC Chassis

Some PCs have metal cabinets that are held together by screws going into the chassis. If so, I suggest that you tie the chassis into your station ground system with as short as possible a braid or heavy conductor. That should solve the problem. If not, go to step three.

Provide Isolation to Eliminate the Ground Path

The sound card interface box folk often kindly provide isolation on the mic and control cables to avoid any "ground loops" on the conductors they have to deal with. There may be some that also provide isolation on the radio speaker line connection. If isolation is already provided in your interface, you don't need to read further — check the documentation. To do it yourself, all you need is a simple 1:1 ratio audio transformer between the two. The "circuit" is shown in Figure 1, perhaps the simplest construction project seen in *QST*. Note that if you put it into a metal box, the shield side of the INPUT and OUTPUT connectors needs to be electrically separated, or you will defeat the purpose. You can use a plastic box, or no box at all, as I did. See Figure 2. You may want to provide this isolation, just to be safe, even if you don't observe any hum.

Joel R. Hallas, W1ZR, is QST *Technical Editor. He can be reached at* **w1zr@arrl.org**. QST

[1]J. Hallas, W1ZR, "Getting to Know Your Radio — The Next Step — Sound Card Modes," *QST*, Jun 2007, pp 55-56.
[2]J. Hallas, W1ZR, "Getting to Know Your Radio — The Next Step — A Down to Earth View of Station Grounds," *QST*, Aug 2006, pp 48-49.

N0AX

HANDS-ON RADIO

Experiment #53 — RF Peak Detector

This experiment is really a "three-fer." Not only do you get the peak detector, but also a dummy load! And wait, there's more — measuring RF power with an oscilloscope! You'll have a useful instrument and a new shack accessory, and you'll learn some valuable techniques by the time the dust clears.

Term to Learn

Detect — Recover modulating information from a waveform.

The Envelope Detector

A detector is a circuit that recovers information from any type of modulated waveform. Different types of detectors are used for AM, FM, PM, SSB and other modes. Most hams use the term to mean *envelope detector*, a circuit whose output is the envelope of an AM signal. A typical envelope detector is shown in Figure 1.

This envelope detector is basically a half-wave rectifier. The input signal source develops a voltage across R1. (R1 can also be the output impedance of the signal source.) If the voltage is greater than that across C1, current flows through diode D1 increasing the voltage across C1 until the voltages are equal. Once C1 is charged, it discharges through R2, which can be the input impedance of a following circuit, such as an audio amplifier. The voltage drop across D1 depends on both the semiconductor material and the current when the diode is conducting. The forward voltage of a silicon diode such as a 1N4148 is close to 0.6 V when fully on, while a germanium diode, such as a 1N34A will have a lower drop, typically 0.3 V.

The input signal to a typical envelope detector is an AM waveform whose carrier, f_C, is many hundreds of times higher in frequency than the highest modulating signal frequency, f_{Max}. For example, the carrier of an AM broadcast station on 1000 kHz is 200 times higher than a 5 kHz modulating frequency. This means C1 has to charge very quickly and discharge very slowly to separate the RF and AF components of the AM signal.

The discharge time constant $\tau 2 = C1 \times R2$ should be chosen so that C1 discharges just slowly enough to reproduce the highest modulating frequency, f_{Max}. An approximation for the minimum value of $\tau 2 = 1 / (4 \times f_{Max})$. To recover human voice audio (f_{Max} of 3 kHz), $\tau 2 = 83$ µs. If R2 = 10 kΩ, then C1 = 83 µs / 10 kΩ = 0.00833 µF and a 0.01 µF capacitor will do nicely.

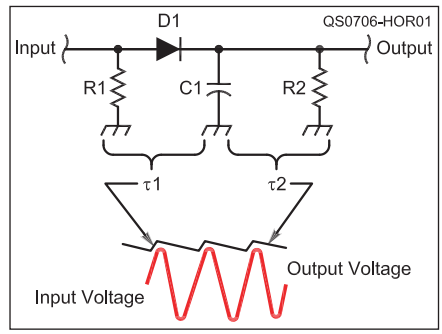


Figure 1 — The basic envelope detector circuit filters out the carrier signal and outputs only the modulating signal that creates the envelope. The time constant of C1 and R2 must be low enough to track the highest modulating frequency.

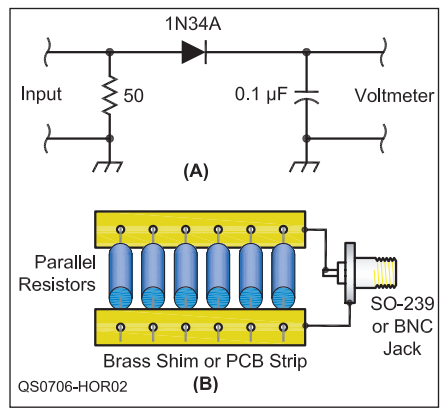


Figure 2 — At A is a peak detector circuit that uses an external voltmeter in place of R2. The input resistor is 50 Ω to present a good match to most generators and transmitters. At B is one way to construct a dummy load out of multiple low-power resistors in parallel.

The combination of R1, R_D and C1 form a low-pass filter with $f_C = 1 / [2\pi \times C1 \times (R1+R_D)]$. This removes the carrier component from the output. R_D is the forward resistance of D1 and depends on the amount of current flowing through the diode. R_D can be estimated as $\Delta V_f / \Delta I_f$, for values of I_f that will be encountered in operation. For example, from a 1N4152 data sheet (enter 1N4152 DATA SHEET into an Internet search engine), V_f for the 1N4152 is about 0.52 V for $I_f = 0.1$ mA and 0.62 V for $I_f = 1.0$ mA so $R_D = 0.1$ V / 0.9 mA = 111 Ω. If R1 = 50 Ω, R_D = 100 Ω, and C1 = 0.01 µF, the low-pass filter's cutoff frequency is approximately 106 kHz, attenuating carrier components above that frequency.

The Peak Detector

An envelope detector does not make a very good power measuring device because its output changes too quickly. What's needed is a *peak detector* whose output corresponds to the peak value of the envelope instead of individual modulating waveform cycles.

There's no need to change the input time constant, τ1. The carrier, after all, still has to be removed. What's needed is to lengthen τ2 so that the output stays at or near the peak value of the envelope long enough to be measured. If R2 is removed completely, then C1 will discharge only through its own and D1's leakage current. The voltage across C1 can be read by either a built-in voltmeter or by an external voltmeter such as a DVM or VOM.

Figure 2A shows a workbench peak detector for low-power signals up to 10 W or so. D1 is a 1N34A germanium diode to increase the sensitivity of the detector and R1 is 50 Ω to present a standard load to the circuit under test. R2 is replaced by the very high impedance of an external voltmeter. C2 is increased to 0.1 µF to increase τ2 and hold the peak voltage steady for a stable reading. If the voltmeter has a 10 MΩ input impedance, τ2 = 0.1 µF × 10 MΩ = 1 s. (Remember — megohms times microfarads equals seconds!)

Dummy Loads and Power Measurement

We'll use a transceiver as a signal source. To do so, you'll need a dummy load to which you can connect the peak detector circuit, so in the true ham spirit, we'll make our own. (Check your rig's manual for instructions on reducing output power below 5 W. You may have to use the ALC input.)

A good option for a single-resistor dummy load is an Ohmite TCH35P51R0J; a 51 Ω, 35 W resistor in a TO-220 transistor package, available from Mouser Electronics (**www.mouser.com/ohmite**) for less than $6. The

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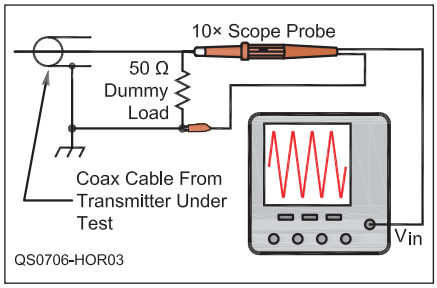

Figure 3 — Use a times 10 probe for power measurement directly at the dummy load. Do not use lengths of coaxial cable and T adapters because the mismatch between the coax and scope input can act as a stub, changing the impedance at the dummy load.

case of the resistor is electrically isolated so you can bolt it directly to a metal heat sink.

If your junk box is well stocked, you can construct a dummy load from multiple high value noninductive resistors whose combined resistance is 50 Ω. For example, 10 510 Ω, 2 W resistors in parallel can make a 51 Ω, 20 W resistor, if there's enough air between them. Be sure to use noninductive resistors — not wirewound or film resistors.

Use two strips of solderable metal such as brass or copper or PC board stock as shown in Figure 2B. Drill holes spaced to allow some airflow between the resistors and solder the resistors to the strips. Attach an SO-239 or BNC coaxial connector at one end as shown. Keep all leads short so that the impedance stays close to 50 Ω at high frequencies.

When you calibrate your peak detector, you'll need to measure the RF power from the transceiver accurately. This requires an oscilloscope. To avoid any impedance changes due to transmission line effects, use a 10× probe connected directly to the dummy load as shown in Figure 3.

Calculate peak envelope power from the voltage measurements as follows:

PEP (watts) $= V_{RMS}^2 / 50$

PEP (watts) $= V_{peak}^2 / (2 \times 50)$

$= V_{pk\text{-}pk}^2 / (8 \times 50)$

Building a Peak Detector

Start by building the peak detector circuit on a solderless prototyping board. Set your transceiver to output a low-power AM or SSB signal (5 W or less) at the bottom of the 160 meter band. Attach the oscilloscope probe directly to the dummy load at the coax connector. Use short wires to connect the dummy load to the detector circuit on the prototyping board.

Verify that the circuit works by measuring the output voltage at several different power levels. You'll notice that the output voltage falls rapidly once below 0.5 V. This is due to the 0.3 V forward drop of D1. If the input signal is not greater than 0.3 V_{pk}, the diode does not turn on very strongly and little current is available to charge C1. When you speak into the microphone, you should see the peak reading jump to a higher level as the waveform envelope tracks voice peaks. Change the value of C1 to higher (add more capacitors in parallel) and lower values and observe the effect on how the detector responds to your voice.

Once you've verified that the circuit works, build it permanently on a terminal strip with three to five terminals. Use the mounting lug as ground. A BNC connector is a good choice for the input. You can use binding posts, or just a pair of wires with tinned ends, as your contact points for the voltmeter — be creative and use whatever is handy to make the voltmeter connection. Now find a metal enclosure big enough for your peak detector, including the dummy load. (Hint — the enclosure can also act as a heat sink!) Assemble the dummy load and detector circuit inside the enclosure. You're ready to calibrate!

The 1N34A diode can withstand a maximum of 65 V_{pk} representing a power of 42.3 W and the absolute maximum your detector can withstand. Set your voltmeter to the 10 V scale and attach it to the detector. Attach the transceiver to the detector input and set power so that the voltmeter reads full-scale. (10 V_{pk} across 50 Ω is 1 W.) Record the oscilloscope's peak (or peak-to-peak) voltage reading and convert to watts. Reduce power and make another four readings approximately equally spaced throughout the voltmeter's range, recording output voltage and input power.

Repeat the calibration steps on 80, 40, 20, 15 and 10 meters. The detector is less sensitive at higher frequencies because the capacitance of the diode's junction (just a few pF) causes it to be a less effective rectifier. Attach the calibration table to the enclosure of the detector and you have a useful peak detecting power meter!

Shopping List

1N34A diode.
0.1 µF disc ceramic capacitor.
Resistors and metal or PCB strips for 50 Ω dummy load (see text).
3 to 5 position terminal strip.
SO-239 or BNC chassis connector.
Binding posts (optional).
Metal enclosure.

Recommended Reading

Chapter 7 of *Experimental Methods in RF Design* discusses the peak detector in detail and presents a wealth of options for increasing its sensitivity and power-handling capabilities.[1]

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

There are also many other instruments and techniques discussed in the book.

Next Month

Let's return to some low-frequency analog circuitry and put the versatile op-amp to work once again. We'll take a look at precision rectifier circuits and rectifiers with gain! QST

Feedback

◊ *Update:* The May 2004 article "A Deluxe HF Receiver Multicontroller" by James Garland, W8ZR, pp 31-38, referred to prefabricated circuit boards. The author has informed us that these are no longer available. Artwork and files for fabrication are now on the ARRLWeb at **www.arrl.org/files/qst-binaries/Garland0504.zip** (scroll down to the May 2004 issue).

◊ In "Making Sense of Decibels" [Apr 2007, p 61], the spreadsheet referenced in Note 2 should say "Just put in the gain or loss in dB in cell B9," not B7. A corrected version is at **www.arrl.org/files/qst-binaries/Hallas-dB0407.xls**.

◊ The "Up Front in QST" item about Bill Finch having upgraded [Apr 2007, p 21] says, in part: "Amateurs were not able to be on the air until a couple months after the war ended in 1946." World War II ended in 1945, of course, and hams were back on the air that year. — *tnx Jim Hanlon, W8KGI*

◊ The Morse code for SIGNING OFF was printed incorrectly in Media Hits [Apr 2007, p 12]. — *tnx KB1KRS and NN8G*

New Products

GLOBALQSL QSL MANAGEMENT SERVICE

◊ GlobalQSL offers an integrated, computer based system that allows hams to create, print, sort and forward QSLs to other amateurs around the world. With GlobalQSL's graphic editing tool, registered users can create their own QSL card designs and upload the finished product to the GlobalQSL Web site. Once the QSL design is uploaded, users can then upload QSO information using either the standard ADIF format found in most electronic log programs or by manually entering the data. GlobalQSL then prints the QSL cards, complete with QSO information, in full color on heavy card stock. Printed cards are sorted and forwarded to the appropriate QSL bureaus around the world. Up to five QSOs with a given station can be printed on each card and users are charged for only one QSL. Users can manage up to 10 secondary call signs and change QSL designs at anytime. Price: $82 for 1000 QSLs. For more information and free download of the graphic editing tool, visit **www.globalqsl.com**.

WR1B

HINTS & KINKS

POWERPOLE AUTOMOTIVE POWER ADAPTER

♢ The number of discarded cell phone automotive power adapters has increased each year as cell phones are upgraded. I find several each week at garage sales for 25 cents or less. There are as many different models of power adapters as there are models of cell phones. I prefer working with the ones that have a threaded and fused tip and spring loaded negative terminals. They can be converted into useful Anderson Powerpole-to-cigarette-lighter adapters with a little work and minimum expense. See Figure 1.

The first step is to open the adapter body by sliding a screwdriver between the halves at the power cord and gently prying them apart. The circuit board and cord are not used and should be recycled through a proper facility.

Next, reassemble the shell and carefully mark the end where the Powerpole connectors will be mounted. The opening height depends on the number of Powerpole connector pairs that you plan to install. A width of 0.55 inches allows the shell to engage the Powerpole connectors at the roll-pin indentation. Separate the shell halves and clear the opening with a rotary hand tool, such as a Dremel tool, and pattern files.

WA6MUU

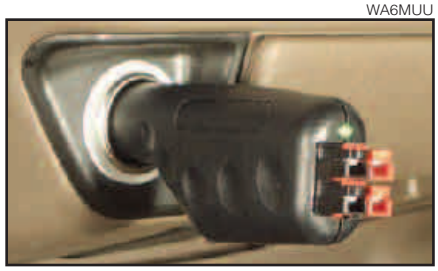

Figure 1 — A discarded cell phone automotive power adapter is easily converted to an Anderson Powerpole-to-cigarette-lighter adapter.

Connect the Powerpole terminals to their respective adapter terminal. You can reuse the pilot LED by connecting a 3 kΩ resistor in series with the LED. See Figure 2.

A spot of hot-melt glue holds the LED and Powerpole connectors in place and the shell halves are brought together. — *73, Gary G. Self, WA6MUU, 4350 Alta Campo Dr, Redding, CA 96002*; **wa6muu@arrl.net**

LIGHTNING PROTECTION FOR OPEN WIRE FEED LINES REVISITED

♢ The June 2006 Hint & Kink from Joe Hutchens, WJ5MH, on grounding for open wire feed lines caught my eye and I read it with interest. I recognized the ground bus bar as close to a type we use for our telecommunications systems, and the use of spark plugs was pretty clever. What also caught my eye, however, was the apparently under-sized Earth ground lead.

In our Telecomm rooms the lead to building ground is a minimum AWG no. 000 cable. Yes, about ½ inch diameter of stranded copper wire! In this case, since it appears that the ground bus is mounted on a block of wood outside, I would sink a ground rod right there and tie it directly to the bus. The original article is not clear about where the ground connection is made. The "system ground" mentioned should be tied back to the bus or ground rod, using at least an AWG no. 6 stranded ground wire (another Telecomm spec).

In any case, it gave me a good idea for future lighting protection, even though in my home area we have few lighting storms and no history of any strikes on a house, tree or building. (I've seen no lighting rods on rooftops anywhere in southern California.) Right now I have a separate ground rod for my two J poles, tied together with no. 6 wire. The damp location next to the house makes for a pretty good ground point. (Now I'm going to have to check for corrosion!) — *73, John Powell, KF6EOJ, 8325 Otto St, Downey, CA 90240*; **jpowell@csulb.edu**

WA6MUU

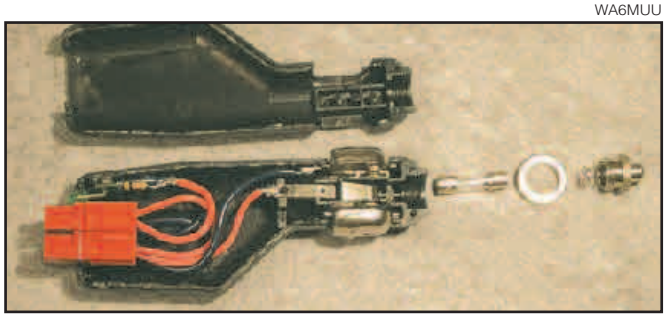

Figure 2 — This photo shows how WA6MUU turns a discarded cell phone automotive power adapter into an Anderson Powerpole-to-cigarette-lighter adapter.

♢ A few years ago I tried the same type of setup as WJ5MH described. Mud Dauber wasps fouled the "spark plug non-fouler" by daubing their mud into the holes clear back to the spark gaps. Needless to say this "fouled" up my antenna system.

I suggest daubing a little bit of silicon in the holes to keep the wasps out. Wasps also filled my banana plug socket system, which I used as a disconnect switch for my open-wire feed line. I have had to clean the mud out of the sockets several times each year. — *73, Bill Hall, K3CQ, 747 Rodney Dr, Nashville, TN 37205*; **k3cq@arrl.net**

CURING ALTERNATOR WHINE

♢ I recently installed an IC-208H transceiver in my truck. On the first day of using the new radio I got reports that I was transmitting very noticeable alternator whine. I could also hear it on receive and when the radio was quiet. I checked the diodes in the alternator, verified I had good grounds, and I even ran the truck with the alternator removed to be sure that the whine was indeed from the alternator.

The alternator produces ac, which is rectified into dc. The problem is that the rectified dc is not filtered adequately. The dc output will have a small ac signal riding on it. That ac signal will have nine cycles for each revolution of the alternator. Suppose your engine is idling at 600 RPM and the drive pulley ratio to your alternator is 1:3. At that engine speed your alternator is turning 1800 RPM, or 30 rotations per second. Each rotation gives you 9 cycles of ac. Do the math and you get a 270 Hz sinusoid (not a perfect sinusoid but close enough). Cruise down the road at 2000 RPM and you get a 900 Hz sinusoid riding on your dc power supply.

I tried an off-the-shelf filter from an auto parts store. It did very little to cure the problem, so I decided to build a filter. The first filter I built worked *very* well. The problem is that not everyone has the tools required to build that filter so I decided to figure out a filter design that could be built in less than an hour by anyone with basic tools, have a cost under $20, and handle a current of at least 12 A with acceptable voltage drop. Table 1 lists the materials I used.

Directions

The ½ inch Quick Link will be used as the

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N4MAA

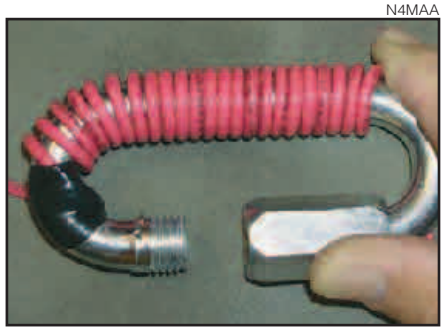


Figure 3 — This photo shows the inductor being wound on a Quick Link form.

N4MAA

Figure 4 — Here is the completed inductor, ready to be wrapped in electrical tape or some other method to hold the turns tightly in place on the form.

N4MAA

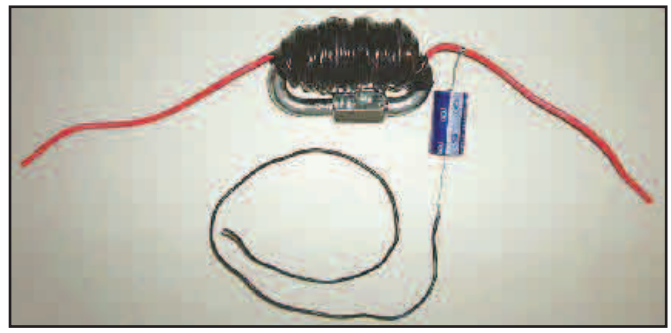


Figure 5 — Solder the positive capacitor lead to one inductor lead as shown here.

N4MAA

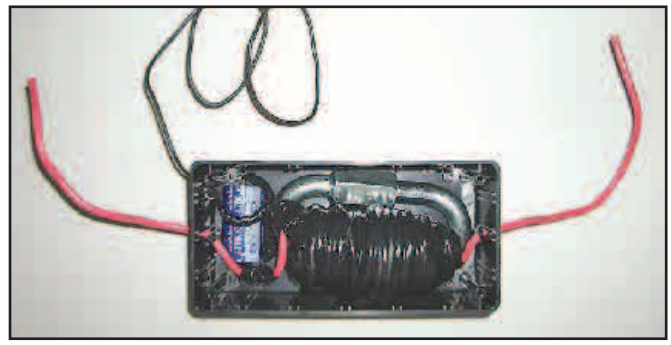


Figure 6 — Secure the inductor and capacitor inside a plastic box.

inductor core. (Quick Links are intended to quickly join sections of chain.) A fellow ham, Dave, KC1LT, suggested using a shackle. I went to get a shackle and came across this quick link. I went with the quick link to make more efficient use of project box space. See Figure 3.

Wrap the hook-up wire around the closed side of the quick link, starting from the left as shown. Leave about 9 inches of wire free on the left end. Try to keep the turns as close together and tight as possible. On the last layer, space the turns so that you have about 9 inches of wire left on the right end. Use all 20 feet of wire. See Figure 4.

Wrap the coil in electrical tape and close the quick link. About 1.5 inches from the right end of the inductor, strip ¼ inch of insulation off the red wire and solder in the positive capacitor lead. Make sure you observe the capacitor polarity. In Figure 5, you can see the negative arrow on the capacitor pointing down. Solder the 18 inch piece of black wire to the negative lead of the capacitor.

Cover the soldered connections and capacitor leads with electrical tape. Drill a 3/16 inch hole in both ends of the project box for the red wires. Drill a ⅛ inch hole in one end of the project box for the black wire. Run the wires through the holes. Put a zip tie on each of the three wires to limit how far the wires can be pulled out of the box. Make sure to leave a little slack in the wires inside the box. Using GOOP or some other thick, strong adhesive, glue the capacitor and inductor into the project box. Leave the cover off until the glue dries. Figure 6 shows the components inside of the plastic box.

Measured Filter Response

I measured the filter response using a low frequency signal generator and an oscilloscope. At 25 Hz, the filter has better than 30 dB of attenuation. In other words for frequencies above 25 Hz, the noise power has been knocked down by more than a factor of 1000. See Figure 7.

Installation

The filter was installed in a Honda CRV owned by Ron, KB1KRG. Ron is very active on the WB1GOF repeater, and one of the first people I talked with on 2 meters. Ron uses an IC-V8000 with a magnetic mount antenna and a cigarette lighter power plug as his mobile

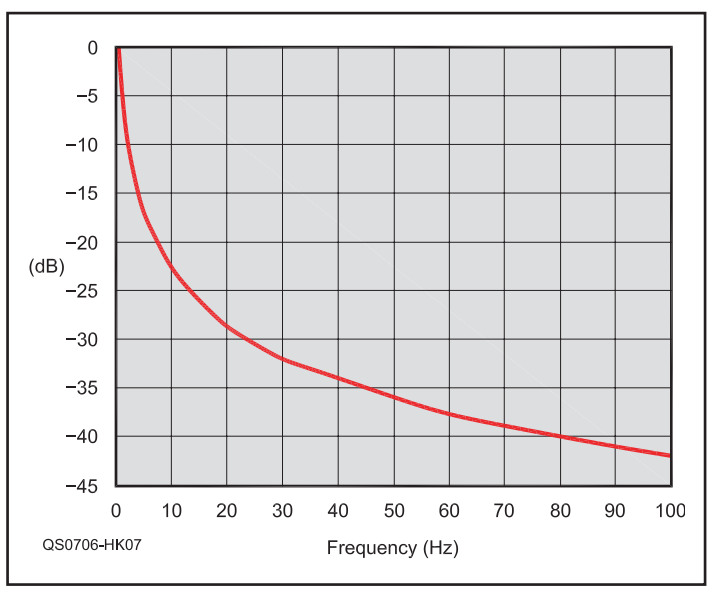


Figure 7 — This graph represents the response of the alternator filter to the ac component of the voltage in an automotive electrical system.

Table 1

Parts List

½ inch Quick Link from Lowe's	$2.98
6 × 3 × 2 inch project box from RadioShack	$3.79
20 foot roll, 12 gauge red hook-up wire from RadioShack	$4.99
4700 µF 35 V capacitor from RadioShack	$5.29
18 inches of black 16 gauge wire	
Electrical tape	
GOOP or similar glue	
3 zip ties	
Total:	$17.05

2 meter rig. We installed Anderson Powerpole connectors on the filter and in the IC-V8000 power leads. On the filter the black wire goes to ground, the red wire on the capacitor side of the inductor goes to the radio and other red wire goes to the battery. This proved to be a very convenient testing setup. We could very easily remove and install the filter and listen to the difference in alternator whine on an HT. The filter worked very well. With the filter installed there is no audible alternator whine on Ron's signal. In a permanent installation, mount the filter using two-sided tape or a good adhesive, and ground the filter to the chassis. The radio should be grounded to the chassis as close to the radio as possible.

I am new to practical electronics. By answering basic questions and making suggestions, several folks contributed to this project. In particular, Dave, KC1LT, was very helpful. I hope this information is useful. If you use this design to build a filter or if the information presented was useful please send an e-mail to **KB1MVX@comcast.net** and let me know it was worth the effort to write this Hint. — *73, Jim Perkins, KB1MVX, 27 Nathan Dr, Clinton, MA 01510*; **kb1mvx@comcast.net**

The KA3IXF Apartment Dwellers Antenna

◊ Having moved from a house — where I had a 5-band vertical and a Kenwood TS-940AT transceiver — after many years of being active, to an apartment, it is very easy to get discouraged. I went several years of being inactive, with little or no hope of putting out a good signal. Recently, with the birth of Elecraft and the K2/100, my interest was peaking to a high level, similar to when I was a Novice. It was like Heathkit was back in business. That warm fuzzy feeling was back, when I used to sit in front of my Galaxy on a cold winter's night and get warm from the heat coming off of my finals.

I had looked through many issues of *QST* and other publications, trying to come up with a "ready-to-buy solution." There were many indoor antennas and an antenna that connected to the windowsill, but it protruded straight out horizontally. None of these would do. I personally went to the rental office of my apartment complex, and tried to explain Amateur Radio and the need for an antenna, but they were not buying it.

The September 1996 issue of *QST* carried a Strays item on page 84 about an antenna I designed for an apartment and had some luck with it. At that time, however, I had a balcony. The apartment that I now live in has no balcony, and although I live on the third (top) floor, the possibility of having an outdoor antenna seemed hopeless. I thought I might have to settle for an indoor antenna.

I purchased a K2/100 kit, and had many hours of fun building this incredible radio. (I had a little help from Alan Wilcox, at Wilcox Engineering — **alan@wilcoxengeneering.com** — in Williamsport, Pennsylvania.) Then it was time to decide on an antenna.

KA3IXF

Figure 8 — This photo shows how KA3IXF wrapped Christmas-wrapping-paper tubes with electrical tape to form a core for his helically wound antenna.

KA3IXF

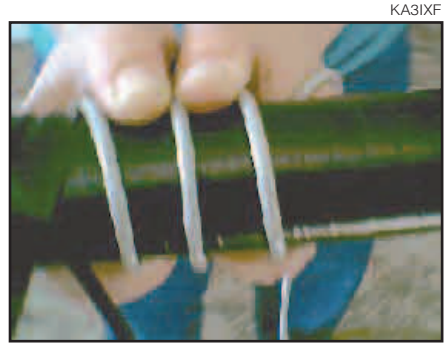


Figure 9 — After securing the coaxial cable feed line to the center of the cardboard tubes, KA3IXF wound the antenna wire around the tube to form a helically wound antenna.

KA3IXF

Figure 10 — This photo shows the completed KA3IXF Apartment Dweller's Antenna on the windowsill outside his apartment.

After spending $1000 on the K2/100, and not having a whole lot of money left over for an antenna, I thought about the idea that I had back in 1996. I took two cardboard tubes from a couple of rolls of Christmas wrapping paper, and placed them end-to-end. Then I wrapped them completely in black electrical tape to give them some strength and a little weather proofing. Figure 8 shows the beginning of this process.

I went to our rear bedroom in the apartment, because it has a double window, similar to a picture window, with a little width to it. I set the cardboard tube on the windowsill and cut it to fit snug in between the cut-out for the window.

I then took some wire and some feed line, and created a limited-space antenna for 10 through 40 meters. I placed the feed line in the middle of the tube, and secured it to the tube with black electrical tape. I then began to wrap the antenna wire around the tube, being careful not to allow the turns to touch each other. I used heavy-duty insulated copper wire for each side of the antenna. I left about a half inch of space between each turn, as shown in Figure 9. It felt as though I was wrapping one of those Elecraft toroids again.

After making what appeared to be a big wire-wound resistor with a coax feed line coming out of the middle, I again wrapped it all up in heavy duty tape, color optional, weather proofing it and adding a little bit of camouflage. You might choose different colored coatings, depending on the color of your apartment building.

I securely placed it on my windowsill(see Figure 10) and connected the feed line to my MFJ Tuner. I was able to tune up on 10 through 40 meters on the CW portions of the bands, with little or no reflected power at the transmitter; the SWR was just what I wanted. Being a CW-only operator, I am unaware how this antenna will do on the phone portions of the bands.

I began working the 40 meter CW band, and having some luck with the K2 at 15 W, working up and down the east coast. Not being satisfied, I added the KPA 100 to my K2. My contacts increased 100%, and to my surprise I began to work DX again. I worked Cyprus Island on 14.027 MHz. I was running approximately 50 to 75 W out, because I did not want any TVI issues in the apartment complex.

To my amazement, this antenna has performed flawlessly. The overall cost of The KA3IXF Apartment Dwellers Antenna, is a hefty $20. Of course, the longer the tube can be, and the larger the tube diameter can be, without attracting too much attention, the better the performance. Individual sizes will vary on the band portions you wish to work. I am not claiming this antenna to be the next big thing in Amateur Radio. For me, however, it was this antenna or nothing, and to my surprise, along with using the excellent overall features of the Elecraft K2/100, this antenna keeps KA3IXF on the air, answering your CQs on 40 and 20 meters from a third floor apartment in "rare" Delaware. — *73, Bill Parker, KA3IXF, 3314 Old Capitol Tr K-12, Wilmington, DE 19808*; **wwjp123@verizon.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-V85 2 Meter FM Handheld Transceiver

Reviewed by Michael Tracy, KC1SX
ARRL Lab Test Engineer

Comparisons between the ICOM IC-V85 and the IC-V8[1] are inevitable. Both are full-featured 2 meter handheld transceivers, and they share many common traits. There's also a familial resemblance to the IC-V82[2] we looked at during our evaluation of ICOM's D-STAR equipment (capable of digital voice and data) a couple of years ago. The 'V85 is not set up for D-STAR, though.

New and Improved Features

When stacked up against the IC-V8, it quickly becomes apparent that the 'V85 includes a number of significant upgrades. For starters, there's a 1700 mAh lithium-ion (Li-ion) battery pack, 7 W of transmitter output power (plus 4 W and 0.5 W levels), a backlit keypad, a rainproof case and an external dc power jack. If that isn't enough, there is a lengthy list of other improvements that I'll describe later in the review. As I had evaluated the IC-V8, it was only natural that the editor would ask me to run the new IC-V85 through its paces.

The IC-V85's case is somewhat shorter (by almost an inch) than the 'V8, and its lines are less rounded, and more rectangular. It still has rounded edges for plenty of comfort and is tapered at the bottom for a good fit in various size hands. The color is a mainstream dark gray (some would call it black). The belt clip on the IC-V85 has a metal mounting plate that attaches to the back of the rig with screws, an arrangement that is theoretically stronger than the IC-V8's one-piece plastic snap-in belt clip. (I've not heard of any problems with the IC-V8's clip, though.)

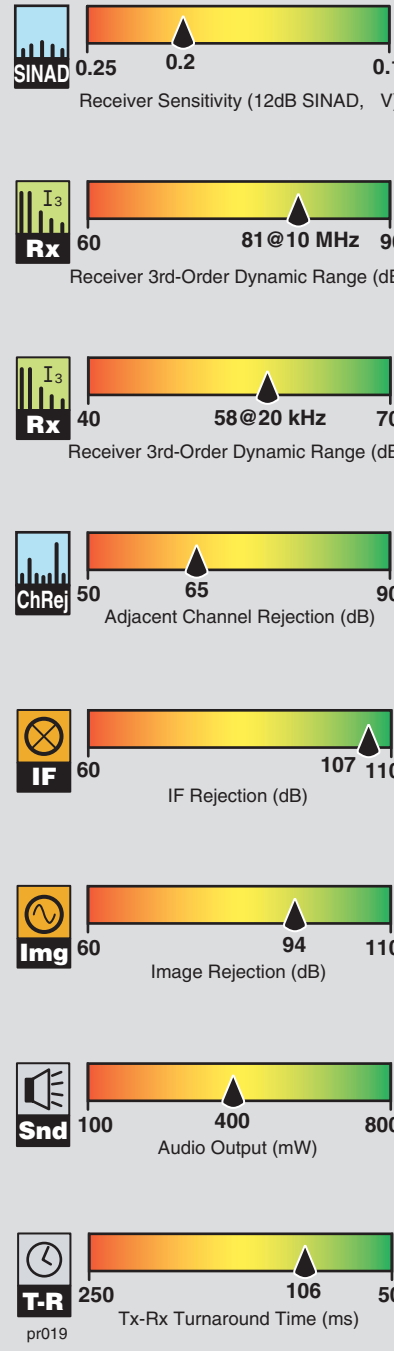
Weight is identical for both units without the battery pack attached, and there is only a slight (0.2 ounce) increase in total weight for the 'V85. That's surprising, given the much greater capacity in the IC-V85's stock battery pack. More performance for the same weight likely results from the use of a modern Li-ion pack compared to the 600 mAh nickel-cadmium (NiCd) pack standard with the IC-V8. The manual says a full charge will give about 7 hours of use, based on 10% transmit, 10% receive and 80% standby. (The IC-V8's standard battery provided 4 hours, but with 5% transmit, 5% receive and 90% standby.) Charging a flat battery takes about 12 hours, but you can cut that to 2.5 hours or so with an optional BC-119N drop-in rapid charger and AD-100 adapter (required to fit this radio to the BC-119N's charging stand).

Arrangement of the buttons of the 'V85

[1]M. Tracy, "ICOM IC-V8 2 meter FM Handheld Transceiver," Product Review, *QST*, Nov 2001, pp 63-66. *QST* Product Reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

[2]D. Henderson, "ICOM IC-V82 2 Meter Handheld Transceiver," Product Review, *QST*, Jun 2005, pp 65-67.

Key Measurements Summary



Bottom Line

If you're looking for a full-featured 2 meter handheld, the IC-V85 belongs on your short list. It's got all the bells and whistles, offers good performance and is easy to use.

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

differs somewhat from the 'V8, and there have been improvements here as well. The PWR button has been moved to the front of the radio and given a label. The UP/DN buttons are now larger and round, making them much easier to use. The keypad is now a 4 × 4 arrangement instead of having two separate sections for numbers and letters.

The MIC and SPK jacks remain the same, located on the right side of the rig, with a rubber cover similar to most current radios. The antenna connector is still a BNC. This bucks the trend toward SMAs on other handhelds we've reviewed recently, but I prefer the larger size connector because it just feels more sturdy. As on the 'V8, the IC-V85 has a single knob on top and its function can be swapped with the arrow buttons on the front of the rig. In the default setting, this knob controls the volume, but it's simple to change it to become the tuning dial.

Similar to the IC-V8, But...

For those who may have missed my earlier review, here is a rundown of the well-rounded list of features that the 'V85 borrows from its close cousin. There are 100 regular memories (with alphanumeric naming), three pairs of scan edge memories and a call channel (for 107 memories total). The radio offers multiple scan modes, direct keypad frequency entry, automatic repeater offset, extended receive range, transmit time-out-timer, repeater transmit lock-out and automatic power shutoff.

The IC-V85 offers the usual full range of tone features including 1750 Hz tone burst; continuous tone coded squelch system (CTCSS) tone encode/decode (50 tones, but the manual recommends using the 39 common ones); and digital coded squelch (DTCS) encode/decode (104 codes, of which 83 are recommended). There's a standard 16 key DTMF (dual tone, multifrequency) keypad and 16 dialing memories that hold up to 24 characters each.

There's also an optional board — the UT-108 DTMF decoder — that adds a "Pager/Code Squelch" system. The code squelch is similar in concept to CTCSS access with a repeater but uses DTMF tones. The squelch remains closed until someone transmitting the proper three-digit code calls. The pager also uses a three-digit code to let you know that someone tried to contact you when you were not near the radio. When a signal from a calling station containing the proper sequence is received, the radio emits a beeping sound and an icon flashes in the display until you press the PTT button to return the call. Both of these features reduce distraction from other activity on frequency.

The memory cloning feature allows transfer of memory information from transceiver to transceiver with the optional OPC-474 cable. You can also transfer memory information from a *Windows* PC with the optional CS-V85 software and OPC-478 series cable (RS-232 and USB versions are available).

Table 1
ICOM IC-V85, serial number 2501100

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 136-174 MHz; transmit, 144-148 MHz.	Receive and transmit, as specified.
Mode of operation: FM.	As specified.
Power requirements: 9.4-12.7 V dc*; receive, 0.25 A (max); transmit, 2.6 A.	Receive (max volume, no signal), 0.18 A; transmit, 2.2 A. Tested at 11 V dc.**
Receiver	**Receiver Dynamic Testing**
Sensitivity: 12 dB SINAD, 0.2 μV.	For 12 dB SINAD: 0.2 μV.
Two-tone, third-order IMD dynamic range: 55 dB (spacing not specified).	20 kHz offset from 146 MHz, 58 dB; 10 MHz offset from 146 MHz, 81 dB.
Two-tone, second-order IMD dynamic range: Not specified.	79 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset from 146 MHz, 65 dB.
Spurious and image rejection: 60 dB.	IF rejection, 107 dB; image rejection, 94 dB.
Squelch sensitivity: 0.16 μV.	0.12 μV at threshold.
Audio output: 300 mW at 10% THD into 8 Ω.	400 mW at 7.5% THD into 8 Ω.
Transmitter	**Transmitter Dynamic Testing**
Power output: 7 W high, 4 W mid, 0.5 W low.	With battery pack, 6.8 / 3.8 / 0.5 W; with 11 V dc, 7 / 3.8 / 0.5 W.
Spurious signal and harmonic suppression: 60 dB.	70 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, 106 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	65 ms.
Size (height, width, depth): 4.3 × 2.2 × 1.3 inches; weight, 12.5 ounces.	
Typical retail price: IC-V85, $200; BC-119N drop-in rapid charger, $70; AD-100 adapter for the BC-119N, $20; BP-226 battery case (for five AA cells), $30; CS-V85 cloning software, $30; OPC-474 radio-to-radio cloning cable, $18; UT-108 DTMF decoder, $30.	

*External dc; standard battery is the BP-227 7.2 V, 1700 mAh Li-ion pack.
**Current draw with the battery is nearly identical to external dc values.

Some features are common to both radios, but nonetheless improved on the IC-V85. As with the 'V8, the 'V85 also offers an optional alkaline pack. The IC-V85 has a rubber seal to preserve the rainproof quality of the case. There are 10 SQL levels on both units, but the 'V85 adds a "sticky" option to the MON button that allows the user to toggle squelch off and on without having to hold the button. Both rigs include weather band reception, but the newer one adds dedicated weather frequency memories and a NOAA weather alert function.

The manual is 80 pages, about twice the size of the IC-V8's manual. Although it contains a lot more information and illustrations, it is too large to carry in a pocket. Nonetheless, it is well organized and concise, and I was always able to find what I was looking for very quickly.

Customizing the Operation

As on the 'V8, there are INITIAL SET MODE and SET MODE menus on the IC-V85. The INITIAL SET MODE is accessed at power-on and used for setting up operating parameters that are not changed often — things like LCD contrast, time-out timer, auto power off and power save. The SET MODE menu is easily accessed for settings that change more often. Items on this menu are tone selection, repeater offset, tuning steps and so on.

The INITIAL SET menu has two new items. A battery protection function memorizes the last power state (ON/OFF) when you detach a battery pack. This must be set to OFF for the Li-ion pack, presumably to prevent a current surge when attaching the pack. A tuning speed acceleration feature is similar to ICOM's home station radios with which turning the tuning knob faster speeds up the tuning rate by more than the change in knob speed. This is a great feature for a radio that covers wide frequency ranges.

The SET menu has some new features as well: memory bank setting, memory bank link and weather alert. The memory bank feature lets you organize the 100 regular memories into up to 10 separate banks (designated A through J) for easier memory man-

agement. This is very helpful if you travel to different locations and want to arrange your saved repeaters geographically. The number of memories in each bank is completely flexible, so you could put 99 memories in one bank and one memory in another bank, or you could set up 10 banks of 10. The maximum total is still 100, of course.

As with the 'V8, the IC-V85 also has a memory copy feature. Since the 'V85 adds memory banks, it also has a bank copy feature so that you can transfer the entire contents of one bank to another. Note that the bank assignments don't directly affect the memory contents. If you erase the contents of a bank, the memories that were assigned to it remain intact (they just wouldn't be assigned to a bank afterward).

Another new feature is the dedicated weather channel memories. These are special memories preprogrammed with the NOAA weather frequencies. They are accessed by hitting the MR button several times, until the display reads WX and the channel number. The display shows only the channel number and not the actual frequency.

The weather alert function, enabled from SET mode, checks the selected weather channel once every five seconds (much like the priority watch feature) to see if the weather alert tone is being transmitted. All NOAA broadcast stations transmit this tone before important weather announcements. When an alert is detected, the transceiver notifies the user with a tone and a display message that alternates between ALT and the selected weather channel.

How Does It Perform?

Lab test results shown in Table 1 are similar to the IC-V8. The 'V85's sensitivity is somewhat lower (although still quite respectable). IMD dynamic range figures are lower by several dB (and 12 dB lower for the 10 MHz offset figure). Adjacent channel rejection and IF rejection are about the same, and image rejection is about 20 dB higher. Both transmit-receive and receive-transmit turnaround times are improved to roughly half the earlier delay values. Audio output on the IC-V85 is still about 400 mW but with less distortion.

Something that most users of FM rigs don't give much consideration to is frequency stability. This is how much the transmit frequency will vary over both time and temperature swings. On the 'V8, this specification was 10 parts per million (ppm), or as much as 1460 Hz for a 146 MHz signal. On the IC-V85, this figure is 2.5 ppm, or 365 Hz at 146 MHz. Given the nature of FM discriminators, this level of stability usually isn't needed, but it can be helpful in areas of weaker signals.

On the air, the transmit audio received good reports on both repeater and simplex contacts. The receive audio was clear, but had a bit of a hollow sound to it — not objectionable, but definitely noticeable.

Overall, I found the ICOM IC-V85 a pleasure to use. Despite a fairly extensive list of included features, the radio is easy to program and operate. The enhanced features make it a good choice to trade up from a more basic 2 meter handheld.

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

National RF Vector-Finder VHF Direction Finding System

Reviewed by Larry Wolfgang, WR1B
Senior Assistant Technical Editor

National RF offers a line of handheld, self-contained VHF radio direction finding units that are of interest for both foxhunting and for tracking down interference. They are all time-difference-of-arrival (TDOA) direction finding systems. The main differences are in frequency coverage and display. This review features the model VF-142QM, which covers 144 to 500 MHz. You can check out the other models at the National RF Web site (**www.nationalrf.com**).

A Brief Overview

Much has been written about TDOA direction finding systems. This review will not cover the technical details about the operation of these systems. Interested readers can find those details in *The ARRL Handbook* and *QST* articles, among other sources.[3, 4] Here I will just cover the basic operation of a TDOA system, so you can understand how the system points you in the direction of a transmitter.

The unit uses a pair of ½ wavelength dipole antennas spaced about λ/4 to λ/2 apart. The TDOA circuit switches between these dipoles at an audio frequency rate. When signals arrive at either antenna before arriving at the other one, there will be an audio tone in the receiver, in addition to the received signal. This is because there is some phase difference between the two signals being switched to the receiver. When a signal arrives perpendicular to a line between the centers of the two antennas, it will reach both antennas simultaneously. In that case there is no phase difference between the two signals being switched to the receiver, and consequently no tone.

The TDOA system can be quite an effective direction finding technique. The most significant problem is that the system defines a line along which the transmitter lies. There is no way to tell if the transmitter is in front of the operator holding the antennas or behind the operator, however. A second consideration is that the length of the dipole antennas must be close to λ/2 for the transmitter you are tracking. The

Bottom Line

National RF's VF-142QM Vector-Finder is useful for finding hidden transmitters in the 144 to 500 MHz range. Its design solves some of the problems with using a time-difference-of-arrival (TDOA) direction finding system over a wide frequency range.

[3] M. Wilson, Ed, *The 2007 ARRL Handbook*, ARRL, p 13.22 and pp 13.28-13.30. Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order no. 9760. Telephone 860-594-0355, or toll-free in the US 888-277-5289, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[4] D. Bowker, "A Companion Tracker for the Miniature UHF Fox Transmitter," *QST*, May 2006, pp 32-35.

Figure 1 — WR1B using the National RF VF-142QM TDOA radio direction finding unit.

spacing between the antennas is not as critical. An antenna system designed for operation on the 2 meter band won't work well to track a transmitter on the 1.25 m band or the 70 cm band, for example. The electronics will work for any frequency, but you would need a different antenna system for each band.

National RF to the Rescue

The Vector-Finder 142 models use an innovative antenna design to solve the second problem in a simple way. A pair of collapsible whip antennas forms each dipole. The antennas are mounted on the ends of 8 inch long folding arms. For storage, the whip antennas collapse to about 5 inches each and then fold against the arms. The arms, in turn, fold against the sides of the Vector-Finder. The electronics are housed in a 6 × 6.25 × 2.5 inch plastic box. A "pistol grip" handle on the bottom of the box provides a convenient way to hold and operate the Vector-Finder.

Each dipole can each be as short as 11 inches or fully extended to 38.25 inches. This allows you to form λ/2 dipoles over the entire 144 to 500 MHz frequency range. When folded straight out to the sides of the box, the arms hold the dipole antennas 18 inches apart for operation at the low end of the frequency range. To position the antennas closer together for higher-frequency operation, simply push the arms forward, in front of the box. The user's guide (three sheets of paper, printed on both sides) includes a convenient chart to show the appropriate dipole length and spacing for the antennas at various frequencies throughout the operating range. Figure 1 shows the VF-142QM in operation.

Let's Find That Hidden Transmitter

A short length of coaxial cable extends from the bottom of the pistol grip. Connect the BNC connector to your handheld radio or scanner. (TDOA systems receive only. Do not transmit into the unit or you may damage the electronics.) A ⅛ inch phone plug attached to a short lead plugs into the speaker-out jack on your radio to bring received audio into the Vector-Finder for further processing. That audio lead is spliced into the RG-58 coax close to the antenna connector through a filter that decouples the RF for the receiver antenna input. The connection is weatherproofed with silicone sealer and a plastic sleeve.

Figure 2 — This map was generated using DeLorme *Street Atlas*, with lines drawn from measurement locations in the direction of a "hidden" transmitter.

The audio line into the Vector-Finder goes to a processing circuit to solve the main problem with TDOA units. By measuring the polarity of the audio signal and using digital processing techniques, the Vector-Finder is able to determine if the received signal is coming from the left or right of center. This information is displayed using three LEDs on the back of the unit — the end you are looking at while using it. When the incoming signal is centered on the two antennas, the CTR LED will light. Now if you swing the unit to the left, the CTR and RGT LEDs will light. This tells you to swing the Vector-Finder to the right. If you go too far to the right, the CTR and LFT LEDs will light. Now you know that you have to swing the unit back to the left.

What if the incoming signal is coming from behind you instead of in front of you? In that case, when you swing the unit to the left of center, the LFT LED will light, in effect leading you to continue turning left 180°. Some of the other models use an LED bar graph instead of the three discrete LEDs. This display is intended to make it easier to track the signal over a 90° arc.

Other controls on the Vector-Finder allow you to vary the pitch of the audio tone and to

control the volume coming from the built-in speaker or going to the optional headphones. A ⅛ inch stereo PHNS jack is provided for that purpose. A 9 V battery powers the Vector-Finder. A normally open pushbutton switch on the handle provides a convenient way to turn the electronics on while making a direction measurement. No other ON/OFF switch is needed. The unit draws only 30 mA when the electronics are on, so the battery lasts quite a while.

A compass is mounted on the top of the Vector-Finder to indicate the direction the unit is pointed. By taking a compass bearing when the Vector-Finder is pointed at the transmitter, you can plot a line on a map to help locate the transmitter. By taking readings from several locations and plotting lines, you will find the transmitter in the area where the lines cross as shown in Figure 2.

One challenge for any DF equipment is determining the right direction when signals are strong. An adjustable attenuator would make the VF-142QM easier to use to locate nearby signals, and according to National RF a new model will have attenuators built in.

Operating Impressions

As with virtually any direction finding system, reflections and other multipath signals can confuse the system. The Vector-Finder works best with receiver squelch turned off. Holding the Vector-Finder and handheld radio away from my body and elevated in front of me while trying to home in on the signal proved a bit tiring on my arms.

When the antennas are positioned at the maximum distance apart, there is a plastic block that tightens against the antenna support bars with a machine screw and wing nut to hold the arms in that open position. When the arms are folded forward to bring the antennas closer together, that plastic block must be left loose. Machine screws serve as the hinge pivots for the arms, and wing nuts tighten to provide some pressure. Still, I often found that I would bump the antennas or arms and change the separation distance.

Newer models are said to use an improved antenna whip and mounting scheme that will not bend at the pivot point.

In addition, there is no convenient way to lay the unit down with the antennas in the open position. This generally makes it difficult to use the unit to take a reading, and then drive (or walk) to a new location for a second reading. This is a bit inconvenient, although I don't see an easy way to lay the unit down and still maintain the convenience of changing the antennas for a range of frequencies.

When setting the antennas closer together for higher-frequency operation, I wondered what the effect would be of not having the antennas set equally forward. Sure enough, even a slight offset in the center position of the antennas results in an error in the indicated direction to the transmitter, at least as referenced by the compass bearing and line of sight across the top of the Vector-Finder. So you must be careful when adjusting the antenna spacing. I also discovered that small changes in antenna length can affect the operation of the unit.

High Tech Foxhunting

After spending some time hunting various "hidden" transmitters, I was having difficulty finding a map with sufficient detail on which to plot lines. Then I realized I had the perfect solution in my wife's laptop computer. Running the DeLorme *Street Atlas* software on the laptop, with my GPS unit connected to the laptop, I had an excellent map with my current location accurately positioned. After taking the compass bearing to the transmitter, I could translate that onto the computer and use *Street Atlas* to draw a line on the map at the correct bearing. See Figure 2.

Despite a few operating challenges, I found the VF-142QM to be fun to use, and at least as accurate as the (few) other RDF systems I have used.

Manufacturer: National RF Inc, 7969 Engineer Rd, #102, San Diego, CA 92111; tel 858-565-1319, fax 858-571-5909; **www.nationalrf.com**. Price: $290.

A Look at Battery Powered Soldering Tools

Reviewed by Geoff Haines, N1GY
Technical Coordinator, ARRL West Central Florida Section

For several years I've seen television commercials for a device somewhat theatrically named ColdHeat. The ads promise a battery operated soldering device that heats up instantly and cools down as soon as the solder is removed from the tip. Supposedly the tip is safe to touch within seconds after use. Several times I was tempted to buy one, just to see if the unit really works or if it's just TV hype, but I never got around to it.

This past Christmas, however, one of those funny duplication of presents occurred. My wife gave me one of the ColdHeat products, and coincidentally, my son gave me a similar unit from Weller, a well-known brand of soldering tools. Of course my curiosity was aroused. Did that "only on TV" gadget really work? Would the name brand unit blow the TV hype out of the solder pool? A thorough test session would provide the answers.

After sharing my initial results with the editors at *QST*, they convinced me to expand the number of devices to include the Pro models from ColdHeat and Weller, plus a similar device from Solderite. Here is a short description of each device, followed by results of testing with some typical ham radio applications.

COLDHEAT CLASSIC

The ColdHeat Classic is the smaller and least expensive of the ColdHeat tools. It comes with a storage case, one chisel tip and instructions. No solder is supplied. Access to the battery compartment is gained by removing the two Philips head screws on the bottom of the unit. It uses four AA alkaline cells (not included) and is said to make 700+ solder joints per set of batteries.

An ON/OFF switch arms the unit and turns on a small work light under the tip. Unlike conventional soldering irons that gradually heat up to operating temperature, the ColdHeat soldering tip remains cold to the touch when switched ON. The tip doesn't preheat because the tool uses a technique called *resistance soldering*.[5]

The tip is black in color and appears to be made of a conductive graphite-like material. It's split, and a strip of insulating material down the center separates the two halves (called *electrodes* in the literature). When both sides of the tip are placed in contact with a conductor, be it solder, a component lead or wire, it completes an electrical circuit. Current flows through the tip material, which has a high resistance and heats up quickly to

Bottom Line

A battery powered soldering tool is a great addition to your toolbox for those times when an ac outlet isn't handy or you don't want to wait for a corded iron to warm up. There are limits to the size of the project, though.

[5]A detailed and illustrated description of ColdHeat soldering tools may be found online at **electronics.howstuffworks.com**. Look for "How Cold Heat Works" by Tracy V. Wilson.

Here are the five battery powered soldering tools reviewed this month, along with their protective caps, tip wrenches and solder (if included). Top to bottom: Weller BP645MP and BP860MP, Solderite 700, ColdHeat Classic and ColdHeat Pro.

allow soldering. When you remove the tip from the work, it breaks the circuit.

When you touch the ColdHeat tip to the joint to be soldered, it creates small sparks and a red LED on the case lights up. If the red LED is not lit, then contact has not been made properly and the unit will not solder. As soon as the tip is withdrawn from the solder or metal, the tip cools down rapidly (much more quickly than a conventional metal tip).

The tip material is brittle and can break if not handled gently. Replacement tips are available for around $10 and are offered in bevel, conical and chisel tip styles. A plastic cover protects the tip from damage when not in use.

The ColdHeat Classic is available online from **www.coldheat.com** and also from retail stores and home centers. (It's not marked "Classic" on the case or retail packages, but that's what it's called on the ColdHeat Web site, now that they have more than one model.) Cost is around $20.

COLDHEAT PRO

The Pro model of the ColdHeat line is significantly larger than its little brother. It uses five AA alkaline cells instead of four and adds a two-step power switch. According to the instructions, the switch allows LOW or HIGH power, but no quantification is made for these settings.

A chart in the *Quick Start Guide* included in the packaging indicates the size of soldering task possible with each setting and tip combination. (Tips are the same as the ColdHeat Classic.) The *Quick Start Guide* suggests LOW power for 20-24 gauge wire and HIGH power for 12-18 gauge wire.

Access to the battery compartment is through a slide-off cover on the underside of the unit. A protective tip cover is supplied, along with a storage case that I found almost impossible to open without the application of tools and force.

The ColdHeat Pro is available online from **www.coldheat.com** and also from some retail stores and home centers. Cost is around $30. Weller markets a version of the ColdHeat Pro as model CHT100 which can be found at some dealers catering to hams and electronics hobbyists.

WELLER BP645MP

This Weller unit is a conventional soldering iron with a conical metal tip. It comes with a small roll of solder, a transparent plastic tip protector and a tip extraction tool. You may find it packaged with or without a plastic storage case. With case, it's model BP645CMP. Warm-up time to working temperature is rated at 15 seconds. The BP645MP uses three AA cells (included), with access to the battery compartment through a pull-off cap at the rear of the unit. According to the literature, a fresh set of batteries is good for 120 or more "intermittent solder joints."

The unit has an ON/OFF switch with a small momentary contact push button in the middle. The iron must be switched on and the button must be held down throughout the preheating and the use cycle. A small red LED in front of the switch lights up to indicate that the tip is heated.

As long as the button is pressed, the BP645MP is like any conventional iron. The tip remains hot whether or not you are actually soldering. The tip also cools down in the same way as a regular iron does — slowly. I did not time this aspect of the BP645MP directly, but heat could be felt for some time after the button was released.

No indication of the working temperature of the tip was found in the instruction leaflet that came with the device. Weller's Web site indicates that it's a 6 W iron with an operating temperature of 900°F.

The BP645MP can be found at retail stores and home centers or online for around $15, a few dollars more with the case. Weller's Web site shows a replacement conical tip, model BP1. The tip is not as easy to find as the iron, but a few online retailers offer them for around $6. Of course a conventional metal tip lasts a long time with proper care. More information about Weller soldering tools may be found at **www.cooperhandtools/brands/weller**.

WELLER BP860MP

The Pro Series Weller includes two tips (chisel and conical), a small roll of solder, a tool for removing the tip, a protective cover for the tip and the four AA cells required to power the device. Access to the battery compartment is via a pull-off cover at the rear of the device. No storage case is included. A fresh set of batteries is said to provide 150 or more intermittent solder joints.

The controls are similar to the smaller BP645MP except that the BP860MP has a two-step ON position for two different heat settings. If set to the first step, the temperature is rated at 850 °F (8 W). If the switch is moved

to the second step, it's 11 W and 950°F.

The BP860MP also has a work light near the front, aimed at the tip. The warm-up time to working temperature is listed as 15 seconds, although no indication is given as to whether this is for 850° or 950°.

Online retailers and vendors catering to the electronics market offer the BP860MP for around $20, and replacement tips are about $8.

SOLDERITE 700

The Solderite 700 battery powered soldering iron looks very different from the other small units, the Weller BP645MP and the ColdHeat Classic. It's a conventional soldering iron with a claimed warm-up time of 10 seconds, about 5 seconds less than the Weller units. Power is specified to be 8 W with a maximum tip temperature of 896°F.

Operation is very similar to the Weller units: Slide the switch forward, push and hold the button within the slide switch, and wait until the tip heats up before soldering. Like the Weller irons, the push button must be held down throughout the warm-up and soldering cycle.

This tool uses three AA cells for power, loaded through a slide-off cap at the rear of the device. One set of batteries is said to provide up to 60 minutes of soldering time. The supplied protective cap looks almost ballpoint-pen like in design, but the pocket clip is in fact intended to shut off the slide switch when installed over the tip. A tip removal tool is supplied, but no storage case or solder.

Unlike the ColdHeat and Weller devices, the Solderite 700 is clearly aimed at the professional market. You won't find Solderite tools at your local home center or online retailer. Solderite's Web site (**www.solderite.com**) offers information on the 700 and shows a price of $39, but you can't order one directly. The review unit was purchased from a distributor that specializes in commercial soldering equipment.[6]

Putting the Tools to Work

I set a few ground rules first, to be as fair as possible. Each tool would be used to attempt a series of different soldered connections. The test solder joints would be duplicated side by side, secured to wooden boards with staples to hold them steady. A light duty rosin core solder from RadioShack was used with all five devices.

[6]The Solderite 700 shown in the review was purchased from K3 Equipment, 279 Front St, Binghamton, NY 13905; tel 607-773-2047; **www.k3equipment.com**.

Table 2
Effectiveness of Battery Powered Soldering Tools

Tool	*#14 Wire*	*#24 Wire*	*Thin Component*	*Lead to Wire*
Cold Heat Classic	No	Yes	Yes	Yes
Cold Heat Pro	Yes	Yes	Yes	Yes
Weller BP645MP	No	Yes	Yes	Yes
Weller BP860MP	No	Yes	Yes	Yes
Solderite 700	No	Yes	Yes	Yes

Note: See text for a description of these tests.

I chose four tests that represent typical ham radio applications:

1) Join two pieces of heavy stranded wire, about 14 gauge.

2) Join two pieces of thin stranded wire, about 24 gauge.

3) Join two thin component leads (¼ W resistors).

4) Join a larger component (1 W resistor) with a heavier lead to 18 gauge wire.

Test Results

Table 2 shows the results. Only one unit, the ColdHeat Pro, was capable of making a usable solder joint in the 14 gauge wire. I expected that the battery powered tools would have a hard time here because you'd normally use a heavy iron or a soldering gun for a job this big. The sheer mass of copper in a connection of this type requires more wattage than you'd expect a battery operated device to muster, and the ColdHeat Pro's success was something of a surprise. The ColdHeat Pro uses five AA cells, more than any of the other devices tested.

On the other test jobs, though, *all* of the units were able to make an adequate solder joint. The small gauge wires soldered properly, as did the thin component leads, in just a little longer time than it would take with a regular corded iron. The heavier component leads took longer, but I was able to make an acceptable solder joint with all of the tools.

Technique is Important

The Weller and Solderite tools work just like standard light-duty soldering irons. The Weller irons took about 15 to 20 seconds to heat up to working temperature. The Solderite unit warmed up to operating temperature in about 10 seconds. Looking at the units it was clear why the Solderite with only three AA cells for power was still faster to warm up — the actual soldering tip is smaller, with less mass.

The ColdHeat units were a little more finicky when soldering. Proper positioning of the tip, solder and connection to be joined is critical with these units. The small red LED on the top of the handle of the smaller unit gave instant indication of good position. On the Pro Model, the work light changed color to red to indicate a good position. On the other hand, these units began soldering as soon as the LED lit up. Technique is a little different but easily mastered with a little practice.

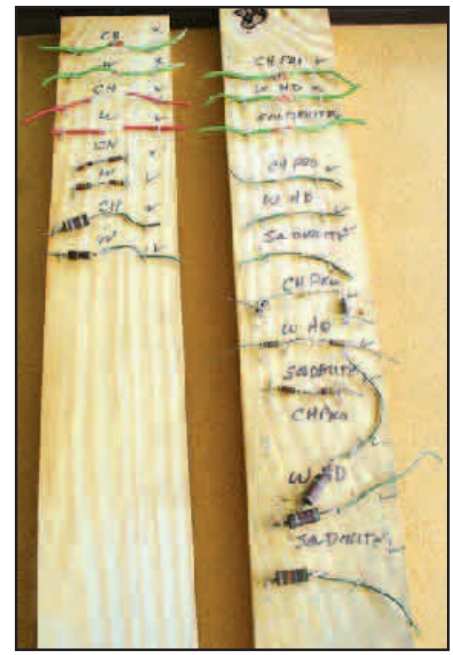


Figure 3 — Here are some of the test rigs I used. Each type of joint has been duplicated so that each tool could have a fresh trial at each joint.

To sum up the tests, all units worked well on small gauge wire and component leads, and they would probably work well for small components and circuit board jobs. Of course, that small gauge work is precisely what these tools are intended for. Only the ColdHeat Pro is suitable for larger wire gauges or applications where you would expect to need a heavier duty iron.

I was pleasantly surprised by these tools. Any of these units will fill your needs if you want a small soldering tool for occasional light duty work without being tied to an electrical outlet.

Geoff Haines, N1GY, has been licensed since 1992 and holds an Amateur Extra class license. He retired after a career in respiratory care. He currently holds several ARRL appointments in the West Central Florida Section and is active in ARES. Geoff can be reached at 708 52nd Av Ln W, Bradenton, FL 34207; **n1gy@arrl.net**.

TECHNICAL CORRESPONDENCE

THE ULTIMATE DX: AN AROUND THE EARTH PATH

◊ During the morning of February 17, 2006, at approximately 0345 UTC, while calling CQ on 3.524 MHz, I heard an interesting echo effect. The echo on my CW signal was strong and delayed so long that I stopped sending to determine if some other station was on my frequency. There was no other station on frequency and the echo appeared to be from my own transmission. Several tests were performed to ensure that there was no digital signal processing (DSP) mode circulating the signal in the transceiver's DSP processor. The effect lasted approximately 30 minutes, which allowed enough time to record the signal using a sound card recording system. Analysis indicates that the signal was most likely propagating from my station location, near Atlanta, Georgia, around the earth, and back again. Additional analysis was performed during the 30 minute period when the effect was observed to determine the stability of the propagation path over a short time.

I was using a Yaesu FT-1000MP-MKV transceiver that morning. I used an ETO 90B linear amplifier to amplify the signal to a level of 1000 W. My antenna system was a double Zepp fed with 450 Ω open wire line, tuned by a Johnson KW Matchbox. The alignment of the antenna was approximately north and south so that maximum power was radiated east and west. The data was recorded using Spectra Pro digital signal recording and processing software.

Capturing the Echoes

After the delay effect was discovered, I set up the transceiver to optimally capture the data. The receiver bandpass was set to attenuate signals below approximately 300 Hz and above approximately 1000 Hz. Using the receiver frequency offset control, the received signal was set to provide a tone of approximately 800 Hz when the echoes were received. The transceiver keyer was set to key a dit with an "on" period of approximately 100 milliseconds. Each dit that was transmitted generated signal with a sidetone frequency of approximately 694 Hz. Both the sidetone CW monitor signal and delayed echo were recorded. I set the automatic gain control (AGC) to manual mode so that the amplitude of any returned signal could be compared to any other returned signal without the compression effect caused by the AGC.

Figure 1 shows the time domain signal of the echo sequence. Time increases from left to right in Figure 1. Referring to Figure 1, the sidetone signal of 694 Hz lasts for approximately 103 ms during the time that the transmitter was keyed. The sidetone keying signal was fixed in amplitude and frequency, and serves as a reference for echo amplitude comparison. The dead time during changeover relay switching was approximately 27 ms. During that 27 ms, the transceiver was not yet in the receive mode. I believe, however, that after the 27 ms changeover period, the receiver recovered to full sensitivity.

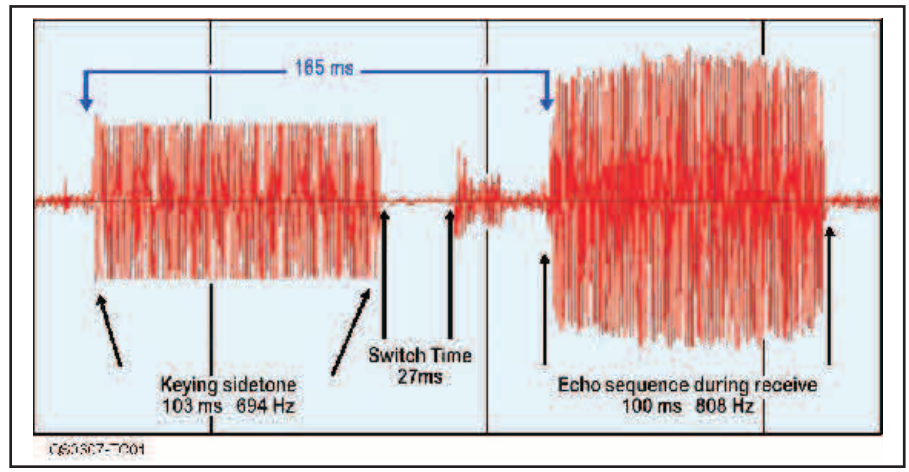


Figure 1 — Keying sidetone followed by change-over switch time and then delayed echo.

How Far Did the Signals Go?

Radio waves propagate from the antenna at a velocity of 300,000,000 meters per second, or 300,000 meters per ms or 186,000 miles per second. The transmitted signal propagated around the earth and was detected approximately 165 ms after the transmitter keying sequence was begun. The distance that the signal traveled during the 165 ms delay period was approximately 49,500 km, or 30,690 statute miles. This signal delay corresponding to 30,690 miles is approximately 5,790 miles greater than the Earth's circumference of 24,900 statute miles.

There are several theories that might explain the extra distance traveled by the signal. The signal may have propagated from the antenna to the F2 layer of the ionosphere approximately 130 to 270 miles (height depending on the season and other ionospheric conditions) above the Earth and back to Earth before reflecting back to the ionosphere for the next up and down cycle. These up and down reflections would have been repeated a number of times during the trip around the world, and the resulting additional slant range between the reflection points could account for the range difference. The exact slant range would depend on the reflection angle and the height of the ionosphere. Alternatively, the signal may have been trapped in a plasma waveguide for the entire trip or some part of the trip. A wave propagating in a plasma medium may travel slower than the normal propagation velocity of the free space velocity of 186,000 miles per second.

There is another theory that could explain the delay. The signal may not have propagated around the Earth at all. The signal may have been reflected from a point approximately 15,345 miles from the transmitting antenna. Whatever the phenomenology that caused the signal delay effect, the return waveform did not suffer from appreciable phase or amplitude distortion for most of the recorded echoes that were recorded and analyzed.

Analyzing the Data

Figure 2 shows the echo waveform isolated and plotted by itself. As in Figure 1, time increases from the left to the right of the figure. The echo is approximately 100 ms in duration and closely approximates the duration of the transmitted signal.

A 1024 point fast Fourier transform (FFT) was taken of the return pulse shown in Figure 2, using a Hamming window. The output of the FFT is shown as Figure 3. [According to a Wikipedia entry (**en.wikipedia.org/wiki/Richard_Hamming**), Richard Hamming was an American mathematician whose work had many implications for computer science and telecommunications.

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

In signal processing, a *window function* is a function that is zero-valued outside of some chosen interval. So a Hamming window is a function, developed by Hamming, that is used in digital signal processing. — *Ed.*]

The frequency of the pulse was measured to be 807 Hz with a resolution (bin width) of approximately 10 Hz. A frequency analysis was conducted on another pulse taken 45.5 seconds later in the same sequence with the same result of 807 Hz. Approximately 20 minutes later, however, the frequency of the pulse was approximately 786 Hz and the delay time had increased from 165 ms to 168 ms (an additional 560 miles). The stability of the transceiver synthesizer is not known and could have been the reason for the frequency shift of 21 Hz. The 3 ms increase in delay time, however, is thought to be real.

The pulse shown in Figure 2 was one of the stronger pulses. There were return pulses of much lower signal strength. A time domain analysis was performed on the amplitude of 48 sequential returned pulses that were transmitted and received over a period of approximately 18.8 s. The time between the transmitted pulses was approximately 408 ms (mean value). In Figure 4, the relative amplitude of each received pulse was plotted as a function of time of pulse occurrence. Without conducting a frequency analysis, there appears to be a periodicity between the signal peaks in amplitude of approximately 5.5 to 6 s. These fades (QSB) are relatively deep when compared to the peak values. The fade frequency rate of approximately 0.182 Hz appears to be very consistent over the analysis period of 18.2 s.

The author is well aware of the reported long delayed echoes, where signals are heard tens of seconds to minutes after the originating transmission. Many of these long delayed echo events were reported in *QST* and other Amateur Radio publications. The short delayed event in this report should not be considered a long-delayed echo. This was the first time during the almost 50 years that I have been an active amateur that I have heard echoes of this signal strength, delay and consistency. — *73, Gene Greneker, K4MOG, 3424 Wilderness Dr, Powder Springs, GA 30127*; **k4mog@bellsouth.net**

Gene Greneker has been an amateur operator since 1957, starting as a Novice at age 15. He currently holds an Extra class license. He recently retired from Georgia Institute of Technology where he was a Principal Research Scientist working in the field of radar research for the past 33 years. He holds 6 patents and is a Senior Member of IEEE. He currently serves as President of RADAR Flashlight, LLC in Marietta, Georgia.

FUSES FOR THE RIG IN YOUR VEHICLE

◊ In the August 2006 issue of *QST*, KD5BYB asked The Doctor about fusing his mobile rig. All of the schemes The Doctor presented could be considered wrong because they include a wrong assumption. The fuses do not have to be the same rating, as is implied, and they should not be the same ratings. There are two types of protection accomplished by fuses or circuit breakers, and they can be combined in one fuse or two separate fuses (or circuit breakers). The schematic presented in that answer is the perfect example of the two types of protection. See Figure 5. The explanation is a quite complex and requires covering some basics about protection as follows:

The more familiar form of protection is overload protection. The fuse is sized to blow when the current exceeds the expected maximum for the load, such as the one supplied with your radio. Its purpose is to

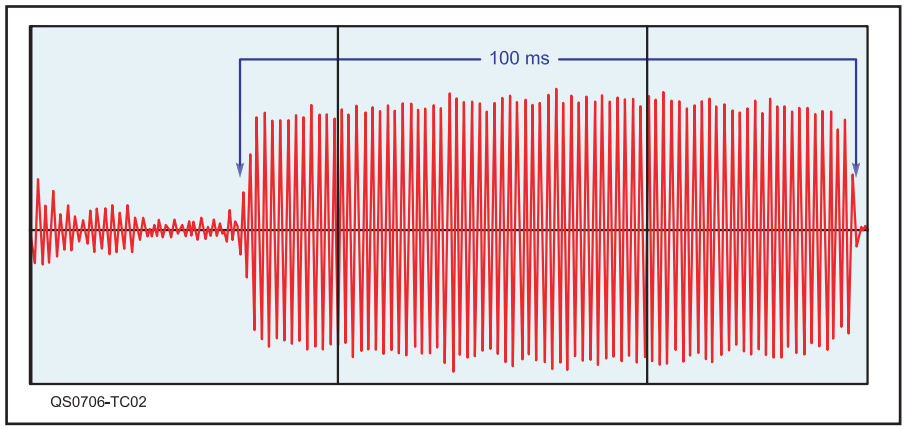


Figure 2 — The echo waveform is isolated and plotted by itself.

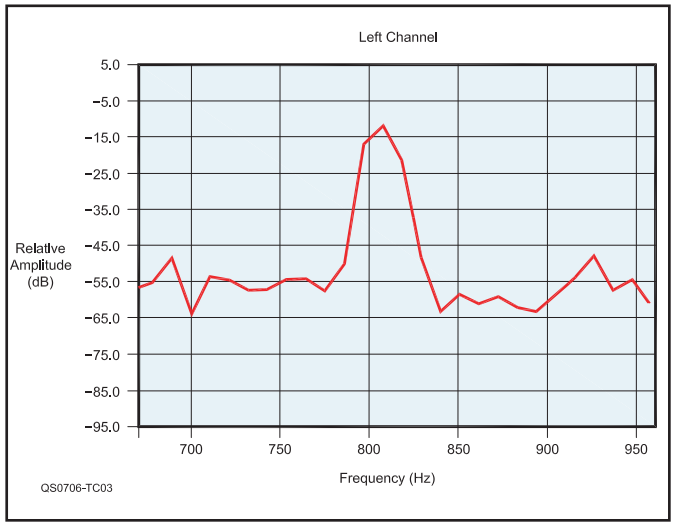


Figure 3 — Time domain recorded signal showing low phase and amplitude distortion.

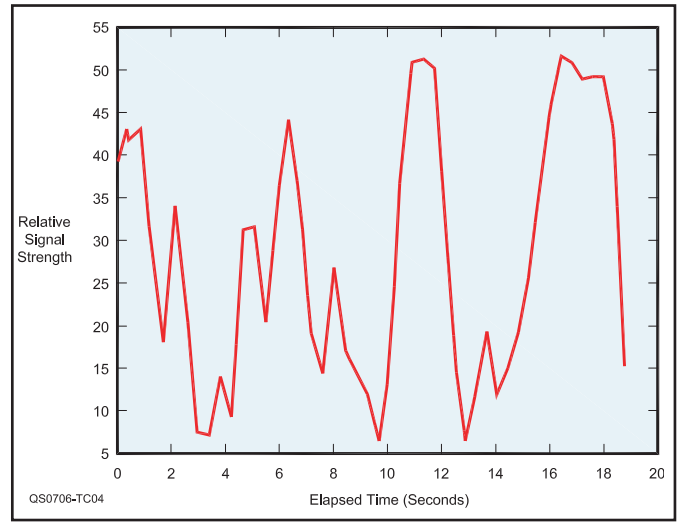


Figure 4 — Amplitude plotted as a function of time of 48 sequential pulses.

limit the current, more specifically, the energy dissipated when a malfunction occurs. This will minimize the damage, and more important, it minimizes the risk of the heat reaching the point of igniting a fire. Fuses for overload protection frequently are of the slow-blow variety because loads like motors or power supply capacitors draw more current for the first few seconds after power is applied. A slow-blow fuse actually is slow only at its rated current, and blows faster as the current increases to set an energy limit.

The second type of protection is short circuit protection, which calls for an instantaneous trip breaker or fast-blow fuse. You may think that this is just the most extreme case of overload, but there is more to it when you consider what part of the circuit is vulnerable to each problem. The objective of this protection is to prevent the catastrophic destruction (explosion) of any part of the electrical system from the maximum current of a short circuit. This protection should protect everything down stream of the source.

Overloads only come from equipment performance problems (assuming a dedicated circuit as for the radio), but a short will draw all the current the source can supply and can occur anywhere.

Fuses and Circuit Breakers

When you buy a circuit breaker for your power panel, it has two ratings — an overload rating (typical household ratings are 15, 20 and 30 A) and a short circuit interrupting rating (common ratings are 10,000 and 20,000 A for household use). The short circuit rating is the maximum amps that the breaker or fuse can interrupt. Under a dead short, the current is so high that a plasma forms, sustaining the arc between the separated contacts.

Power circuit breakers are built with the arms of the contacts forming a half-turn coil such that the magnetic forces deflect the contacts apart and the arc outward against materials that absorb the heat to quench it. Larger circuit breakers have small coils in series, called "blowout coils," to deflect the arc into a quenching chute, and some fuses are filled with sand to absorb the heat of the arc. If the interrupting rating is exceeded, the arc between the opening contacts or ends of the fuse will not quench, and the heat of the arc and/or the magnetic forces will cause it to blow apart with a flash that can blind you and a spray of molten parts that can set your house on fire.

Pole-top transformers can deliver about 8,000 A to a short in your house, and pad-mount units provide slightly over 10,000 A. Check those ratings when you install a new

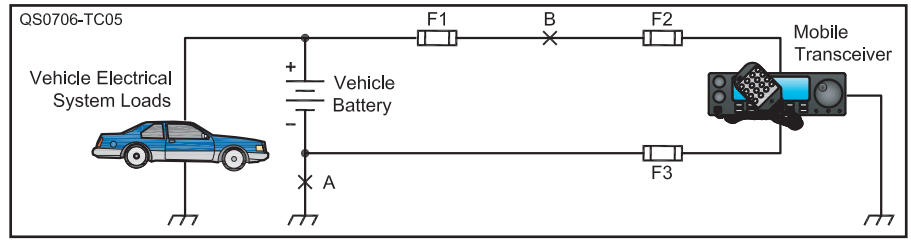


Figure 5 — Simplified schematic of a vehicle electrical system showing radio connections directly to the battery and fuse positions.

circuit for your shack. Most stores only sell the higher rated breakers to be safe, but it is best to double check for old stock.

Short circuit protection must be at the source because the short can happen anywhere along the circuit, but overload protection merely has to be is series with the load and can be at the equipment. A good example is that of a motor with a built-in thermal overload protector. This device is designed to reset automatically when the motor cools down to a safe temperature. You must have short circuit protection at your panel, so the problem is how to make sure the breaker protects the wiring but does not open for a simple overload defeating the automatic reset in the motor overload protector. This design process is called protection device coordination.

Typically, when using two fuses, the upstream fuse in series must be two to three times the value of the down-stream fuse to ensure that only the fuse closest to the fault will blow. Since the motor or your radio with the fuse close to it (or in it) is protected for overload, we are allowed by the electrical code to oversize the device for protecting the wire on the basis that the downstream overload device will eliminate simple overloads, leaving only short circuits in the wiring to be protected against by the upstream device.

Insulation deterioration can cause less than the short circuit current to flow, but because the wire is already lost, we need only prevent fires, which can be accomplished with a higher fuse rating than the continuous current limit we would use without a downstream protector. The maximum rating allowed is based on the cable heating limit, so that a loose wire hitting ground will blow the fuse before the cable temperature reaches the point of insulation damage. Otherwise, you would have to replace your wiring just because your screwdriver slipped.

Because of the extreme current in a bolted fault (the worst case of a wrong connection), the clearing time of the protective device matters most — not its long-term rating. (Standard circuit breakers will carry their rated current for a minimum of 20 minutes but trip in a few cycles at 10 times their rating.) Household electrical materials usually have sufficient safety factors that we do not have to hire an engineer to check our design. The codes have rules of thumb that suffice. You can get adequate cable short circuit protection with coordination by sizing the source fuse at 3 times the value of the overload fuse at the radio.

Conclusion

The correct answer is to fuse the negative lead at three times the rating of the radio fuse. If you have the radio overload fuse at the radio, size the fuse at the battery for the positive lead at three times the radio fuse rating, or combine both protections by locating the radio overload fuse at the battery. If the fuses are identical except for current rating, you usually can get coordination at 2 times instead of 3 times, but don't cut it close without checking the fuse manufacturer's recommendations. This method protects against all of the scenarios described in your answer. It also has the added benefit indicating what kind of problem occurred by which fuse blows. — *Dennis L. Green, KB8CS, 27960 Bayberry Rd, Farmington Hills, MI 48331*; **d7green@yahoo.com**

Dennis Green, KB8CS is the Head Water Systems Engineer for Facilities Design at the Detroit Water and Sewerage Department, where he has worked for 37 years after earning a BSEE. He is a Licensed Professional Engineer in Michigan.

People often ask what an electrical engineer does in the water department. The answer is that it takes big electric pumps to make the water flow uphill, and all of the treatment plants and pumping stations are highly automated.

Although he has yet to work packet radio on the ham bands, Dennis's design of an all-digital wholesale master meter system won the HART Communications Foundation international award in 2003 for the best use of their protocol (a protocol for interrogating process instrumentation). To preserve the all-digital data, the system uses spread spectrum 900 MHz packet radios to relay the data from customer communities spread over 1000 square miles, to the operations and billing centers and to "carbon copy" each customer community with their data — something conventional radio can't do. QST

HAPPENINGS

Amateur Radio-Related WRC-07 Text Survives Conference Preparatory Meeting

Technical report text on two World Radiocommunication Conference 2007 (WRC-07) agenda items of interest to Amateur Radio has survived the WRC-07 Conference Preparatory Meeting (CPM-07) held in Geneva February 19 through March 2. Thanks to the efforts of the IARU delegation, the nearly 600 page *Conference Preparatory Meeting Report* (*CPM Report*) contains "methods" that satisfy the International Amateur Radio Union's (IARU) desired options for allocations in the vicinity of 136 kHz, 5 MHz and 7 MHz.

"The IARU was successful in retaining these options in the official report," said IARU President Larry Price, W4RA, who headed the IARU delegation to CPM-07. "Of course, it is a long step to actually get an allocation at the WRC." Ken Pulfer, VE3PU, also served on the IARU delegation.

Sponsored by the International Telecommunication Union (ITU), CPM-07 drew some 1100 delegates from more than 100 countries to finalize and adopt the massive technical report, which has been in preparation for the past four years. The *CPM Report* will guide the work of delegates attending WRC-07 October 22 through November 16. It provides background information on each WRC-07 agenda item, various methods of addressing the agenda items and the advantages and disadvantages of each.

Agenda Item (AI) 1.13 addresses the allocation of HF spectrum between 4 and 10 MHz, including the possibility of allocation changes in the 40 and 60 meter bands, while AI 1.15 opens the possibility of a secondary ham radio allocation in the vicinity of 136 kHz. IARU Secretary David Sumner, K1ZZ, concedes that AI 1.13 is "one of the most complex and controversial items" on the WRC-07 agenda.

"It's anyone's guess as to how the dust might settle come November," he commented. The *CPM Report* presents eight methods to satisfy specific parts of AI 1.13. Methods 6 and 7 are favorable to the Amateur Radio Service.

Method 6 would provide a worldwide secondary amateur allocation of 5.260 to 5.410 MHz "to allow communications at times when propagation conditions do not permit the use of the presently allocated bands at 3.5 and 7 MHz." On the downside, the *CPM Report* said, was that such a 5 MHz amateur allocation could impact spectrum available for the Fixed and Mobile and the Broadcasting services.

Method 7 provides a primary allocation at 7.200 to 7.300 MHz in Regions 1 and 3 "to globally harmonize the Amateur Service allocations." Among Method 7's disadvantages, the *CPM Report* said, was that it could reduce spectrum now allocated to HF broadcasting in Regions 1 and 3 and "significantly complicates the problem of identifying" additional Broadcasting Service spectrum.

Adoption of Method 7 at WRC-07 would achieve the IARU's goal of a worldwide, 300 kHz Amateur Radio allocation at 7 MHz, however. It essentially implements the second phase of the work begun at WRC-03, which expanded the Amateur Radio allocation at 7 MHz by 100 kHz (7.100 to 7.200 MHz) by March 2009. It would have no impact on the current 7.000 to 7.300 MHz 40 meter allocation in Region 2 (the Americas).

AI 1.15 Method A would establish a secondary amateur allocation at 135.7 to 137.8 kHz in all three regions "with footnotes ensuring protection of other services operating in the same band." One alternative footnote would set a maximum radiated power limit of 1 W effective isotropic radiated power (EIRP) and would require that stations not cause harmful interference to radionavigation stations in certain countries. A second alternative footnote doesn't include the 1 W EIRP power limit. Method B would make no changes to the allocations table. The *CPM Report* lists no "foreseen" disadvantages to Method A.

The *CPM Report* notes that more than 20 countries have established either domestic amateur allocations or authorized experimental and amateur communication in the low-frequency range, including 135.7 to 137.8 kHz.

"We were able to achieve at CPM-07 the methods that would result in the allocations we seek," Sumner explains. "However, it remains for administrations to propose them if they are to be considered this fall at WRC-07."

Radio amateurs served on some national delegations to CPM-07. Jon Siverling, WB3ERA, and Walt Ireland, WB7CSL — both of the ARRL's Technical Relations Office near Washington, DC — represented the League on the US delegation to CPM-07. Jim Dean, VE3IQ, represented Radio Amateurs of Canada (RAC) on Canada's delegation, while Jay Oka, JA1TRC represented the Japan Amateur Radio League (JARL) on Japan's delegation.

ARRL Education and Technology Program Expands its Reach

The ARRL Education and Technology Program (ETP) continues to expand and evolve. Conceived and put into motion in 2000 as "The Big Project" by then-ARRL President (now President Emeritus) Jim Haynie, W5JBP, the ETP exposes youngsters to Amateur Radio and electronics in a school setting. Funded solely through donor dollars, the program not only offers a comprehensive curriculum on wireless technology, it sponsors free Teachers Institutes (TIs) to get educators up to speed. Some of the latest schools to come aboard received their ham radio stations this spring and have been putting their programs into gear. ETP Coordinator Mark Spencer, WA8SME, says some 250 schools and colleges, public and private, now are participating.

"I am constantly reviewing the program and making adjustments in an attempt to

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

Members of a 2005 Teachers Institute session at ARRL Headquarters puzzle out a radio direction-finding exercise. Educators attending ETP Teachers Institutes are eligible for 3 units of graduate credit through Fresno Pacific University.

DON LONG, WØXDL

make the program more effective," Spencer said. That's especially true in an era of standardized achievement tests to address states' educational accountability requirements. Spencer says the educational standards he's been studying validate what the ETP has been doing over the past few years and have given him ways to show educators how the program's goals address the standards.

"This has resulted mainly in changes to the TI content," Spencer explains. "In future TIs, I will increase emphasis on space and on radio direction-finding — fox hunting." While he's abandoned providing "activity circuit boards" as kits to Teachers Institute attendees, he will be adding a "Soldering 101" module, where educators will build one of the simpler boards under his supervision. Teachers attending TIs now will get completed activity boards instead of kits, plus 3 units of graduate-level credit through Fresno Pacific University.

By inspiring enthusiasm in educators, the TIs have become one route for schools to apply for ETP grants. Several lead teachers among the recent round of ETP participants were TI attendees. Spencer explains that more educators are taking an in-depth look at space-related activities that can be used over years of curriculum. "Consequently an increasing number of ETP grant requests are related to Earth stations to support space communication," he noted.

Students at many ETP-grant schools have been motivated to become radio amateurs, and some ETP programs incorporate licensing classes. Becoming an Amateur Radio operator is not a primary program goal, however. Several teachers also have obtained their Amateur Radio licenses as a result of their involvement in the program.

For a school to be considered an ETP participant, it must have received some level of support from the program — such as Teachers Institute participation, activity board kits or equipment grants. Schools awarded ETP grants may choose from a number of Amateur Radio station packages, each adjusted to accommodate specific needs

Fort Osage School ARC member Mason Murphy checks out the school's new transceiver for the first time.

— particularly antenna needs — if possible. Progress grants include curriculum and printed materials plus ancillary components and pieces of equipment to enhance existing programs. No cash is awarded.

Recent schools' proposals include one to integrate ham radio satellite activity into the curriculum. A college in Mississippi is hoping to rebuild its ham radio program after Hurricane Katrina destroyed its station. A third school wants to emphasis emergency communication-related activities as well as radio direction finding and balloon-borne radio payloads. Others are looking to Amateur Radio and a school station to support extracurricular opportunities. Some progress grant recipients plan to implement "Space in the Classroom" concepts like the one presented during a Teachers Institute.

For more information about the ARRL Education and Technology Program, visit the ARRL ETP Web site, **www.arrl.org/FandES/tbp**, or e-mail Mark Spencer, WA8SME, **mspencer@arrl.org**. To support the ARRL Education and Technology Program, visit the secure donor page, **https://www.arrl.org/forms/development/donations/education/education.html**.

ARRL OFFERS ALTERNATE APPROACH TO "REGULATION BY BANDWIDTH"

In the wake of recent changes in the Part 97 Amateur Radio rules, the ARRL has revised its "regulation by bandwidth" proposals to match the new reality, avoid some unintended consequences and temper some of the controversy the petition has sparked. In a November 2005 *Petition for Rule Making* (RM-11306), the League asked the FCC to establish a regulatory regime that would segment bands by necessary bandwidths ranging from 200 Hz to 100 kHz rather than by emission mode. The ARRL now is urging the FCC to adopt a "subset" of the rules contained in its original petition that largely affects only the amateur bands at 28 MHz and above.

"Because the proposals affecting the bands above 28 MHz had not aroused much controversy, they were retained in the shortened list," explains ARRL CEO David Sumner, K1ZZ. "Regulation by bandwidth rather than by mode of emission remains controversial below 28 MHz because of its perceived potential impact on established operating patterns, so these proposals were removed from the list with one narrow exception."

That exception addresses the fact that existing FCC rules impose *no* effective bandwidth limit on HF digital operation. "Digital emissions using multiple carriers, such as OFDM [orthogonal frequency division multiplexing], can be designed for any bandwidth while staying within the existing rules," Sumner points out, "so, the subset of proposed rule changes includes a bandwidth limit of 3 kHz on RTTY and data emissions below 28 MHz."

The proposed 3 kHz RTTY/data bandwidth limit aims to avoid the possibility existing under the present rules that a single digital station could monopolize large MF and HF band segments. In an *Erratum* filed in March, the ARRL also asked the FCC to retain the existing 500 Hz bandwidth limit that applies to certain automatically controlled RTTY/data stations under §97.221.

The ARRL proposal would amend the definition of "bandwidth" in §97.3(a)(8) to read: "For a given class of emission, the width of the frequency band which is sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions." The rule references the definition of "necessary bandwidth" appearing in Parts 2 and 97 of the FCC rules.

If the FCC adopts the League's revised proposals, the 10, 6 and 2 meter amateur bands would be segmented into subbands allowing maximum emission bandwidths of

FCC News

FCC FINES CONSTRUCTION FIRM FOR ILLEGAL AMATEUR BAND OPERATION

The FCC has affirmed a $10,000 fine it proposed to levy on a Florida construction company for transmitting on ham radio frequencies without a license. In a *Forfeiture Order* (*NoF*) released April 2, the Commission said it was fining Parker Construction Inc of Panama City, Florida, for "willful and repeated violation" of the Communications Act of 1934 for operating radio transmitting equipment on 2 meters without a license. Responding to a complaint of apparently unlicensed radio activity, agents from the FCC's Tampa Office using mobile direction-finding equipment tracked the source of the transmissions.

Agents found an Amateur Radio handheld transceiver set to 145.02 MHz. Parker's owner admitted the company had been using Amateur Radio transceivers for about three years to talk with crew members.

Responding to the FCC's January 2007 *Notice of Apparent Liability* in the case, Parker requested a reduction claiming it did not know that Amateur Radio Service radios required a license, that it had stopped using them and had obtained the proper radio license. The FCC turned down the request, saying corrective action taken to come into compliance with the rules "does not nullify or mitigate any prior forfeitures or violations."

ALL AMATEUR RADIO APPLICANTS MUST USE FRN

All Amateur Radio license and upgrade applicants must use their FCC Registration Number (FRN), if they have one, and not a Social Security number, when completing Form 605. Register via the FCC's *CO*mmission *RE*gistration *S*ystem (CORES) to obtain an FRN, which uniquely identifies an applicant in all transactions with the FCC and avoids the need to provide a Social Security number on the application form.

If a Volunteer Examiner Coordinator (VEC) submits license data to the FCC using a Social Security number when the applicant already has an FRN, the FCC will reject the data because an FRN already exists. Using your FRN will eliminate delays in obtaining your license or upgrade.

Amateur Enforcement

♦ **FCC accepts Technician ticket for cancellation, warns Indiana licensee:** The FCC has accepted for cancellation the Technician ticket of a licensee who has been the target of inquiries and warnings from the Commission's Enforcement Bureau dating back to 2005. Special Counsel in the FCC's Spectrum Enforcement Division Riley Hollingsworth wrote Brandon Duke, KCØUWS, March 6 to confirm receipt of Duke's Amateur Radio license.

"We have forwarded your license to the Wireless Telecommunications Bureau [WTB] for cancellation and for dismissal of your application for a vanity call sign," Hollingsworth informed Duke, who has a Minnesota address on file with the Commission. Duke applied for WØBMD last fall. In January, a "last warning" from Hollingsworth, mailed to Duke at a Colorado address, came back as undeliverable.

Past "Riley-Grams" to Duke have cited "information before the Commission" as well as his own admission to indicate he had been operating on 10 and 20 meter frequencies not available to him as a Technician licensee. Hollingsworth also has taken Duke to task for allegedly ignoring requests to stop using repeaters in his area.

"You have used false call signs, transmitted sexually explicit material and other recordings over radio and re-broadcast radio activity on police frequencies," Hollingsworth charged in a January 2007 letter to Duke. "In spite of your assurances on January 26, 2006, that your rule violations would end, you have continued operating in violation of Commission rules and the Communications Act." In 2006, an apologetic Duke pledged in a letter to Hollingsworth to change his on-the-air behavior.

Licensee Warned

Another frequent Riley-Gram recipient heard from the FCC again on March 8, when Hollingsworth warned David O. Castle, WA9KJI, of Evansville, Indiana, to keep off a local repeater system. In February, Hollingsworth noted, the trustee of the Tri-State Amateur Radio Society's W9OG repeater asked Castle to refrain from using the system. "That letter was issued as a result of your failure to follow operational rules set forth by the licensee/control operators of the repeater system for its users," he wrote.

Hollingsworth told Castle the FCC expects him to abide by the request "and any other such request by a repeater licensee, control operator or trustee." He also raised the specter of fines and license revocation.

Castle's license renewal application has been referred for a *Hearing Designation Order*, and Hollingsworth said the issue of the alleged interference to the Tri-State Amateur Radio Society repeater would be "an issue in your upcoming license renewal hearing" before an administrative law judge. The WTB referred Castle's renewal application to the Enforcement Bureau for review "as a result of long standing complaints against the operation of your station," Hollingsworth has told Castle. Castle's General ticket expired last July, but he may continue to operate while his renewal application is in limbo.

200 Hz, 500 Hz, 3.0 kHz (with an exception for double-sideband, full-carrier AM phone), 16 kHz or 100 kHz. Above 222 MHz, the sole requirement would be that entire emission remain within the allocated Amateur Radio band, to comply with §97.307(d).

Sumner concedes that the subset of proposed rule changes in RM-11306 would provide less protection to CW, RTTY and other narrowband modes than the League's original proposals afforded, but *not* less than current rules provide. "In fact, protection against interference from wideband digital modes would be increased, not decreased, even by adoption of the subset," he contends.

Some confusion arose because of an inadvertent omission in the initial notice of a meeting on this subject earlier this year between ARRL officials and FCC staff. The League's *Erratum* addressed that issue.

Additional consternation followed in the wake of a widely circulated, but erroneous, comment alleging "the complete absence of CW as a mode in the table of HF modes" the ARRL submitted. The League proposed no change to §97.305(a), which authorizes CW on all amateur frequencies except on 60 meters. The League has petitioned the FCC to permit CW and other modes on 60 meters, in addition to the presently permitted upper sideband phone.

After studying the topic several years, the ARRL Board of Directors reiterated its support for the principles of regulation by bandwidth contained in the original RM-11306 petition.

"Regulation by bandwidth provides a better regulatory framework, not only for the introduction of future digital emissions but for the protection of traditional narrowband modes as well," Sumner asserted. He expressed the hope that the subset of RM-11306 modifications offers an alternative that "will make it easier for the FCC to move at least part of the way in that direction."

ARRL: DXing ON 60 METERS HAS DOWNSIDE

The ARRL has expressed concern that negative consequences could result from chasing DX on 60 meters. Some DXpeditions have announced plans to operate on Amateur Radio's only channelized band, where amateur operations hold secondary status to fixed service operations, including some US government stations. ARRL CEO David Sumner, K1ZZ, says that while it's legal for DXpeditions to operate on the 5 MHz band, provided the licensing administration extends privileges there, DX pileups on 60 meters pose the potential for real and unique problems.

"US amateurs are limited to five channels on 60 meters, USB only, maximum effective radiated power (ERP) of 50 W, audio bandwidth not exceeding 2.8 kHz, and not all of the channels are useable because of ongoing fixed service operation," Sumner points out. "It is absolutely imperative that any amateur transmitting on a 60 meter channel be prepared to relinquish the channel immediately upon being requested to do so" by a primary service user.

Among other things, Sumner says, this means constantly monitoring the transmitting channel, thus ruling out any split-frequency operation while using a single-channel receiver.

Given the sometimes substantial distances involved in working a DXpedition, Sumner stresses that amateurs must resist the temptation to exceed the radiated power limit. He further warned amateurs in countries that do not authorize amateur operation on 60 meters to refrain from making contacts there. Radio amateurs transmitting on a 5 MHz frequency without authorization, Sumner asserts, not only are breaking the law but are putting their continued participation in the ARRL DXCC program in jeopardy.

"Anyone who submits a 5 MHz confirmation for DXCC credit may be asked to provide evidence that their operation on that frequency was authorized," he said.

Even countries that authorize operation on 60 meters impose the express condition Amateur Radio stations not cause harmful interference to fixed and mobile service stations.

"Should such interference occur and not be immediately corrected, it will place in jeopardy our existing limited privileges, our chances of increasing those privileges on a domestic basis, and any chance we might have of ever obtaining an international allocation," Sumner emphasized.

Last fall the League petitioned the FCC to authorize radio amateurs of General and higher class to run 100 W ERP and to allow Morse code and data communication. It also wants 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. If the FCC agrees with the ARRL's suggested changes, 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.

SPACE STATION HOSTS FIFTH CIVILIAN, GETS NEW CREW

The fifth civilian to visit the International Space Station accompanied the station's Expedition 15 crew into space in April. Software pioneer and aviator Charles Simonyi, KE7KDP, spoke with students at four schools during his ISS stay — one in his native Hungary plus schools in Ohio, Washington and Virginia. The Amateur Radio on the International Space Station (ARISS) program arranged the events. Simonyi also made some casual ham radio contacts, and he fit in time to perform some needed antenna testing and transceiver re-programming during his time aboard the space station.

A client of Vienna, Virginia-based Space Adventures Ltd, Simonyi, 58, occupied the third seat aboard the *Soyuz* TMA-10 "taxi mission" that carried Expedition 15 Russian cosmonauts Fyodor Yurchikhin, RN3FI, and Oleg Kotov, to the ISS. Simonyi paid an estimated $25 million for the privilege. The one-time Microsoft application developer is a reputed billionaire. Space Adventures also organized the flights for earlier private space explorers Dennis Tito, KG6FZX, Mark Shuttleworth, Greg Olsen, KC2ONX, and Anousheh Ansari.

Simonyi returned to Earth with Expedition 14 crew members Mike Lopez-Alegria, KE5GTK, and Mikhail Tyurin, RZ3FT, aboard the *Soyuz* TMA-9 that had been docked to the ISS. Yurchikhin, 48, is making his second flight to the ISS; he was a member of a 2002 shuttle crew that did construction work on the station. Kotov, 41, is on his first spaceflight.

The two cosmonauts joined US astronaut Suni Williams, KD5PLB, whose duty tour has spanned Expeditions 14 and 15. Yurchikhin and Kotov will spend about six months aboard the ISS, while Williams will return home this month. — *some information from NASA*

ARRL, NATIONAL PUBLIC SAFETY TELECOMMUNICATIONS COUNCIL INK PACT

ARRL and the National Public Safety Telecommunications Council (NPSTC) have signed a *Memorandum of Agreement* (*MoA*). The League is an NPSTC member organization, and the *MoA* culminates efforts begun in 2003 to formalize the relationship between the two organizations.

"This agreement promotes the concept of strength in unity," the *MoA* says. "Speaking with one unified voice provides a clear and strong message from the public safety community." The agreement also aims "to promote a consensus input decision-making process." The NPSTC has been among the organizations that have asked the FCC to thoroughly explore the potential of broadband over power line (BPL) technology to interfere with public safety and other licensed radio systems.

A federation of public safety organizations, NPSTC serves as a forum for the exchange of ideas and information for effective public safety telecommunications in the US and abroad.

Under the ARRL-NPSTC pact the ARRL designated Chief Technology Officer Paul Rinaldo, W4RI, to be its primary representa-

NASA

(L-R) Charles Simonyi, KE7KDP, Oleg Kotov and Fyodor Yurchikhin, RN3FI.

tive to the Council (ARRL Atlantic Division Vice Director Tom Abernethy, W3TOM, is the alternate representative). Rinaldo will participate in NPSTC meetings and serve on committees and working groups. The League also has agreed to provide "other expertise, advice and resources" to further the goals of the *MoA* and in support of the NPSTC Charter and to promote NPSTC as "the collective voice of public safety telecommunications."

NPSTC agrees to provide a National Support Office that will, among other things, coordinate its outreach activities and provide "national level technical assistance to the public safety telecommunications community."

In addition to the ARRL, the Council's 13 member organizations include the American Red Cross, the Association of Public-Safety Communications Officials — International (APCO), the International Association of Chiefs of Police and the National Association of State Telecommunications Directors.

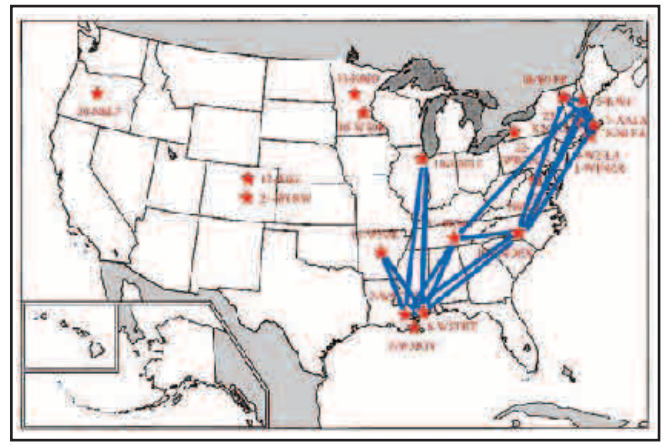
NPSTC celebrates its 10th anniversary this year. The Council will mark "10 Years of Progress" during its Committee & Governing Board Meetings June 11-13 in Denver, Colorado.

ARRL 500 kHz EXPERIMENT LOGS THOUSANDS OF ACTIVITY HOURS

ARRL 500 kHz Experiment Coordinator Fritz Raab, W1FR, reports that a total of 16 participating stations have been active on the air since the experiment got under way last fall. The FCC Office of Engineering and Technology granted the WD2XSH experimental license to the ARRL last September. Raab says the low-frequency investigation has demonstrated ground-wave communication at distances of 100 miles in New England, in the Gulf Coast states and in Colorado.

"This might not sound very dramatic, but it is very important, as no current amateur band has the capability for beyond-line-of-sight communication that does not depend upon the whims of the ionosphere," Raab told ARRL. In his second quarterly *Project Status Report*, Raab noted that during January through March, WD2XSH participants racked up another 2250 hours of operation, bringing the total to 4629. The project also recorded 75 two-way contacts and more than 3100 reception reports via its Web site.

Raab says most of the records for QSO and reception distances set in the experiment's first three months have not been broken. "The longest distance over which a QSO has been maintained is 884 miles — from New Hampshire to Tennessee," he notes. WD4XSH/1Ø (W4DEX operator) completed a crossband (500 kHz/137 kHz) QSO with WD2XNS (W1VD operator) in Connecticut. Stations have been using CW or very slow-speed CW (QRSs).



A map showing the paths of two-way contacts among WD2XSH participants as of April 1.

Even daylight contacts have been completed via ground wave. These include a 127-mile path between Massachusetts and Connecticut and an 87-mile path between Mississippi and Louisiana. Daytime ground wave reception also has been reported over paths of 25 miles and 150 miles.

"These QSOs and reception reports provide preliminary verification of the capability for amateurs to use this band for regional emergency communication that does not depend upon the ionosphere," Raab said.

SM6BHZ in Sweden has been authorized to operate from 505.0 to 505.2 kHz. Two German experimental stations that had been operating in the vicinity of 400 kHz have shifted to 500 kHz too. "We moved our operations up 200 Hz to create a 'DX Window' for them," Raab noted. "The UK is now issuing special permits for 501-504 kHz."

Raab says the WD2XSH participants would like to begin using PSK/FSK/MSK31, possibly as early as this summer. "Since these signals fit within the spectrum of the currently authorized CW signal, we should be able to use these digital modes by simply filing notice under Section 5.77 of the FCC rules," he explained.

Because a few original WD2XSH stations no longer are able to participate, Raab is looking into adding new stations to the experiment. "At present, nearly two dozen amateurs have submitted information forms with the hope of being added to the license," he notes. Criteria for additional participants include expansion of geographic coverage, expansion of ground wave tests, narrowband digital-mode capability and an ongoing ability to contribute to the experiment.

The two-year WD2XSH authorization permits experimentation and research between 505 and 510 kHz using narrowband modes at power levels of up to 20 W effective radiated power.

Important WD2XSH Frequencies

CW beacons: 505.300-506.300 kHz
QRSs operation: 505.250-505.255 kHz
Calling frequency: 507.5 kHz (band center)

In Brief

- **ARRL announces card checking program changes:** The ARRL has announced some changes in the DXCC, WAS and VUCC card checking program rules. Effective immediately, the 10 year rule has been dropped for DXCC card checking. ARRL DXCC card checkers now have been authorized to check cards *for current entities only*, dating back to November 15, 1945. Card checkers still may not verify cards for 160 meter contacts nor cards confirming contacts with deleted entities. In addition, DXCC card checkers now may check applications for Worked All States Award (WAS) and The VHF/UHF Century Club Award (VUCC), if they agree to do so. For more information, contact DXCC Manager Bill Moore, NC1L, **dxcc@arrl.org**.

- **Puerto Rico gets new Section Manager:** Roberto Jimenez, KP4AC, of San Juan, became ARRL Puerto Rico Section Manager on April 1. He succeeds Victor Madera, KP4PQ, who had held the office since January 2000. An Assistant Section Manager since early this year, Jimenez worked with Madera to ensure a smooth transition. His term of office will run through October 2008. QST

PUBLIC SERVICE

The Sunshine Ride

Kenneth Buley, KY4DES (SK)

KEN BULEY, KY4DES

Riders gather near the start of the Sunshine Ride, while the Red Cross ECRV gets ready to be the communication command post.

Saturday, August 6, 2005, was a special day for several members of the Bullitt Amateur Radio Society (Kentucky) and the ECRV 4710 of the Louisville Chapter of the American Red Cross. The Sunshine ride was a benefit bike-a-thon sponsored by Kelly Lenfort, whose twin sister, Lori Lenfort Tilton, succumbed to cancer. The event organizers requested that hams provide communications. The money raised from the bike-a-thon was to go to cancer-fighting charities.

The ECRV (Emergency Communications Response Vehicle) was on loan from the Red Cross Louisville Chapter. It is one of nine such vehicles that the Red Cross deployed throughout the US to provide first response disaster communications support in disaster areas. Each ECRV carries 14 mobile radios (including a Kenwood TS-2000 and an ICOM IC-706) that cover HF amateur frequencies up to the commercial/public service UHF band, two 800 MHz trunking capable scanners and a NOAA weather radio scanner.

The vehicles also have a TVRO dish, a two-way satellite dish, a 50 foot pneumatic tower (with video camera) with a rotator for the Mosley three-element tribander (this is stored on the roof) and an under-the-hood 8 kW generator. We were interested in the tower, generator and VHF radios for our communications assignment.

The Sunshine Ride was held in the area of Huber's Orchard in southern Indiana, with starting and ending points at the nearby Forest Discovery Center. The area is noted for wide-open spaces intermixed with fields of grapes, corn, tomatoes and other vegetables and fruits. Soft, rolling hills (with a couple of steep spots) cover the terrain.

A Great Turnout for the Big Day

At the final volunteers' meeting on the Wednesday before the event, more than 300 entrants had signed up for the Saturday morning event. Imagine their surprise when they had a final count of 639 entries! The weather that day was nearly perfect — around 80° with a soft, gentle breeze and just enough upper level, thin cloud cover to keep the sun from being too harsh.

To say that it was a successful event would be a great understatement. Many riders left glowing comments about the organization of the ride, the paths that had been laid out and the activities for those that stayed at the registration area and came in support of the riders. The event offered courses for 5, 25, 40 and 62 kilometer trails, as well as some courses for walkers and runners.

The Radio Amateur's Role

The radio amateurs were assigned to provide communications between the base at the Forest Center (where the ECRV served as the command post), two stop-and-go stations along the trails and also those that roamed the trails. The roaming operators reported injuries, bicycle mechanical breakdowns, as well as calls for riders who needed a lift back to the starting point.

We also delivered food, ice and water to the break stations and patrolled the routes to ensure that all riders had completed the trails by the end of the day. With an 8 AM registration and start, the ride finished around 4 PM and went fairly smoothly throughout the day. While the roaming hams were very tired after patrolling the bike routes all day, they were very satisfied that they were able to assist with the successful operation of this event.

RACES Goes to the Races

Bill Moffitt, AE6GS, San Jose RACES PIO
ae6gs@arrl.net

For the last two years in San Jose, RACES has gone to the races. The Grand Prix of San Jose has given San Jose RACES the opportunity to help the community and our served agencies by providing communications support for the San Jose police and fire departments. We have since discovered a new service we could provide to our served agencies, and proved the value of that service to the San Jose Police department.

We are used to thinking of RACES or ARES work as involving talking on a handheld radio, passing information between an emergency scene to a command center. It may involve several groups of hams all speaking clearly, spelling out messages using (mostly) correct mnemonics and passing traffic in the most efficient possible manner. The old saying still holds true, however: A picture is worth a thousand words.

ATV is Key Component

Under the direction of Don Apte, KK6MX, our intrepid Amateur Television (ATV) manager, San Jose RACES has been developing an ATV capability for the last two years. We have developed a couple of portable ATV stations using funds obtained through the Urban Area Security Initiative (UASI), a grant program under the Department of Homeland Security. The 2005 San Jose Grand Prix was our first opportunity to really show the value that this ham radio mode can bring to emergency and public service operations.

In the 2005 Grand Prix, a problem developed when the number of pedestrians threatened to overwhelm pedestrian bridges provided for the crowd to move from one part of the track to another. San Jose police were asked to direct traffic to ensure safety, but they had to stay active throughout the event maintaining security and safety for all spectators. San Jose RACES was able to take one of our portable ATV stations and position it with a clear view of the pedestrian bridge. By transmitting the picture back to the

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BILL MOFFITT, AE6GS

One of the San Jose RACES portable ATV monitoring positions with a cable ready portable LCD TV.

BILL MOFFITT, AE6GS

An ATV operating position on a balcony, overlooking one of the footbridges over the race course.

command center, police could easily keep tabs on the congestion on the pedestrian bridge and respond when dangerous congestion occurred on the bridge.

Last year, the police department asked San Jose RACES to come again and provide communications and visual support for the San Jose Grand Prix. We were brought in early to the planning process where we were able to plan our part of the event much more thoroughly. This time there were several pedestrian bridges, and we stationed our ATV equipment in local buildings overlooking the planned positions of three of the bridges. This was a perfect plan. We were in an elevated position with an excellent view of the area, and we had good line-of-sight for our communications links. We were very well positioned to really "strut our stuff."

Lessons Learned

At the last minute, race organizers chose to move one of the watched bridges several hundred feet away. Our vantage point did not provide a good view of that bridge. In order to have a good view of the bridge, we would have had to compromise our radio link. We decided to stick with a longer view of that bridge and a good view of the other two. In the end, this proved more than adequate to assure our served agencies that there were no significant problems.

We also found that maintaining the radio links was sometimes very difficult due to the general RF environment of a large automotive race. All the race teams are using multiple two-way radio channels for voice and data transmissions. The race organizers have their own radio systems, and there are police and commercial radio and television transmissions as well. Interference was almost unavoidable, so good selection of frequencies and good filtering were vital.

Over the last two years, we have shown our served agencies that we can deliver not only reliable voice communications, but also effective and informative television pictures. Our Chief Radio Officer, Bob Steinberg, K6RPS, has been strongly supportive of using alternative modes including ATV and digital. The ability to provide a variety of different modes of communications increases our value to the City and our served agencies, and that makes us an important partner to the City's Office of Emergency Services.

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
March 2007

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.

620 W7ARC
600 W7TVA
488 W2LTB
455 KD8BGQ
434 KI4GEM
425 KB4TND
390 KB9KEG
375 KA2ZNZ
365 WB7WOW
310 AK2Z N2LTC
306 W2MTA
270 KB2ETO
245 KI4GWC W2LC
235 K5SFM
225 WD9FLJ
220 N4VAD
215 K4RLD
213 K2ABX
210 K7EAJ
205 KD5TXD
200 K4DND WA2WMJ
199 WA2BSS
195 W4DNA WB9JSR W5PY WAØKVC
181 W2DWR
178 KA2GJV
175 KØIBS
173 WA4UJC
170 KC2MQU
169 KB2KOJ
167 KA2BCE
164 NØYR
160 KGØGG NØUKO
155 N1UMJ
150 KF4ZLU WB2KNS KE5HYW N7CM
149 WA9APQ
145 K9LGU
140 K7BFL
136 W4CAC
135 W3YVQ
134 KD7THV
130 W4EAT W4FAL W4TTO WØSJS KK3F KA5KLU N2QZ N8IO W8UL KG9B K4GK
128 KI4RBB
125 W1REP KC5OZT W7IG KA8ZGY
122 K7VRE
121 KC2ODN K8AMR
120 K4IWW WØUCE WA2YBM K3CSX KC2LIX KA4FZI KW1U W1GMF K6JT WØLAW K9FHI AG9G
118 KV4AN
115 KK1X WZ9I K5ER
111 NØENO
110 KE4JHJ N3YTD KB2RTZ WB2UVB W2EAG W5ESE K8AE KD1LE N1IQI K1YCQ N7XG N7YSS WV8RG WB8OIF W7GB K5MC KK5GY WØWSP W7QM
N7YSS
108 WB8RCR
109 W4WHI
105 K2UL W4LN KD7ZLF NUØF KO4OL
104 W4ZJY K7BC
102 W3CB K4FQU
101 K2GW
100 K2VX W7GHT W2DSX N3ZOC AA3SB WB4FDT N5OUJ N2VC WA8SSI W8SB AF2K K2AN KC2ANN N3RB NR2F WX4H N9MN NØMEA K4SCL N4MEH
99 W5GKH WA2YL
98 KB8NDS
97 WA5OUV
96 N2GJ
W2CC AD4BL
95 K2TV WG8Z N1LKJ K4BEH
92 W4NTI
91 AL7N
90 NX1Q KA1RMV KA1GWE N3KB KI4CIA KI4JQB W7EKB KM1N KD4FUN KI4YV K3IN WE2G N8DD WD8Q WB8SIQ KC8WSE NY4E KG2D WB2IJH NG1A N1JX KC2PFV W3GQJ W8IM K1JPG K8KV N2VQA KF4WIJ K4ZZA W8IVF KA8WNO WD8DHC W8CPG K8GA WB4BIK KF7GC W9XAN
88 KØBXF
N2JRS W4DLZ
86 AA4BN
85 NN7H AB8SY WB6OTS
84 N2LJD W9JDH
81 KK7TN
80 WA1JVV KG4YNM KE7DVV K7MQF
78 W4CC W5HUD
77 N3AO WØCLS N7EIE
76 KB3KKY
75 KBØDTI K8ZJU N2OMK WDØGUF
73 NØZIZ K8RDN
72 W4TY KK1A AE5V
71 W4DGH W9RSX
70 N5MEL KAØFUI NØMHJ KA4LRM

The following stations qualified for PSHR in previous months, but were not recognized in this column: (Feb) N2LJD 70, (Jan) W8SB 100, WB8SIQ 90.

Section Traffic Manager Reports
March 2007

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CO, EMA, ENY, EPA, EWA, GA, ID, IL, KS, LA, MDC, MI, MN, MO, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, OH, OK, OR, SC, SD, SFL, SJV, SNJ, STX, TN, VA, WI, WCF, WNY, WV, WWA, WY.

Section Emergency Coordinator Reports
March 2007

The following ARRL Section Emergency Coordinators reported: AK, AR, AZ, EWA, IL, IN, KS, KY, LA, MDC, ME, MI, MO, NC, NNJ, NTX, NV, OH, OK, RI, SD, SFL, SJV, SNJ, STX, VA, WTX, WV, WWA.

Brass Pounders League
March 2007

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*
WB5ZED	25	1415	1489	41	2970
W4ZJY	0	1438	1399	0	2837
N1IQI	0	431	2183	1	2615
W1GMF	0	300	1756	0	2056
K7BDU	22	837	880	19	1758
KA9EKG	43	681	642	7	1373
KA5KLU	0	593	559	1	1153
KW1U	0	517	632	2	1151
WB5NKD	24	487	555	0	1066
W7QM	195	344	423	25	987
WB5NKC	58	195	680	12	945
N8IXF	0	443	377	7	827
WZ9I	18	369	18	369	774
KK3F	12	362	352	10	736
W8UL	0	352	361	4	717
W7ARC	0	349	349	3	701
WX4H	2	331	350	8	691
N1UMJ	29	276	294	8	617
KB9KEG	37	262	37	262	598
WB9JSR	2	293	281	19	595
KK5GY	0	270	51	258	579
N2LTC	0	247	236	58	541
W7SMC	35	225	260	0	520

The following station qualified for BPL with originations plus deliveries: W7TVA 125. The following station qualified for BPL in a previous month, but was not listed in this column: (Feb) KA9EKG 1380, (Jan) N8IXF 891.


W3ZZ

THE WORLD ABOVE 50 MHz

From The Mailbag

Feed Lines for All

Bob Biss, W8ZA, writes: "I have a new HF/VHF radio. I have all the HF antennas I need but I need a good place to start building a VHF system. What kinds of coax do I need? And when do I go from RG-8 to hardline, etc?"

This sounds like a relatively simple question but it does not have a necessarily simple answer. Unlike HF, every dB counts to one extent or another on VHF. That becomes even more evident the higher you go in frequency. In what I have to say, I will assume we are talking about the bottom four VHF+ bands, 50 to 432 MHz. At the microwave frequencies, preventing feed line losses becomes an even more magnified problem and we won't consider some exotic consequences, like what happens when the wavelength becomes a significant fraction of the coax diameter. (That topic was discussed by Kent Britain, WA5VJB, in the Winter 2007 issue of *CQVHF*, page 80.)

As a general rule of thumb, you want to limit your total feed line loss to some acceptable value. I have always believed that a good target is 1 dB or less. For the average station, your feed lines won't exceed about 100 feet. So you are looking to analyze your entire transmission line such that it, and its component parts, will yield losses that do not exceed 1 dB. If you have longer transmission lines like mine, at about 170 feet, you may want to reduce your losses per unit length even more, so that the total will not be debilitating.

A Few Coaxial Basics

Coax is constructed of concentric conductors separated by a non-conducting dielectric. The center conductor is either solid or consists of several smaller wires twisted into a cable. The outer conductor surrounds the outside of the dielectric and ranges in complexity from a simple braid often with about 95% coverage, to a solid metal shield made of copper or aluminum, to a tinned copper braid covering a thin aluminum foil. The latter two provide 100% coverage. The outer conductor is covered by a jacket which is made of polyvinyl chloride or even Teflon. The characteristic impedance of the coax depends on the diameter of the center conductor (d), the inner diameter of the cable shield (D) and the dielectric constant (ε) of the material between the inner and outer conductors. The dielectric constant of air is 1; the dielectric constant of other materials is less than 1. In case you are interested, the characteristic impedance Z_0 of coaxial cable is given by:

$$Z_0 = (138 / \varepsilon^{1/2}) \times \log (D / d)$$

Most low-loss coax achieves its improved loss characteristics by using some kind of low-loss dielectric like high density foam, micro-cell foam, and similar materials. Earlier versions of low-loss Belden 9913 cables used spiral polyethylene tubing to suspend the center conductor midway between the inner walls of the outer conductor; thus the dielectric was partially low-loss air. While this sounds like a great idea it has two serious drawbacks: condensation of water vapor in the air inside the coax and some problems maintaining exact position of the center conductor. Both lead to variations in the characteristic impedance.

Jackets contain plasticizers, which keep the coax supple at temperature extremes. Some jackets contain chemicals that make the jacket much more impervious to ultraviolet (UV) degradation. In cables that are not UV-resistant, and are exposed to sunlight, the plasticizer migrates out of the jacket and into the dielectric at a relatively rapid rate. The resulting contamination seriously increases the amount of attenuation and turns what was once a good piece of coax into the equivalent of a dummy load. Jackets come in three varieties: Type I, which normally is not UV-resistant; Type II, which can be UV resistant if so noted; and Type III, which is UV resistant. As you progress from Type I to Type III coax, the jacket becomes more and more hydrophobic; in other words, it is resistant to water intrusion.

Finally, when I talk about coax in this column I am talking about 50 Ω coax. Coax of other impedances is used in VHF+ operation. Phasing lines sometimes use 75 Ω coax. A very handy and inexpensive way to move VHF signals over considerable distances is

Table 1
Characteristics of Feed Lines Commonly Encountered in VHF Use
Look Particularly at the Attenuation and Power Handling Capacity

Feed Line	*Attenuation (dB/100 ft) (At 450 MHz)*	*Power Handling Capacity (W) (At 450 MHz)*	*Velocity Factor (%)*	*Outer Diameter (Inches)*
Normal-loss				
RG-174	17.5	60	0.66	0.100
RG-58A/U	12.0	135	0.66	0.195
RG-8X	7.9	250	0.78	0.242
RG-213	4.1	450	0.66	0.405
Low-loss				
LMR-240UF	6.3	310	0.85	0.200
9913(F7)	2.6	450	0.84	0.405
LMR400UF	2.5	830	0.85	0.405
LMR600UF	1.7	1350	0.87	0.590
LDF-4-50A	1.4	906	0.88	0.630
LDF-5-50A	0.78	2550	0.88	1.090

This Month

June 9-11	ARRL June QSO Party
June 10	Good EME Conditions*
June 16-17	SMIRK QSO Party
June 23-24	ARRL Field Day

*Moon data from W5LUU

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 ♦ w3zz@arrl.org; (301-948-2594)

with ¾ inch 75 Ω CATV cable. There are ways to match 75 Ω CATV cable to 50 Ω, but even unmatched it represents only a 1.5:1 SWR. In this column I will deal only with 50 Ω coax, the nominal impedance of essentially all VHF radios and antennas.

Flexible Coaxial Lines

These come in two versions, normal and low-loss, and in various sizes (diameters). Look at Table 1. Attenuation data and power handling capability were derived from a variety of sources including manufacturers' data where available, and from data at sites such as **www.therfc.com**. Each type of coax is the right kind for specific uses. Looking at the normal loss cables, RG-174, which some of us old timers remember as minax, is an extremely small cable that is used where a constant impedance connection is required and space is a serious consideration, like wiring between boards and connectors inside really small radios like some of the modern transceivers. At VHF, losses are prohibitive (6.6 dB / 100 feet even at 6 meters) so don't use this unless nothing else will fit. The RG-58 sized cables are convenient, quite flexible and suitable for very short connections (with a loss of 3.1 dB / 100 feet) but not for longer connections. RG-8X is an intermediate sized coax that is very useful for wiring your HF station. It has less loss than RG-58 but we will discuss some better alternatives for your VHF station. Everyone knows about RG-8 sized cables like RG-213, and many use some in their HF station, where the losses are quite acceptable up to 30 MHz. For 6 meters, the losses are still not so bad but by 2 meters they are at 2 dB / 100 feet, which is more than ⅓ of your power. At 432 MHz the loss is over 4 dB / 100 feet — not good!

What about low-loss cables? I want to concentrate first on the small and medium sized cables that are good choices for VHF+ use. Times Microwave Systems makes series of low loss cables that recapitulate most of the sizes of normal-loss coax (see Table 2). LMR240UF (UF means ultra flexible) is a useful alternative to the RG-58 and RG-8X sized coaxial cables. It is flexible and has significantly less loss, particularly than RG-58 type cables. The workhorse of any VHF station is the 9913-type cable, which has some 30% less loss than equivalent RG-213 cables. But beware! Not all 9913-like cables are the same. Ordinary 9913-type cable has a Type I jacket and a spiral poly dielectric. It is prone to condensation, taking on water from the outside and UV degradation. It is also not very flexible so it makes a particularly poor choice for a drip loop around your rotator. Flexible 9913-like cables with foam dielectrics are the way to go. The two best choices are Belden 9913F7 and LMR400UF. Remember to get the LMR cable with the UF suffix if you want flexibility.

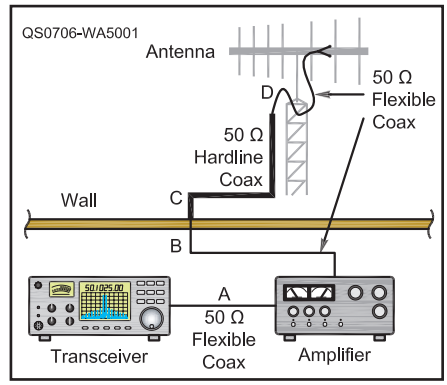


Figure 1 — Use of coax in a typical VHF+ station. A is the connection between the transceiver and amplifier. B is the connection between the amplifier and the main feed line. C is the main feed line. D shows a drip loop at the antenna. See text for coax types.

Table 2
Times Microwave Systems Equivalence Table
Coaxial Types Similar to Times Low-Loss Cables

Times	*Other*
LMR-195	RG-58/U
LMR-240UF	RG-8X
LMR-400UF	Belden 9913
LMR600	LDF-4-50A
LMR900DB	LDF-5-50A

The king of low loss cables is hardline, so-called because it is difficult though not impossible to bend and has a substantial, solid center conductor and outer conductor. Hardline is used mostly to carry a signal up to the top of your tower, after which a drip loop of flexible low-loss coax is attached to the antenna as a rotator loop around your mast. Why is this called a drip loop? Because it is a loop of coax that allows the rain to run down the loop and fall off the feed line. New hardline is expensive although many types of surplus hardline are readily available. Since hardline normally has a solid outer conductor, used cable is usually still good, something that is often not true with the smaller cables. The most recognizable hardlines are those made by Andrew — LDF4-50A and LDF5-50A, known respectively as ½ inch and ⅞ inch Heliax for their commercial appellations. There are, however, lots of surplus hardlines that are usable, and many are only marginally lossier than Heliax. They carry various designations like RG-333 and RG-339 and are made by a variety of manufacturers like Phelps-Dodge, Cablewave and Times Wire & Cable. Most of these use aluminum jackets and copper clad aluminum center conductors. For that matter Times makes large-diameter, low-loss cables as well but these are relatively recent arrivals on the scene and are essentially never seen on the surplus market (read — you will pay full price).

Choosing the Right Coax for Your Station

The average VHF+ station uses four pieces of coax between the transceiver and the antenna (see Figure 1). For the purposes of this exercise I will disregard the fact that most stations have a wattmeter inserted close to the amplifier before the flexible piece of coax that goes out of the shack. I will also assume that the amplifier is a brick type that contains a preamp. The elegant way to wire this station is to use LMR240UF for jumper A, either Belden 9913F7 or LMR400UF for flexible jumper B through the wall of the shack, LDF4-50A or LDF5-50A hardline, C, for the run up to the top of the tower and either 9913F7 or LMR400UF for the drip loop, D, to the antenna. The coax jumper at A can be almost any coax — even RG-58 if it is only a few feet long. I find no reason not to use 400UF or 9913F7 for jumper B and the drip loop D. If we are dealing with 432 MHz and have a 25 foot drip loop we could save about 0.4 dB by using LMR600UF which has close to half the loss. Finally, someone is going to ask about the seven coax connectors in this generalized scheme (eight connectors if the antenna uses a coax connector instead of pigtails). At 432 MHz and lower frequencies, the loss from proper and properly made coax connectors is negligible. Yes it can be measured, but likely even on EME no one will notice the difference. Of course you should not use UHF connectors at 222 MHz and higher frequencies though they are fine at 6 and 2 meters.

There are, of course, qualifications to this general approach. On 6 meters you can get away with a single low loss 9913-like piece of coax, especially if it is less than 100 feet long (loss will be less than 1 dB), but make sure it is the flexible type. At some point you will want to go from ½ inch to ⅞ inch hardline for segment C. Unless you have a very long run, you will probably want to use ⅞ inch hardline only on 432 MHz. If you own a single piece of very high quality large hardline like 1⅝ inch Heliax, you may wish to use it as a single feed line and put high quality motorized coaxial switches like those made by Transco, TRW and others

at both ends of the Heliax. You will have to homebrew the switch controller. The downside is that if anything fails you are completely off the air. In the final analysis, you will look to find what you need and use what you have. So it pays to be constantly on the lookout for inexpensive sources of hardline. As the pundit once said, "You can never be rich enough, young enough or have enough hardline."

A US Most Wanted Grid Squares List

Sean Kutzko, KX9X, is interested in compiling a list of grid squares that need to be activated. His original idea was to solicit grid totals from those who have a lot of grids on a given band and see which ones they still needed. This turned out not to be practical, so he wrote and asked if the ARRL might release the contents of the logs of the top scorers from the last few years of the three major ARRL VHF contests, so that inactive grids could be determined.

Such a database does exist for Europe. The most wanted grid-square survey is updated annually. That list is found at **www.dl8ebw.de/MWS-PROJECT/mws-project.html**. Previously conducted by Guido, DL8EBW, it is now run by DL8HCZ/CT1HCZ and *DUBUS* magazine (**www.marsport.org.uk/dubus/index.htm**). In 1998, Joe, NA3T, considered the possibility of using ARRL VHF contest logs to generate AZ-PROJ maps of the most wanted grids in the United States. He learned that as a matter of policy, the ARRL does not release contest logs for two reasons: privacy issues — some competitors consider their logs proprietary information; and the lack of ARRL resources to provide the information. I understand that *CQ* has similar concerns about privacy issues and will not release their contest logs.

Clearly, a list of the rarest grids would be very useful for grid expeditions both in and outside of contests. Even better would be a list generated at yearly intervals with updated information like the one for Europe. One major requirement would be that the project be highly automated. Privacy issues, however, prevent the use of the most obvious electronic data: contest logs. Furthermore, the most direct information, data from a select group of stations with high VUCC totals on a particular band, is likewise not accessible for the same reasons. So what to do? From time to time participants on the VHF Reflectors have discussed finding a site where contest logs can be uploaded such that everyone can see them. While some stations would not participate, most high scoring contest stations would be willing to provide their logs. For many years I used to compare my HF contest logs with my closest competitors, and it was a lot of fun. For the VHF logs, the contest Cabrillo files would serve the dual purpose of providing a grid square database that could be used to determine which grids are common and which grids are rare.

FRED HONNOLD, W6YM

Figure 2 — Paul, KH6HME (left) and George, KI6CG (right) at the famous KH6HME beacon site on Mauna Loa. KH6HME/B has been a harbinger of many, many transpacific tropo ducts.

So how much interest is there in a contest-log repository that could be the basis for a most-needed North American grid squares list? Would the biggest scoring stations actually post their logs, and would anyone be interested in seeing them? If so I would endeavor to find the Web space with the understanding that this project would be completely separate and have no connection with the ARRL, and the contribution of logs would be strictly voluntary.

ON THE BANDS

The propagation gods must be saving it all up for later in the year because it has been even slower in March than in February. Thus, we continue to see those who won't wait using that reflector in the sky — the moon — to forge ahead.

6 Meters

Julio, NP3CW, laments the poor propagation in KP4 during the past few months. A small E_s opening on the 4th showed John, W5UWB (EL17) working into GA/FL. Jon, NØJK (EM18) worked into FL and notes that XE3ARV (EK59) in the Yucatan, was working stations in TN, FL, NC, SC and OK. Dan, K3ZXL (EL87) worked into KP4 on the 7th. Transequatorial propagation (TEP) peaks around the equinox, and this year was no different even though we are at or very near sunspot minimum. TEP was noted by XE3ARV to OA on the 4th; LU and OA on the 9th; and OA on the 10th. The propagation reflector at **dxworld.com** notes contacts between LU and KP4 on the 9th and Guadeloupe and OA/LU on the 11th. Julio, NP3CW, worked several LU stations on the 27th.

Tropospheric Ducting

Given the relatively unstable weather in March, nothing particularly interesting showed up in March. Jon, NØJK (EM18) found enhanced local tropo to EM26 and EM09 on the 13th and EM26 and EM09 on the 28th. Jon also reports enhanced conditions from the APRS maps at **mountainlake.k12.mn.us/ham/aprs/path.cgi?map=na** over TX/OK/LA/AR and along the southeast coast. Sure enough, the **dxworld.com** reflector notes contacts between EL94 and EM85 and EL87 and FM06/FM03. In addition good conditions were reported on the 25th between DM09 and DM41 in the southwest and EN37 to EM48/EN43/EN53 on the 26th.

EME

Lance, W7GJ, reports the first North American-Nepal QSO on 6 meters with a March 23 contact with 9N7JO at 1712 Z using JT65A on his moonset and Lance's moonrise. This should be the first EME contact ever from Nepal and represents DXCC no. 112 and field no. 72 for Lance. Lance explains that the mountains on the 9N7JO moonset subtend only a few vertical degrees of the horizon. The ones on his moonrise are much higher to the northeast. Lance would like to try him on his moonrise, too; that looks to be okay as long as his moon is at greater than 90° azimuth. Meanwhile the large, partially elevatable array of small Yagis at K6QXY continues to rack up new countries in Europe for Bob; on March 19 EI6IZ for DXCC no. 140 and initial no. 55. Bill, WAØKBZ, reports SM2ILF on 2 meters for a new DXCC country on JT65.

HERE AND THERE

June ARRL VHF QSO Party

Last year's June VHF contest was on of the best ever with E-skip band openings for most of the contest on 6 meters and even some 2 meter E-skip. Will conditions repeat? Will the band be open to Europe, to the Caribbean and/or to Japan and the Pacific? Join in the fun and find out. The contest runs from 1800Z June 9 to 0300Z June 11. Details are in May 2007 *QST* or at **www.arrl.org/contests/rules/2007/june-vhf.html**.

2007 SMIRK Contest

The 2007 Six-Meter International Radio Klub (SMIRK) QSO Party runs from 0000 Z June 16 to 2400 Z June 17. Exchange grid square and SMIRK number (if you have one). All 6 meter stations are welcome, SMIRK members or not. Entry class is single operator only; all contacts must be SSB or CW; no digital modes allowed. More information can be found at **www.smirk.org**. The SMIRK Web site notes that the top five world-wide winners in 2006 were UT1IC/p, K4NAM, S51CK, W3MEL and N4BAA. Congratulations to all!

DXpedition to Haiti

Chris, W3CMP, returns to Haiti June 17-28 as HH4/W3CMP. Since HH7PV passed away there is no regular 6 meter operator on the island, so Chris thought he'd keep it active one more summer. Equipment should be about the same as last year although K1WHS may make him a larger 6 meter beam (11 dBd gain versus 9.1 dBd). He will concentrate on 6 and 2 meters and will probably be on HF in the evenings.

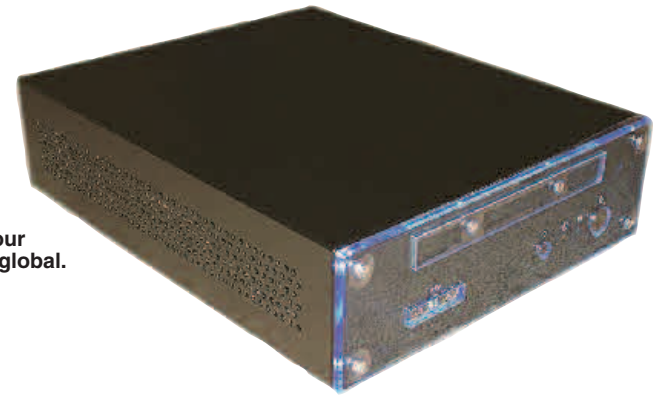
Results of the 2005 Fall Sprints

Jim, W4KXY, reports that 124 fixed station and 14 rover logs were submitted. The fixed station winners were W4AAH (50 MHz), KA1ZE (144 MHz), WZ1V (222 MHz), K4QI (432 MHz) and N2CEI (Microwaves); W4SHG/R (144, 222, 432 MHz), K9JK/R (50 MHz) and WB8BZK and K9JK/R (Microwaves) were the Rover winners. First rate efforts by all! QST

WB8IMY

ECLECTIC TECHNOLOGY

Outpost

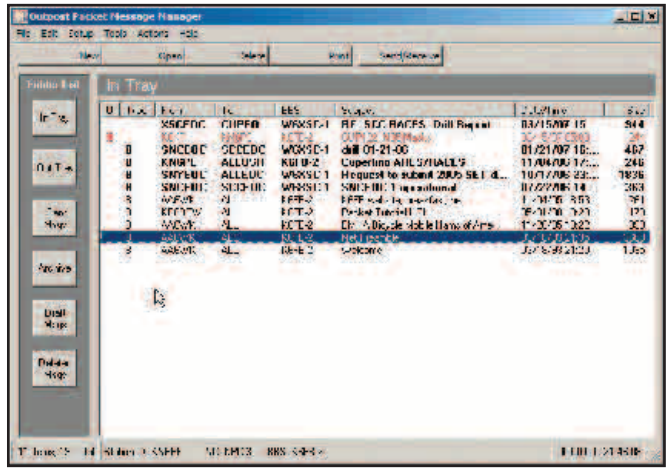


This unassuming box is an IRLP Embedded Computer. With one of these at your repeater site, you can expand your coverage from local to global.

I depend on *QST* readers to keep me informed of interesting developments in ham technology. Take Jerry Reimer, KK5CA, for example. He pointed me toward a nifty piece of *Windows* packet radio software created by Jim Oberhofer, KN6PE. The application is known as the *Outpost Packet Message Manager* and it was developed originally for the Cupertino (California) ARES with emergency communication in mind.

Outpost isn't just a standard packet radio terminal program, although it provides that functionality if you need it. Instead, it effectively creates a user interface similar to Microsoft *Outlook* through which the operator can easily send and receive packet messages, files, etc. This is strictly RF communication using traditional packet radio hardware in an *ad-hoc* network that may or may not have a digipeater or packet bulletin board at its hub.

What makes *Outpost* special is that it allows any ham with basic Internet e-mail experience to sit down in front of a keyboard, along with a transceiver and packet Terminal Node Controller (TNC), and immediately begin communicating. The operator doesn't need to know cryptic TNC commands or anything else related to the inner workings of packet radio. The person who sets up the *Outpost* station (at an emergency operations center, for instance) has presumably plugged in the call signs of the *ad-hoc* network stations and set up the radio on the proper frequency. The assigned operator merely sits down and types.



The *Outpost* main window. *Outpost* simulates the look and feel of Internet e-mail over a packet radio network.

Outpost includes some extra features specifically designed for emergency communication messaging including tactical call signs, automatic message numbering, selective receipt requests and more. It's free for downloading at **www.outpostpm.org/**.

Fldigi News

Dave Freese, W1HKJ, has created a "Live CD distro" of Puppy *Linux* with the latest version of his excellent *Fldigi* multimode HF digital software. If you read my May column, you saw my step-by-step description of how to put *Linux* on a USB flash drive. With the flash drive you can run *Linux* (and *Fldigi*) on any PC that will boot from a USB device. In that example I used a 2 GByte flash drive with Mandriva *Linux*, but with Dave's Puppy *Linux* version you can use dirt-cheap 128 MByte drives. They're practically giving these things away. Dave mentions seeing 128 MByte flash drives selling for $9 at a Big Lots store. You can grab the free Puppy *Linux* image files at **www.w1hkj.com/flpuppy.html**.

IRLP—Packaged and Ready to Go

If you've never heard of IRLP, the Internet Radio Linking Project, here is a two-sentence primer. IRLP is a means of connecting FM repeaters, or FM simplex nodes, using Internet "wormholes" to pass the audio back and forth. This allows VHF/UHF FM users to dramatically extend their coverage; a local FM repeater, for instance, can suddenly have international reach.

You may be saying to yourself, "This sounds just like EchoLink." The difference, however, is that the IRLP network only accepts users who access it via an RF link. You can't normally access the IRLP system with an Internet connection and a microphone. This makes IRLP much more secure.

IRLP has become quite popular, but one sticking point for some hams is that the repeater or node operator has to set up a *Linux* computer with all the necessary software and hardware required to function as the IRLP interface. This is a serious hassle if you're not *Linux* savvy.

That impediment has vanished with the introduction of the IRLP Embedded Computer. For $700 you can purchase an IRLP "box" complete with an IRLP v3.0 board, 667 MHz motherboard, 256 Mbytes of RAM and all software (including *Linux*) preinstalled. Everything fits into a case that's only about 8 × 2 × 10 inches. It even runs on 12 V dc. The Embedded Computer connects to the outside world through an RS-232 serial port. Check it out at **www.irlp.net/embedded.html**. QST

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

W3UR

HOW'S DX?

DX Cluster Etiquette

[Editor's Note: The viewpoints expressed here are the opinion of the author and not necessarily those of the ARRL.]

Paul Kidd, A35RK

Networks like *DX Summit* (**oh2aq.kolumbus.com/dxs/**) give instant access to real-time DX information from everywhere on the planet. Internet DX spots enable many of us to work a new one that we might otherwise have missed. They give us a "heads-up" to listen for something that might be heard later, when propagation conditions change in our favor. That's the good news.

The bad news comes in two forms: First of all, the system is abused by "flamers," as well as those with chat-room mentalities; a whole lot of folks are simply ignorant about how the system works and what it's for. Secondly, the DX spotting networks (and some of the whizz-bang software that goes along with it) tend to encourage lazy, parasitic DXers and the added interference that they can generate.

Fixing the Problem

There are some fairly simple solutions to the problem of abuse, but it's going to take a little effort and a little common sense. For those abusers who simply don't understand what's going on, the answer is education.

Each network could certainly make available to new users an online handbook that states the purpose and proper use of the network. This could outline the "how to's" and the "do not's," with reference to additional sources of information. The conscientious newcomer will read it, but the flamers and blabbermouths won't. For them, there's another solution.

The *DX Summit* submission page contains the following warning: "NO ABUSE, TNX! Watch your language. Everything is monitored and logged with your TCP/IP identity."

Each and every posting is tagged with the TCP/IP Internet address of the message originator; this is completely distinct from whatever call sign or "handle" is used when making a submission. You can see this for yourself if you just click on the link that says, "You will find some data from here."

Now, if only the DX Summit moderators could enforce their own rules and take some appropriate action, such as blocking the IP address of the abusers. I believe if this happens, the garbage spots would simply disappear. Put those IP addresses on a "blacklist" filter and they're gone forever.

I know they can do that, but the question remains: Will they do it? They probably would, if enough of us complain about it. But it will take some persuasion and an even-handed approach. Fairness and free speech might become issues, but I doubt if anyone would object to the loss of "Bozo" and his ilk.

As for the "Chatty Cathy" postings, they are usually not malicious — just stupid. Folks should realize that just because a DX station is posted, it doesn't necessarily mean that station is connected to the network. Therefore, all of those "Please 160M at our sunrise" type spots are a complete waste of time and bandwidth, as are the "Are you listening?" and "Did you get my QSL?" spots. If you already have a computer and Internet access, then send that kind of message via instant messenger or e-mail.

"Lounging" Around

Now regarding the conjunction of spotting networks, "smart" software and the "lounge lizard" DXer. From my perspective, a resident in a not-too-rare DX country who enjoys ragchewing with friends and the occasional "run," it is easy to tell when I have been spotted on the DX networks. Within

COURTESY YT1AD

Members of the N8S Swains Island DXpedition team made an amazing 117,205 QSOs during their April 2007 operation. This is the fourth highest number of QSOs for a DXpedition and the first highest number of QSOs from a tent and generator DXpedition. Team members included (not in order) YT1AD, K3LP, K1LZ, N6TQS, K6SRZ, RK3AD, RA3AUU, SV2BFN, UR0MC, YZ7AA, YZ1BX, UA4HOX, YU7NU, RU4SU, YU1AU, JT1CO and Z32ZM.

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two minutes of a posting, the heretofore quiet frequency suddenly becomes a dog pile of callers. It is obvious that some of those callers really haven't heard me yet, since they are calling off-frequency and have my call sign wrong. Sometimes they can't even hear me, but they're calling anyway!

These DXers are connected to the network, but they probably are not even listening to their radio; they may even be in another room. They have the flashy software that monitors the cluster, picks up on a "needed" DX prefix, sounds an alarm, tunes the rig to the spot frequency, rotates the beam to the short path heading, fires up the amplifier, turns on the desk lamp and the coffee maker, all that. And the lounge lizard wasn't even listening to what's actually going on.

The lounge lizard trusts the robot completely and starts calling without listening carefully. I don't know how many times I have worked one of those types after he finally put his headset on and got on the right frequency; only then does he discover that I'm not A45RK, P5RK or AP5RK, after all. Oops, it was a bad spot on the DX cluster (busted call sign, wrong frequency). The robot gave him a bum steer. Well, at least it got him up off the couch.

"The Deserving"

I don't think that Martti Laine, OH2BH, had this sort of DXer in mind when he talked about "The Deserving." I think Martti was referring to someone who actually sits in front of his radio and *listens*. Someone who tunes slowly and carefully, listening, digging the weak one out of the noise, never passing by a single signal until it is clearly identified; listening, searching, always on the alert for the elusive "new one."

There is still a lot of "The Deserving" out there, and now they have computers. *They* listen, *they* work the DX first and then they post a spot on the DX cluster. That's when all the alarms go off, the radios change frequency, the beams start spinning — all on autopilot — and the so-called DXer merely strolls in from the TV room to work a new one. The lounge lizard gets a free ride all because a "real" DXer did all the work for him.

Furthermore, it was that single DX network spot that woke up the lounge lizard — him and maybe hundreds more like him— that increases the pileup interference by orders of magnitude. The little pistols out there just got stomped by the lizard stampede.

DX Cluster Etiquette

Times have definitely changed since the days of the "telephone tree," local DX club repeaters and local VHF packet clusters. It's different now, that's for sure. With a global network and thousands of spots from people you don't even know, there are a few rules of conduct that might help us all adjust to the New World DX Order, and here they are:

- If you work a DX station, and he asks to be spotted or if you hear him calling CQ without getting any response, and you don't need him — then by all means, spot him on the network. He'll thank you for that; however, when you submit a DX spot, make sure that you have the correct call, correct frequency, correct QSL info and such.
- Don't post an existing pileup. There are already too many folks there, calling their feeble 100 W hearts out, struggling to get the guy in their log. The Deserving are probably already there, and the interference is probably already fierce. Don't make it worse by waking the sleeping lounge lizard, with his 3 kW amp and no ears. Leave him on the couch snoozing, and save us all the grief of additional interference.
- Don't flame "lids" on the net — restrain yourself. Let the others do it for you. If the guy is really a problem, you're not going to solve anything by posting adverse comments. We already know who the real lids are, as we hear them all the time.
- Don't use the DX net for an intercom. Telephone your friend, send him an instant message or e-mail him. Keep personal messages off the net.
- Don't send messages on the network to a DX station "in the blind," as he's probably not even connected. Save your requests for skeds and QSYs for e-mail. And save the TNX QSO and TNX NEW ONE for your QSL card.
- Don't post spots telling the rest of us that you can't hear the DX! Nobody cares what sort of antenna you have that you can't hear him with, how much power you're running, how many bands you've worked him on or how many DXCC countries you've worked. Don't clutter up the net with that rubbish.
- If you want to brag or complain, don't do it on the DX cluster. Go to the next local DX club meeting where you are sure to find someone who cares.

DX NEWS FROM AROUND THE GLOBE

End of Cycle 23?

As of press time, we still have not entered into Cycle 24. In early April 2007, the US Department of Commerce, NOAA and Space Environment Center released the new updated predicted minimum. The good news is they are now saying July 2007 will have a predicted solar flux average of 75.0. The complete chart, usually updated the first week of the month, can be seen at **www.sec.noaa.gov/ftpdir/weekly/Predict.txt**. The prediction values are based on ISES Cycle 23 forecast of 13 month running smoothed values. We are getting close to the bottom of the cycle. Start working on those improved antennas for 10 and 6 meters.

Ham Com

This year's Ham Com is scheduled for June 8-9. The Lone Star DX Association's DX Banquet will be held on Friday, June 8. The banquet speaker is Glenn Johnson, WØGJ; he will speak about the recent VU7RG DXpedition. Tickets are $36 and can be purchased online at the Ham Com Web site at **www.hamcom.org/cgi-bin/ccp51/cp-app.cgi?usr=&pg=store**.

Pacific Northwest DX Convention

Mark your calendar for the Pacific Northwest DX Convention on August 10-12 at the Holiday Inn in Everett, Washington. Details can be found at **www.wwdxc.org/convention**.

A2 — Botswana

Charles "Frosty" Frost, K5LBU, is organizing a DXpedition to Botswana, scheduled to take place from July 5-21. So far there are four ops. Frosty is hoping to have two more join the team. Watch your favorite DX bulletin for more details.

HBØ — Liechtenstein

From May 26-30, group will be on the air on 10-160 meters from Liechtenstein. Watch for David Schon, HBØ/DL1GDS; Michael Deutschbein, HBØ/DO1ARS, and Eddy Ennis (KF4SFW), HBØ/DK4SFW. QSL via their home calls either via the bureau or direct.

HH — HAITI

Chris Patterson, W3CMP, is heading back to Haiti this coming June. He'll be on as HH4/W3CMP from the North West Haiti Christian Mission from June 17-28, running on 2 and 6 meters, as well as with some HF.

HI — Dominican Republic

Rumor has it there will be a 6 meter DXpedition to Isla Cabras (FK39) in June. The call HIØC will be used with a 7-element 6M7JHV and Drake 2×3-500Z amplifier. Look for activity around June 9-17.

J8 — St Vincent

Jimmy Treybig, W6JKV, plans to put on his next 6 meter DXpedition from Bequia Island, St Vincent. He's looking at June 28-July 11. Watch for him on CW and SSB. QSL via W6JKV.

OJØ — Market Reef

Eric Wennström, SM1TDE, reports there are plans for a Market Reef (EU-053) DXpedition during the first seven days of July. This will be a 2-160 meter operation on CW, SSB and the digital modes by three or four ops using OJØ/homecall.

TF — Iceland

Karrlander Kent, TF7/SM5ELV, will be on Heimaey Island, Iceland, EU-071, June 10-13. He will get on as many bands and modes as he can. He plans on using 100 W and a vertical antenna, with a dipole possible as a second antenna. QSL to his home call.

Wrap Up

Well, that's all for this month. A special thanks to Paul Kidd, A35RK. Don't forget to send me any DX news via **w3ur@arrl.org**. Until next month — see you in the pileups! QST

K2TQN

OLD RADIO

Why SOS?

I have some old ledgers dating back as far as 1825 that belonged to my great-grandfather who had a general store and sold to local farmers and sea captains; my great-grandfather carefully marked down everything sold. He also owned shares of several coastal schooners. Each time the schooner returned to port, he would collect his share of profits from the previous trip. Other captains who owed him money would also pay off their accounts as they returned to port, and the ledger accounts would show a zero balance again.

There are a few entries that were marked, "Lost at Sea — with all hands." The account would then be zeroed out. He would mark an entry "Lost $324.38," or whatever the amount was at the bottom of the page.

Before radio communications, a ship could be in danger of sinking and help might only be a few miles away, just out of sight of signal rockets or some other visual device. Many lives were lost at sea over the years, with families forever wondering what happened and where.

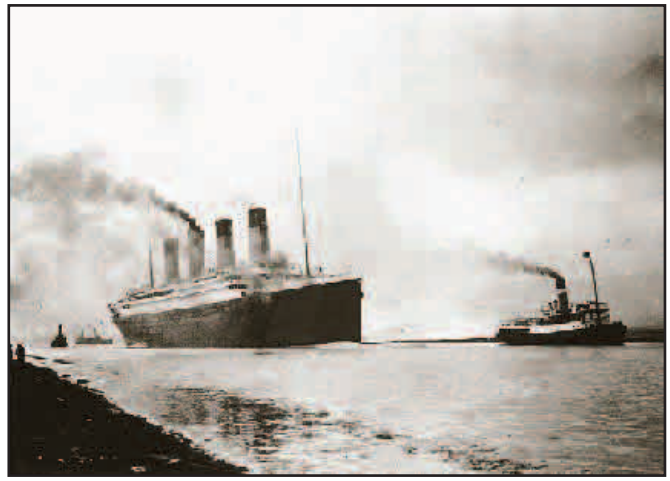
When Marconi invented radio, he quickly recognized the need to equip each ship with one. He was very successful in doing so and the number of ships with radios grew. Sinking ships, collisions and other disasters were still occurring, so how did the ships summon help with their radios? The trick was to catch the attention of the other nearby ships.

Companies such as Marconi's had set procedures on what to call and how to respond. Other ships without Marconi radios had different calls and procedures. As the number of radio-equipped ships increased, it became more confusing. Radio operators could be listening on frequency and completely miss a distress call due to the calling station using plain text or different words for the distress.

SOS to the Rescue

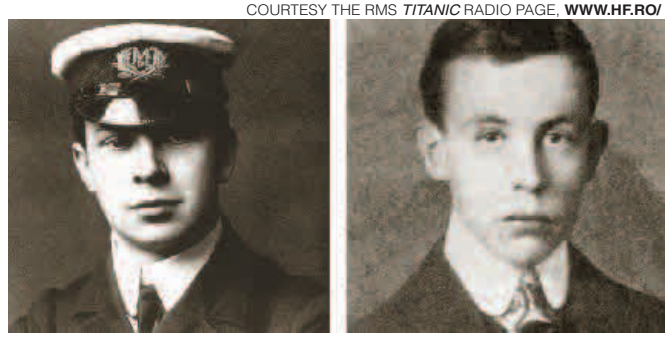
The book *SOS to the Rescue*, written in 1935 by veteran wireless operator Karl Baarslag, is the best researched reference on this subject. He said that the origin of the SOS signal was obscure and surrounded by fanciful misconceptions. I will post the first chapter of the book on my Web site (**www.k2tqn.com/**) so you can read the complete story of SOS. But for now, I'll quote some highlights from his book. I do recommend you try to find your own copy, as there are many chapters of great sea stories and dramatic rescues within. It's worth owning.

COURTESY NATIONAL ARCHIVES AND RECORDS ADMINISTRATION



The RMS *Titanic* leaving Belfast, Ireland for sea trials on April 2, 1912. The *Titanic*'s original Marconi Company call sign was MUC, but was changed to MGY in January 1912.

COURTESY THE RMS *TITANIC* RADIO PAGE, **WWW.HF.RO/**



Twenty-five year old John (Jack) G. Phillips (left) was in charge of *Titanic*'s radio room; Harold Bride (right), the deputy radio operator was only 21. Both men were employed by the Marconi Company, but received their paychecks from the White Star Line, the company that owned the *Titanic*. Phillips died of hypothermia on or near one of the lifeboats; his body was never recovered. Bride was picked up by the *Carpathia*, where he assisted her sole radio operator in dealing with a constant exchange of messages in the hours following *Titanic*'s sinking.

The first distress call from an American vessel that I have been able to trace was sent out by Relief Ship No. 58 while on Nantucket Shoals Station on December 10, 1905 — a year before SOS was born. The relief ship had been on her station only five days when heavy gales set in. These lasted for several days, reaching hurricane force at times. Buffeted unmercifully by tremendous seas on its exposed position, the ship sprang a leak that grew to alarming proportions. All pumps and hand-bailing facilities were employed to the limit a desperate, but losing, battle to keep the water down. Finally, when it became apparent that the pumps could no longer cope with the inflow, a radio message was sent on December 10 at 9 AM to the Lighthouse authorities asking that aid be sent without delay.

The radio staff on board the lightship was composed of three naval electricians: Chief Electrician Burbank, and Second Class Electricians C. J. Blankenship and William E. Snyder. The latter, now Lt Snyder, USN, Retired, says that he broadcast the word HELP in both American Morse and the International code, since no distress call existed at that time. He added, "Nantucket Shoals Lightship in distress, send aid from anywhere."

The Naval Radio Station at Newport, Rhode Island, seems to have been the only one to have heard the call — at least it was the only one to reply. By 3 PM the rising water had reached and extinguished the fires; the gale backed northwest and kicked up a murderous cross-sea. The last sputtering radio received from the stricken lightship was, "Water gaining, we are helpless."

The Lighthouse Service Tender *Azalea* was dispatched from New Bedford and, in spite of the heavy gale and high seas, reached the wallowing lightship's side after a terrifying passage. Several hours were spent getting a line over the relief ship; finally, a towing hawser was successfully passed to her. Both small vessels were tossed around like canoes. The *Azalea* began to tow the sinking vessel toward New Bedford.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

After almost 6 hours of towing and struggling through mountainous seas, the captain of the lightship signaled that his vessel would have to be abandoned at once; she was sinking beneath their feet. The *Azalea* put over a small boat was, and the crew of 13 member crew on the lightship was taken aboard the rescuing tender without mishap. They had left none too soon — Lightship No. 58 sank from sight 10 minutes after she had been abandoned. The *Azalea*, which was only a small vessel, made port several hours later, after what was described in the official report as a "fearful trip."

A Distressing Situation

By 1904 a number of ships in the trans-Atlantic trade were equipped with wireless telegraphy. The British operators were nearly all landline telegraphers who had left railroad or post office keys to go to sea in the newly opened field. They brought along with them not only their Morse code but also many of their telegraphic abbreviations and signals. One was the general call CQ, which had been used to attract attention of all operators along a wire. It preceded the time signal in the morning at 10 o'clock and also all notices of general importance. CQ went to sea and became a general call to all ships.

Early in 1904 the Marconi Company, realizing the desirability of some universal distress signal, filled the need by issuing the following general order:

It has been brought to our notice that the call "CQ" (All stations) while being satisfactory for general purposes, does not sufficiently express the urgency required in a signal of distress."

Therefore, on and after the 1st of February, 1904, the call to be given by ships in distress, or in any way requiring assistance, shall be "CQD."

This signal must on no account be used except by order of the Captain of the ship in distress or by other vessels or stations re-transmitting the signal on account of the ship in distress. All stations must recognize the urgency of this call and make every effort to establish satisfactory communication with the least possible delay.

Any misuse of the call will result in the instant dismissal of the person improperly employing it.

CQD was popularly interpreted to mean "Come Quick Danger," but from the above order it can be seen that the letters in themselves had no such definite significance, being an old telegraphic general call — CQ — to which had been appended the letter D for distress.

An international meeting was held in Berlin during 1906 to try and sort out the problems. At that time the Italians were using SSSDDD and the Germans used SOE. Politics entered the debate, slowing the progress of the committee:

Impelled to action by the "Radio chaos in America," the American delegation was at first almost alone in its advocacy of compulsory intercommunication between all radio stations, irrespective of systems employed. The Marconi Company, dominant in its unassailable patent position and world-wide prestige, opposed this proposition on the grounds that it would be forced to place at the disposal of its rivals the far-flung network of its established facilities and equipment. Great Britain, Italy, Montenegro, and several other countries, already committed by agreements with the Marconi Company, officially opposed the American proposal of compulsory intercommunication. The American delegation persisted and succeeded in enlisting support from other powers

so that the broad principle of compulsory intercommunication by international agreement was finally adopted by the Conference.

The selection of a suitable distress signal presented no great difficulties. German ships had been accustomed to using as a general inquiry call the signal "SOE," and the German delegation suggested this signal as an international distress call. This led to considerable discussion and the objection was advanced that the final "E" in "SOE," being only a dot in the Morse code, would be too easily lost in atmospheric disturbances, through interference, or if nervously transmitted. It was therefore judged preferable to substitute "SOS" for "SOE." Three dots, three dashes, three dots, could not be mistaken for anything else and was deemed to be the attention-arresting and distinctive signal desired to precede all international distress calls. It was to be sent as one unbroken signal, ... --- ... and is therefore SOS and not S.O.S. as it is so often seen misspelled.

Orthography demanded an equivalent in letters, and so SOS was used, although the letters VTB, IJS, or SMB sent as one signal would form the same ... --- ... in the Morse code. Thus it can be seen that all such popular interpretations as "Save Our Souls," "Save Our Ship," or "Send Out Succor" have no foundation in fact but are merely the result of imagination and misconception.

SOS was officially adopted by international ratification in 1908, but the older CQD lingered on for several more years, especially in the British service where it had originated. Jack Binns was to make it famous in the Republic-Florida collision in 1909, and as late as 1912, Phillips on the foundering *Titanic* used both CQD and SOS. British operators, for sentimental reasons, regretted the abandonment of their CQD, which was a company and national signal, for the newer and "made in Germany" SOS. After the *Titanic* disaster, CQD was gradually forgotten, and SOS became supreme over the vast empire of the air. The United States, generally lagging in radio legislation, did not officially adopt SOS until 1912, four years after all other nations had ratified the 1906 Conference. It might not have acted even then had not the *Titanic*, and Phillips' dramatic use of SOS, directed world attention to the use of the signal as a call for help at sea. QST

Strays

2003 GOLDFARB WINNER RECEIVES NSF FELLOWSHIP

◊ Ben Schupack, NW7DX, of Sammamish, Washington, recipient of the 2003 William R. Goldfarb Memorial Scholarship, has been awarded a National Science Foundation graduate fellowship of $120,000 over the next three years. Ben is currently a senior at Whitman College in Walla Walla, Washington, majoring in geology and environmental studies. He plans to attend graduate school at the University of Colorado in Boulder, where he will be working within INSTAAR (Institute of Arctic and Alpine Research), focusing on the interaction between volcanic eruptions and Arctic climate variability; he expects to do ice-core and lake-core field work in Iceland and Greenland.

In addition to Ben's broad scholarly reach, he still finds time for Amateur Radio. He spent a semester abroad in the Turks and Caicos Islands and brings his ham gear whenever he goes out into the field for research. Ben is the lead trombonist in the Whitman Jazz Band and participates with the college's award-winning cycling team.

Since 2003, the William R. Goldfarb Memorial Scholarship is awarded to one high school senior each year. This scholarship ensures the recipient will receive a four year undergraduate degree in computers, medical or nursing, engineering or sciences, or a business related field. For more information, please see **www.arrlf.org/**.

I would like to get in touch with…

◊ members of Boston College High School's Amateur Radio Society, W1BCH, who knew Fr James McCaffrey, K1TTY. Please contact Khrystyne Keane, K1SFA (wife of Michael Keane, K1MK, Class of '75), at **k1sfa@arrl.net**.

◊ cystic fibrosis patients and family members who would like to help start an Amateur Radio club. — *David Wagner, KCØZQI,* **fghtcfdavid@aol.com**

◊ young hams interested in joining an HF net. — *Caeden Clark, KI4RSS,* **cdn5704@nefcom.net**

AT THE FOUNDATION

Georgia Ham Wins 2007 William Goldfarb Scholarship

The ARRL Foundation Board is proud to congratulate Andrea Hartlage, KG4IUM, of Grayson, Georgia. Andrea was unanimously selected by the Board to receive the William R. Goldfarb Memorial Scholarship for 2007. She will graduate from Grayson High School in May 2007 with a 96.05 grade point average and expects to attend Georgia Institute of Technology in the fall where she will concentrate on studies in aerospace engineering. She plans for a future as an astronaut or engineer.

The Goldfarb Scholarship is awarded to one high school senior each year. This scholarship ensures the recipient will receive a four year undergraduate degree in computers, medical or nursing, engineering or sciences, or a business related field.

Andrea is the fifth Goldfarb Scholarship winner and her credentials are extraordinary. She continues the tradition of prior winners, demonstrating peak academic performance, outstanding leadership abilities and extraordinary Amateur Radio and community activities.

A Life Member of ARRL, Andrea is Georgia Assistant Section Manager for Youth. But that's only the tip of the iceberg! In her 17 years, Andrea has created an impressive resume of Amateur Radio training, activities and awards.

Licensed since 2000, and an Amateur Extra class licensee since 2003, Andrea is active in two Amateur Radio clubs, operating CW and voice on 10-80 meters during contests when she can. Her training for emergency operations includes CPR certification, CERT and SKYWARN training, as well as three FEMA courses. For the past two years, Andrea has more than 400 volunteer community service hours. She participates in Simulated Emergency Tests and Field Day operations, and even coordinates the youth activities for the Georgia State Convention.

Andrea Hartlage, KG4IUM

Andrea contributes her volunteer energies to the Georgia Teen Institute and is Administrative EOC Response Team Leader for the Gwinnett County ARES. She is a member of her radio club Hamfest Committee and volunteers as a communicator for parades, walks, 5K runs and a dog show.

With all of these volunteer activities, Andrea still finds time to serve for two years as the Editor-in-Chief of her high school newspaper, contribute as Youth Editor to ARRL and on the Youth Leadership Conference Youth Advisory Board. She also is on the National Association of Teen Institutes Board of Directors. And there's more — service on the Governor's Cooperative Agreement Advisory Committee Youth and as a participant in Substance Abuse Prevention program round out her activities.

It should be no surprise that Andrea has won both the Hiram Percy Maxim Award in 2003 and the Young Ham of the Year Award in 2004.

Congratulations, Andrea! You represent the best qualities of young radio amateurs!

Important note: For young hams who plan to apply for ARRL Foundation Scholarships in the future, Andrea's story is an example for you to follow. A solid balance of top academic performance, activities in Amateur Radio and *in community service is the combination that will make you an outstanding candidate for an ARRL Foundation Scholarship.*

Complete information on the William Goldfarb Scholarship and the ARRL Foundation Scholarship Program can be found on the Web at **www.arrl.org/arrlf**. QST

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

ARRL Emergency Communications Course Honor Roll

We honor the following individuals who have passed all three ARRL Amateur Radio Emergency Communications courses (Levels I, II and III) between January 1 and March 31, 2007. This list also includes recertified individuals. If you are interested in taking an Amateur Radio Emergency Communications course, or one of our other ARRL online courses, see **www.arrl.org/cce/**.

Melissa Armstrong, N9UGX
Coleman Bentley, KI4APL
Thomas Berne, W6TAG
Barry Bogart, WV2J
Michael Bonuchi, AC9Y
Thomas Burkhart, KI4MDU
John Cotner, KC9IED
Douglas Dart, KC2MVC
William Davidson, KW4J
Clifford Dice, W8WHO
Nick DiGirolamo, AD5ZB
Guy Distaffen, KBØSWS
Joel Dunlap, W5ANK
Joseph Estep, W8TSP
Jeffrey Fehr, KX3Q
Jose Fernandez, KI4BIE
Jeff Garnett, KG4CNM
Kenneth Gibson, KE7IGZ
William Grogan, WA4UFS
Robert Guernsey, KA9GHC
Gregory Hanson, KI8AF
E. Hardy, KB1KIX
Anthony Hebert, W9YP
Carl Jagielski, KA4HLO
Joe Hudgins, K5BYS
Bobby Jones, N6USP
William Jones, WA6GFD
Ralph Katz, KB8ZOY
Brian Keahl, KI4LZG
Brian Krumm, NØMXK
Stanton Le Sieur, AD7HO
Stephen Licht, WF2S
Paul Lineen, N9IX
William Longworth, KM1N
James Marston, K4DOI
Jory McIntosh, KJ5RM
Ross Merlin, WA2WDT
Tuck Miller, NZ6T
Tom Parkinson, KB8UUZ
Stephen Peterson, KI7L
Nicholas Proy, KB3LSR
Robert Rand, KA5DON
Richard Rankin, WM7P
Richard Renaud, W8KDR
Edward Rollor, N4ZRA
John Scheuchenzuber, W4QVA
Norman Schklar, WA4ZXV
Robert Scorah, WØAGE
Archie Shetler, WN3DHI
Joseph Spears, AF1E
Gary Takis, K7GJT
Thomas Tenney, W8OJM
Stephen Van Den Akker, W4SJV
Kevin Vickers, AC5UV
Richard Wayt, WD8SDH

www.arrl.org/cce/

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

W1AK **Eldridge**, Luther W., Farmington, MN
W1BFA **Bracy**, Ernest L., Readfield, ME
N1CGD **Lausier**, Paul L., Marblehead, MA
KB1CYK **Taylor**, Cecil B. III, Walpole, NH
KD1EA **Kinnon**, Albert R. III, Tewksbury, MA
W1EYZ **Ringland**, George R., Stoneham, MA
W1GAC **Mouridian**, George, Framingham, MA
KB1JHF **Carton**, John M., Claremont, NH
W1QJR **Gillum**, Kenneth F., Fairhaven, MA
KA1RAQ **Knisell**, Lester D., East Orleans, MA
K1TTY **McCaffrey**, **SJ**, James P., Weston, MA
K1UQV **Tidmarsh**, Ronald, Lyme, CT
W1US **Kelemen**, Robert J., Chester, VT
W1YCW **King**, Donald A., Manchaug, MA
K2AEF **Finlay**, John C., Shawnee, KS
KC2ARL **Shisler**, Robert P., Brewster, NY
W2DTO **Conn**, Ralph I., Ocean, NJ
♦ K2EDQ **Pilot**, Eugene R., Neptune, NJ
KB2EH **Steinberg**, Richard M., Brooksville, FL
W2EO **O' Brien**, Edmond F., Paramus, NJ
W2HWY **Ruffalo**, Henry P., Cedar Grove, NJ
W2JUB **Vreeland**, Howard C., Wellsville, NY
♦ W2KKT **Leveson**, Lawrence, Niagara Falls, NY
WB2LWC **Young**, Richard, Edison, NJ
WA2LYZ **Esposito**, James, Barrington, NJ
WA2QOY **Berry**, Harold B., Malaga, NJ
WA2RKV **Lehner**, Willard F., Buffalo, NY
N2RMY **Mamed**, Walter F., Syracuse, NY
KA2YPX **Pawiak**, Chester, Cairo, NY
KF3AS **Best**, Jeffery O., Effingham, NH
N3DTY **Riale**, Paul V., Bryn Mawr, PA
N3HVI **Roberts**, Raymond W., Pocomoke City, MD
WB3KUH **Oakjones**, Donald E., Baltimore, MD
W3PHL **Doughty**, Frederic C., Valley Forge, PA
WA3TKU **Shuey**, Norman F., Enola, PA
♦ WA3Z **Hartman**, John D., Burlington, WA
KA3ZXX **Peters**, Robert A. Sr, Rising Sun, MD
♦ WD4BPI **Stoll**, Jeffrey C., Beaufort, SC
N4DDZ **Parr**, Arthur D. Jr, Lancaster, SC
WB4DER **Winkler**, James E. Jr, Nashville, TN
N4EAH **Ledford**, Barbara, Fisherville, KY
KR4EM **Hollon**, Leslie, Campton, KY
WA4EQE **Story**, Luther L., Wetumpka, AL
KG4FUL **Gray**, David J., Clarksville, TN
AB4GJ **Hawkins**, James W., Macon, GA
WB4HAD **Gleaves**, William H., Hixson, TN
KA4HVU **Wallace**, Roland, Shelby, NC
KI4ID **Doremus**, Ogden, Metter, GA
AC4JN **Bullock**, Nathan D., Valley Head, AL
KD4KIE **Sisk**, Roy E. Jr, Williamston, SC
KA4KRZ **Westcott**, Marl R. Jr, Greensboro, NC
W4LWE **Lange**, William J., Clarksville, TN
KI4MBO **Ipock**, Dana S., Servierville, TN
KM4NV **Edwards**, William M., Columbus, GA
♦ WA4NZT **Graham**, Dillard L., Ben Hur, VA
KI4OG **Lewis**, Lance L., Mount Juliet, TN
K4PDN **Albro**, James C., La Grange, KY
KC4PO **Ensley**, George W. Sr, New Bern, NC
K4RLU **Chaplin**, Earnest C., Radcliff, KY
K4RUW **Frizzell**, Clifford H. Sr, Ocala, FL
KF4VZ **Barncard**, Robert G., Daphne, AL
WA4WWA **Dorsey**, Noel L., Flemingsburg, KY
♦ K4YBB **Kelley**, James M., Fruitland Park, FL
KR4YM **Reid**, Donald E., Valley, AL
♦ WB4ZNB **Atkinson**, Ralph B., Courtland, VA
W5BAW **Kennedy**, Charles H., Richardson, TX
KM5BC **Cosand**, Carl L., Williamsville, IL
WB5BJD **Berry**, Robert W., North Little Rock, AR
WD5BTN **Isaacs**, Leonard F. Sr., Christoval, TX
W5CT **Wiley**, Herbert T., Grand Prairie, TX
W5EBM **Meyer**, Leonard A., New Braunfels, TX
KD5KBD **Nolan**, Mark L., Westminster, CO
WA5SHP **Elliott**, Dale T., Columbus, OH
K5STF **Gardner**, James O., Pasadena, TX
♦ W5STI **Brittain**, Perry G., Center, TX
KJ5TG **Dutton**, Charles A., Burleson, TX
NB5U **Nieman**, Ordria B., Nolanville, TX
KD5YWG **Econopouly**, Kris, Rio Rancho, NM
KD6EWM **Witt**, Harry R., Nevada City, CA
W6FDT **Fell**, Robert J. Sr, Kearney, MO
♦ WB6FWZ **Owings**, James S., Huntington Bch, CA
K6JKC **Corey**, Alan G., Susanville, CA
AD6RP **Rogers**, Jack W., Coarsegold, CA
♦ WA6RTK **Nuzum**, Richard W., La Crescenta, CA
♦♦ W6TET **Simpson**, Ivan C., San Diego, CA
N6TST **Rosenthal**, David A., Ridgecrest, CA
W6UBM **Hart**, Albert H., North Hollywood, CA
W7AZ **Ver Steeg**, Robert H., Richland, WA
W7BOA **Schochet**, Bernard J., Salt Lake City, UT
WA7CWM **Stathis**, Pete, Winnemucca, NV
W7EBL **Purbaugh**, Harold O., Mesa, AZ
KL7HDY **Zarkovich**, Robert J., Anchorage, AK
N7JCA **Nichols**, James, Yellowtail, MT
KC7LGV **Hall**, Herbert C., Olympia, WA
K7QCN **Knottingham**, Mary Louise, Gold Beach, OR
KB7SHI **Linsley**, Paul H., Ogden, UT
K7SUQ **Ellis**, Jack C., Vancouver, WA
WA7YDG **Ball**, John D., Yakima, WA
NI7Y **Yelverton**, Forest C., Kamuela, HI
WD8BMR **Friedman**, Bernard M., Oak Park, MI
♦ WB8BVF **Williams**, Erold D., Hubbard, OH
KG8ED **Fairbanks**, Charles R., Mascot, TN
W8EWD **Stevens**, Paul K., Xenia, OH
N8EXY **Van Cise**, Paul, Hubbard, OH
KB8GK **Weidner**, Kenneth W., Uniontown, OH
W8JBZ **Carter**, William R., Mingo Junction, OH
N8KBK **Kirks**, Lois, Kalamazoo, MI
WD8ODE **Price**, Randall E., Sylvester, WV
W8OQW **Merriam**, Ronald J., Saginaw, MI
♦ K8ORG **Calderone**, Armand, Youngstown, OH
AB9DD **Balzano**, Emil J., Homer Glen, IL
N9ELP **Bentley**, Sheldon L., Lafayette, IN
W9EUZ **Cohn**, Myron, Scottsdale, AZ
KB9EWK **Ciha**, Thomas C., Brussels, WI
K9GCO **Howerter**, Michael J., Galesburg, IL
W9GNI **Witting**, Martin J., Aurora, IL
KC9IXS **Zeglin**, Roger A., Nappanee, IN
KA9LVB **Swain**, John D., Fort Wayne, IN
W9LYA **Sher**, David W., Skokie, IL
WB9NFW **Mulloy**, Walter J., Edgerton, WI
K9VMG **Creviston**, Robert E. Sr, Bainbridge, IN
WB9ZRB **Alm**, Paul F., Milwaukee, WI
KBØAMY **Pederson**, Wayne A., Horton, KS
KDØAY **Wilson**, Roger N., Topeka, KS
WØAYL **Koons**, Ella, Wichita, KS
KCØCOL **Faus**, Richard N., Denver, CO
WBØC **Bishop**, David J., Canton, KS
WØDDL **Atkinson**, Verlin M., Blue Springs, MO
KLØHD **Hammond**, Carol J., Fairbanks, AK
NØJFC **Higgins**, Peggy J., Saint Paul, NE
KBØLN **Polk**, Grady G., Kansas City, MO
WØNFM **Brown**, Clair J., Solon, IA
KBØQE **Showalter**, George, Sr, Climax Springs, MS
WØSPY **Slack**, Donald B., Springfield, MO
KUØV **Grehl**, James P., Minneapolis, MN
♦ VE4AT **Sherman**, Jack, Winnipeg, MB
CT1BT **Teles**, Romualdo Pereira Covas, Portugal
CX8BE **De Castro**, Jorge, Uruguay

♦ Life Member, ARRL
♦♦ Charter 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 or older to designate IRA assets to a qualified 501(c)(3) organization during 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 period — contributions must be made before December 31, 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.

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; **mhobart@arrl.org**.

75, 50, AND 25 YEARS AGO

June 1932

• The cover photo shows an array of the calibrated dials used by hams.
• The editorial discusses the current Senate's efforts to institute a fee schedule for Amateur Radio examinations, licenses, etc. However, the editorial opines that "We do not see why there should be any fees on amateur stations."
• Technical Editor James Lamb asks, "What's Wrong with Our C.W. Receivers?", suggesting that hams need better selectivity and single-signal performance.
• Vere Davis, W9FJV, tells how to make a "D.C. Plate Supply from Ford Spark Coils."
• "Fun on Five Meters" tells about recent test results and possibilities on 5 meters.
• George Grammer discusses "The A, B and C of Amplifier Classifications," clearing up the confusion that envelops many hams when considering which amplifier class to use.
• A "Stray" points out that the US Post Office requires 2¢ to deliver a QSL to Canada, rather than the current rate of 1¢ for U.S. addresses.
• "'Phone-C.W. Consistent DX QSO's Contest" invites U.S. and Canadian hams to report their 20 best DX QSO's made during the period June 5-18 on the 1.7, 3.5 and/or 7 Mc bands.

June 1957

• The cover shows the Podunk hollow RC at the V.H.F. section of their Field Day expedition. Is that Ed Handy, W1BDI, in the tent?
• The editorial corrects misinformation that has been published recently with regard to international third-party traffic, saying, *"You can't do it!"*
• R. J. Moser, W8QBP, discusses his work with "'Autosync' Frequency Control," with a modified Hammarlund Super Pro receiver providing frequency control for both transmitter and receiver.
• Sam Sabaroff, W3DM, describes "A Novel Transmit-Receive Switch" that uses a 6AH6 in a cathode-follower circuit to connect the receiver to the transmitting antenna.
• In "A 200-Watt Balun Coupler for Center-Fed Antennas," J. M. Shulman, W6EBY, tells us how to feed balanced line from a pi network antenna tuning system.
• "A One-Tube Two-Meter Rig with Transistor Modulator," by R. J. Schlesinger, K6LZM, uses a 6U8 dual-section tube as an oscillator-amplifier and four transistors in the audio amplifier–modulator.
• Thomas Bryant, WØKLP, tells about "Mounting a Beam Antenna on a Telephone Pole," using plumbing supplies.
• Irwin Wolfe, W6HHN, describes "A 500-Watt Audio System" that uses a pair of 4X250Bs operating Class AB_1.

June 1982

• The cover photo shows an assortment of QSL cards from BY1PK, the headquarters station of the Chinese Radio Sports Association, with the announcement "China is back on the air!"
• The editorial addresses the current problem of cable TV systems interfering with the 144 and 220 MHz ham bands, and how a solution may be in sight.
• John Kraus, W8JK, reminds us of his famous and excellent antenna, first described in 1937 in *Radio* magazine, in his article, "The W8JK Antenna: Recap and Update."
• R. R. Schellenbach, W1JF, suggests, "Try the 'TJ'," a five-band vertically polarized antenna system for HF.
• Ted Theroux, N9BQ, describes "A Digital CMOS Iambic Keyer" that provides excellent performance at low cost.
• Doug DeMaw, W1FB, urges the reader to "Build a Bare-Bones CW 'Superhet'" for 20-meter portable or QRP operation.
• An old-time HF antenna concept is adapted to VHF by Jim McDonald, WBØJQH, in his article, "An End-Fed Extended Double Zepp for 2 Meters."
• Geoffrey Krauss, WA2GFP, describes "Low-Noise Preamplifiers for 1296 MHz."
• Tony DePrato, WA4JQS, tells about his latest antenna project, "A 40-Meter Quad, the EZ Way."
• Alan Coiro, W4KSA, and James Wilson, K4BAV, report on "Potomac Air Disaster: Hams' Response Swift, Sure." Air Florida flight 90, taking off from Washington National Airport, crashed onto Washington's 14th Street Bridge. Hams helped overcome radio incompatibility problems among the emergency crews from the various local jurisdictions.

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 3.625, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent at 45.45-baud Baudot and 100-baud AMTOR, FEC Mode B. 110-baud ASCII will be sent only as time allows.

On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:** Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **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

IOWA STATE CONVENTION

June 29-30, South Sioux City, NE

F D V S

The Iowa State Convention (Hamboree 2007 — 31st Annual Hamboree), co-sponsored by the 3900 Club and the Calabash Group, will be held at the Marina Inn Center, 5th and "C" Sts. Doors are open Friday 2-8 PM, Saturday 8 AM-4 PM. Features include a huge 150+ table flea market; new equipment dealers; exhibitors; VE sessions; full slate of seminars; special guest Katie Breen, W1KRB, ARRL Membership Manager; 3900 Club luncheon meeting (Saturday); DXCC card checking; left foot keying contest; Friday eve buffet dinner; Saturday eve banquet with entertainment; Ladies Day activities (Saturday); souvenir T-shirts; plenty of free parking; refreshments. Talk-in on 146.91. Admission is $7 in advance with registration for events, $8 at the door (good both days). Tables are $10 and up. Make checks payable to "Hamboree 2007" and send to Tom Brosamle, WB0YNX, Box 2332, Sioux City, IA 51106; 712-252-4107 (10 AM-5:30 PM, Monday through Saturday); **wb0ynx@arrl.net**; **www.3900club.com**.

ARIZONA STATE CONVENTION

July 6-8, Williams

F D V S

The Arizona State Convention (formerly known as the Fort Tuthill Hamfest), sponsored by the Amateur Radio Council of Arizona, will be held at the Williams Rodeo Grounds, 800 E Rodeo Rd. Doors are open for setup on Thursday (Jul 5) at 5 PM; Friday hamfest opens at dawn and hall opens at Noon, Saturday 8 AM-5 PM, Sunday 8 AM-1 PM. Features include huge swap area (outdoor spaces $15 before Jun 1; after Jun 1, $20), dealers, commercial vendors, manufacturers, exhibits, seminars, nationally renowned speakers, VE sessions, BBQ dinner (Saturday eve), on-site dry camping ($15 per space or free with selling space before Jun 1; after Jun 1, $20). Talk-in on 146.78 (91.5 Hz). Admission is free. Contact Mark Kesauer, N7KKQ, 16845 N 29th Ave, Phoenix, AZ 85053-3041; 602-881-2722; **www.arca-az.org/arca/**.

F = FLEA MARKET
D = DEALERS / VENDORS
H = HANDICAP ACCESS
V = VE SESSIONS
S = SEMINARS / PRESENTATIONS

May 19
Delaware Section, Georgetown*

May 25-26
Delta Division, Rayne, LA*

May 26-27
Wyoming State, Casper*

June 1-2
San Francisco Section, Ferndale, CA*

June 1-3
Atlantic Division, Rochester (Henrietta), NY*
Northwestern Division, Seaside, OR*

June 2
Georgia State, Marietta*

June 8-9
West Gulf Division, Plano, TX*

June 9
Tennessee State, Knoxville*

July 20-21
Oklahoma Section, Oklahoma City

July 20-22
Montana State, East Glacier

July 26-29
Central States VHF, San Antonio, TX

July 27-29
3905 Century Club Eyeball, Guthrie, OK

August 3-4
Texas State, Austin

August 3-5
Wyoming Section, Jackson Hole

August 5
Illinois State, Bolingbrook

*See May *QST* for details.

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance. QST

HAMFEST CALENDAR

Attention: The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **June 1** to be listed in the **August** 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.

Abbreviations: *Spr* = Sponsor, *Tl* = Talk-in frequency, *Adm* = Admission

Arizona (Show Low) — Jun 2 F D V
7 AM-noon. *Sprs:* Kachina ARC, ARCA. Show Low Intermediate School, 500 W Old Linden Rd. 5th Annual White MountainHamfest, vendors, tailgating, VE sessions. *Tl:* 146.61 (162.2 Hz), 146.52. *Adm:* $1. Tables: $5. Heidi Shipitalo, KD7NEE, 1300 W Nikolaus, Show Low, AZ 85901; 928-537-0041; **shipitalo@ citilink.net**; **www.whitemountainhamfest.com**.

Arizona (Williams) — Jul 6-8, Arizona State Convention. See "Coming Conventions."

California (Santa Maria) — Jun 16 F
8 AM-4 PM. *Spr:* Satellite ARC. Santa Maria Elks Lodge Parking Lot, 1309 N Bradley Rd. Swapfest, refreshments. *Tl:* 147.3 (131.8 Hz). *Adm:* Free. Tables: $15 for space only (bring your own tables and chairs). Eric Lemmon, WB6FLY, 4416 Titan Ave, Lompoc, CA 93436; 805-733-4416; fax 805-733-4418; **wb6fly@arrl.net**; **www.SatelliteARC.com**.

Connecticut (Goshen) — Jun 16 F D V
8 AM-1 PM. *Spr:* Southern Berkshire ARC. Goshen Fairgrounds, Rte 63 S. Vendors, VE sessions. *Tl:* 147.285 (77 Hz). *Adm:* $3. Tables: $5. Lee Collins, K1LEE, 5 White Hollow Rd, Lakeville, CT 06039; 860-435-0051; **k1lee@arrl.net**.

Illinois (Aurora) — Jul 8 F D H V S
Set up Saturday 5-7:30 PM, Sunday 6-8 AM; public 8 AM. *Spr:* Fox River Radio League. Aurora Central Catholic High School, 1255 N Edgelawn Dr. Large paved outdoor flea market, commercial vendors, new and used Amateur Radio equipment, homebrew awards, mobile installation display with award for best, HF antenna symposiums, QRP and CW operations, VE sessions (10 AM), hidden transmitter hunt, handicapped accessible, free parking, refreshments. *Tl:* 147.21 (103.5 Hz). *Adm:* advance $6, door $8. Tables: $10. Dean Holste, KC9EOQ, c/o FRRL, Box 673, Batavia, IL

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

60510; 630-966-8521; fax 630-879-0000; **hamfest@frrl.org**; **www.frrl.org**.

Indiana (Indianapolis) — Jul 7 F V S
6 AM-3 PM. *Spr:* Indianapolis Hamfest Assn. Camp Sertoma, 2316 S German Church Rd. Indoor and outdoor flea markets, forums, VE sessions. *Tl:* 146.76. *Adm:* advance $6, door $8. Tables: $15. Bob Blake, N9FIM, 11064 Indian Lake Blvd, Indianapolis, IN 46236; 317-261-6658; **bob9fim@aol.com**; **www.indyhamfest.com**.

Maryland (Frederick) — Jun 17 F V
8 AM-3 PM. *Spr:* Frederick ARC. Frederick County Fairgrounds, 797 E Patrick St. 29th Annual Father's Day Hamfest; free VE sessions; QSL card checking for DXCC, WAS, and VUCC awards. *Tl:* 147.06 (123.0 Hz), 146.64 (156.7 Hz), 146.52. *Adm:* $6. Tables: advance (by Jun 11) $15, after Jun 11 $20. Bob Moroney, K9CMR, 13597 Old Annapolis Ct, Mount Airy, MD 21771; 301-831-5060; **k3erm@qsl.net**; **www.qsl.net/k3erm/hamfest.htm**.

Massachusetts (Cambridge) — Jun 17. Nick Altenbernd, KA1MQX, 617-253-3776 (9 AM-5 PM); **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Elmira) — Jun 23. James Davis, KC8NTE, **kc8nte@arrl.net; www.nmares.net**.

Michigan (Midland) — Jun 16 F V
8 AM-noon. *Spr:* Midland ARC. Midland Fairgrounds, Eastman Rd. 33rd Annual Hamfest, VE sessions. *Tl:* 147.0. *Adm:* $5. Tables: $5. Keith Johnson, KB8SOE, 1300 E Olson Rd, Midland, MI 48641; 989-832-4123; **kb8soe@kb8soe.com**; **www.qsl.net/w8kea/**.

Michigan (Monroe) — Jun 17 F
7:30 AM-1 PM. *Spr:* Monroe County Radio Communications Assn. Monroe County Fairgrounds, 3775 S Custer Rd. Buildings and outdoor trunk sales. *Tl:* 146.72. *Adm:* $6. Tables: $15. Fred VanDaele, KA8EBI, 4 Carl Dr, Monroe, MI 48162; 734-242-9487; fax 734-587-2250; **ka8ebi@yahoo.com**; **www.mcrca.org/hamfest.htm**.

Nebraska (South Sioux City) — Jun 29-30, Iowa State Convention. See "Coming Conventions."

New Hampshire (Rochester) — Jun 2. Larry Inman, K1SRJ, 603-335-4805; **k1srj@arrl.net**.

New Jersey (Augusta) — Jul 8 F
8 AM. *Spr:* Sussex County ARC. Sussex County Fairgrounds, Plains Rd. Flea market, indoor sellers. *Tl:* 147.3. *Adm:* $6. Tables: $15. Dan Carter, N2ERH, 8 Carter Ln, Branchville, NJ 07826; 973-948-6999; **hamfest@scarcnj.org**; **www.scarcnj.org**.

New Jersey (Piscataway) — Jun 16 S
7 AM-2 PM. *Spr:* Raritan Valley RC. Piscataway High School, 100 Behmer Rd. Demonstrations (IRLP, PSK-31, HF Station). *Tl:* 146.625, 442.25. *Adm:* $6. Tables: $6. Eric Lund, NW2P, 112 Rock Rd, Greenbrook, NJ 08812; 908-251-3938; **nw2p@w2qw.net**; **www.w2qw.org**.

New York (Bethpage) — Jun 3 F D V
Sellers 7:30 AM; buyers 9 AM. *Spr:* Long Island Mobile ARC. Briarcliff College, 1055 Stewart Ave. Outdoor Hamfest, AR equipment, computers, dealers, vendors, ARRL information, VHF tune-up clinic, VE sessions, free parking, refreshments. *Tl:* 146.85 (136.5 Hz). *Adm:* $6; under 12 (when accompanied by a paying adult) and nonham sweethearts free. Tables: $10 (space only; bring your own tables, chairs, umbrellas). Richard Cetron, K2KNB, c/o LIMARC, Box 392, Levittown, NY 11756; 516-694-4937; fax 631-574-4851; **hamfest@limarc.org** or **k2knb@limarc.org**; **www.limarc.org**.

New York (Queens) — Jun 10 F D H V
Set up 7:30 AM; public 9 AM-2 PM. *Spr:* Hall of Science ARC. New York Hall of Science Parking Lot, 47-01 111th St (Flushing Meadow Corona Park). Flea market, electronics and computer equipment, tailgating, dealers, Drop and Shop, Museum Exhibit Station WB2JSM, DXCC card checking, VE sessions (10 AM, walk-ins, exact change or check; Lenny Menna, W2LJM, 718-835-1548), tune-up clinic, handicapped accessible, free parking, refreshments. *Tl:* 444.2 (136.5 Hz), 146.52. *Adm:* buyers $5, sellers $10 per space. Stephen Greenbaum, WB2KDG, 85-10 34th Ave, Apt 323, Jackson Heights, NY 11372; 718-898-5599; **wb2kdg@arrl.net**; **www.HOSARC.org**.

North Carolina (Salisbury) — Jul 7 F V
Spr: Rowan ARS. Salisbury Civic Center, 315 S Boundary St. Paved tailgating, spacious air-conditioned indoor area,VE sessions (10 AM), free coffee, refreshments. *Tl:* 146.73 (94.8 Hz). *Adm:* advance $4, door $5. Tables: $5. Ralph Brown, WB4AQK, 1621 Emerald St, Salisbury, NC 28144; 704-636-5902; **rkbrown5902@bellsouth.net**; **www.w4exu.net**.

Ohio (Milford) — Jun 16 F D V
Set up 6 AM; public 8 AM-2 PM. *Spr:* Milford ARC. Eastside Christian Church, 5874 Montclair Blvd. 17th Annual Hamfest, commercial vendors, tailgating ($1 regardless of spaces needed), foxhunt (register at 10 AM; contact Donna, KC8KIA upon arrival), VE sessions (9 AM; walk-ins welcomed, bring ID), plenty of parking, refreshments. *Tl:* 147.345. *Adm:* $5. Tables: $5 (plus admission; Chris, KB8SNH, 513-351-2776; **kb8snh@fuse.net**). Jim Linn, WB8RRR, 5110 Romohr Rd, Cincinnati, OH 45244-1023; 513-831-6255; **wb8rrr.arrl.net**; **www.w8mrc.com**.

Ohio (Tedrow) — Jun 9 V
8 AM-1 PM. *Spr:* Fulton County ARC. Roth Family Park, 131 Hill Ave. VE sessions. *Tl:* 147.195. *Adm:* $3. Tables: Free. Lindsay Infante, K8LI, 7649 County Rd L, Delta, OH 43515; 419-822-4382; **webmaster@k8bxq.org**; **k8bxq.org**.

Pennsylvania (Bressler) — Jul 4 F S
8 AM. *Spr:* Harrisburg RAC. Emerick Cibort Park, Penn St. 35th Annual Firecracker Hamfest, seminars, DXCC and WAS QSL card checking. *Tl:* 146.76 (100 Hz). *Adm:* $5. Tables: $15. Terry Snyder, WB3BKN, Box 355, Halifax, PA 17032-0355; 717-979-9515; **terry@djterry.com**; **hrac.tripod.com**.

Pennsylvania (Lake Lehman) — Jul 1 F V
8 AM-3 PM. *Spr:* Murgas ARC. Luzerne County Fairgrounds, Rte 118. 28th Annual Hamfest and Computerfest, VE sessions. *Tl:* 146.61 (82.5 Hz). *Adm:* advance $4, door $5. Tables: $15 (inside). Ray Gusher, KB3ACO, 29 Eroh Rd, Wapwallopen, PA 18660; 570-379-3934 or 570-574-2294 (cell); **dena6@epix.net**; **www.qsl.net/k3ytl.**

Pennsylvania (Pittsburgh) — Jul 8 F
8 AM-2 PM. *Spr:* North Hills ARC. Northland Public Library, 300 Cumberland Rd. 22nd Annual Hamfest, paved tailgating (first space free, additional spaces $5 per space). *Tl:* 147.09 (88.5 Hz). *Adm:* Free. John Gorman, N3RQD, 162 Home Dr, Pittsburgh, PA 15223; 412-487-9254; **n3rqd@earthlink.net**; **www.nharc.pgh.pa.us**.

Tennessee (Mountain City) — May 19 V
7 AM-1 PM. *Spr:* Johnson County ARC. National Guard Armory, Hwy 421 S. Wheelchair races (licensed hams in wheelchairs), VE sessions. *Tl:* 146.61 (103.5 Hz). *Adm:* $3. Tables: $5. Frank Liberstein, W4FRL, Box 155, Trade, TN 37691; 423-727-0333; **quailrun@xtn.net**.

Texas (Amarillo) — May 19, 9 AM-2 PM. *Spr:* Panhandle ARC. Thompson Park, Area 17, NE 24th and US 287. BBQ Lunch with advanced registration. *Tl:* 146.94 (88.5 Hz). *Adm:* Free. Carl Jeans, N5YXN, 8801 Red Wing Rd, Amarillo, TX 79119; 806-353-3747; **carlj@arn.net**; **www.orgsites.com/tx/w5wx**.

F = FLEA MARKET
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H = HANDICAP ACCESS
V= VE SESSIONS
S = SEMINARS / PRESENTATIONS

Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as an announcement in these listings, donated ARRL publications, handouts, discounted rates for display advertising, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111, 860-594-0262, or send e-mail to **giannone@arrl.org**.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and *ARRLWeb* banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**. QST

VHF/UHF Century Club Awards

Compiled by Eileen Sapko
Awards Manager

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceding call signs are the assigned award numbers. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from February 8 to April 9, 2007.

The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/awards/vucc**. An SASE to ARRL is required if you cannot download these forms. If you have questions relating to VUCC, send an e-mail to **vucc@arrl.org**.

50 MHz
100

1556	W4DEE
1557	KE5CVM
1558	KC8TMU
1559	VE7DAY
1560	KG4NLZ
1561	AB4IQ
1562	KC2TN
1563	K4PI
1564	N9ISN
1565	KB3CWQ
KA1LMR	200
K1NU	275
W2CNS	625
K2BLA	225
AK3E	600
W4RBO	175
AE5B	600
W5TD	400
W5CIA	450
K6WRL	225
K6QG	475
AA7A	725
W8LHP	200
N8IEZ	300

144 MHz
100

673	N5SIX
K2BLA	250
AK3E	150
KC6ZWT	200
AA7A	550
N8IEZ	125
N9LR	475

432 MHz
50

320	N8IEZ
321	N4JQQ

3.4 GHz
5

76	N1GJ

5.7 GHz
5

56	K8EB

Satellite
100

156	K8BZ
N5AFV	600

QST

CONTEST CORRAL

W1AW Qualifying Runs are 10 PM EDT Friday, Jun 8 (0200 UTC Jun 9) and 7 PM EDT Wednesday, Jun 20 (2300 UTC Jun 20). The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, Jun 13 (0400 UTC Jun14); K9JM serves as alternate. 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**.

June

Digital Pentathlon — sponsored by Digital QSO Club (D-QSO-C). 1800Z-2200Z. PSK Jun 1; MFSK Jun 8; Olivia Jun 15; Hellschreiber Jun 22; Throb Jun 29. Frequencies: 80-10 meters, work stations once per band/mode. Categories: SO, 50 W max. Exchange: Serial number, 6-digit grid locator, power. QSO points: distance in km divided by product of powers. Score: total of QSO points. For more information: **dqso.net/start.html**. Logs due Jul 30 in Cabrillo format to **club@dqso.net**.

June 2-3

2007 Alabama QSO Party — SSB/CW, sponsored by the Alabama Contest Group from 1600Z Jun 2-0400Z Jun 3. Frequencies: 160-10 meters. Categories: SO, MS, MM, Mobile, QRP/LP (<150 W) /HP all categories. Exchange: RST and County or S/P/C. QSO points: CW — 2 points, SSB — 1 point. Score: QSO points × AL counties (AL stations count S/P/C) × power multiplier (QRP ×3, LP ×1.5). For more information: **www.AlabamaQSOParty.org**. Logs due 30 days after the contest to **logs@alabamaqsoparty.org** or Jim Johnson, KC4HW, 6274 S CR 49, Slocomb, AL 36375

Regional DX contests, such as SEANET, often bring out rare and semi-rare stations looking for your QSOs. Using propagation prediction software can help you be on the air when the bands are open to SE Asia.

SEANET Contest — CW/SSB/Digital, sponsored by the SEANET Convention, 1200Z Jun 2-1200Z Jun 3. Frequencies (MHz): CW — 160 meters, 3.525, 7.025, 14.025, 21.025, 28.025; SSB — 7.090, 14.320, 21.320, 28.320. Categories: SO, MS, AB, SB; Mixed and Single Mode all categories. Exchange: RS(T) and serial number. QSO points: SEANET-SEANET — 10 points (5 points if same country), SEANET-World — 10 points. Score: QSO points × DXCC entities for SEANET entrants; QSO points × SEANET entities for non-SEANET entrants, counted once per band and mode. For more information and list of SEANET countries: **www.sabah.net.my/seanet/contest_rules.htm**. Logs due Jul 31 to **e21eic@gmail.com** or SEANET Contest 2007, Champ Muangamphun, E21EIC, PO Box 1090, Kasetsart University, Bangkok 10903, Thailand.

IARU Region 1 Field Day — CW, sponsored by IARU Societies, from 1500Z Jun 2-1459Z Jun 2 (SSB — Sep 2-3). Frequencies: 160-10 meters. Categories: SOAB (LP, QRP), MS (HP, LP). Exchange: RST and serial number. QSO points: EU to EU fixed stations — 2 points, non-EU to EU — 3 points, with portable EU stations — 4 points. Score: QSO points × DXCC and WAE entities counted once/band. See IARU Region 1 Society Web sites for more information. Send logs to the appropriate national societies — *not* ARRL. NA hams to **nfd.logs@rsgbhfcc.org** or RSGB G3UFY, 77 Bensham Manor Rd, Thornton Heath, Surrey CR7 7AF, England.

Look Around in the Field Contest — CW/SSB, managed by NJ2OM from 1600Z-2200Z Jun 2. Frequencies: 160-10 meters. Categories: Home QRP, Home QRO, Field QRP, Field QRO. Exchange: Call + RS(T) + S/P/C + Op name + wildlife name. QSO points: CW — 2 points, SSB — 1 pt. Score: QSO points × wildlife sent or received (see Web site) × S/P/C × category multiplier + bonus points. For more information: **mysite.verizon.net/vze7v384/nj2om/index.html**. Logs due Jun 16 to **mikekopacki@verizon.net**.

June 9-11

Make some simple dipoles to join the fun in this most popular of the ARRL VHF+ contests. Horizontal antennas give best results on SSB or CW with most activity near "weak-signal" calling frequencies (see **www.arrl.org/FandES/field/regulations/bandplan.html***).*

ARRL June VHF QSO Party — from 1800Z Jun 9-0300Z Jun 11 (see May *QST*, p 102 or **www.arrl.org/contests**).

ANARTS WW RTTY/Digital Contest — sponsored by Australian National Amateur Radio Teleprinter Society (ANARTS), from 0000Z Jun 9-2400Z Jun 10. Frequencies: 80-10 meters. Categories: SO, MS and SWL; SO and SWL only operate 30 hours. Exchange RST, CQ zone and time (UTC). QSO points are determined by an exchange table available from ANARTS. Score is QSO points × DXCC entities + VK, JA, VE and W call districts + continents (counted only once; Antarctica not included). For more information: **anarts.com.au/rules2007.htm**. Logs due Sep 1 to **ctdavies@bigpond.net.au** or Contest Manager, Colin Davies, VK2CTD, PO Box 93, Toongabbie, NSW 2146, Australia.

Asia-Pacific Sprint — SSB, from 1100Z-1300Z Jun 10. Frequencies: 20 and 15 meters only (see Feb *QST*, p 100, or **jsfc.org/apsprint/aprule.txt**).

Portugal Day Contest — SSB, sponsored by Rede dos Emissores Portugueses (REP), from 0000Z-2400Z Jun 9. Frequencies: 80-10 meters. Categories: SOAB only. Exchange: RS + serial number or CT district or region abbreviation. QSO points: different country — 3 points, CT stations — 6 points. Score: QSO points × CT districts counted once per band. For more information: **www.rep.pt/pdf/contest_portugalday.pdf**. Logs due Sep 1 to **rep-concursos@rep.pt** or REP-Rede dos Emissores Portugueses, Award/Contest Manager, Rua D. Pedro V, Nº 7-4º, 1250-092 Lisboa, Portugal.

GACW WWSA CW DX Contest — sponsored by Grupo Argentino de Radiotelegrafia (GACW), from 1500Z Jun 9-1500Z Jun 10. Frequencies: 80-10 meters. Categories: SOAB and SOSB (QRP, LP, HP), MS, MM. Exchange: RST and CQ Zone. QSO points: own country — 0 points (mult credit only), different country — 1 point, different continent — 3 points, non-SA to SA — 5 points. Score is QSO points × zone + countries from DXCC/WAE/GACW lists. For more information: **gacw.no-ip.org**. Logs due Jul 15 to **auranito@speedy.com.ar** or GACW DX Contest, PO Box 9, B1875ZAA Wilde, Buenos Aires, Argentina.

This is the First-Class Operator's Club contest open to all. Get your Morse apparatus in good working order and join the fun!

Bill Windle QSO Party — CW, sponsored by First Class Operator's Club (FOC), from 0000Z-2359Z Jun 9 (also on Oct 13). Frequencies: 160-10 meters, 6 and 2 meters. Call CQ BW from 15 to 45 kHz above band edge. Open to all hams, not just FOC members. Exchange: RST and name or FOC number (if member). Report total QSOs with FOC members, counted once per band, FOC members report total QSOs and total FOC QSOs. For more information: **www.firstclasscw.org.uk**. QSO totals due 1 week after the contest to **kz5d@aol.com**.

June 16-17

Kids Day Operating Event — 1800Z-2400Z Jun 16 (see **www.arrl.org/FandES/ead/kd-rules.html**).

West Virginia QSO Party — CW/SSB, sponsored by the West Virginia State Amateur Radio Council from 1600Z Jun 16-0200Z Jun 17. Frequencies: 80-10 meters; CW — 35 kHz up from band edge, Phone — General class segment and Novice/Tech 10 meter segment. Categories: SO, MS, MM and Mobile (keep separate log each county), HP/LP/QRP and Phone/CW/Mixed all categories. County line stations count as 2 QSOs and 2 multipliers. Exchange: RS(T) and WV county or S/P/C. QSO points: WV Mobiles: CW — 3 points, SSB — 2 points; others: CW — 2 points, SSB — 1 point. Score: QSO points × WV counties (WV stations add S/P/C) counted only once. Bonuses: 100 points for QSOs with W8WVA on each band/mode; WV mobiles add 100 points per county activated with at least 1 valid QSO; 100 points for fixed stations working same Mobile in 5 WV counties. For more information: **www.qsl.net/wvsarc**. Logs due Jul 20 to **rldillon@aol.com** or Richard Dillon, K8VE, PO Box 1177, Buckhannon, WV 26201.

All-Asian DX Contest — CW, sponsored by the Japan Amateur Radio League from 0000Z Jun 16-2400Z Jun 17 (SSB — Sep 1-2). Frequencies: 160-10 meters (160 CW only), includes 10 minute band change rule. Categories: SOAB, SOSB, MO, Low Power (Asian stations only), Junior (JA stations <20 years), Senior (JA stations >70 years). Exchange: RS(T) and a 2 digit number denoting the operator's age; YL stations may send 00.

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

QSO points for non-Asian stations: 40-15 meters — 1 point, 80 and 10 meters — 2 pts, 160 meters — 3 pts. Score: QSO points × Asian prefixes (WPX rules). For more information and Asian station QSO points: **www.jarl.or.jp/English**. Logs due Jul 31 (Oct 31 for phone) to **aacw@jarl.or.jp** (SSB logs to **aaph@jarl.or.jp**) or JARL, All Asian DX Contest, Tokyo, 170-8073, Japan.

SMIRK QSO Party — CW/Phone, sponsored by the Six Meter International Radio Klub, 0000Z Jun 16-2400Z Jun 17. Frequencies: 6 meters. SO category only. No repeater QSOs. Exchange: SMIRK number and grid square. QSO points: SMIRK member — 2 points, non-member — 1 point. Score: QSO points × grid squares. For more information: **www.smirk.org**. Logs due Aug 1 to **aa5xe@ktc.com** or Dale Richardson, AA5XE, 214 Palo Verde Dr, Kerrville, TX 78028.

Quebec QSO Party — CW/Digital/Voice, sponsored by the Radio Amateurs du Quebec from 1700Z Jun 16-0300Z Jun 17. Frequencies: 80-2 meters, no repeater contacts. Categories: SOAB (150 W max), MO, QRP, VHF (QRP and VHF for VE2 and NA stations only). Exchange: RS(T) and Quebec region, or S/P/C; /MM send ITU zone. QSO points: Voice —1 point, CW/Digital — 2 points, VE2RIO —10 points. Score: QSO points × VE2 regions and ITU Zones counted once per band and mode. For more information: **www.raqi.ca/qqp**. Logs due 60 days after the contest to **qso-log@raqi.ca** or Radio Amateur du Quebec (QQP), 4545 Av Pierre-de-Coubertin, CP 1000, Succursale M, Montreal QC, Canada H1V 3R2.

Summer Meteor Scatter Contest — FSK441, sponsored by Radio Club "Golubinci," YT7GOL, from 2000Z Jun 15-2000Z Jun 17. Frequencies: 144 MHz. Categories: SO and MO. Exchange: call sign, report, final acknowledgement (ROGER). QSO points: 1 point/QSO. Score: QST points × DXCC entities. For more information and changes for US station rules: **solair.eunet.yu/~s.ilic/summer_msc.htm**. Logs due July 10 to **golmscont@ptt.yu**.

Spanish Islands Contest — CW/SSB/RTTY, sponsored by the Diploma Islas Españolas (DIE), from 0600Z-1200Z Jun 17. Frequencies: 80-10 meters. Exchange: RST + DIE number or serial number. QSO points: island stations — 2 points/QSO, otherwise 5 points/QSO. For more information: **www.ea5ol.net/die**. Logs due 60 days after the contest to **ea5aen@ure.es** or EA5AEN, Apartado 11055 de 46080, Valencia, Spain.

June 23-24

Field Day may not be a contest, but it certainly gave many contesters their start. Whether your club takes the competitive route or not, take time to help a new HF operator learn the ropes.

ARRL Field Day — 1800Z Jun 23-2100Z Jun 24 (see May *QST*, page 98 or **www.arrl.org/contests**)

His Majesty King of Spain Contest — SSB, 1200Z Jun 23-1200Z Jun 24 (see May *QST*, page 97).

QRP ARCI Milliwatt Field Day — 1800Z Jun 23-2100Z Jun 24. Follows ARRL Field Day rules. See **www.qrparci.org** for more information. QST

Are you interested in finding out more about contesting and "how they do it?" Try the free, biweekly e-mail newsletter *Contester's Rate Sheet* (**www.arrl.org/contests**), or the bi-monthly magazine *NCJ, National Contest Journal* (**www.ncjweb.com**).

US/Canada Section Abbreviation List

Those new to the ins and outs of Field Day will find this list of Section abbreviations useful — for those in the US and Canada, they're an important part of the FD exchange, along with station call sign and class. Be sure to bring a copy of this Section Abbreviation List with you to FD 2007.

1

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

2

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

3

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

4

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

5

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

6

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

7

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

8

Michigan	MI
West Virginia	WV
Ohio	OH

9

Illinois	IL
Wisconsin	WI
Indiana	IN

Ø

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

Canada

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

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

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

May 11-May 13, 1200Z-2300Z, Harwich, United Kingdom. GB4ØØAA events team, GB4ØØAA. 400th anniversary of ships setting out for America (UK side). 14.284 14.024 7.040 3.724. QSL. Tom Robinson, 2 Beacon Heights, St Osyth, Clacton-on-sea CO16 8JW, United Kingdom. **www.gb400aa.net**.

May 19, 1400Z-2100Z, Palestine, TX. Palestine/Anderson County Amateur Radio Club, K5PAL. Armed Forces Day. 21.325 14.250 7.250. Certificate. Tom Wardell, KB5YUE, 1706 West Point Tap, Palestine, TX 75803. *From the historical Texas State Railroad Park.* **K5PAL@arrl.net**.

May 24-May 28, 1500Z-0300Z, Indianapolis, IN. Indianapolis Motor Speedway Amateur Radio Club, W9IMS. 91st running of the Indianapolis 500. 21.340 14.240 7.240 3.840. QSL. Indianapolis Motor Speedway Amateur Radio Club, PO Box 18495, Indianapolis, IN 46218-0495. *Certificate and QSL available, see* **www.w9ims.com**.

May 26, 1300Z-2100Z, Wright Patterson AFB, OH. XWARN, W8XRN. Celebrate ARMAD & USAF 60th anniversary. 28.360 14.260 7.060. Certificate. WB8CEH, PO Box 546, Xenia, OH 45385-0546. **www.xwarn.net**.

May 26, 1600Z-2200Z, Pasadena, CA. Pasadena Radio Club, W6KA. The Pasadena Radio Club commemorates its 50th anniversary. 28.400 21.300 14.270 7.270 145.180 (PL 156.7). Certificate. Peter Fogg, c/o Pasadena Radio Club, PO Box 282, Altadena, CA 91003-0282. **www.qsl.net/w6ka**.

May 28, 1200Z-2200Z, Fayetteville, AR. ARKAN, W5T. Memorial Day Troop Train. 14.240. QSL. Joe Dunn, 12358 W Ervan Beeks Rd, Farmington, AR 72730. **www.arkansasmissouri-rr.com/passenger.html**.

May 28, 1200Z-2359Z, Nutley, NJ. Robert D. Grant United Labor Amateur Radio Assoc, N2UL. CQ Memorial Day, honoring our heroes. 28.420 14.260 449.975. Certificate. RDGULARA, c/o WA2VJA, 112 Prospect St, Nutley, NJ 07110-0716.

May 28, 1500Z-2200Z, Waterloo, IA. Five Sullivan Brothers Amateur Radio Club, WØFSB. Memorial Day Honoring All Veterans. 21.240 14.240 7.240. Certificate. Vernon Mc Nulty, 4015 Independence Ave, Waterloo, IA 50703. **t-mc-nulty@msn.com**.

Jun 1-Jun 2, 2300Z-0300Z, Newington, CT. Team ARRL, W1R. American Cancer Society Relay For Life. 21.350, 14.260. Certificate. Joel Kleinman, N1BKE, 225 Main St, Newington, CT 06111. **jkleinman@arrl.org**.

Jun 2, 1300Z-1800Z, Asheboro, NC. Randolph Amateur Radio Club, NC4ZO. North Carolina Aviation Museum Annual Fly-In. 21.350 14.260 7.250. Certificate. Randolph ARC, 6747 King Mountain Rd, Asheboro, NC 27205. **butch@atomic.net**.

Jun 2, 1400Z-2000Z, Tylertown, MS. Southwest Mississippi ARC, W5WQ. Celebration of Dairy Industry in Walthall County. 14.270 7.270. QSL. Homer Richardson, 1545 Friendship Lane NW, Brookhaven, MS 39601.**w5wq.com**.

Jun 2, 1600Z-2300Z, San Diego, CA. USS *Midway* CV-41 COMEDTRA, NI6IW. 65th anniversary of the Battle of Midway, June 4-7, 1942. 18.142 14.242 7.242. QSL. USS *Midway* Museum CV-41, 910 Harbor Dr, San Diego, CA 92101.

Jun 2-Jun 3, 1300Z-2200Z, Little Rock, AR. United States Power Squadrons Amateur Radio Net, N5R. National Safe Boating Week from the Sub USS *Razorback* at the Arkansas Inland Maritime Museum. 28.367 21.367 14.267 7.267. Certificate. Donald R. Stark, N3HOW, 65 Stark Spur, Eighty Four, PA 15330-2547. **stark84@earthlink.net**.

Jun 2-Jun 3, 1300Z-0700Z, San Diego, CA. Sponsored by KI6FDN and W6NWG, W6P. Hale Telescope on Palomar Mountain dedication anniversary. 14.260 7.260. QSL. Michelle Thompson, W5NYV, 5379 Carmel Knolls Dr, San Diego, CA 92130. **www.palomararc.org/special-event.htm**.

Jun 2-Jun 3, 1400Z-2200Z daily, East Providence, RI. Associated Radio Amateurs of Southern New England, W1AQ. 80th anniversary of the club's founding. 14.280. Certificate. ARASNE, 54 Kelly Ave, East Providence, RI 02916. **w1aq.com**.

Jun 2-Jun 10, 1300Z-2000Z, Baltimore, MD. Historical Electronics Museum Amateur Radio Club, W2W. The use of electronics in D-Day. 14.241 14.041 7.241 7.041. Certificate. HEMARC W2W D-Day Event, PO Box 746, Mail Stop 4015, Baltimore, MD 21203. **www.hemarc.us**.

Jun 5-Jun 10, 1500Z-0600Z, Edmonton, AB. John S. Melo, VC6CTCU. The arrival of the First Portuguese Immigrants to Edmonton. 14.200 7.155. Certificate. John S. Melo, VE6JDD, 5236 - 157 Ave NW, Edmonton, AB T5Y 2X6, Canada. **www.melo.ca**.

Jun 8-Jun 9, 2300Z-2300Z, Bloomfield, MO. Bootheel and SEMo Amateur Radio Clubs, WØS. Commemorating 146 years of the *Stars & Stripes* newspaper. 3.950 7.260 14.260. Certificate. Stars and Stripes, PO Box 98, Jackson, MO 63755.

Jun 9, 1300Z-1900Z, Bloomfield, NY. Rochester DX Association, W2RDX/6Ø. Rochester DX Association's 60th anniversary from the Antique Wireless Museum. All HF bands SSB CW AM on 3.885. QSL. Via bureau, LoTW or direct to Irwin J. Goodman, AF2K, 515 Drumm Rd, Webster, NY 14580-1579. **www.rdxa.com**.

Jun 9-Jun 10, 0000Z-2359Z, Honolulu, HI. Battleship *Missouri* Amateur Radio Club, KH6BB. Museum Ships Weekend Operations will be on *OPENIRLP* & HF. 28.463 21.363 18.163 14.263. QSL. Battleship *Missouri* Amateur Radio Club, 98-1547 Akaaka St, Aiea, HI 96701. **www.kh6bb.org.**

Jun 9-Jun 10, 0100Z-2359Z, Camden, NJ. Battleship *New Jersey* Amateur Radio Station, NJ2BB. Museum Ships Weekend Event Work. 18.150 14.270 14.040 7.250. QSL. Margaret Burgess, KB2BRR, 150 Schooner Ave, Barnegat, NJ 08005. *Special certificate for working 15 ships.* **www.nj2bb.org**.

Jun 9-Jun 10, 1400Z-2200Z, Manitowoc, WI. USS *Cobia* Radio Club/ManCoRad Radio Club, N9BQV. WWII Sub USS *Cobia* Museum Ships Afloat Weekend. 14.260 14.070 7.250 3.900. QSL. Fred Neuenfeldt, W6BSF, 4932 S 10th St, Manitowoc, WI 54220-9121. **www.w9dk.com**.

Jun 10-Jun 17, 1400Z-0300Z, Fountain Valley, CA. Fountain Valley RACES/FACT, N6F. 50th anniversary of the incorporation of Fountain Valley, CA. 21.260 14.260 7.260 3.860 2 m 6 m 70 cm. QSL. Fountain Valley RACES, 15849 Los Reyes St, Fountain Valley, CA 92708. **www.qsl.net/fvraces**.

Jun 11-Jun 26, 0400Z-0359Z, Atkinson, NH. Atkinson Amateur Radio, K1D. W1DAD and K1MOM Kids Day and Amateur Radio Field Day Awareness. 21.273 14.273. QSL. Peter Schipelliti, 7 Dearborn Ridge Rd, Atkinson, NH 03811. **w1dad@arrl.net**.

Jun 13-Jun 21, 1200Z-0400Z, Salt Lake City, UT. Rotarians of Amateur Radio, W7R. Rotary International Convention held in Salt Lake City. 21.310 14.293 7.280 3.955. QSL. Brett Sutherland, 860 W 1500 S, Woods Cross, UT 84087. **roar.mainlink.net.au**.

Jun 15-Jun 18, 1500Z-0300Z, Indianapolis, IN. Indianapolis Motor Speedway Amateur Radio Club, W9IMS. United States Grand Prix. 21.340 14.240 7.240 3.840. QSL. Indianapolis Motor Speedway Amateur Radio Club, PO Box 18495, Indianapolis, IN 46218-0495. *Certificate and QSL available; see* **www.w9ims.com**.

Jun 16, 1300Z-2000Z, New Suffolk, NY. Peconic Amateur Radio Club, W2AMC. New Suffolk School Centennial (little red 2-room schoolhouse). 14.270 7.270. QSL. Jim Baker, W2NSF, PO Box 9, New Suffolk, NY 11956. **w2nsf@arrl.net**.

Jun 16, 1500Z-2000Z, Mansfield, OH. Intercity Amateur Radio Club/Richland County ARES, W8WE. Pleasant Hill Safe Boating and Fishing Festival. 14.260 7.260. QSL. Robert Ruth, 2656½ Lexington Ave, Lexington, OH 44904. **kd8azq@iarc.ws**.

Jun 19-Jun 23, 0900Z-1700Z, Isle of Mull, Scotland. Clan MacLean Amateur Radio Society, GB2IMG/CMA. International Gathering of the Clan MacLean. 80-10m possible Echolink. QSL. Ian MacLean, GØBMH/N3XSA, Scotland. *GB2IMG from Duart Caster on June 23; GB2CMA from Aros Hall in Tobermory during June 19-22.* **www.cmars.org.uk**.

Jun 21-Jun 24, 1806Z-1806Z, Merchantville, NJ, Worldwide. Amateur Radio Lighthouse Society (ARLHS), KC2HOU. Lighthouse Summer Solstice Sweepstakes. 28.370 21.370 14.270 7.270 3.970. Certificate. ARLHS Hdq, 114 Woodbine Ave, Merchantville, NJ 08109. *This is not a contest. Do not send logs. See* **arlhs.com/SSSS-2007-guidelines.html**.

Jun 22-Jun 25, 0400Z-0400Z, Jupiter, FL. Jupiter Tequesta Repeater Group, W4J. Jupiter Tequesta Repeater Group 25th Anniversary. 146.625 444.225. QSL. Jupiter Tequesta Repeater Group, PO Box 7751, Jupiter, FL 33468. **www.jtrg.org**.

Jun 23-Jun 24, 1200Z-0000Z, Allegan, MI. Allegan County Amateur Radio Club, KC8ITU. 7th Annual West Michigan Fly In 2007. 28.450 21.350 14.273 7.200. QSL. Allegan County Amateur Radio, 708 W Franklin St, Otsego, MI 49078. **kc8itu@yahoogroups.com**.

Jun 23-Jun 24, 1900Z-1700Z, Woodland, CA. Yolo Amateur Radio Society, W6Y. Boy Scout Radio Daze at Field Day. Skeds via **k6kn@arrl.net**. 14.290 7.190 IRLP 5750 EL 107315. QSL. Bill Ragsdale, K6KN, PO Box 1500, Woodland, CA 95776. **yolobsa.editme.com/W6Y**.

Jun 30, 1800Z-2200Z, Los Alamos, NM. Los Alamos Amateur Radio Club, W5PDO. The Earthwatch Institute's Student Challenge Awards Program, from Fenton Hill Observatory. 28.450 21.350 14.250. Certificate. Don Casperson, AA5PA, 1423 43rd St, Los Alamos, NM 87544. **www.laa.lanl.gov/earthwatch**. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

2006 ARRL 160 Meter Contest Results

The mystique of Top Band can be irresistible!

Gary Breed, K9AY
k9ay@k9ay.com

This was my first time on 160 meters! To get on this contest, I was one of those guys crazy enough to whip something together the night before. I managed to get a 140 foot wire 20 feet vertically up into a tree. The rest of the antenna shoots over the second story of the house and ends about 20 feet up in a tree in the front yard by the curb. — Wayne Wagner, AA9DY

So I could operate the ARRL 160 meter contest, I designed a simple base loaded 31 foot vertical wire. This is supported by a 33 foot fiberglass pop-up mast that I strap (and duct tape) to a wooden post that is part of our small deck. I pop up the mast when it gets dark and take it down in the morning when the sun comes up. We have restrictions on antennas, and this antenna lets me operate my favorite contest. — Don Kirk, WD8DSB

Talk about enthusiasm! Wayne and Don were just two of 1053 entries by hams who could not resist the lure of the challenging and enigmatic 160 meter band. That's 3 percent more than 2005 and 10 percent higher than two years ago. While this may be expected at the bottom of the sunspot cycle, more hams are discovering 160 meters each year, and activity in this contest should remain high even after sunspots start to increase again.

Top 10 Highlights

The QRP winner was VY2ZM, with Jeff Briggs, K1ZM, at the helm of his impressive Prince Edward Island station. The result is a new QRP record, more than double the score of the previous record. Down in the "Lower 48," "Mike" Michael, W3TS, captured second place with a personal best, topping his own EPA section record. The best score from Out West was submitted by Gary Hembree, N7IR, capturing the fifth place spot from AZ.

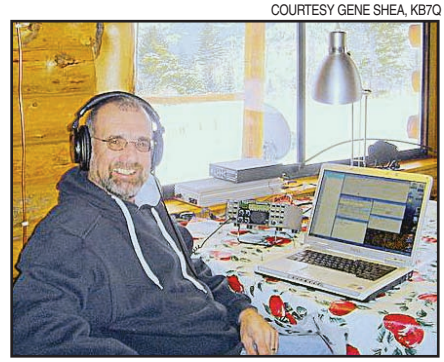
In the popular Low Power category (482 entries), Fred Helwig, K8FH, in Ohio came out on top by a decisive margin, followed by KØSF in Minnesota (operated by Jim Lageson, NØUR). Julius Fazekas, N2WN, in Tennessee captured the third spot. Not far behind in fourth place was the farthest-west of the Top 10, Gene Shea, KB7Q, operating portable in the snowy (and quiet) Montana mountains.

Tom Rauch, W8JI, led the always-competitive High Power category using South East Contest Club's W4AN club call at his Georgia station. John Sluymer, VE3EJ, also used a special call sign, CG3EJ, to place second from Ontario. Farther west in Illinois, John Battin, K9DX, snagged third place from his well-appointed station. The next four places were very close, with the scores of Peter Briggs, K3ZM; Richard King, K5NA; Bryan Bydal, W5MX, and John Rodgers, WE3C, having a spread of just 2 percent.

The multi-operator teams always seem to enjoy working together to find every possible QSO and multiplier, whether as a close-knit group, or one operator connected with his or her colleagues via a spotting network. The W2GD gang had a convincing victory this year, once again operating portable from their coastal New Jersey site. They were followed by a strong second place effort at W4MYA. The highest score away from East Coast allowed the team at NØNI in Iowa to finish in sixth place. In Colorado, Bill Johnson, KVØQ, and friends made the Top 10 list with a ninth place finish.

Although personal objectives, such as helping WAS totals, are often the goal of DX participants, a notable few make serious efforts. Their hard work and operating skill provides a new multiplier for many competitors, including low power and QRP stations. PJ2T, operated by Jeff Maass, K8ND, was

COURTESY GENE SHEA, KB7Q



Gene Shea, KB7Q, hauled his radio, generators and a tank of helium up to his Montana mountain cabin near Yellowstone Park for the 2006 ARRL 160 Meter Contest.

Top 10

Single Operator QRP

VY2ZM	199,662
W3TS	75,584
N8BB	55,974
W8VK	55,556
N7IR	54,936
KØPK	46,020
W4TMR	35,807
WA2RZJ	34,574
KA1LMR	34,370
K4ORD	27,293

Single Operator, Low Power

K8FH	204,510
KØSF (NØUR op)	171,040
N2WN	168,345
KB7Q	161,622
NØFP	144,924
WA4PGM	142,560
WO4O	131,784
K9OT	128,000
K1PX	127,156
NØAT	121,212

Single Operator, High Power

W4AN (W8JI op)	443,016
CG3EJ	360,009
K9DX	331,436
K3ZM	310,750
K5NA	310,692
W5MX	304,290
WE3C	298,430
WØSD	262,105
K9AY	250,700
K5BG	250,610

Multioperator

W2GD	429,641
W4MYA	394,247
NO2R	361,364
AA1K	350,980
K1LT	333,888
NØNI	319,800
W9AZ	282,999
K1TTT	276,134
KVØQ	266,538
KE9I	260,728

Top DX Scores

Single Operator QRP

JH4UYB	18

Single Operator, Low Power

HI3A	100,196
C6AQQ (ND3F op)	81,834
HKØGU (DL7VOG op)	30,798
PS7DX	6,724
JE1SPY	1,892
HP3XUG	1,488

Single Operator, High Power

PJ2T (K8ND op)	179,102
P4ØTA (K6TA op)	83,638
GIØKOW (GI3NWG op)	38,272
ZF2AH	31,464
F6CWN (F6FGZ op)	23,782
IK1YDB	6084
JH2FXK	5916

Multioperator

OM3GI	9,828
LY2IJ	9,112
ES5Q	8,784
JA3YBK	7,920
IQ2CJ	4,032
UU7J	3,968

Affiliated Club Competition

	Score	Entries
Unlimited		
Potomac Valley Radio Club	4,742,793	75
Society of Midwest Contesters	4,231,162	58
Minnesota Wireless Assn	3,019,700	59
Medium		
Frankford Radio Club	2,939,387	31
Yankee Clipper Contest Club	2,120,456	43
Tennessee Contest Group	2,011,258	26
South East Contest Club	1,708,603	18
Northern California Contest Club	1,468,075	44
Contest Club Ontario	1,265,308	27
Mad River Radio Club	1,096,199	15
Hudson Valley Contesters	820,279	11
Florida Contest Group	660,620	14
Western Washington DX Club	455,736	12
Local		
North Texas Contest Club	524,226	3
Grand Mesa Contesters of	437,551	10
Central Texas DX and Contest	411,409	7
Kansas City DX Club	401,218	5
Medina 2 Meter Group	359,980	5
Alabama Contest Group	353,362	8
Carolina DX Assn	303,156	5
Spokane DX Assn	298,016	3
North Coast Contesters	280,730	5
Southern California Contest	272,091	9
Western New York DX Assn	242,765	5
West Park Radiops	155,319	8
Order of Boiled Owls	134,892	3
Redmond Top Key Contest Club	116,975	3
Motor City Radio Club	98,191	3
Kentucky Contest Group	98,040	4
Central Arizona DX Assn	95,034	3
Rochester (NY) DX Assn	49,168	3
Dominion DX Group	23,982	3
CTRI Contest Group	14,676	3
Florida Contest Group	8,197	3

Regional Leaders

Northeast Region
(New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

VY2ZM	199,662	783	107	A
W3TS	75,584	590	64	A
WA2RZJ	34,574	293	59	A
KA1LMR	34,370	240	70	A
KR2Q	25,032	302	42	A
K1PX	127,156	752	83	B
N1RL	97,736	629	76	B
N2ZX	91,104	617	73	B
K1EP	89,217	640	69	B
K3WI	79,127	586	67	B
WE3C	298,430	1239	110	C
W3BGN	250,496	1129	103	C
N3KS	248,574	1129	102	C
VE2TZT	206,024	1109	91	C
W3GH	183,825	940	95	C
W2GD	429,641	1491	127	D
NO2R	361,364	1268	122	D
AA1K	350,980	1425	115	D
K1TTT	276,134	1313	101	D
K3WW	257,050	1139	106	D

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

W4TMR	35,807	292	61	A
K4ORD	27,293	277	49	A
KW4JS	23,058	215	54	A
KC4AUF	14,952	194	42	A
K4UK	14,274	184	39	A
N2WN	168,345	949	87	B
WA4PGM	142,560	881	80	B
WO4O	131,784	869	76	B
KA9EKJ	104,335	693	77	B
K4CNW	88,844	570	76	B
W4AN	443,016	1535	126	C
K3ZM	310,750	1249	113	C
W5ZN	227,240	1214	92	C
N4XD	206,415	1013	99	C
AF4OX	197,695	1011	95	C
W4MYA	394,247	1528	119	D
N4PN	258,774	1204	102	D
W0UCE	246,089	1238	97	D
K1ZZI	229,710	1182	95	D
WD5R	202,952	1086	92	D

Central Region
(Central and Great Lakes Divisions; Ontario Section)

N8BB	55,974	492	57	A
W8VK	55,556	413	68	A
AD9T	22,086	206	54	A
KM4CH	19,680	213	48	A
K8LN	19,350	194	50	A
K8FH	204,510	1190	85	B
K9OT	128,000	796	80	B
K8BL	113,600	706	80	B
NE9U	110,475	739	75	B
K2AAW	109,964	753	74	B
CG3EJ	360,009	1434	117	C
K9DX	331,436	1643	98	C
W5MX	304,290	1397	105	C
K9AY	250,700	1341	92	C
AD8P	245,716	1276	94	C
K1LT	333,888	1427	111	D
W9AZ	282,999	1509	93	D
KE9I	260,728	1401	92	D
W0AIH	236,918	1325	89	D
W8MJ	231,768	1319	87	D

Midwest Region
(Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

KØPK	46,020	354	65	A
N2AWE	20,935	210	53	A
KØHW	18,540	215	45	A
WØRSP	18,048	190	48	A
W5ESE	13,489	144	47	A
KØSF	171,040	1070	80	B
NØFP	144,924	925	78	B
NØAT	121,212	779	78	B
K7RE	121,044	795	77	B
KØTT	111,496	722	77	B
K5NA	310,692	1410	102	C
WØSD	262,105	1444	89	C
K5BG	250,610	1259	95	C
K5TR	200,187	1119	87	C
NØTT	199,070	1156	85	C
NØNI	319,800	1539	100	D
KVØQ	266,538	1351	93	D
W5TM	222,390	1213	90	D
WØGG	153,804	909	84	D
KDØS	130,240	806	80	D

West Coast Region
(Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

N7IR	54,936	372	72	A
N6WG	15,795	206	39	A
K6EI	12,580	185	34	A
K7TQ	7,980	117	35	A
NU7T	5,368	124	22	A
KB7Q	161,622	976	82	B
NT6K	109,109	703	77	B
W7RH	99,630	572	82	B
W7DX	96,876	587	81	B
N6RK	93,210	560	78	B
K7RL	160,440	903	84	C
K7BG	153,633	884	83	C
WA7LT	150,360	858	84	C
AC6DD	139,635	716	87	C
VE7CC	137,531	765	83	C
N7GP	191,610	1015	90	D
N6DZ	147,552	769	87	D
K7OX	128,000	771	80	D
N6RO	94,405	576	79	D
W9NGA	84,864	474	78	D

Division Leaders

Single Operator QRP

Atlantic	W3TS	75,584
Central	AD9T	22,086
Dakota	KØPK	46,020
Delta	KW4JS	23,058
Great Lakes	N8BB	55,974
Hudson	KR2Q	25,032
Midwest	N2AWE	20,935
New England	KA1LMR	34,370
Northwestern	K7TQ	7,980
Pacific	N6WG	15,795
Roanoke	W4TMR	35,807
Rocky Mountain	W5GZ	10,332
Southeastern	N4YQ	3,900
Southwestern	N7IR	54,936
West Gulf	W5ESE	13,489
Canada	VY2ZM	199,662

Single Operator High Power

Atlantic	WE3C	298,430
Central	K9DX	331,436
Dakota	WØSD	262,105
Delta	W5ZN	227,240
Great Lakes	W5MX	304,290
Hudson	K2XA	131,120
Midwest	NØTT	199,070
New England	W1SJ	141,988
Northwestern	K7RL	160,440
Pacific	W7DR	95,840
Roanoke	K3ZM	310,750
Rocky Mountain	W6PU	144,222
Southeastern	W4AN	443,016
Southwestern	AC6DD	139,635
West Gulf	K5NA	310,692
Canada	CG3EJ	360,009

Single Operator Low Power

Atlantic	K3WI	79,127
Central	K9OT	128,000
Dakota	KØSF	171,040
Delta	N2WN	168,345
Great Lakes	K8FH	204,510
Hudson	N2ZX	91,104
Midwest	NØPB	76,425
New England	K1PX	127,156
Northwestern	KB7Q	161,622
Pacific	NT6K	109,109
Roanoke	WA4PGM	142,560
Rocky Mountain	WØETT	69,692
Southeastern	KA9EKJ	104,335
Southwestern	W7RH	99,630
West Gulf	WØUO	101,752
Canada	VE5UF	110,160

Multioperator

Atlantic	W2GD	429,641
Central	W9AZ	282,999
Dakota	KDØS	130,240
Delta	WD5R	202,952
Great Lakes	K1LT	333,888
Hudson	NO2R	361,364
Midwest	NØNI	319,800
New England	K1TTT	276,134
Northwestern	K7OX	128,000
Pacific	N6DZ	147,552
Roanoke	W4MYA	394,247
Rocky Mountain	KVØQ	266,538
Southeastern	N4PN	258,774
Southwestern	N7GP	191,610
West Gulf	W5TM	222,390
Canada	VE2OJ	131,377

the top scoring DX station, while low power entry Julio Henriquez, HI3A, was next best, ahead of fellow low power competitor, C6AQQ, operated by Brian Skutt, ND3F. GIØKOW, piloted by Andrew Williamson, GIØNWG, topped all European entries, giving 376 US/VE stations the Northern Ireland multiplier. P4ØTA, operated by Ken Anderson, K6TA, was tops from South America, while ZL6QH, operated by the Wellington Amateur Radio Club, fought poor conditions and noise to make 15 QSOs, the best from Oceania. Multi-op JA3YBK, followed by single-op Shigeru Tsukeshiba, JH2FXK, were the top scorers from Asia, where 22 entries nearly matched the 27 logs submitted from Europe.

Geographical Notes

Analyzing the results provides some insight into the dynamics of Top Band conditions and activity. In the High Power category, only three of the Top 10 can be considered East Coast stations; five were in the Central Time Zone. The Low Power category had the same general pattern, with four representatives from the Upper Midwest, and fourth place achieved from Montana.

At first glance, the QRP results look skewed to the East, but that is probably related to activity more than anything else. After all, fifth place finisher N7IR, was the farthest-west station to make any of the Top 10 lists. It is probably fair to say that the multi-op results did favor the eastern US and its shorter path to European QSOs and multipliers, but the Top 10 also includes strong efforts from the central part of the country.

The strong performances by many stations in the eastern and central parts of the US can be credited to the high level of activity in that area of the country. Sections with the most entries were Eastern Pennsylvania, Illinois, Indiana, Michigan, Ontario, Tennessee and Virginia. That's a lot of easy contacts if you are within a one-hop distance.

As a single band contest, the pool of available QSOs is steadily drained by well-equipped stations and competitive operators. Having lots of stations on the air keeps everyone busy for a longer time, even in years when conditions may not be the best.

Another contributor to this contest's appeal is its combination of US/VE and DX participation. The availability of DX contacts and multipliers is often considered a "bonus" enjoyed mainly by big stations and those with advantageous locations near the Atlantic Ocean. Although conditions in the 2006 contest were not spectacular, propagation was good enough to reach inland fairly well. Seventeen stations collected 100 multipliers or more. Richard King, K5NA, in Texas and multi-op NØNI in Iowa were part of that elite club. While the others were all in the Eastern Time Zone, not all were near the coast, such as Victor Kean, K1LT, in Ohio and Bryan Bydal, W5MX, in Kentucky.

Finally, if you were not a participant in the 2006 ARRL 160 Meter Contest, join the fun later this year (November 30-December 2). If you need help, these clubs and the many individual hams who enjoy Top Band are ready and willing to lend a hand! QST

2006 ARRL Phone Sweepstakes Results

Kelly Taylor, VE4XT
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The Sweepstakes contest has its roots in the earliest days of Amateur Radio. Its exchange — made to resemble a message header — harkens back to the birth of the American Radio Relay League. And yet, almost a century later, the radios may have changed — with digital IFs replacing the galena crystals and drifty regens of old, when computers do in less than a second what took weeks before, when hundreds of stations can fit in the bandwidth of a single spark gap — one of Amateur Radio's oldest contests remains one of its most popular.

This year, a combined 1541 stations racked up a total 505,065 QSOs. And this isn't even a busy year, with the sunspots still on vacation. Much of that must be due to the accessibility of Sweepstakes. It's not a DX contest, so it's one of few majors where a New England location can actually be a hindrance. That it's not a DX contest means many superstations are at a disadvantage. And that it's not a DX contest means even modest stations can rack up impressive — and competitive — scores.

That it's domestic also means that winners can come from all over. Art Hambleton, K1BX, drove his New Hampshire station to the top of Low Power. Al Sinopoli, KC5R, won QRP from Louisiana, with Doug Zwiebel, KR2Q, from New Jersey right behind him. Mitch Mason, K7RL, took Unlimited from Washington, and the Mount Frank Contesters at K9NS won Multioperator from Illinois. The Hesston College Amateur Radio Club, KØHC, rang up its second consecutive school club victory from Kansas. And, of course, Rich Boyd, KE3Q, operating WP3R in Puerto Rico claimed his eighth High Power victory.

High Power

With another Sweepstakes comes another WP3R victory. Rich, KE3Q, has again proven his operating skills. His Arecibo location has what it takes to be top of the field, having won every Sweepstakes since he started going down there in 1999.

Rich's own prediction that 2006 was the year he'd be most vulnerable just didn't come true. Granted, it was a prediction dismissed out of hand by challengers George Fremin, K5TR, and Bill Kollenbaum, K4XS, but Rich thought the absence of high bands last year would give the Gulf Coast stations (such as Pat Sonnier, W5WMU, or K5TR) an advantage on 40 and 80 meters.

As far as single operators go, George, K5TR, is once again the winner of the "every-body-except-Rich" category, placing second in the B category as he has done regularly for some time. In third place was another Caribbean station, this being KP2TM (Tim Mitchell, K9TM, op) from the US Virgin Islands. With Tim only 3200 points, or 20 contacts, behind George, 2007 could shape up as the key battle in all of Sweepstakes.

Top 10

Single Operator, QRP

KC5R	100,800
KR2Q	82,082
N8IE	73,872
K8IR	66,676
NA4BW	64,834
KØFRP	63,048
NX9T	54,604
VE6CNU	52,822
KØHW	52,500
KA1LMR	52,140

Single Operator, Low Power

K1BX	199,520
KØUK	197,600
N4PN	196,320
VE6EX	190,880
AJ9C	190,240
WA3A	188,160
N6NF	183,040
ACØW	164,800
NØKK	162,240
K1HTV	162,240

Single Operator, High Power

WP3R	364,800
K5TR	314,400
KP2TM	311,200
KDØS	295,840
W7WA	295,840
W6NL	282,720
K6NA	276,800
W5KFT	271,520
N6BV	271,200
N5AA	260,960

Single Operator, Unlimited

K7RL	282,240
NI1N	264,640
W7RN	246,880
WB1GQR	242,880
K6XX	241,120
W4NF	229,760
W8MJ	228,000
K3MM	227,520
N3KS	221,760
K7OX	211,224

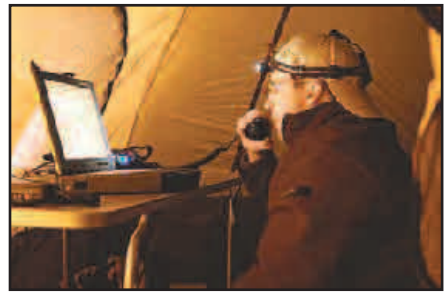
Multioperator

K9NS	321,440
W6YI	299,200
N2NT	289,280
K8BB	250,720
KTØR	246,720
KØFJ	228,640
K2NNY	225,120
NI7T	221,120
KA1ARB	212,640
N3OC	212,000
NK7U	212,000

School Club

KØHC	222,400
N9UC	109,280
W5YM	104,438
W8SH	93,170
W6RFU	69,264
K4KDJ	60,372
W3ABT	51,948
KD5VVI	47,196
WA5BU	42,712
KU5B	37,762

COURTESY ROBERT HIGLEY, N4YQ



Robert Higley, NY4Q, and Daniel Mitchell, KG4ADS, operated Sweepstakes from a tent with battery power.

COURTESY FRANK MACKENZIE-LAMB, NG1I

Frank Mackenzie-Lamb, NG1I, worked the contest with only a G5RV on high power. He says it was his best effort yet and he looks forward to next year.

Affiliated Club Competition

Category/Club	*Score*	*Entries*
Unlimited		
Potomac Valley Radio Club	20,585,820	290
Northern California Contest Club	20,016,034	260
Society of Midwest Contesters	12,620,118	220
Minnesota Wireless Assn	6,829,358	104
Yankee Clipper Contest Club	5,484,622	83
Mad River Radio Club	4,765,040	57
Florida Contest Group	3,266,336	56
Medium		
South East Contest Club	3,062,328	36
Southern California Contest Club	2,832,074	31
Western Washington DX Club	2,257,670	26
Tennessee Contest Group	2,037,186	30
Central Texas DX and Contest Club	1,991,826	22
Frankford Radio Club	1,978,064	34
Contest Club Ontario	1,930,868	40
Grand Mesa Contesters of Colorado	1,659,776	18
Hudson Valley Contesters and	1,114,126	21
Kentucky Contest Group	1,058,512	14
Oklahoma DX Assn	1,033,270	11
Rochester (NY) DX Assn	829,742	13
Motor City Radio Club	786,766	25
CTRI Contest Group	734,520	14
Central Arizona DX Assn	655,536	11
Order of Boiled Owls of New York	541,142	11
West Park Radiops	272,248	15
Local		
New Mexico Big River Contesters	1,085,752	10
Saskatchewan Contest Club	944,164	10
Florida Contest Group - Panhandle	799,042	8
North Texas Contest Club	777,082	8
Utah DX Assn	700,682	6
Maritime Contest Club	665,680	7
Spokane DX Association	630,146	6
North Coast Contesters	525,350	9
Willamette Valley DX Club	516,210	9
Kansas City DX Club	491,680	4
Alberta Clippers	420,662	3
Northern Rockies DX Association	344,100	4
Carolina DX Assn	334,942	6
East Coast Canada Contest Club	333,026	6
MIT Radio Society	329,636	5
Lincoln ARC	267,278	3
BC DX Club	258,120	3
Dominion DX Group	245,948	9
Northern Arizona DX Assn	230,392	5
Bay Area Wireless Assn	217,096	3
North Hills Amateur Radio Contest	216,272	3
Medina 2 Meter Group	208,802	3
Alabama Contest Group	151,440	3
Cherryland ARC	149,992	3
University of Pennsylvania ARC	141,250	3
Sussex County ARC	123,808	5
Fort Smith Area ARC	123,306	3
Northeast Maryland Amateur Radio	122,310	6
Sterling Park ARC	120,532	4
Caribbean Contesting Consortium	119,700	3
Green River Valley ARS	119,474	4
Western New York DX Assn	103,638	4
Woodbridge Wireless	100,380	3
Radio Club of Tacoma	98,410	4
Bergen ARA	95,830	7
Meriden ARC	93,992	4
Southern California DX Club	79,612	4
Portage County Amateur Radio	78,240	3
Redmond Top Key Contest Club	75,446	3
Eastern Iowa DX Assn	70,264	3
Texas DX Society	65,508	4
Southwest Ohio DX Assn	61,914	3
South Jersey Radio Assn	60,672	3
Trojan ARC	59,380	3
Great South Bay ARC	46,908	3
Hazel Park ARC	33,528	3
Downey ARC	30,038	3
Alexandria Radio Club	23,794	3
East Coast DX Assn	6,640	3

Low Power

Art Hambleton, K1BX, was "blown away" to hear he outlasted Bill Brown, KØUK, to take top spot in Low Power. "I don't know what happened to KØUK, because he was about 50 contacts ahead of me," Art said.

With his win, Art has gone against history. Typically, New England stations do not place well in Sweepstakes. While they can often crack the Top 10 or even Top 5, it isn't often a K1 has claimed the Number 1 spot. Bill's Colorado location is usually an advantage, so Art's accomplishment is even more impressive. But it was hard-fought to the last contact, with Art finishing with just a 1920 point lead. That's a mere 12 contacts.

The fight for second was won by an even smaller margin, with Bill edging out Paul Newberry, N4PN, by only eight contacts. Two stations fought to the closest of margins — zero points. Both Kirk Pengelly, NØKK, and Richard Zwirko, K1HTV, scored 162,240 points (a similar draw decided the bottom of Multioperator Top 10).

Unlimited

Notable by his absence was Dave Hachadorian, K6LL, who has had a stranglehold on this category for a number of years. Coming up strong in his place, however, was Mitch Mason, K7RL, whose 282,240 points beat second place Tom McAlee Jr, NI1N, by roughly 18,000 points. "With so many great ops and competitive stations around the country, I am very grateful to achieve my first Sweepstakes win," Mitch said.

Mitch explains why this is one of his favorite contests: "Sweepstakes, in my opinion, is the most challenging contest of them all with the long exchange," he said. "Add that to a solar cycle low, with extremely crowded 20 and 40 meter bands, and you have the perfect ingredients to test the abilities of an operator physically, mentally and emotionally."

Mitch's aluminum farm is impressive. He's grown a 135 foot rotating monopole with three tribanders, and two 40 meter beams and an 80 meter beam at 100 feet. Another tower holds another 40 meter 2-element Yagi and a 3-element multibander. A pair of 140 foot trees provided support for a cage vertical for 160 meters, fed against five elevated radials.

2006 ARRL November Phone Sweepstakes Plaque Winners

Thanks to the generous sponsorship of numerous clubs, individuals and ICOM — principal awards sponsor for the 2006 ARRL November Sweepstakes— we are pleased to announce that the Overall and Division leaders in each category receives a sponsored Sweepstakes plaque. Many thanks to the sponsors for their continued commitment to the ARRL Plaque Program. Without their support and dedication, the Plaque program would not be possible.

Division/Plaque	*Winner*	*Plaque Sponsor*
Overall		
Single Operator High Power Phone	WP3R (KE3Q, op)	Mike Fatchett, WØMU
Single Operator Low Power Phone	K1BX	Ken Adams, K5KA
Single Operator QRP Phone	KC5R	QRP Amateur Radio Club International
Single Operator Unlimited Phone	K7RL	ICOM
Multioperator Phone	K9NS	ICOM
School Club Phone	KØHC	ICOM
Atlantic		
Single Operator High Power Phone	KD4D	ICOM
Single Operator Low Power Phone	WA3A	Potomac Valley Radio Club
Single Operator QRP Phone	K3SWZ	ICOM
Single Operator Unlimited Phone	K3MM	ICOM
Multioperator Phone	K2NNY	Mark Sickmeyer, KB3GJ Memorial
School Club Phone	W3ABT (K3BHX, op)	ICOM
Central		
Single Operator High Power Phone	K9BGL	ICOM
Single Operator Low Power Phone	AJ9C	ICOM
Single Operator QRP Phone	KC9AMM	ICOM
Single Operator Unlimited Phone	K9CT	ICOM
Multioperator Phone	K9NS	ICOM
School Club Phone	N9UC (WO9S, op)	ICOM
Dakota		
Single Operator High Power Phone	KDØS	Minnesota Wireless Association
Single Operator Low Power Phone	ACØW	Minnesota Wireless Association
Single Operator QRP Phone	KØHW	Tod Olson, KØTO
Single Operator Unlimited Phone	KØHB	Minnesota Wireless Association
Multioperator Phone	KTØR	In Memory of Jim Dokmo, KØFVF Minnesota Wireless Association
Delta		
Single Operator High Power Phone	W5WMU	ICOM
Single Operator Low Power Phone	AE5T	ICOM
Single Operator QRP Phone	KC5R	ICOM
Single Operator Unlimited Phone	N4OGW	ICOM
Multioperator Phone	KG5VK	ICOM
School Club Phone	W5YM	ICOM
Great Lakes		
Single Operator High Power Phone	K8AO	ICOM
Single Operator Low Power Phone	K8BL	Mad River Radio Club
Single Operator QRP Phone	N8IE	Mad River Radio Club
Single Operator Unlimited Phone	W8MJ	ICOM
Multioperator Phone	K8BB (+WD8S)	ICOM
School Club Phone	W8SH	ICOM
Hudson		
Single Operator High Power Phone	W2OIB	ICOM
Single Operator Low Power Phone	W2ID	ICOM
Single Operator QRP Phone	KR2Q	ICOM
Single Operator Unlimited Phone	NN2W (NY6DX, op)	ICOM
Multioperator Phone	N2NT	ICOM
School Club Phone	K2GQ	ICOM
Midwest		
Single Operator High Power Phone	WØCEM	ICOM
Single Operator Low Power Phone	NØAC	ICOM
Single Operator QRP Phone	KIØOV	ICOM
Single Operator Unlimited Phone	KØOU	ICOM
Multioperator Phone	KØFJ	ICOM
School Club Phone	KØHC	ICOM

Division/Plaque	*Winner*	*Plaque Sponsor*
New England		
Single Operator High Power Phone	KK1L	ICOM
Single Operator Low Power Phone	K1BX	CTRI Contest Group
Single Operator QRP Phone	KA1LMR	ICOM
Single Operator Unlimited Phone	WB1GQR (W1SJ, op)	ICOM
Multioperator Phone	W1AW	ICOM
School Club Phone	W1AF	ICOM
Northwestern		
Single Operator High Power Phone	W7WA	ICOM
Single Operator Low Power Phone	N7WI	ICOM
Single Operator QRP Phone	N4SL	ICOM
Single Operator Unlimited Phone	K7RL	ICOM
Multioperator Phone	NK7U (+KL2A)	ICOM
Pacific		
Single Operator High Power Phone	W6NL (N6KT, op)	ICOM
Single Operator Low Power Phone	N6NF	ICOM
Single Operator QRP Phone	N6WG	ICOM
Single Operator Unlimited Phone	W7RN (WX5S,op)	ICOM
Multioperator Phone	W6YX	ICOM
Roanoke		
Single Operator High Power Phone	NN3W	Potomac Valley Radio Club
Single Operator Low Power Phone	KZ2I	Raleigh Amateur Radio Society - W4DW
Single Operator QRP Phone	NX9T	NoVa QRP Group
Single Operator Unlimited Phone	NI1N	ICOM
Multioperator Phone	KA1ARB (+WB1ADR)	ICOM
School Club Phone	K4KDJ	ICOM
Rocky Mountain		
Single Operator High Power Phone	K5TA	ICOM
Single Operator Low Power Phone	K0UK	ICOM
Single Operator QRP Phone	KØFRP	Colorado QRP Club
Single Operator Unlimited Phone	WØZA	ICOM
Multioperator Phone	NI7T	ICOM
Southeastern		
Single Operator High Power Phone	WP3R (KE3Q, op)	ICOM
Single Operator Low Power Phone	N4PN	ICOM
Single Operator QRP Phone	NA4BW	ICOM
Single Operator Unlimited Phone	N4LR	ICOM
Multioperator Phone	WW4LL	ICOM
School Club Phone	KU5B	ICOM
Southwestern		
Single Operator High Power Phone	K6NA (N6ED, op)	ICOM
Single Operator Low Power Phone	WA0KDS	ICOM
Single Operator QRP Phone	KE6K	ICOM
Single Operator Unlimited Phone	W6TK	ICOM
Multioperator Phone	W6YI	ICOM
School Club Phone	W6RFU	ICOM
West Gulf		
Single Operator High Power Phone	K5TR	Ken Adams, K5KA
Single Operator Low Power Phone	WD5K	Ralph "Gator" Bowen, N5RZ
Single Operator QRP Phone	WA8ZBT	ICOM
Single Operator Unlimited Phone	N5ZC	ICOM
Multioperator Phone	KBØHH	ICOM
School Club Phone	KD5VVI	ICOM
Canada		
Single Operator QRP Phone	VE6CNU	ICOM
Single Operator High Power Phone	VY2TT (K6LA, op)	ICOM
Single Operator Low Power Phone	VE6EX	ICOM
Single Operator Unlimited Phone	VE5UF	ICOM
Multioperator Phone	VO2WL	ICOM

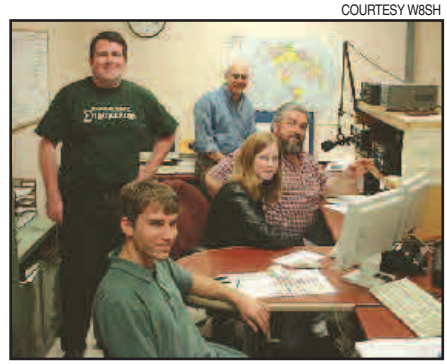
Top 5
Boxes list call sign, score and class (Q = QRP, A = Low Power, B = High Power, U=Unlimited, M = Multioperator)

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)		
VY2TT	257,440	B	WP3R	364,800	B	K9BGL	206,560	B	K5TR	314,400	B	W7WA	295,840	B
KD4D	249,440	B	KP2TM	311,200	B	K9GX	199,360	B	KDØS	295,840	B	W6NL	282,720	B
KK1L	228,784	B	W5WMU	253,280	B	K8AO	197,652	B	W5KFT	271,520	B	K6NA	276,800	B
K3ZO	228,640	B	N4OX	246,400	B	N8VW	186,240	B	N5AA	260,960	B	N6BV	271,200	B
W1XX	200,772	B	NN3W	241,280	B	WB9Z	180,752	B	VE4XT	186,560	B	WC6H	256,480	B
K1BX	199,520	A	N4PN	196,320	A	AJ9C	190,240	A	KØUK	197,600	A	VE6EX	190,880	A
WA3A	188,160	A	KZ2I	150,080	A	VA3DX	154,720	A	ACØW	164,800	A	N6NF	183,040	A
K1HTV	162,240	A	K4EJ	133,440	A	N9AX	135,680	A	NØKK	162,240	A	WAØKDS	128,640	A
K1PY	131,976	A	N8II	126,126	A	KØPJ	113,920	A	NØAC	156,894	A	W7ZR	124,000	A
W2ID	114,348	A	AE5T	113,600	A	KB9OWD	107,840	A	WD5K	151,520	A	K7HP	102,700	A
KR2Q	82,082	Q	KC5R	100,800	Q	N8IE	73,872	Q	KØFRP	63,048	Q	VE6CNU	52,822	Q
KA1LMR	52,140	Q	NA4BW	64,834	Q	K8IR	66,676	Q	KØHW	52,500	Q	N4SL	34,160	Q
K3SWZ	49,950	Q	NX9T	54,604	Q	VA3JNO	45,844	Q	KIØOV	48,618	Q	N6WG	23,552	Q
NK8Q	44,696	Q	NØHT	35,140	Q	AI4BJ	25,116	Q	WA8ZBT	38,908	Q	KE6K	17,400	Q
N3YD	37,762	Q	(N3JW, op)			KT8K	24,960	Q	WØETT	26,752	Q	WA7PVE	5,616	Q
			KI3O	30,820	Q									
WB1GQR	242,880	U	NI1N	264,640	U	W8MJ	228,000	U	KØOU	193,440	U	K7RL	282,240	U
K3MM	227,520	U	W4NF	229,760	U	K9CT	184,800	U	WØZA	181,740	U	W7RN	246,880	U
N3KS	221,760	U	K2WK	198,720	U	N2BJ	184,640	U	VE5UF	167,840	U	K6XX	241,120	U
W3PP	203,040	U	N4LR	172,960	U	W9IU	164,160	U	KØHB	140,160	U	K7OX	211,224	U
K2PLF	188,800	U	N4BAA	161,760	U	KI9A	157,440	U	KO7X	126,880	U	N6NZ	204,800	U
N2NT	289,280	M	KA1ARB	212,640	M	K9NS	321,440	M	KTØR	246,720	M	W6YI	299,200	M
K2NNY	225,120	M	W4MYA	189,120	M	K8BB	250,720	M	KØFJ	228,640	M	NK7U	212,000	M
N3OC	212,000	M	WW4LL	172,640	M	N8HR	201,600	M	NI7T	221,120	M	N7PP	158,720	M
W1AW	183,680	M	KG5VK	165,268	M	K9ZO	198,240	M	W7TBG	187,200	M	W6YX	152,800	M
W1MKY	149,600	M	K4TS	161,120	M	ND8DX	186,400	M	KØFVF	133,280	M	WA7U	127,608	M

Mitch's advice for up-and-comers is to not focus on other people's serial number. "It may be good for gauging performance at that point in time, but with variable band conditions and time-off periods, numbers can be misleading," he said. Getting discouraged at another's early high numbers and quitting could deprive you of the opportunity to pull ahead. It's advice that has paid off.

The Nevada Association of Contest Highland Operators, club station, W7RN, was third in Unlimited, while the Vermont Contest Radio Club, WB1GQR, and Bob Wolbert, K6XX, fought one of the closest battles in Sweepstakes. WB1GQR edged out K6XX for fourth by only 1760 points.

COURTESY W8SH



With a clean sweep and over 700 contacts in the log, this year's Sweepstakes effort from the Michigan State University club station, W8SH, was a big success.

QRP

Another first-time winner is Al Sinopoli, KC5R, who took top spot in QRP by a large margin. For Al, it's also his first time operating with some serious hardware. "This year I was fortunate in that I got a 75 foot tower approved and finally got some aluminum in the air in April," said the perennial wire-antenna aficionado. "So it was a little more like fishing with bait, rather than a bare hook, as I could hold a frequency at certain times and get some runs — plus my 20 meter signal was significantly better."

If there's an award for "Hardest-working Player," it would have to go to someone in QRP. "As for QRP, don't kid yourself — fun in QRP is going camping and working Tahiti on 5 W sitting by a fire," he writes. "But running QRP for nearly 24 hours with people stepping all over you, working you and then sliding 0.5 KCs down from you and blasting you, having to repeat yourself half the time, and fighting static on 80 meters just to bag some close in multipliers is work. It really is more of a lesson in perseverance, survival and a bit of luck, with a moment or two of fun and relief mixed in."

Still, he's not complaining. "I am happy and feel fortunate to have gotten a sweep and a win to boot. This will be the first time I've gotten a plaque for any contest, and I do plan to try to repeat in 2007, as well as get a CW win."

Multioperator

Dynasties come and dynasties go (unless you're KE3Q), but friendships are forever. That's what has kept K9NS at the top of the more-than-one-operator crowd for some time. Operating out of the station of Frank Miller, K9HMB, the K9NS crew (Dave Carlson, AA9D; Pete Walter, K9PW; John Kay, K9XW; Keith Moorehouse, W9RM, and K9HMB) has forged yet another impressive victory with 321,440 points. They beat their 2005 score despite arguably worse conditions.

For a category that was perennially on the fringes, multioperator has come into its own. K9NS even beat K5TR, despite George's advantageous Texas location and time-proven ability. To do that from Illinois is doubly impressive. K9NS has been steadily improving. In 2004, the gang was Number 4 overall. In 2005, they were Number 3, and in 2006, Number 2. Is the first multioperator overall victory ahead? Just wait and see.

The nearest challenger to K9NS was James Stevenson, W6YI, at 299,200 points. At the bottom of the multi crowd is the other of the two closest fights for Top 10 this year (Low Power had a similar result). Zero points separated Brian McGinness, N3OC, and Joe Rudi, NK7U; both had 212,000 points, 1325 contacts and a sweep. It really doesn't get any closer than that.

School

The class at KØHC, Hesston College in Kansas, continues to give a clinic in combating for top school club honors. The Hesston College crowd more than doubled their nearest rival with 220,400 points, a score good enough to even beat out the ninth place station in Unlimited. Congratulations, and... how can I enroll?

The gang at the University of Chicago ARS, N9UC, took home second with 109,280 points. Considering that only current students and staff may operate in this category, it's possibly the most important category in contesting. It has the potential to introduce new students with each graduation. Each new student exposed is possibly one more young contester in the making.

The next running of the November Phone Sweepstakes is November 17-19 — now's the time to get your station in shape! QST

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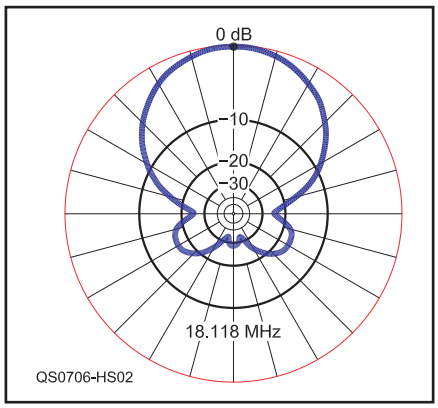
Azimuth pattern — Plot of antenna radiation level as a function of azimuth angle around the antenna.



Balun — A balanced to unbalanced transformer. These are used to make the transition between coaxial cable and balanced transmission line or a balanced antenna. **www.arrl.org/tis/info/pdf/8004019.pdf**

Broadside — Direction perpendicular to an antenna element.

Carbon film resistor — A resistor that uses a spiral of carbon film as the resistive element.

Director — One of the elements of a multielement directive antenna. The director receives energy from the driven element (attached to the feed line) and reradiates it to combine in the direction of the director. The director is usually shorter than the driven element. See **www.cebik.com/fdim/fdim11.pdf**.

Elevation angle — Angle above the horizon at which the maximum radiation occurs from an antenna. Lower elevation angles generally result in longer range communications.

End loaded dipole — A dipole that is electrically lengthened by placing loading inductance or capacitance structures near the outward ends of the antenna. Such an antenna can be more efficient than having the loading near the center or feedpoint.

Feed-point impedance — Impedance at the connection point of an antenna.

Half power beam width — The width of the main beam of an antenna, usually at its maximum elevation angle, between the angles at which the radiated power drops to half (–3 dB) that of the peak of the main beam.

Linear loading — Using a section of transmission line rather than a lumped element inductor or capacitor to change the electrical length of an antenna. See **www.cebik.com/wire/linres.html**.

Plumber's delight — A type of antenna construction in which the metallic boom is connected directly to the electrically neutral center of each element. It could be entirely made from pipe and plumbing fittings.

Reflector — One of the elements of a multielement directive antenna. The reflector is usually longer than the driven element.

Resonant — The frequency at which a circuit of a resistor, capacitor and inductor has an impedance that is only resistive. The inductive and capacitive reactances are equal and opposite.

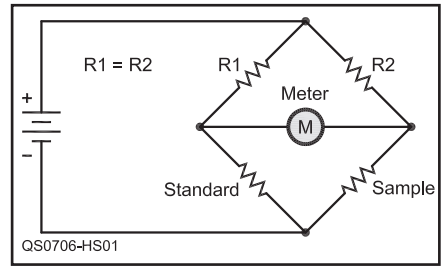
SteppIR Yagi — A series of multiband antenna offered by SteppIR Antennas (**www.steppir.com**). See **www.steppir.com**.

Top loaded vertical — Vertical antennas that are electrically lengthened by placing loading inductance or capacitance structures near the top of the antenna. These can be more efficient than having the loading near the bottom. See **www.arrl.org/tis/info/pdf/7107016.pdf**.

The Audible Antenna Bridge

Analog to digital converter — Electronic circuit that samples the value of an analog signal and provides a digital encoding corresponding to its value. See **www.answers.com/topic/analog-to-digital-converter**.

Bridge — An electrical circuit with two "arms." If the impedances are adjusted so that the voltage at the measurement point on each arm is the same, no current will flow between the two arms. This can be used to determine the value of an impedance by comparison to a known reference.



Forward power — Power leaving a source and traveling toward a load. In contrast to reflected power, which returns from the load if mismatched.

SWR foldback — Feature of some modern transceivers that automatically reduce transmitter output power if there is excessive SWR. This protects the final transmit amplifier stage from possible damage.

Ugly construction — Method of electronic construction in which (ground) leads of components are soldered to the copper foil of printed circuit board material without making printed wiring.

ESD Control for the Radio Amateur

Bi-polar transistors — A "regular" type of transistor consisting of a sandwich of semiconductor material with alternating properties, either NPN or PNP. The transistor operates by allowing a current flow that is some multiple of the input current. See **cnx.org/content/m1014/latest/**.

Metal oxide semiconductor (MOS) devices — A semiconductor device that controls the flow of electrical current by application of a voltage. A kind of *field effect* device. See **www.fairchildsemi.com/an/AN/AN-9010.pdf**.

Fixture for Measuring Inductor Q with your Antenna Analyzer

Loading coils — Inductors that are designed to simulate the electrical lengthening of antennas or transmission lines.

Q — Quality factor of a reactive element. Equal to the ratio of the inductive or capacitive reactance to the total series loss resistance in the tuned circuit. Thus for an inductor, the $Q = 2\pi fL/R$.

Toroid-wound coils — Inductances formed by winding wire around a donut shaped core. With appropriate material, the magnetic field is contained within the core making the coil "self shielding."

Variable capacitor — Capacitor that can be adjusted to different values by moving a shaft or adjustment screw.

Vernier drive — Drive mechanism for an adjustable component with geared or other reduction drive. Originally also had a vernier readout mechanism, however, now frequently applied to anything with a turns reduction.

The Next Step — "Sound Card" Modes

Digital transmission modes — Modes that allow the transmission of digital format character or binary data.

EchoLink — Combined computer-Amateur Radio voice system that operates using voice over Internet protocol (VOIP). Communication between distant radios can be extended by use of the Internet for the long distance portion. See **www.echolink.org/**.

Emulation software — Code that will make a PC appear as if it were something else. Typically it is used to make a PC act like a computer terminal.

Line level — Audio interface connections usually at a fixed level of 0 dBm, similar to that of a telephone line.

Radioteletype (RTTY) — Interconnection of two TELEPRINTER type devices by radio connection rather than wire line. See **nostalgia.wikipedia.org/wiki/Radioteletype**.

Teleprinter — Electromechanical typewriter like device that sends teletype signals when a key is struck, and prints characters that are received on its input.

Terminal units — Name given to electronic device that connects between a radio system and a teletype machine to convert the teletype pulses to frequency shifting radio signals and vice-versa.

Voice operated transmit switching (VOX) — Circuitry in an SSB radio transmitter that switches from receive to transmit in the presence of a signal from the microphone. QST

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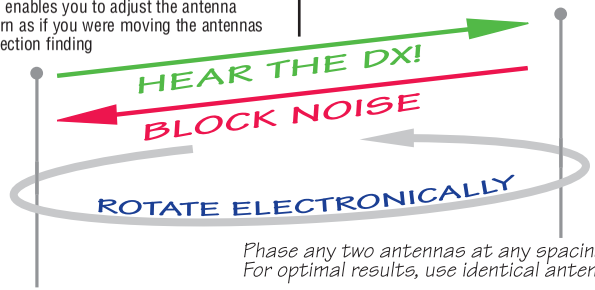

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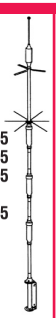

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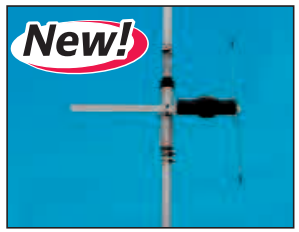

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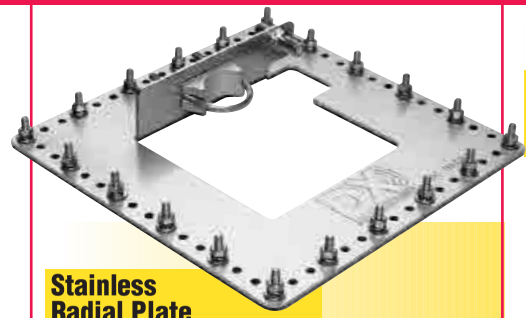

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DXE-RADW-500K	Radial Wire Kit, 500 feet of wire, 20 lugs, 100 anchor pins	**$59.90**
DXE-RADW-1000K	Radial Wire Kit, 1000 feet of wire, 40 lugs, 200 anchor pins	**$119.95**
DXE-STPL-100P	Radial Wire Anchor Pins, 100-pack	**$14.00**

Thick, Laser Cut Stainless Steel Tilt Base

- Patent pending cam action allows you to easily raise or lower DX Engineering, Hustler, Hy-Gain, or Butternut for tuning, weather or CC&R accommodation.

Patent Pending

DXE-TB-3P	For Hustler BTV verticals	**$59.50**
DXE-TB-4P	For DX Engineering 40VA-1, Butternut, most Hy-Gain 1/4-wave verticals	**$79.50**

TVSU-1 Time Variable Sequencer Unit

- Protect receiver front end, preamplifiers, linear amplifiers, or other sensitive equipment from damage due to improper switching during the receive/transmit transition
- Five outputs tied to the CW keying or push-to-talk (PTT) lines each have adjustable delay from 0-30 ms in 2 ms increments
- Side-tone generator follows input of keyer, not transmitter
- Supports full CW break-in
- Ideal for protecting DXE ARAV-2 or ARAH-2 Active Antennas from RF damage

DXE-TVSU-1 Time Variable Sequencer Unit **$159.95**

Low Loss Coax Cable Assemblies

- All connectors are soldered, not crimped
- Connectors have silver plated body and barrel with center Teflon dielectric
- Highest quality Belden coaxial cable is used
- All cable assemblies are high voltage tested to handle full-rated power
- Watertight seal between connectors and coax
- Call to order custom lengths
- N connectors are also available

Belden

DXE-CBC-213U6	RG-213, PL259 each end, 6 feet	**$28.99**
DXE-CBC-213U12	RG-213, PL259 each end, 12 feet	**$39.99**
DXE-CBC-213U25	RG-213, PL259 each end, 25 feet	**$49.99**
DXE-CBC-213UN6	RG-213, PL259 one end, Type N other, 6 feet	**$35.99**
DXE-CBC-8XU3	RG-8X, PL259 each end, 3 feet	**$19.99**
DXE-CBC-8XUN3	RG-8X, PL259 one end, Type N other, 3 feet	**$24.50**
DXE-CBC-8XN3	RG-8X, Type N each end, 3 feet	**$29.50**
DXE-CBC-8XU6	RG-8X, PL259 each end, 6 feet	**$21.99**
DXE-CBC-8XU12	RG-8X, PL259 each end, 12 feet	**$25.99**
DXE-CBC-8XU25	RG-8X, PL259 each end, 25 feet	**$29.50**

See DXEngineering.com for details!

Remote Antenna Switches

- Best SWR and port isolation on the market!
- Weatherproof, welded stainless steel housing for best RF shielding
- 8-position switch, controller included
- Better than 1.1:1 SWR below 30 MHz

5 KW Key-Down RF Switch

- Better than 70 dB of port-to-port isolation

RR8-HP-P **$375.00**

10 KW Key-Down RF Switch

- Better than 60 dB of port-to-port isolation

RR8-SD-P **$495.00**

Current Baluns and Feedline Current Chokes

- 5, 10 and 10 KW+ Baluns and Current Chokes
- High efficiency, low loss—W8JI design
- All standard ratios available

Feedline Current Chokes

- Reduce RFI and pattern distortion

Starting at just $69.95 for FCC050-H05-A

Active Receive Antenna

- Now available with relay protection from transmitter overload when used with TVSU-1
- Weak signal sensitivity rivals full size antenna
- Operates from 100 kHz to 30 MHz
- Excellent strong signal handling with +30 dBm output third order intercept
- Easy installation
- Available in vertical or dipole configuration

Active Receive Antennas

DXE-ARAH-1P	Horizontal Configuration	**$259.00**
DXE-ARAV-1P	Vertical Configuration	**$229.00**
DXE-ARAH2-1P	Horizontal Configuration with relay	**$289.00**
DXE-ARAV2-1P	Vertical Configuration with relay	**$259.00**

SOURCE CODE: 0706QS

True Plug and Play Simplicity
All of the Cables Included - Nothing More to Buy

LDG Now Includes All Cables Ready to go!

At LDG Electronics we have always been the innovators in the automatic tuner industry. We built the first desktop switched-L tuner, the first automatic tuner for QRP radios, the first automatic tuner with a remote control head, and the first automatic tuner with 3-D memories. We were also the first manufacturer with a two year warranty on all of our products. **Now we are including all of the necessary interface cables with every tuner we sell.** No more getting your new tuner home and not having the right interface cable—**everything you need is included in the box!**

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

Getting the Most Out of Your IC-7000

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-1000

An Autotuner for use with your amplifier!

No more knob spinning or inductor rolling. Tunes your antenna in 1 to 8 seconds when you QSY either in the same band or to a different band! Easy installation and use make this the choice for any Amateur Radio Operator with an amplifier. Power rating HF (1.8 to 30 MHz): 1000 Watts Single Side Band, 750 Watts CW, 500 Watts Digital (RTTY, Packet, etc.) **including 6 meters**.

Ready to go right out of the box!
No extra cable to buy.

List Price $599

Z-100

The definitive low cost automatic antenna tuner!

Designed from the ground up to provide the 100 watt power handling you asked for, in a small, lightweight package, perfect for portable as well as sitting on your desk in your shack!

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.

List Price $149

LDG ELECTRONICS Two-Year Warranty

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.

List Price $219

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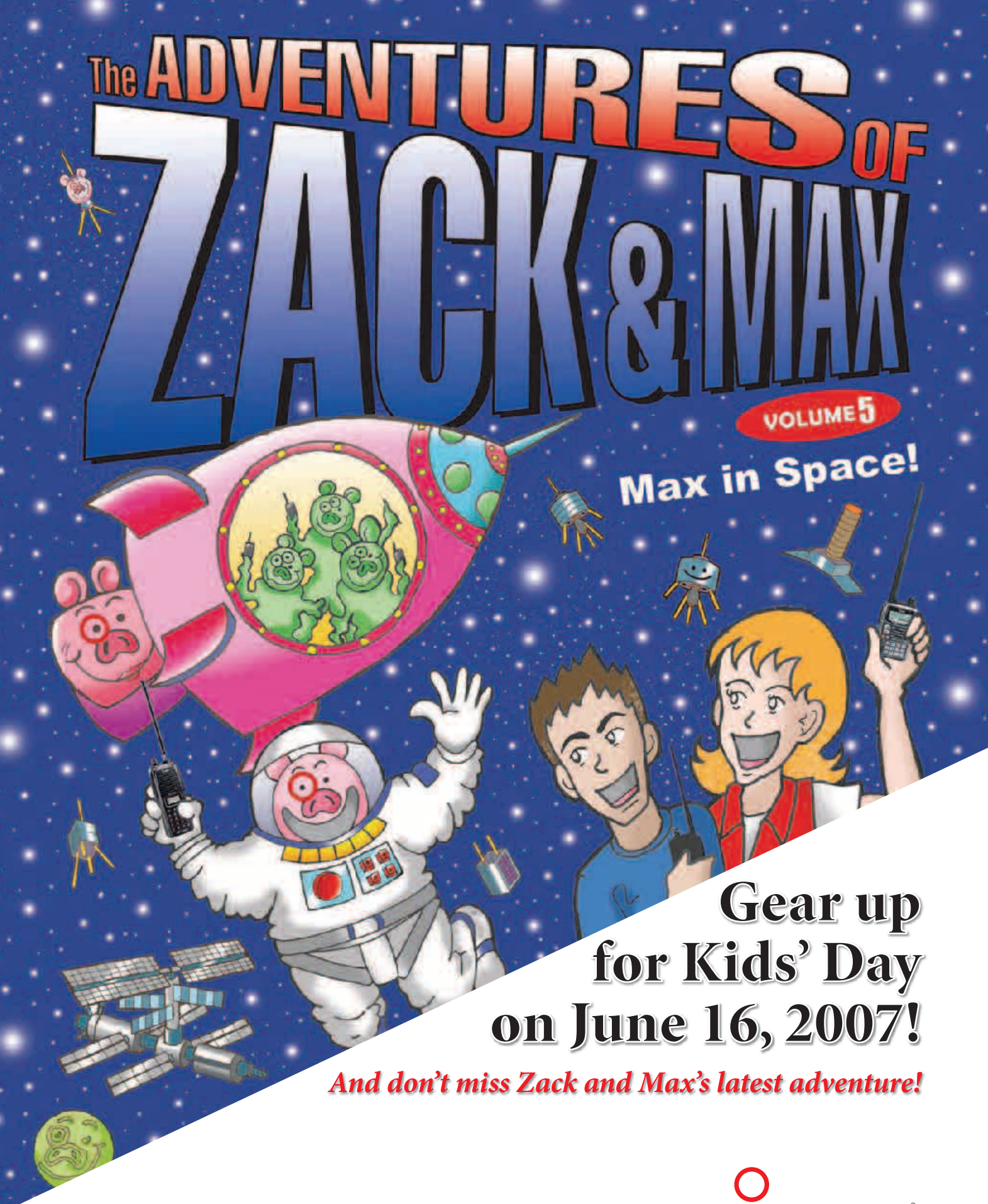
Phone: 410-586-2177
Fax: 410-586-8475



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And don't miss Zack and Max's latest adventure!

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ANDREW® Cinta CNT-600

HALF INCH SIZE SHOWN

Connector: **N, PL259, TNC & 7/16,** Burial: **Yes**, UV Resistant: **Yes**.
Shields: **2** (100% bonded foil +90% TC Braid) **VP 87%,** Attenuation 3.9dB @ 2 GHz at 100ft.
Usage 450 MHz and Higher.

PL259 CONNECTORS EACH END

Part #	Footage	Price
600C125	125 ft	$235.95
600C100	100 ft	$205.95
600C75	75 ft	$175.95
600C50	50 ft	$145.95
600C25	25 ft	$115.95
600C3	3 ft	$ 88.95

PL259(UHF) TO "N" MALE CONNECTOR

Part #	Footage	Price
600CN100	100 ft	$187.95

"N" MALE CONNECTORS EACH END

Part #	Footage	Price
600N100	100 ft	$168.95
600N75	75 ft	$139.95
600N50	50 ft	$108.95
600N25	25 ft	$ 77.95
600N15	15 ft	$ 66.49
600N6	6 ft	$ 55.49

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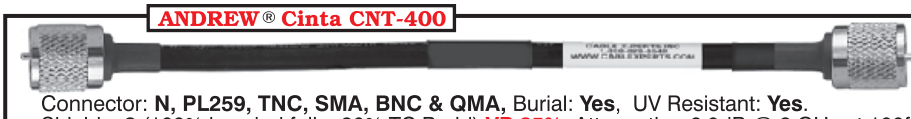
ANDREW® Cinta CNT-400



RG8U SIZE SHOWN

Connector: **N, PL259, TNC, SMA, BNC & QMA,** Burial: **Yes**, UV Resistant: **Yes**.
Shields: **2** (100% bonded foil +90% TC Braid) **VP 85%,** Attenuation 6.0dB @ 2 GHz at 100ft.
Usage 450 MHz and Higher.

PL259 CONNECTORS EACH END

Part #	Footage	Price
400C100	100 ft	$ 82.49
400C75	75 ft	$ 63.95
400C50	50 ft	$ 45.49
400C25	25 ft	$ 27.49
400C6	6 ft	$ 14.95
400C3	3 ft	$ 11.95

"N" MALE CONNECTORS EACH END

Part #	Footage	Price
400N50	50 ft	$ 54.95
400N6	6 ft	$ 22.95
400N3	3 ft	$ 20.95

Or CREATE YOUR OWN CUSTOM LENGTH ON-LINE.

ANDREW® Cinta CNT-240

RG8X SIZE SHOWN

Connector: **N, PL259, TNC, SMA, BNC & QMA,** Burial: **Yes**, UV Resistant: **Yes**.
Shields: **2** (100% bonded foil +90% TC Braid) **VP 84%,** Attenuation 3.0dB @ 150 MHz at 100ft.
Usage 1 MHz and Higher.

PL259 CONNECTORS EACH END

Part #	Footage	Price
240C6	6 ft	$ 14.75
240C3	3 ft	$ 12.95

Or CREATE YOUR OWN CUSTOM LENGTH ON-LINE.

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What makes us better than the competition?

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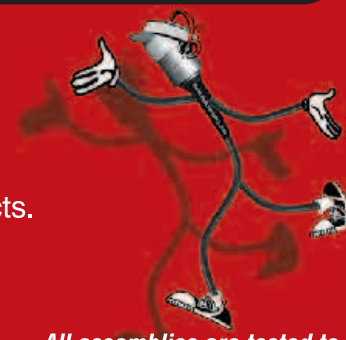

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VHF/UHF HANDHELDS

TH-K2AT *2M FM HT*
5W output; 100 memories; CTCSS/DCS; Weather RX; 1100 mAh Ni-Mh battery; SMA antenna connector. © **$119.99**

TH-K2AT

TH-D7A(G) *2M/440 MHz Dual Band HT* – 5W output. Covers: 144–148 & 430–450 MHz TX; 118–174 & 400–480 MHz RX; Built-in TNC, ready for APRS (needs GPS). © **$324.99**

TH-D7A(G)

TH-F6A *FM Triband HT*
Covers 144, 220 and 440 MHz + RX 0.1-1300 MHz (cell blocked). 435 memories; 5W output with 7.4V 1550 mAh lithium-ion battery. © **$309.99**

TH-F6A

VHF/UHF MOBILES

TM-271A *2M FM Mobile*
60W output power. Covers 144-148 MHz TX with 136–174 MHz RX. © **$149.99**

TM-271A

TM-V708A

TM-V708A *144/440 MHz Dual Band Mobile*
Covers: 144-148/430-450 MHz; Power: (VHF) 50W & (UHF) 35W; RX: 136-175, 300-524 & 800-1300 MHz (cell blocked). **$369.99**

TM-D700A

TM-D700A *144/440 MHz Dual Band Data Communicator*
Covers: 144-148, 430-450 MHz TX with 118–148, 136–175, 300–524 & 800–1300 MHz wideband RX (cell blkd). Power: 50/10/5W (VHF); 35/10/5W (UHF). Built-in TNC, ready for APRS (needs GPS).
© **$489.99**

HF RADIOS

TS-2000 *HF/VHF/UHF All Mode Transceiver* – 100W output (HF/6M/2M), 50W (70cm), 10W (optional 1.2 GHz). © **$1564.99**
TS-B2000 – Same as the TS-2000 with high-tech "silver box" look. Includes PC control software. © **$1349.99**
TS-2000X – Same as the TS-2000 with 1.2 GHz. © **$2024.99**

TS-480HX *HF/6M All-Mode Transceiver* – Covers 1.8 to 50 MHz, including 60M with continuous RX from 500 kHz to 60 MHz. Power: Up to 200W output (with two PS53s) HF & 100W 6M. © **$1044.99**
TS-480SAT – 100W version of the HX. Includes built-in HF automatic antenna tuner. © **$939.99**

TS-570D(G) *HF Transceiver* – Covers 160–10M with 500 kHz to 30 MHz RX. Output: 5-100W SSB/CW/FM & FSK. © **$889.99**
TS-570S(G) *HF+6M Transceiver*
Same as the TS-570D(G), but covers 160–10M + 6M. © **$1079.99**

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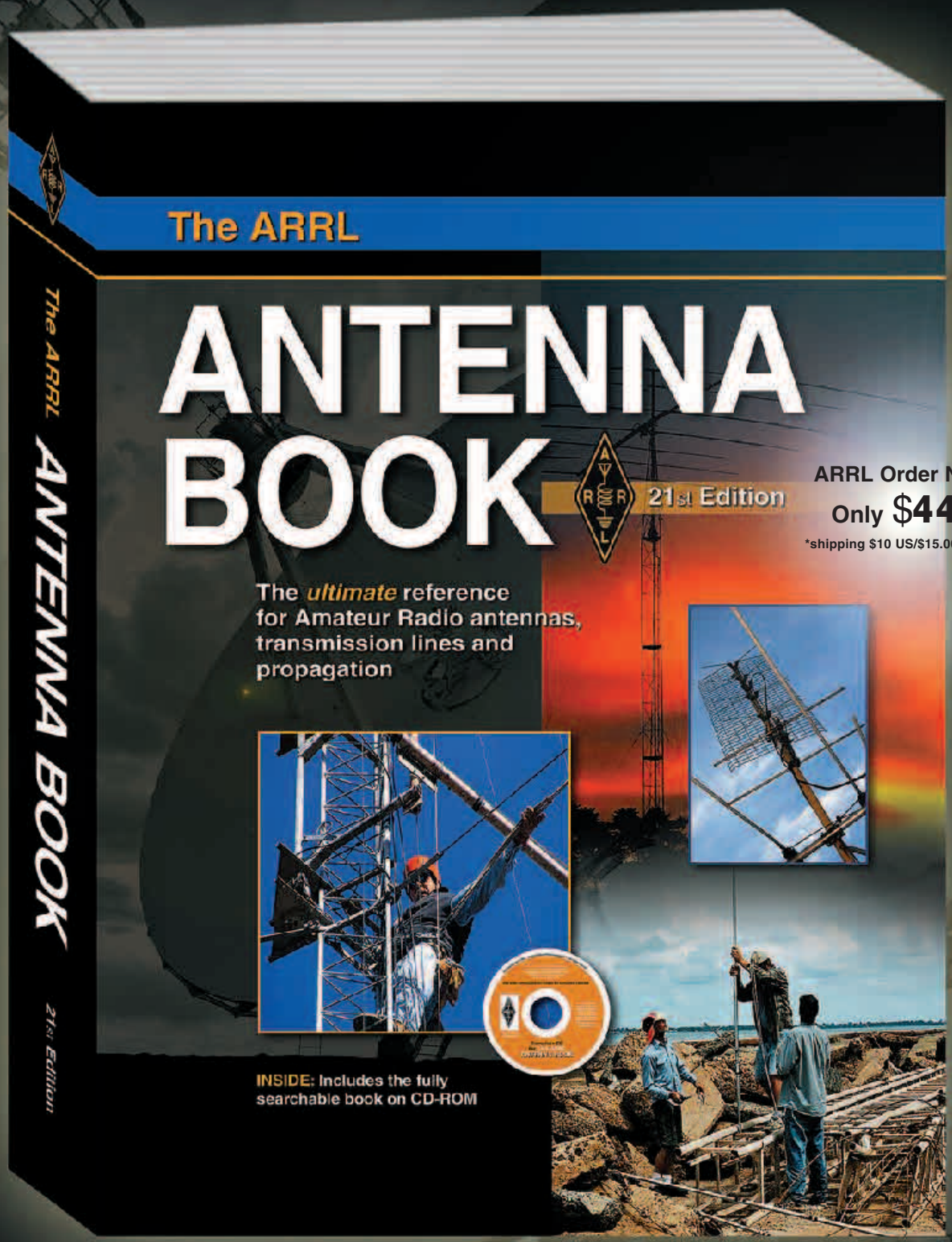

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VHF/UHF HT & MOBILE

IC-2200H

IC-2200H ***2M FM Mobile*** – Covers: 144-148 MHz TX; 118-174 MHz RX, AM aircraft and WX w/alert. Power levels: 65, 25, 10 or 5W; Choice of FM/Narrow mode; UT-118 **D-Star** Digital unit optional. Ⓡ **$139.99**

IC-91A ***Digital Upgradable Dual Band HT*** – TX 2M and 440 MHz; RX: 495 kHz to 999.990 MHz (cell blocked); Alpha memories: 1304; Power: 5/0.5W; Analog/Digital upgradable with optional UT-121 Digital Voice Unit. JIS-4 spec. for weather resistance. Includes SMA-type antenna, Li-Ion battery, belt clip & charger. **$329.99**

IC-91AD – IC-91A with UT-121 **D-Star** Unit installed. **$449.99**

HF RADIOS


IC-703 PLUS

IC-7000

IC-703 PLUS ***HF QRP Transceiver*** – Covers 160-10M + 6M in SSB/CW/RTTY/AM/FM modes; Power: 10W @ 13.8VDC and 5W @ 9.6VDC; 105 memories; Built-in HF auto. antenna tuner. Ⓡ **$679.99**

IC-7000 ***Multi band Multimode Mobile Transceiver*** Covers HF/6M/2M/440 MHz and has 503 alpha memories. Power: 100W (HF+6M), 50W (2M), 35W (440 MHz); 2.5 inch color TFT; 41 bandwidths with sharp or soft filter shape. Twin PBT; Digital RF Speech Processor; S/PWR/SWR meter; RIT; Preamp/Attenuator; RTTY Demodulator; Adjustable SSB bandwidth; DTMF memory; VOX, Full break-in CW. 13.8VDC @ 22A. Free RMK-7000 © **$1299.99**

© After Instant coupon Coupon & Freebie expires 5/31/07

IC-718 ***HF All Band Transceiver*** – Now includes DSP! Covers 160-10M with 0.03-30 MHz receive in SSB, CW, RTTY and AM modes; 100W (40W AM); 101 memories. Ⓡ **$549.99**

NEW AT AES

IC-2820H ***2M/440 Analog Dual Bander with Digital and GPS Optional*** – Covers 144-148 and 430-450 MHz with wideband receive (Left Band) 118-549.95 / (Right Band) 118-173.995, 375-549.995 and 810-990.990 MHz (cellular blocked). V/V and U/U simultaneous receive, 522 memory channels. Weather Alert. Power: 50/15/5W out on both bands. Removable front panel, built-in CTCSS Encode/Decode, selectable amber/green display, PC compatibility. Two antenna jacks support diversity reception in the 127, 136, 146, 375, 440 and 500 MHz bands (two antennas required). Diversity compares signal strength from the two antennas, and automatically selects the strongest signal to hear. Upgradable **D-Star** DV (digital voice) and GPS capabilities with the optional UT-123. Packet ready (9600 BPS – 6-pin DIN). Includes the full-function backlit HM-133 remote DTMF hand microphone, mounting bracket, power cord and spare fuses. Supplied with OPC-1663 and OPC-1712 separation cables. Dim: 5.9"w x 1.65"h x 7.4"d, 3.3 lbs. **$649.99**

D-STAR RADIOS

ID-800 ***2M/440 Analog/Digital Dual Bander*** – D-STAR Digital Ready. Detachable control head; wideband RX; Three power settings: 55/15/5W (2M), 50/15/5W (440 MHz); Built-in CTCSS decode/encode with tone scan; PC compatible; 500 alphanumeric memories; Includes remote hand mic., sep. cable, & more. Ⓡ **$609.99**


CONTROL HEAD

ID-1 ***10W 1.2 GHz FM Digital Transceiver with Control Head*** Operates with D-STAR 1.2GHz repeaters, or simplex digital operation with another ID-1. High speed 128KB data. Includes 100 alphanumeric memories, CTCSS encode/decode and scanning. Ⓡ **$979.99**

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Introducing...the ME-2 Starter Series Yagi's...

The **ME-2 Starters Series Yagi's** have been designed for New and Seasoned Hams operators alike.

New licensed Hams will find these low cost, medium performance antennas, to be a great choice for a starter antenna without compromising quality. And when it's time to move up to a more tailored antenna, M2 will be there to help them make the best choice from our High Performance models.

The Seasoned Ham operator, will find these antennas to be a fun experimental antenna or a great mobile antenna for getting out on the road.

Each antenna has been specifically tailored for:

Compact Size and Portability: Great for Field Days, Mountain Topping, Fox Hunts, DXpeditions and ATV use. Each antenna breaks down to no more than 40" long, making it a natural for trips. Not to mention, it's a perfect fit for deed restricted antenna areas where wind load and overall appearance must be kept to a minimum.

Quality Construction: A medium performance Gamma Match feed with no balun. Giving you the capability of adjustments for best match. A single heavy duty mounting cradle and stainless steel hardware, give you the confidence of quality construction you have come to expect from M2.

Four Models to choose from

* **6 Meter 3 Element**
* **2 Meter 3 Element**
* **1.25 Meter 4 Element**
* **70 Centimeter 6 Element**

Attention 2.4 GHz antenna users...




Introducing...Our New 2.4 GHz Series Wave Guide Fed Yagi antennas...

The **2.4 GHz** series of Wave Guide Fed Yagi's, have been computer optimized for use in the 2350 to 2500 MHz band. Mechanically optimum computer calculations are held by CNC stamping out the director element structure. The loss-less Polyethylene Radome cover actually enhances the clean pattern and increases gain. The short boom version is the best performer for it's size on the market. If more gain is required, stacking two at 8" apart nets another 3.0 dB gain. Or you can simply step up it's big brother with the 32" boom model for a jump of 2.7 dB more gain. Both antennas come complete with stainless steel hardware for long life.

Two Models to choose from

* **2.4 GHz 12.8 dBd 17" Boom**
* **2.4 GHz 15.7 dBd 32" Boom**

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VHF/UHF HANDHELDS

VX-170 *2 meter FM Submersible handheld*
RX coverage: 136-174 MHz and 200 memories. Power: 5W.
© **$119.99**

VX-177 *440 MHz FM Submersible handheld*
RX coverage: 420-470 MHz and 200 memories. Power: 5W.
$149.99

VX-170 VX-7R

VX-7R *Tri-band Submersible HT* – Full 5W output on 50, 144 & 440 MHz FM, 300mW on 222 MHz. Submersible at 3' for 1/2 hour. 0.5 to 999 MHz continuous RX (cell blocked); Over 900 memories including 40 memory scan band limit, & 10 weather; "Split Tone" capability; Auto-Range Transponding System; WIRES™ internet-linking.

VX-7RB – Same as VX-7R but with a black case. Each © **$314.99**

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. © **$139.99**

FT-7800R *2M/440 MHz FM Mobile*
Covers: 144-148 & 430-450 MHz TX with 108-520 & 700-999 MHz RX (cell blocked); Power: 50W (2M), 40W (430 MHz); Over 1,000 Memories; WX alert; WIRES™ capability.
© **$249.99**

(FT-8900R shown)

FT-8800R *2M/440 MHz FM Mobile* – Covers 144-148 & 430-450 MHz TX with 108-520 & 700-999 MHz RX (cell blkd); Power: 50W on 144 MHz, 35W on 430 MHz; Crossband repeat. Free YSK-8900 **$374.99**

FT-8900R *Quad Band FM Mobile* – Like the FT-8800R but also covers 10M (28-29.7) & 6M (50-54) at 50W output. Free YSK-8900 **$424.99**

HF RADIOS

FT-450 *HF + 6M All-Mode Portable/Base Transceiver*
Covers HF + 50 MHz with 100W output, all mode, 500 memory channels, DSP. Loaded with many more outstanding Yaesu features. Dim: 9"w x 3.3"h x 8.5"d; 7.9 lb. **$999.99**

Perfect for Field Day!

FT-897D *HF/VHF/UHF Multi-Mode Portable/Base*
Power: 100W HF/50 MHz, 50W 2M & 20W 70CM, all adjustable down to 5 Watts; Includes 60M; SSB/ CW/AM/FM & digital modes. © **$799.99**

FNB-78 *4500mAh NiMH Battery Pack for FT-897(D)*
The bottom of the FT-897(D) can accommodate up to 2 of these optional 13.2V, 4500mAh NiMH battery packs for up to 8 hours of completely portable operation. Max. power output is 20W (10W, 70cm) during battery operation. Each **$129.99**

CD-24 *4 Hour Charger for FNB-78 Battery Packs*
Recharges one FNB-78 battery pack at a time using your FT-897(D) DC cord. **$129.99**

FT-817ND *HF/VHF/UHF Backpack Transceiver*
Covers 160-10M, 6M, 2M, 70CM; RX: 100 kHz - 56 MHz, 76-154 MHz, 420-470 MHz. Power: 5W SSB/CW/FM (13.8V ext. DC), 1.5W AM, 2.5W SSB/CW/FM (9.6V NiMH pack or 8 AA's), 0.7W AM, up to 5W SSB/CW/FM. 1400mAh NiMH battery & charger. **$599.99**

Perfect for those new to HF!

FT-857D *Ultra-compact, HF/VHF/UHF All-Mode Mobile*
Power: 100W HF/6M, 50W 2M, 20W 70CM with 0.1-56, 76-108, 118-164 and 430-470 MHz RX; 200 memories.
Free YSK-857 © **$679.99**

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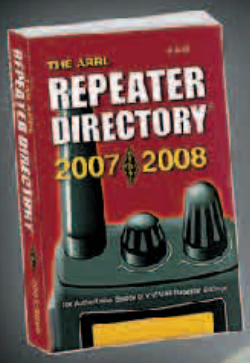

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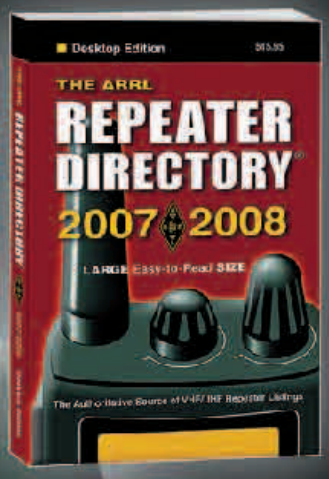

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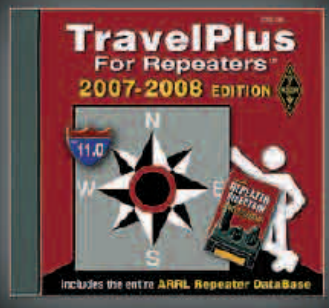

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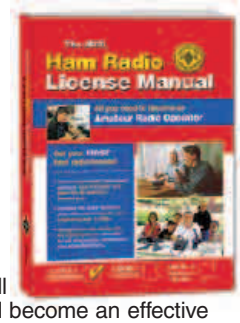

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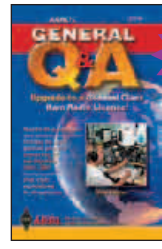

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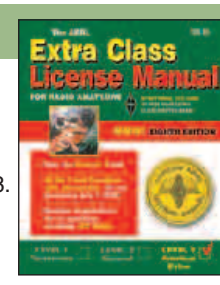

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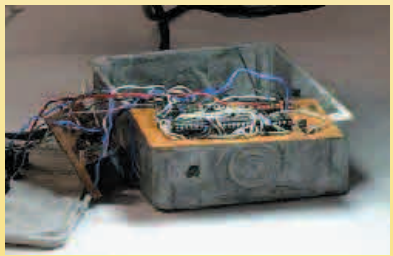

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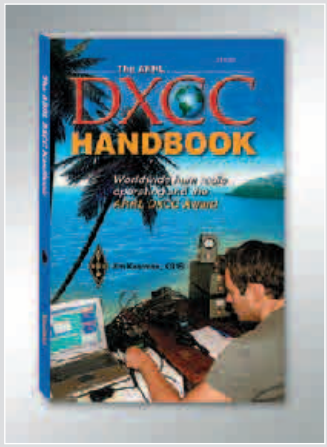

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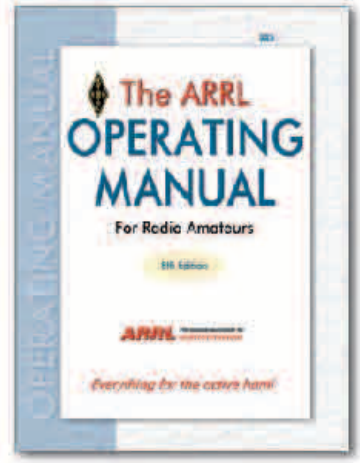

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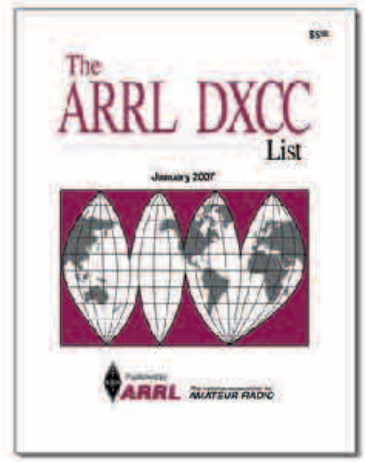

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Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™. Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ in.

B-5018-G
$329

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT/mobile/base amp. 160 Watts out/10W in. For 0.25-10W rigs.

B-2518-G, $329. Like B-5018-G but for 10-25 Watt mobile/base. 160W out/25W in.

RC-2, $49. Remote Control. On/Off, preamp On/Off, selects SSB/FM. 25 ft. cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

FCC Type Accepted

6 Meter Amplifier

A-1015-G, $389, *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out/10W in. For 1-15 W transceivers. 20 dB GaAsFET preamp.

300 Watts on 2-Meters, $739

3 models: 300 Watts out for 10, 25, or 50 Watts in. FM/SSB/CW. 15/20 dB gain, *GaAsFET* preamp.

Repeater Amps

11 models: *continuous* duty FM/SSB/CW *Repeater* Amps for 6, 2, 1¼ Meters, 70 cm, 450 MHz, ATV.

70 cm Amplifiers (420-450 MHz)

D-3010-N, $389 -- 100 W out/30W in. For 5-45 Watt *mobile/base*. **D-1010-N, $419**, 100W out/10W in. *Dual purpose* -- for handhelds or mobile/ base. **D-26-N, $299**, 60W out/2W in, for *handhelds*.

Low Noise GaAsFET preamps

High gain ultra low noise *GaAsFET* preamps for receiving weak signals. Selectable 15-22 dB gain prevents intermod. < 0.8 dB noise figure, auto RF switching to 160W.

In-shack or Mast-Mount models.

Frequency, MHz	*In Shack, $149.95*	*MastMount, $199.95*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

Amateur TV Amps

Industry standard ATV amps: **D-1010-ATVN, $439**, 82 W PEP out/10W in. **D-100-ATVN, $449**, 82W PEP out/2W in. (without sync compression).

Accurate SWR/Wattmeters

Read SWR directly and Forward/ Reflected, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

http://www.mirageamp.com
Nearest Dealer, Free catalog, To Order . . .
800-647-1800
Tech: 662-323-8287 **Fax:** 662-323-6551

MIRAGE

300 Industrial Park Rd Starkville, MS 39759
Prices/specs subject to change without notice/obligation ©2006.

10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground or radials

Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna
Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance gives high efficiency for more power radiated. Results? Stronger signals and more Q-5 QSOs.

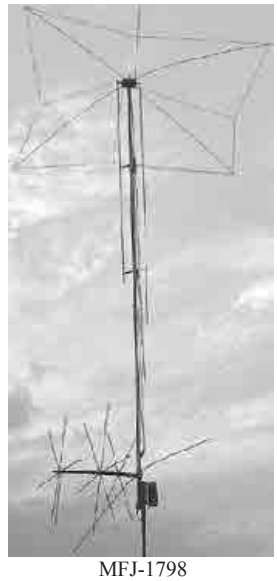
Full size performance also gives you exceptionally wide bandwidths so you can use more of your hard earned frequencies.

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.



MFJ-1798
$289.95
Ship Code F

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate Full Size Radiators

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. *In phase* antenna current flows in all parallel radiators.

This forms a very large equivalent radiator and gives you incredible bandwidths.

Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

End Loading

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands.

Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

No Ground or Radials Needed

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation.

You can mount it from ground level to roof top and get awesome performance.

No Feedline Radiation to Waste Power

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Built to Last

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$399.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes.

Enjoy both DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto-tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, no mechanical joints, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- not a lossy thin flat-strip -- *gives you highest possible efficiency*.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning.

Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

MFJ-1788, $449.95. Same as MFJ-1786 but covers 40 Meters-15 Meters continuous. Includes super remote control.

MFJ-1782, $359.95. Like MFJ-1786 but control has only fast/slow tune buttons.

MFJ-1780, $259.95. *Box Fan* Portable Loop is about the same size (2x2 foot) as a box fan, complete with handle. Covers 14-30 MHz. Control has fast/slow tunes.

MFJ Apartment Antenna

MFJ-1622 $99.95

Covers 40 thru 2 Meters. Mounts outdoor to windows, balconies, railings. Works great indoors mounted to desks, tables, bookshelves. Highly efficient air wound *bug catcher* loading coil and telescoping 5½ foot radiator lets you really get out! Radiator collapses to 2½ feet for easy storage/carrying. Includes coax RF choke balun, coax feed line, counterpoise wire, safety rope. 200 Watts PEP.

MFJ's G5RV Antenna

MFJ-1778
$39.95

Covers all bands, 160-10 Meters with antenna tuner. 102 feet long, shorter than 80 Meter dipole. Use as inverted vee or sloper to be more compact. Use on 160 Meters as Marconi with tuner and ground. Handles full legal limit power. Add coax feedline and some rope or other nonconductor and you're *on the air!*

MFJ halfwave vertical

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$219.95

Only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments,small lots, trailers. Perfect for vacations, field day, DXpedition, camping.

Efficient end-loading, no lossy traps. Entire length is always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting 1 band has minimum effect on others.

MFJ-1792, $179.95. Full size 1/4 wave radiator for 40 Meters. 33 feet, handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $199.95. Like MFJ-1792 but has full size 20 Meter ¼ wave also.

Free MFJ Catalog

and Nearest Dealer . . . 800-647-1800

http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders from MFJ

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Tech Help: (662) 323-0549

MFJ . . . the world leader in ham radio accessories!

Robotics! Space Technology! Electronics!
Satellites! Amateur Radio!

The ARRL Education & Technology Program is building our future...

Equipment grants and trained teachers are stimulating young minds to experiment with ham radio and wireless technology...giving them confidence...leading them to careers in science and engineering.

These teachers and students are a force for the future of Amateur Radio —

will you join them?

More than 200 schools, 120 teachers and over 18,000 students are counting on you to make a generous contribution by mail, by phone or on the web at: **www.arrl.org/education**.

Remember —
The ARRL Education & Technology Program is entirely funded by contributions.

MFJ *giant* SWR/Wattmeter

World's *largest HF SWR/Wattmeter has* ***giant*** *6½ inch meter!*

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually examining the scale. New!

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

MFJ-868 $139.95

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5¹/2Hx5D in. SO-239 connectors.

New!

Giant 144/220/440 MHz SWR/Wattmeter

MFJ-867, $149.95. Similar to MFJ-868 giant SWR/Wattmeter, but for 144/220/440 MHz.

MFJ *Weather-Proof* Antenna *Feedthrough* Panel

New! ***Bring three coax-fed HF/VHF/UHF antennas, balanced line, random wire and ground into your hamshack without drilling through walls . . .*** MFJ-4602 $59.95

MFJ's Weather-proof *Antenna Feedthrough Panel* mounts in your window sill. Lets you feed three coax-fed antennas, balanced line, random wire and ground without drilling through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. High-quality pressure-treated wood with excellent 3/4 inch thick insulating properties is painted with heavy coat of white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Gives years of trouble-free service. ³/4Dx3¹/2Hx48W in.

Inside/outside stainless steel plates bond all coax shields to ground. Stainless steel ground post brings outside ground connection inside. Three *Teflon*® SO-239 coax connectors, *ceramic* balanced line/randomwire feedthru insulators.

Stainless Steel Bonding Plate

Indoor View

Outdoor View

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

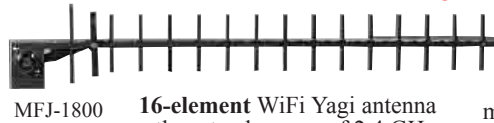
MFJ-822
MFJ-842
$59.95
New!

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. 18Wx2³/4 Hx 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.

Dealer/Catalog/Manuals

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . the World Leader in Ham Radio Accessories!

MFJ *Pocket size* Morse Code Reader™

Hold near your receiver -- it instantly displays CW in English!

Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . .

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 miscopy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

Automatic Speed Tracking

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW.

Four Display Modes

1. Bottom line scrolls and fills with text, then that entire line is displayed on top line until bottom line refills -- makes reading text extra easy! Automatically displays speed in WPM.

2. Same as **1**, without speed display -- gives you maximum text display.

3. Top line scrolls, bottom line displays speed in Words-Per-Minute.

4. Both top and bottom lines scroll.

Two-line LCD display has 32 large 1/4 inch high-contrast characters.

MFJ Instant Replay

The last 140 characters can be instantly replayed. This lets you re-read or check your copy if you're copying along side the MFJ-461.

High Performance Modem

Consistently get solid copy from MFJ's high performance *PLL* (*phase-lock loop*) modem. Digs out weak signals. Even tracks slightly drifting signals.

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

Computer Interface

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

More Features

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable.

Battery saving feature puts MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery (not included).

True Pocket Size

Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 2¼x3¼x1 in. 5½ ounces.

No Instruction Manual needed!

Super easy-to-use! Just turn it on -- it starts copying instantly!

Accessories

MFJ-26B, $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

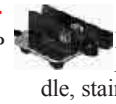
MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. 8½x2¼x3¾ inches.

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 2¼Wx3¼H x1D inches.

MFJ *miniature* Travel Iambic Paddle



MFJ-561, $24.95. 1¾Wx1¾Dx¾H in. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

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and Nearest Dealer . . . 800-647-1800

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MFJ . . . the world leader in ham radio accessories!

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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Please contact the **Advertising Department** at **860-594-0231** or **hamads@arrl.org** for further information or to submit your ad.

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JOIN 10-10 – 70000 members dedicated to preserving ten meters. Daily Nets on 28.380 and 28.800 at 1800Z. Information at www.10-10.org

MARCO The Medical Amateur Radio Council Ltd. is a charitable non-profit group of health care professionals who meet weekly at 10:00am Eastern on Sunday for "Grand Rounds" of the air on 14.307 MHz. All are welcome. For membership inquiries and/or free complimentary newsletter email: Danny@w4din.us, toll free Ph 866-479-6160, or write to: MARCO, 2712 Bryant Dr., Cleveland TN, 37311. http://www.marco-ltd.org

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

All-in-one handheld antenna test lab lets you quickly check and tune HF, VHF, UHF antennas anywhere. Covers 1.8-170 MHz and 415-470 MHz

Measures: SWR…Return Loss…Reflection Coefficient…Antenna Resistance(R), Reactance(X), Impedance(Z) and Phase Angle(degrees) . . . Coax cable loss(dB) . . . Coax cable length . . . Distance to short or open in coax . . . Inductance . . . Capacitance . . . Resonant Frequency . . . Bandwidth . . . Q . . . Velocity Factor . . . Attenuation . . . Has: LCD readout . . . frequency counter . . . side-by-side meters . . . Ni-MH/Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . One year No Matter What™ warranty . . .

MFJ-269

$379.95

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

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

SWR Analyzer

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

Complex Impedance Analyzer

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

Coax Analyzer

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

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

Use any Characteristic Impedance

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

Inductance/Capacitance Meter

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

Frequency Counter/Signal Source

You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

Digital and Analog displays

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz Range features

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

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

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

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

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

Super Easy-to-Use

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

Take it anywhere

Take it anywhere - to remote sites, up towers, in cramp places. Fully portable -- battery operated, compact 4Wx2Dx6¾ in., weighs 2 lbs. *Free* "N" to SO-239 adapter.

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

Use 10 AA Ni-MH or Ni-Cad or alkaline batteries (not incl.) or 110VAC with MFJ-1312D, $15.95.

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.
Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors.

MFJ-66, $24.95.
Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer™* and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer™*.

MFJ-99C, $40.90.
SWR** Analyzer Power Pack.* 10 Pack MFJ *SuperCell™* Ni-MH batteries, and power supply for SWR analyzers. ***Save $5!

MFJ-98, $60.85.
MFJ-269** Accessory Pack.* MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coils, power supply for MFJ-269. ***Save $5!

MFJ-98B, $88.90.
MFJ-269** Deluxe Accessory Pack.* Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. ***Save $7!

MFJ-269*PRO*™ Analyzer

Like MFJ-269, but has extended coverage in UHF range ***(430 to 520 MHz)*** and ruggedized cabinet that protects LCD display, knobs, meters and connectors from damage.

MFJ-269*PRO*
$409.95
NEW!

Free MFJ Catalog
Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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WILLIAMS, AZ. Amateur Radio Council of Arizona. Arizona's largest hamfest, JULY 6th through 8th. Newly graveled lots. I-40 exit 165. ARRL, Dealers, Exhibits, VE Testing, Forums, Seminars, HUGH SWAP AREA, RV's Welcome. SPONSORS: ARCA & City of Williams, AZ. ARCA, 16845 N 29th Ave #312, Phoenix, AZ 85053-3041. VM 602-881-2722, www.arca-az.org/arca.

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ANTENNA FARM 3 1/2 acres, beautiful views, mild climate, southwestern CO. 3 br, 2 bath Log Home. Lots of Antennas. Angelie@bliss.org, 970-882-5477

ANTIGUA West Indies QTH with radio and 7 towers with antennas. Constant electricity. Contact Roy, V21N, 954-894-6675 or 954-801-6061 or Sam at wt3q@frontier.net www.n3oc.dyndns.org/v26b

BELIZE VACATION QTH www.wishwilly.net

COLORADO CHALET with ham gear for rent, www.lostcreekcabin.com. WØLSD, Buena Vista, CO.

COSTA RICA - www.yantis.us/ti5kd

CUSTOM 2BR, 1.5 BA Log Home with tower and HF antennas on 1.23 level acres. Gorgeous Mountain views. Outbuildings and shop. QTH is located in the Blue Hole in beautiful Sequim, Washington. Active Ham community. Call Ronnie KF6YYZ @ 800-998-4131, ronnie@olypen.com

DX Hilltop for sale **WWW.LITTLEFAMILYFARM.COM**

HAM RADIO friendly QTH in west Broward County (Tamarac) Florida. 3/2 home, Florida room, breakfast room and screened-in patio facing lake with magnificent sunsets. "55 and over" community pool, tennis, clubhouse. "Release of Restrictions" permits tower and antenna. Contact Dave, K2DP, for information and photo CD at 314-862-5698(h) or K2DP@charter.net

HAWAII VACATION, Big Island rental HAM station! FREE brochure. KD4ML@JUNO.COM

OZARK MOUNTAIN TOP QTH for sale! www.realestatebuffaloriver.com W5BQ

SCIENTIFIC RADIO SYSTEMS INC. model SR-110, Commercial 1 KW, HF (1.8-30 mc) linear amplifier. $995 (970)882-5477, w5eoe@isp.com

VY2TT www.peidxlodge.com

"WANNA HAM in the **Cayman Islands?**" go to www.martykaiser.com/24.htm

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BROADCAST MICROPHONES and accessories (call letter plates, stands) wanted: early carbon, condenser, ribbon, dynamic models. Cash or trade. James Steele, Box 610, Kingsland, GA 31548. 912-729-6106. jsteele@k-bay106.com; http://www.k-bay106.com/mics.htm

CLASSIC REPAIR - Specializing in Collins, Drake and other fine tube radios. Steve, 661-822-6850. n6hk@hotmail.com

MFJ *IntelliTuner*™ Automatic Tuner

Automatically tunes unbalanced/balanced antennas . . .Ultra fast . . . New 20,000 memories . . . Antenna Switch . . . Efficient L-network . . . Select 300 Watts (6-1600 Ohms) or 150 Watts (6-3200 Ohms) . . . 1.8-30 MHz . . . 4:1 current balun . . . Cross-Needle and Digital SWR/ Wattmeter . . . Audio SWR meter . . . Backlit LCD . . . Remote control port . . . Radio interface . . .

MFJ-993B
$259.95 New!

World's First dual power level 300/150 Watts SSB/CW Tuner --

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna *automatically* balanced or unbalanced -- *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *InstantRecall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

You get a highly efficient L-network, 6-1600 ohm matching at 300 Watts SSB/CW or *extra-wide* 6-3200 Ohm matching at 150 Watts SSB/CW, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

It learns while you're having fun

As you're ragchewing, contesting or DXing, *your MFJ-993B is learning!*

When you transmit, the MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!*

MFJ's new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 antenna connectors. Select up to 4 antennas on each antenna connector. Each antenna has 2500 memories, 20,000 total.

Intelligent ultra fast tuning

MFJ's *InstantRecall*™ first checks its memory to see if you have operated this frequency before. If so, tuning is instantaneous and you're ready to operate.

If not, MFJ's *IntelliTuner*™ algorithm -- based on MFJ's famous SWR Analyzer technology - - kicks in. It *measures* the complex impedance of your antenna. Next, it *calculates* the components it needs and instantly *snaps* them in. Then, it fine tunes to minimize SWR -- you're ready to operate. It's all done in a *fraction* of a second.

When the impedance is within its measurement range, the MFJ-993B is the *fastest automatic antenna tuner in the world.*

If it can't accurately determine impedance, MFJ's *AdaptiveSearch*™ algorithm goes into action. Frequency is measured and relevant components values are determined. Only those values are searched for ultra-fast tuning.

For even faster searches, you can set the target SWR to 2 (settable 1.0-2.0).

You can manually tune when you can't transmit (for listening out of ham bands).

Cross Needle and Digital SWR/Watt Meters

Lighted Cross-Needle and *digital* meters lets you accurately read SWR, forward and reflected power at a glance.

An *audio* SWR meter lets you *hear* the tuned SWR when you can't see/read meters.

Turn on a highly visible, instant response SWR LCD bargraph when you need it.

Backlit LCD Display

An easy-to-read *backlit* LCD displays SWR, forward/reflected power, frequency, antenna 1 or 2, L/C tuner values, on/off indicators and other information.

The MFJ-993B is a compact 10Wx2¾ Hx9D inches. Use 12 to 15 VDC at 1 amp or 110 VAC with **MFJ-1316, $21.95**.

Tune any Antenna

You can tune any antenna -- dipoles, verticals, beams, phased arrays, inverted vees, quads, random wires, mobile antennas, compact limited space antennas.

A 4:1 *true* current balun lets you tune any balanced antenna - - horizontal loops, vertical loops, multi-band doublets, quads, folded dipoles, Zepps.

Remote Control

Plug in the **MFJ-993RC, $39.95**, remote control and use your tuner elsewhere remotely.

MFJ-993B Interface Pre-wired Cables

Allows automatic tuning of your MFJ-991B/993B/994B *IntelliTuner*™ through radio.

MFJ-5124I, $19.95, *ICOM*. Supports IC-706, 707, 718, 725, 728, 736, 746, 756, 765, 775, others that support AH-3 or AH-4.

MFJ-5124A, $19.95, *ALINCO*. Supports DX-70, DX-77 and others.

MFJ-5124K, $59.95, *KENWOOD*. Supports TS-50S, 450S, 570S, 690S, 850S, 870S, 2000 and others that support AT-300.

MFJ-5124Y, $59.95, *YAESU*. Supports FT-100D, FT-857, FT-897, others.

MFJ-5124Y2, $59.95, *YAESU* FT-847.

Dual 300/150 Watt Auto Tuner

World's First dual power level Tuner

MFJ-991B New!
$219.95

-- Select **300 Watt** SSB/CW and match 6-1600 Ohm antennas ***Or*** select **150 Watt** SSB/CW and match *extra wide-range* 6-3200 Ohms. New 10,000 *VirtualAntenna*™ Memories. Like MFJ-993B, less digital SWR/Wattmeter/ LCD display, audio SWR meter/audio feedback, antenna switch or 4:1 current balun.

MFJ Weather-sealed Automatic Antenna Tuner, 1.8-30 MHz

MFJ-926, $399.95. Weather-sealed for outdoor/marine use. *Heavy duty* custom plastic enclosure has inner rubber gasket that seals interior electronics. Stainless steel mounting bracket. Handles 200 Watts PEP. Tunes wire in less than .2 seconds from memory (200 memories). Requires 13.8 VDC, 1.5A. Compact 9¼Wx14¼Hx3D inches, 4 lbs.

600 Watt MFJ Automatic Tuner

MFJ-994B
$359.95 New!

MFJ-994B, *600 Watt IntelliTuner*™! automatic antenna tuner with new 10,000 *VirtualAntenna*™ Memories. Like MFJ-993B but handles 600 Watts SSB/300 Watts CW, matches 12-800 Ohms. Does not have digital SWR/Wattmeter/LCD display, audio SWR meter/audio feedback, antenna switch or 4:1 current balun.

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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
$139.95

ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

Long 10/12 foot Telescoping Whips

MFJ-1954
$22.95
10 Feet

MFJ-1956
$29.95
12 Feet

10 foot extended, 19 inches collapsed, MFJ-1954, $22.95. 12 foot extended, 22.5 inches collapsed. MFJ-1956, $29.95. Standard 3/8 inch by 24 threaded stud for use with all standard mounts. Durable 1/2 inch diameter plated brass. Telescopes for full 1/4 wave operation 2 to 12/15 Meters. Cover 17, 20, 30, 40, 60, 80, 160 Meters with loading coil. Use two for multi-band dipoles. Replace screwdriver antenna whip for highly efficient *fixed* mobile operation.

MFJ RF Isolator

MFJ-915 *RF Isolator*

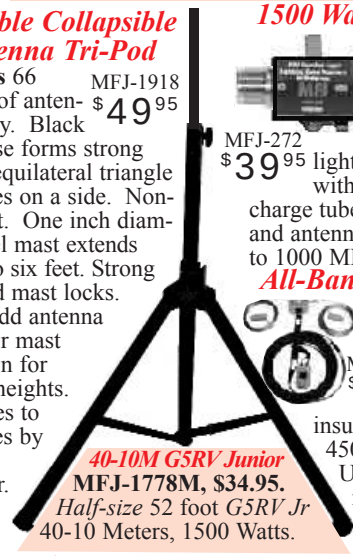
MFJ-915
$29.95

prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. *Don't operate without one!* 5x1½ inches. For 1.8 to 30 MHz.

Portable Collapsible Antenna Tri-Pod

MFJ-1918
$49.95

Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.



40-10M G5RV Junior
MFJ-1778M, $34.95.
Half-size 52 foot *G5RV Jr*
40-10 Meters, 1500 Watts.

1500 Watt Lightning Surge Protector

MFJ-272
$39.95

Protect your expensive transceiver from static electricity and lightning induced surges with an ultra-fast gas discharge tube. Plug between rig and antenna, attach ground. DC to 1000 MHz. SO-239s.

All-Band G5RV Antenna

MFJ-1778
$39.95

Cover all bands, 160-10M with tuner. 102 ft. long, 1.5kW. Custom fiberglass insulator stress relieves 450 Ohm ladder line. Use horizontally, as inverted vee or sloper. Marconi on 160M.

Glazed Ceramic Antenna Insulator

MFJ-16C06
6-Pack
$4.56
(79 cents each)

Authentic *glazed ceramic* antenna insulator. Extra-strong -- will not break with long antennas and will not arc over or melt even under full legal power. Molded ridges give extra-long high voltage path to prevent high-voltage breakdown. Smooth wire holes prevent wire damage. Use as center or end insulator for dipoles, doublets, G5RVs, guy wires and others.

Current Balun/Center Insulator

MFJ-918
$24.95

True *1:1 Current Balun/Center Insulator* forces equal currents into dipole halves to reduce coax feedline radiation and field pattern distortion. Reduces TVI, RFI and RF hot spots in your shack. 50 ferrite beads on *Teflon*(R) coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

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and Nearest Dealer . . . 800-647-1800

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FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . the world leader in ham radio accessories!

MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974HB is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

***The** MFJ-974HB is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974HB gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974HB tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974HB is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

MFJ-974HB
$199.95

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to un-balanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974B
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MFJ-974B, $179.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $49.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ *High Current* DC Multi-Outlet Strips

Choose super versatile 5-way binding posts AND/OR Anderson PowerPole(R) connectors

Anderson PowerPole® is a registered trademark of *Anderson Power Products.*

Provide multiple high current DC outlets for transceivers and accessories from your main 12 VDC power supply – keeps you neat, organized and safe. Prevents fire hazard. Keeps wires from tangling up and shorting. Outlets are fused and RF bypassed.

All MFJ DC power strips have *built-in* six foot, eight gauge, flexible color-coded cable with ring tongue terminals -- *no extra cost*. *RF-tight* aluminum cabinet has mounting ears and ground post with wing nut.

Choose MFJ's *super versatile* super heavy duty 5-way binding posts (spaced for standard dual banana plugs) and/or *Anderson PowerPole*® outlets.

Each *Anderson PowerPole*® is individually fused as needed. Standard color coded automobile fuses plug in externally. Extra *PowerPole*® connectors, contacts, fuses are included at *no extra cost*.

Versatile 5-Way Binding Posts

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All PowerPoles®

MFJ-1128
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12 outlets, each fused, 40 Amps total. Three high-current outlets for transceivers. Nine *switched* outlets for accessories. Mix and match in-cluded fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). *Built-in 0-25 VDC Voltmeter*. Includes *extra* 12 pairs of *PowerPole*® contacts and *extra* 10 fuses (2 each: 1, 5, 10, 25, 40A) -- *no extra cost*. 12Wx1¼Hx2¾D in.

MFJ-1126
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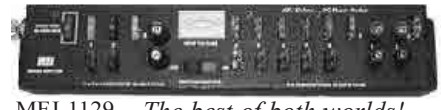
PowerPoles® AND 5-Way Binding Posts



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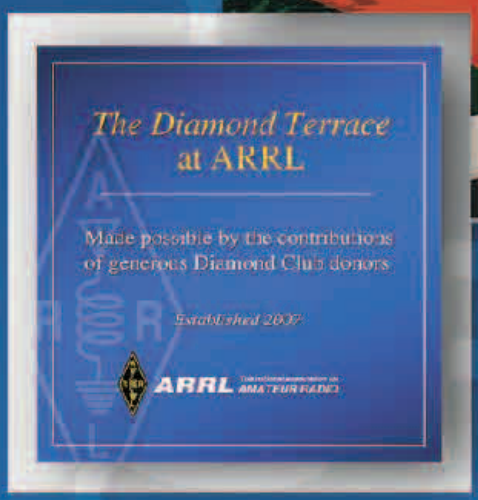

For more information, contact:

Mary M. Hobart, K1MMH
Chief Development Officer
ARRL
225 Main Street
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Telephone: **860-594-0397**
Email: **mhobart@arrl.org**

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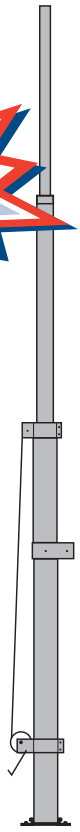

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