QST

DEVOTED ENTIRELY TO AMATEUR RADIO

October 2009 WWW.ARRL.ORG

Annual Radiosport Issue

QST reviews:

45| **FlexRadio Systems FLEX-3000** Software Defined HF/50 MHz Transceiver

Inside:

$4.99 US $6.99 can.

10>

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Special Contesting Ad Section page 129

Official Journal of ARRL The national association for AMATEUR RADIO

Icom Digital Technology Leads the Way

IC-7800

- 200 Watt, Full Duty Cycle
- Four 32 Bit IF-DSPs + 24 Bit AD/DA Converters
- 2 Completely Independent Receivers
- +40 dBm 3rd Order Intercept Point
- 3 Roofing Filters
- Selectable, “Build Your Own” IF Filter Shapes

IC-7700

- 200 Watt, Full Duty Cycle
- 32 Bit IF-DSPs + 24 Bit AD/DA Converters
- Single Receive
- +40 dBm 3rd Order Intercept Point
- 3 Roofing Filters
- Selectable, “Build Your Own” IF Filter Shapes

IC-7600

- 100 Watt, Full Duty Cycle
- 2 Independent DSP Units
- Dualwatch Receive
- +30 dBm 3rd Order Intercept Point
- 3 Roofing Filters
- Selectable, “Build Your Own” IF Filter Shapes

Congratulations to K3LR!

For the first time in over 45 years a USA station has won the 2008 CQWW Phone contest Multi Multi for the WORLD.

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100% Icom radio equipment

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Icom has the receivers for the experts...

IC-R9500 ICOM'S ULTIMATE WIDE BAND RECEIVER

- 0.005 - 3335.000MHz*
- USB, LSB, CW, FSK, FM, WFM, AM
- 1020 Alphanumeric Memory Channels
- P25 (Option UT-122)
- Five Roofing Filters and so much more!

Icom Mobile Receivers

IC-R1500

MOBILE OR PC CONTROL

- 0.01 - 3299.99 MHz*
- AM, FM, WFM, USB, LSB, CW
- 1000 Memory Channels
- Fast Scan
- Optional DSP (UT-106)
- PCR Software Included
- Very Compact Design

IC-R2500

2 WIDE BAND RX IN 1

- 0.01 - 3299.99 MHz*
- AM, FM, WFM, SSB, CW (Main)
- AM, FM and WFM (Sub)
- 1000 Memory Channels
- Optional D-STAR (UT-118)
- Optional P25 (UT-122)
- Optional DSP (UT-106)

...or for those just getting started.

IC-R75 WIDE BAND RECEIVER

- 0.03 - 60.0 MHz*
- Triple Conversion
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- Digital Signal Processing (DSP)

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

hy-gain/AlfaSpid Azimuth & Elevation Rotators

***Super heavy-duty Rotators . . .* Super strong Double Worm Gear Drive, Self-Braking, Extremely Quiet Motors, One Degree Position Resolution, Automatic Digital Controller. *Up to . . .* 38 sq. ft. wind load . . . 8000 in./lbs. turning torque . . . 24,000 in./lbs. brake torque . . . 700 lbs. vertical load**

These *super heavy-duty* RAK Rotators are designed with a simple *double worm gear* drive. This results in a super-strong ultra-reliable rotator system with inherent self-braking. Each includes a precision automatic digital controller.

Turning is powerful, smooth, precise and extremely quiet. The inherent self-braking action of its double worm gear drive positively stops it every time -- *it won't move!*

It's fast! A high-torque DC gear motor rotates your antenna 360 degrees in just 60 seconds with 24 Volts on the motor. The RAK Rotators operate from 12 to 24 Volts AC *or* DC. The higher the voltage the higher the torque and the faster the turning speed -- *a unique RAK feature*.

RAK-1 (RAK)
$999.95
Includes RAK-1C controller

Plate adaptor, mouse not included

It's simple to mount! Pipe mast mount on both ends allow coax cables to pass through the center of the rotator and prevents cable tangling and damage. An optional adaptor is available for plate mounting. *See accessories section below.*

It's precise! The included RAK-1C controller has one degree resolution and a large 3/4 inch 4-digit *easy-to-read* soft green LED digital readout. Sealed reed switch sensor technology gives reliable all-weather operation and super tight tolerances with minimal play.

RAK-2 (BIG RAK)
$1499.95
Includes RAK-1C controller

Plate adaptor, mouse not included

It's tough and durable! Heavy-duty construction uses 3/16 inch thick-wall steel pipe and ultra-durable steel housing.

RAK-1 Specs	RAK-1 @ 12 V	RAK-1 @ 18 V	RAK-1 @ 24 V
Wind Load Area	Approx. 30 sq. feet	Approx. 30 sq. feet	Approx. 30 sq. feet
Turning Torque,in-lbs	1400 in-lbs.	1800 in-lbs.	3240 in-lbs.
Brake Torque, in-lbs.	14,000 in-lbs.	14,000 in-lbs.	14,000 in-lbs.
Brake Construction	Double Worm Gears	Double Worm Gears	Double Worm Gears
Vertical Load	550 lbs.	550 lbs.	550 lbs.
Rotation Speed/*360 deg*	120 seconds	90 seconds	60 seconds
Precision	1 degree	1 degree	1 degree
Rotation Range	720 degrees	720 degrees	720 degrees
Rotator Weight	16 lbs.	16 lbs.	16 lbs.
Position Sensor	Reed Switch	Reed Switch	Reed Switch
Mast size	2.0/2.6 in. Top/Bot.	2.0/2.6 in. Top/Bot.	2.0/2.6 in. Top/Bot.

RAK-2 Specs	RAK-2 @ 12 V	RAK-2 @ 18 V	RAK-2 @ 24 V
Wind Load Area	Approx. 38 sq. ft.	Approx. 38 sq. ft.	Approx. 38 sq. ft.
Turning Torque,in-lbs	>5000 in-lbs.	>8000 in-lbs.	Contact *Hy-Gain*®
Brake Torque, in-lbs.	24,000 in-lbs.	24,000 in-lbs.	24,000 in-lbs.
Brake Construction	Double Worm Gears	Double Worm Gears	Double Worm Gears
Vertical Load	>700 lbs.	>700 lbs.	>700 lbs.
Rotation Speed/*360 deg*	120 seconds	90 seconds	60 seconds
Precision	1 or 0.5 degree	1 or 0.5 degree	1 or 0.5 degree
Rotation Range	720 degrees	720 degrees	720 degrees
Rotator Weight	24 lbs.	24 lbs.	24 lbs.
Position Sensor	Reed Switch	Reed Switch	Reed Switch
Mast size	2.6/2.6 in. Top/Bot.	2.6/2.6 in. Top/Bot.	2.6/2.6 in. Top/Bot.

Azimuth-Elevation Rotators

Hy-gain offers the RAS (RAS-1) and BIG RAS (RAS-2) super heavy-duty *Azimuth-Elevation Rotators*. Has same heavy-duty design as RAK rotators. Each includes the RAS-2C Automatic Digital Controller.

RAS-2 has same specifications as RAS-1 below but with these super-specs. *Turning Power*: 5,000 in-lbs. torque@12V; 8000 in-lbs. torque@18V; *Brake Torque*: 24,000 in-lbs. at all voltages; *Vertical Load:* greater than 700 lbs; RAS-2 weighs 44 lbs.

RAS-1
$1599.95
Includes RAS-2C Controller.

RAS-2
$2299.95

Plate adapters not included.

RAS-1 Specs	RAS-1 @ 12 V	RAS-1 @ 18 V	RAS-1 @ 24 V
Wind Load Area	Approx. 30 square feet	Approx. 30 square feet	Approx. 30 square feet
Turning Torque in-lbs	1400 in-lbs.	1800 in-lbs.	3240 in-lbs.
Brake Torque, in-lbs.	14,000 in-lbs.	14,000 in-lbs.	14,000 in-lbs.
Brake Construction	Double Worm Gears	Double Worm Gears	Double Worm Gears
Vertical Load	550 lbs.	550 lbs.	550 lbs.
Rotation Speed *(360 degrees)*	120 seconds	90 seconds	60 seconds
Precision, Rotator Weight	1 degree, 29 lbs.	1 degree, 29 lbs.	1 degree, 29 lbs.
Rotation Range (Azi/Elev.)	360/180 degrees	360 azi/180 degrees	360/180 degrees
Position Sensor	Reed Switch	Reed Switch	Reed Switch
Mast size Bottom/Elevation	2.6 bottom/2.0 elevation	2.6 bottom/2.0 elevation	2.6 bottom/2.0 elevation

Elevation Rotator

The REAL-1 *Elevation Rotator* has all the super heavy-duty specifications of the RAK-1 but is for moving antennas 180 degrees up or down. Includes RAK-1C digital rotator controller.

REAL-1
$1069.95
Includes RAK-1C controller

Rotator Accessories

Model#	Cost	Description
AZ-1M	$39.95	Rotator Cntrlr Mouse only
RAK-1R	$599.95	RAK Rotator Only
RAK-2R	$1199.95	BIG RAK Rotator only
RAK-1C	$479.95	RAK Auto Controller only
RAS-1R	$1099.95	RAS Rotator only
RAS-2R	$1199.95	BIG RAS Rotator only
RAS-2C	$599.95	RAS Auto Controller only
REAL-1R	$599.95	REAL Rotator only
FPA-4	$39.95	4" Pipe to Flat Plate Adptr
FPA-8	$49.95	8" Pipe to Flat Plate Adptr
FTP-18	$79.95	18" Pipe to Pipe Adaptor

FPA-4 **$39.95**

FPA-8 **$49.95**

PTP-18 **$79.95**

Digital Rotator Controllers

RAK-1C
$479.95

RAK-1 and RAK-2 Rotators are supplied with the RAK-1C Automatic Controller.

Manual Mode: Left/Right arrows, moves rotator clockwise and counter clockwise.

Semi-Automatic Mode: Allows pre-set of desired beam locations (requires optional mouse).

Automatic Mode: Your external computer connected to RS-232 interface provides automatic control. Works with most rotator control computer programs.

Controller can be zeroed at any position to allow for installation inaccuracy or antenna mount slippage. Has one degree resolution and a large 3/4 inch 4-digit easy-to-read soft green LED digital readout.

Uses standard four conductor cable to controller. Compact 5Wx1$^{1}/_{2}$Hx8$^{3}/_{4}$D in.

Optional Mouse, **AZ-1M, $39.95**, allows 6 user programmable preset buttons. Mouse rotates rotator left, right and stop.

RAK-1C / RAS-2C Specs	RAK-1C, $479.95	RAS-2C, $599.95
Computer Interface	RS-232, 1200 Baud 8N 1	RS-232, 600 Baud, 8N 1
Pre-sets with Mouse	6 User settable	N/A
Emulation	Spid, HY, OR, Yaesu	Spid, Yaesu
Limit Settings	2-AZ-CW & CCW	4 (2 AZ - 2 EL)
User-settable Calibration	N-S or any degree	AZ & EL, any degree
Precision	1 or 0.5 degree	1, 0.5, 0.25 degree
Rotation Range	720 degrees	360/180 degrees
Weight	2.75 lbs.	4.75 lbs.
Connections to Rotator	4 wire (2 sens, 2 motor)	4 wire (2 sens, 2 motor) EL 4 wire (2 sens, 2 motor) AZ

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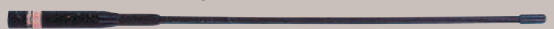
Life is a JOURNEY, Enjoy the ride!

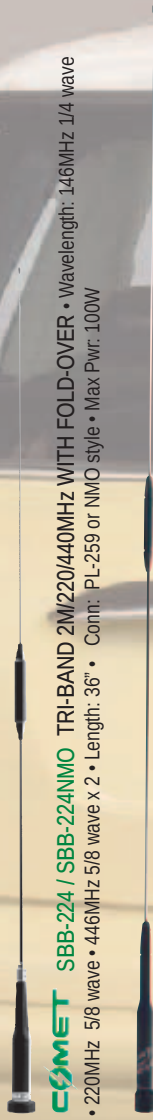
Maldol MH-511 TRI-BAND 6M/2M/70CM HT ANTENNA • Length: 4" • Conn: Male SMA

Maldol MH-510 TRI-BAND 6M/2M/70CM HT ANTENNA • Wavelength: 6M 1/4 wave top-load • 2M 1/4 wave • 440MHz 1/2 wave • Length: 20.75" • Conn: Male SMA

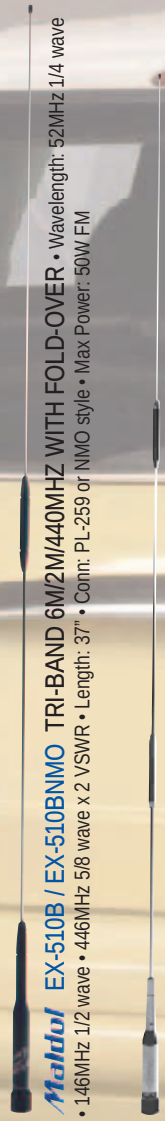


COMET HT-224 TRI-BAND 2M/220/70CM HT ANTENNA • Wavelength: 2M 1/4 wave • 220MHz 1/2 wave • 440MHz 1/2 wave • Length: 11.5" • Conn: Male SMA

Maldol MH-610 TRI-BAND 2M/220/70CM HT ANTENNA • Wavelength: 2M 1/4 wave • 220MHz 1/2 wave • 70cm 5/8 wave • Length: 14" • Conn: Male SMA

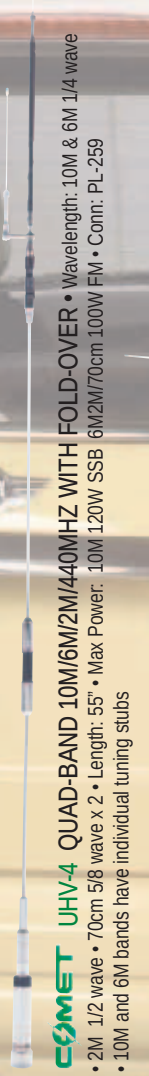


COMET SBB-224 / SBB-224NMO TRI-BAND 2M/220/440MHz WITH FOLD-OVER • Wavelength: 146MHz 1/4 wave • 220MHz 5/8 wave • 446MHz 5/8 wave x 2 • Length: 36" • Conn: PL-259 or NMO style • Max Pwr: 100W

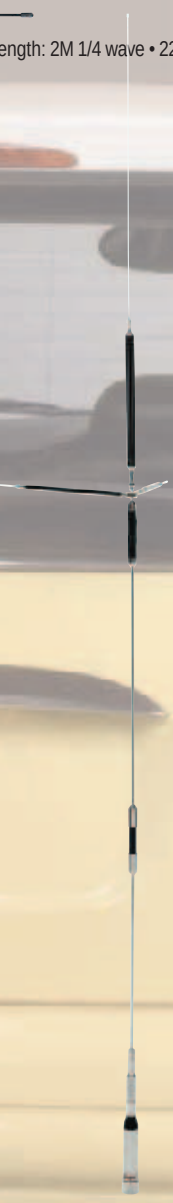


Maldol EX-510B / EX-510BNMO TRI-BAND 6M/2M/440MHZ WITH FOLD-OVER • Wavelength: 52MHz 1/4 wave • 146MHz 1/2 wave • 446MHz 5/8 wave x 2 VSWR • Length: 37" • Conn: PL-259 or NMO style • Max Power: 50W FM

COMET SB-15 TRI-BAND 6M/2M/440MHZ WITH FOLD-OVER • Wavelength: 52MHz 1/4 wave • 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58" • Conn: PL-259 • Max Pwr: 120W



COMET UHV-4 QUAD-BAND 10M/6M/2M/440MHZ WITH FOLD-OVER • Wavelength: 10M & 6M 1/4 wave • 2M 1/2 wave • 70cm 5/8 wave x 2 • Length: 55" • Max Power: 10M 120W SSB 6M2M/70cm 100W FM • Conn: PL-259 • 10M and 6M bands have individual tuning stubs



COMET UHV-6 HF/6M/2M/440MHZ MOBILE ANTENNA *80/*20/*17/40/15/10/6/2M/70cm Mobile antenna with fold-over hinge• Wavelength: 2M 1/2 wave • 70cm 5/8 wave x 2 • VSWR: HF 1.6:1 or less, 6M-70cm 1.5:1 or less • Length: 44" (min), 78"(max) • Max Pwr: HF 120W SSB, 6M 200W SSB/100W FM, 2M/70cm 100W FM • **L-14 optional 20M coil *L-18 optional 17M coil *L-3.5 optional 80/75M coil • Features: • 6M/2M/ 70cm operation is constant. You CHOOSE the HF coils you want to add, up to four stock or optional. One vertical, the rest horizontal. • Easily mounts to standard trunk/door mount in minutes • Economical • Fold-over hinge built in• Select the duplexer or triplexer for your specific radio(s). CF-706A, CF-530, CFX-514N • Conn: PL-259

UHV-6 in fold-over position.
Fold-over hinge included for easy entry to garage, parking structure, drive-thru etc... SB-15 / UHV-4 / UHV-6 / HMC-6S fold-over hinge has a threaded collar to lock the hinge vertically in place. It can't fold-over by itself at highway speed!

Maldol HMC-6S *40/20/15/10/6/2/440MHZ MOBILE ANTENNA WITH FOLD-OVER Wavelength: HF 1/4 wave • 2M 1/2 wave • 70cm 5/8 wave x 2 • VSWR: HF-6M 1.6:1 orless 2M/70cm 1.5:1 or less • Length: 66" • Max Power: HF 120W SSB 6/2/70cm 150W FM*HMC-7C optional 40M coil • Conn: PL-259

MINI COOPER SHOWN WITH CP-5M UNIVERSAL LIP MOUNT ON THE DOOR EDGE.

All the mounts attach to van doors, truck side doors, SUV doors, etc... and require no holes. Includes 16' 6" deluxe cable assy w/18" mini RG-1888A/U type coax for weather seal entry.

Choose a mount depending on the antenna size and vehicle mounting location space.

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MODEL / ANT CONN / COAX CONN

Maldol EM-5M SO-239 / PL-259

Footprint: 1.1"x .75"

Max Antenna: 40"

For Medium Size Antennas

MODEL / ANT CONN / COAX CONN

COMET CP-5M SO-239 / PL-259

COMET CP-5NMO NMO / PL-259

Footprint: 3.4" x 1.25"

Max Antenna: 60"

For Tall or Multi-band HF Antennas

MODEL / ANT CONN / COAX CONN

COMET HD-5M SO-239 / PL-259

COMET HD- 5 3/8-24 3/8-24 / PL-259

Footprint: 3.75" x 1.1 "

Max antenna: 80"

COMET and Maldol Mobile

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

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Radiosport

Our Cover
As the Sun sets gloriously in front of them, Scott Burkhardt, WØKU, of Denver, and John Maxwell, NØWBW, of Lakewood, Colorado, take down their Cushcraft 719B UHF antennas after the 2009 ARRL June VHF QSO Party. Photo by Scott Taylor, WØKVA. Inset: Ted Saba, KN5O, of Covington, Louisiana, operating as W5RU, found plenty of DX to work in the 2008 ARRL 10 Meter Contest, sunspots or no. Photo courtesy of KN5O.

Departments

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Size: 6.3" (W) x 2.0" (H) x 7.3" (D) / Weight: 4.0 lb

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- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users

NEW

ULTRA RUGGED 55 W 2 m FM TRANSCEIVER

FT-1900R

2 m MONO BAND

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- Large Backlit LCD Display for easy operation
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Actual Size

NEW 2 m/70 cm DUAL BAND FM TRANSCEIVER

FT-7900R

2 m/70 cm DUAL BAND

Size: 5.5" (W) x 1.6" (H) x 6.6" (D) / Weight: 2.2 lb

• Separation Kit for Remote Mounting (optional separation kit YSK-7800 requires)

50 W 10 m/6 m/2 m/70 cm* Quad Band FM Mobile

FT-8900R

*70 cm 35 W

QUAD BAND DUAL RECEIVE

50 W 2 m/70 cm* Dual Band FM Mobile

FT-8800R

*70 cm 35 W

DUAL BAND DUAL RECEIVE

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FT-897D

TCXO DSP 60 m Band

HF/50/144/430 MHz
100 W All Mode Transceiver (144 MHz 50 W/430 MHz 20 W)

HF/VHF/UHF Multimode Mobile Transceiver, now Including Built-in DSP

FT-857D

DSP 60 m Band

HF/50/144/430 MHz
100 W All Mode Transceiver (144 MHz 50 W/430 MHz 20 W)

Automatic Matching for FT-897/857 Series Transceivers

FC-40

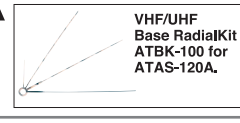
Automatic-Matching 200-Memory Antenna Tuner (160 m ~ 6 m Band)

WATERPROOF

Mobile Auto-Resonating 7~430 MHz for FT-897/857 Series Transceivers

ATAS-120A

Active Tuning Antenna System (no separate tuner required)



VHF/UHF Base RadialKit ATBK-100 for ATAS-120A.

REAL PERFORMANCE, REALLY PORTABLE

FT-817ND

HF/50/144/430 MHz
5 W All Mode Transceiver (AM 1.5 W)

60 m Band

ATAS-25 ATAS MICRO
Manually-Tuned Portable Antenna

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"It Seems to Us"

Our Global Community

"When you earn an Amateur Radio license you join a global community of more than two million people who share your interest in radio communication as an avocation."

There are radio amateurs all over the world — and even above it, orbiting on the International Space Station! We are a select group, each having qualified for a license issued by our telecommunications administration in accordance with international regulations. We are also remarkably diverse, spanning the full ranges of ethnicity, cultural and religious traditions and political thought. Granted, the most impoverished have no opportunity to be radio amateurs — but many of the greatest contributors to our global community are of very modest means. A radio signal sounds pretty much the same whether it comes from the latest, most expensive transceiver or from a homebrew transmitter built from castoff components, and its effectiveness depends more on the skill of the operator than on the price tag.

An attentive listener can trace population shifts from what he or she hears on the ham bands. The movement of retirees from the Northeast to Florida is evident from both call signs and accents. More subtle are the swelling of the ranks of Israeli amateurs by emigration from the former Soviet Union and of Canadian amateurs drawn from there as well as from other Eastern European countries, to name but two examples.

Amateur Radio is growing impressively in China and in some other Asian countries that are making the transition to technology-based economies. By contrast, in most countries where Amateur Radio is a mature activity the licensing figures are trending downward. Among the exceptions to that trend are Australia, where effective promotion of an entry level "Foundation" license by the WIA has brought in a wave of newcomers, and the US. Apparently fueled by public awareness of our role in disaster mitigation, the issuance of new FCC licenses has increased every year since 2005. The 10-year license term builds a lot of inertia into the figure for total licenses, but that is climbing once again.

The United States now has the largest number of Amateur Radio stations of any country, although the number of amateurs per capita is a bit greater in several others. The ARRL is the largest Amateur Radio organization in the world but is not the oldest; the Wireless Institute of Australia lays claim to that distinction (the WIA is preparing to celebrate its centennial next year) followed by the Radio Society of Great Britain. Outstanding operators and technical innovators hail from dozens of countries, yet it is fair to say that our colleagues abroad often look in the ARRL's direction for leadership — particularly in the field of emergency and disaster communications.

The ARRL's international leadership also takes the form of service as the International Secretariat (IS) of the International Amateur Radio Union. The IARU Constitution places some obligations on the member-society that serves as the IS. In exchange, that member-society has the prerogative to manage the nomination process for the volunteer positions of IARU President and Vice President and to appoint the IARU Secretary. For the first time in its history both the President and the Vice President of the IARU — Tim Ellam, VE6SH and Ole Garpestad, LA2RR respectively — are from outside the US. Tim and Ole were nominated for five-year terms by the ARRL following a lengthy consultative process with the regional representatives on the IARU Administrative Council and other opinion leaders within the IARU community.

As of October 1 the IARU Secretary will be Rod Stafford, W6ROD. Rod has served the ARRL as a volunteer for more than 25 years, including as Section Manager, Director, and Vice President prior to becoming President in 1995. He moved to his current ARRL post of International Affairs Vice President in 2000. Since 1998 Rod also has served IARU Region 2 as Secretary, President, and regional director. The October 1 date is not arbitrary; Rod is willing to assume this new volunteer role as IARU Secretary upon his retirement as a Superior Court Judge in Santa Clara County, California.

Our support of the IARU is hardly a one-way street. While we rightly think of the FCC as our most important regulatory body, radio waves do not respect borders and the use of the radio spectrum is not purely a domestic matter. As far as radio is concerned, the FCC regulations exist within a framework of international regulations.

The International Telecommunication Union (ITU) is the body through which nations seek agreement on how the radio spectrum is to be used, through complex negotiations at World Radiocommunication Conferences (WRCs). The IARU is a Sector Member of the ITU in both the Radiocommunication and Development Sectors and is recognized by the ITU as the international organization representing the amateur services. While the IARU and similar organizations have no vote at WRCs, they have the opportunity to participate in preparatory work and to attend and observe the conferences themselves.

Regional telecommunications organizations such as CITEL, the Inter-American Telecommunication Commission, play a major role in the ITU decision-making process. It is through IARU Region 2 that Amateur Radio participates in the work of CITEL.

As Americans we have no chance to influence other governments or regional telecommunications organizations other than CITEL, yet we must have their support to achieve our own objectives. Scores of volunteers from all around the planet contribute to the work of the IARU, its three regional organizations and its national member-societies, accomplishing what we cannot do ourselves. What they do benefits us all, whether or not we ever make a radio contact outside our own country — or county.

David Sumner, K1ZZ
ARRL Chief Executive Officer

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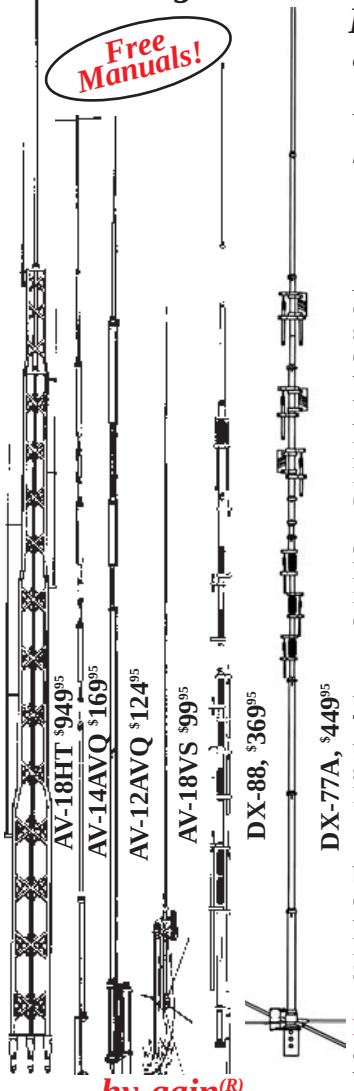

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AV-12AVQ, $124.95. (10, 15, 20 Meters). 13 ft., 9 lbs. **AV-12AVQ** also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Roof mount with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

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

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

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AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$124.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$99.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 80 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 40 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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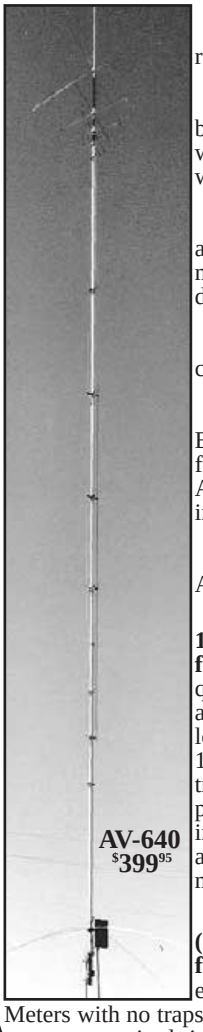

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- ARES® members in the Santa Cruz, California area helped in the initial response to the Lockheed Fire.
- In the wake of state and local action that would prohibit the use of cell phones while driving, ARRL President Joel Harrison, W5ZN, explained the differences between cell phone use and Amateur Radio communication in a letter to the National Safety Council.
- The Hurricane Watch Net and the VoIP Hurricane Net prepared for Hurricane Bill, which churned up the Atlantic off the US East Coast.
- As of this writing, a total of 20 representatives have pledged their support for HR 2160, The Amateur Radio Emergency Communications Enhancement Act of 2009.
- The ARRL announced an operating event scheduled for September 2-9 that will commemorate the 140th anniversary of the birth of Hiram Percy Maxim, W1AW.
- The FCC's Twitter page had more than 1200 followers soon after it was launched in mid-August. A new FCC blog called *Blogband* is also up and running.
- The ARRL has filed comments in response to an FCC Notice of Proposed Rulemaking that would allow implanted medical devices to be used in the 70 cm band.
- WX4NHC, the Amateur Radio station at the National Hurricane Center in Miami, is featured in a new radio spot for Duracell batteries.
- After a lengthy review, the ARRL DXCC program has accepted the 7O1YGF DXpedition to Yemen in 2000 for DXCC credit.
- The FCC has announced that a 10 year Amateur Radio vanity call sign will cost $13.40, effective September 10, up from $12.30.
- The series of eight ARRL Teachers Institutes on Wireless Technology wrapped up at ARRL HQ in Newington, Connecticut. In addition, a new advanced Institute, called the TI-2, focused on satellite communications. In July, the ARRL Executive Committee reviewed Education & Technology Program grant applications, awarding nearly $9000 to eight schools.
- With the addition of Meredith Attwell Baker and Mignon Clyburn, the FCC is at its full complement of five commissioners.
- MFJ Enterprises has purchased the Cushcraft Amateur Radio antennas product line from Missouri-based Laird Technologies.
- In August, the FCC issued a Citation to Future Hobbies for marketing unauthorized radio frequency devices in the US that operate on restricted frequencies. On July 28, the FCC issued a Citation to The Spy Store for the same infraction.
- The winner of the *QST* Cover Plaque Award for July is Robert Wilson, AL7KK/VE7ZKK, for his article "A High Gain Single Wire Beam."
- These online course sessions began September 4: Amateur Radio Emergency Communications Level 1; Antenna Modeling; Radio Frequency Interference; Antenna Design and Construction; Ham Radio (Technician) License Course; Propagation; Analog Electronics, and Digital Electronics.

Media Hits

Allen Pitts, W1AGP
Media & Public Relations Manager

- Field Day is over. How good is your local PR and Publicity person now? Some are excellent, but most have no training at all. Maybe you are that person and you want to be more effective. Your club or Section Manager appointed you, but you don't know what is expected or how to do it well. Take "PR-101" for Public Information Officers. This is a basic course giving students the skills to accomplish the purpose, strategy and job expectations of being a PIO. It's at **www.arrl.org/shop/?item=0133**. If you took on the title, then take the training to do it right.

But you don't have to go it alone. There is a lot of help available for you! Start with the basics; there are three primary ARRL Public Relations campaigns:

- "Hello" — the hobby and friendships of Amateur Radio
- "Getting the Message Through" — ARES and emergency work
- "We Do That!" — ham technological activities

If you are doing a presentation, "Talk on a Disk" contains all the materials you need to make a good PowerPoint presentation before a non-ham group on any of these three topics. It contains scripts, notes, audio and video files. If you have a talk to make, write me at **apitts@arrl.org** and ask for a copy. Attractive companion brochures and handouts are also available on all three of these topics at **www.arrl.org/brochures**. Then, there are the three special Web sites: **Hello-Radio.org**, **Emergency-Radio.org** and **WeDoThat-Radio.org**.

There are also short videos for discussion starters you can download:

- Katrina Response Video — **www.emergencyradio.org/video/Katrina.wmv**
- Hello Video — **p1k.arrl.org/files/Hello-Movie.wmv**.

If you are looking for ideas, "The Swiss Army Knife for PIOs" is a computer CD with all the basic forms and information a PIO should need in one place. The disks are available by writing to **apitts@arrl.org**. Other sources of good information are in *CONTACT!* a monthly "e-zine" of PR information at **www.arrl.org/pio/contact**. The ARRL Public Relations Committee is also a key source of PR information if major events begin to unfold.

Have a local broadcast radio station in the area? We have many audio public service announcements. These are mp3 recordings available for download with various themes to fit different broadcast stations' styles from humorous (**www.arrl.org/pio/PSA_2008march.mp3**) to advocating for women (**www.arrl.org/pio/ARRL709D.mp3**) plus seven attributes of Amateur Radio (**www.arrl.org/pio/PSA_master_withCount.mp3**).

For local TV stations there's an ARES® related video (**www.emergency-radio.org/video/2007PSA.mp4**) and two levels of a technology campaign video — **www.arrl.org/pio/videos/LowRes2009.wmv** and a hi-def one at **www.arrl.org/pio/videos/ARRL30secPSA2009.mov**.

Backgrounders are short paper handouts covering the basics you hand to reporters with media inquiries. They are available for you at **www.arrl.org/pio/#backgrounders**.

The club publicity chairman, PIO, or whatever the title may be that covers promoting Amateur Radio to non-hams in your area, needs to advocate for us all 365 days a year. It's not just about Field Day. Maybe "all news is local," but 364 days of silence is not golden.

Third Annual Space Jam

Boy Scouts of America Venture Crew 272 of Hillsboro, Indiana and Troop 17 from Champaign, Illinois hosted hundreds of Scouts in July at the third annual Space Jam. It was held at the Chanute Aerospace Museum & Rantoul National Aviation Center in Rantoul, Illinois. Top on the list was talking to Canadian Astronaut Dr Bob Thirsk, VA3CSA, on the International Space Station, as the ISS flew over Argentina at 17,500 miles per hour.

The Vermilion County Amateur Radio Association (VCARA) team taught the Radio merit badge, with David Cline, KB9ZMF, heading up the WB9SA contacts to complete the Scout merit badge. DePauw Professor Howard Brooks, KC9QBN, oversaw the launch of two high altitude balloons. One carried a crossband repeater that allowed line of sight communication between Ohio and Missouri as it went to 93,000 feet. The Central Illinois Aerospace club entertained all with model rockets, and the Champaign Radio Control Club put on an awesome show, too. — *Brian Walker, K9BKW*

AUSTIN WALKER, KC9EVS

Dr Howard Brooks, KC9QBN, DePauw University's Physics and Astronomy Chair, helps Scouts ready a crossband repeater high altitude balloon at Space Jam 3 (www.spacejamboree.com/multimedia.php). Hams in four states enjoyed working the balloon-borne repeater, which enjoyed nonstop activity during its short lifespan. Next August, Space Jam 4 will feature ATV ballooning, APRS Search & Rescue and Going Green technologies.

BOB SMITH, KDØATN

The whole ham family: **When my daughter Melissa Johnson, K1MJ, was married to Roland Holcomb, KJ4HRA, in Bemidji, Minnesota, the hams got together for a photo: From the left: David West, NØDTL (uncle of the bride), Paul Johnson, WØPJ (brother of the bride), Carrie Johnson, NØCMJ (sister of the bride), the bride, the groom, Vivien Johnson, KL7YL (mother of the bride), Glenn Johnson, WØGJ (father of the bride) and Mark Johnson, NØMJ, brother of the bride. Missing: Maynard Johnson, WDØGOS, grandfather of the bride. —** ***Glenn Johnson, WØGJ, ARRL Life Member***

Inside HQ

The 2010 ARRL Handbook

It takes a building, and then some, to create the 2010 edition of the *ARRL Handbook*. We've started touting the *Handbook* in this issue of *QST* because this edition is the biggest one we've ever produced — more than 1250 pages. It was a massive effort that has taken over a year to complete. To learn about the content changes, you can read the article by Ward Silver, NØAX, on page 68.

Mark Wilson, K1RO, edited the *2010 Handbook* with assistance from Ward. *QST* Editor and ARRL Publications Manager Steve Ford, WB8IMY, was responsible for its overall production. Along with the many updates to its editorial content, the *Handbook* contains hundreds of photographs, original drawings and schematics. Graphics and photography including the front and back covers were the responsibility of Graphics Supervisor Sue Fagan, KB1OKW, and CAD/CAM Artist Dave Pingree, N1NAS.

When I was a Novice of 14, the ads in the back were my favorite part of the book — those rigs from Collins, Hallicrafters and Hammarlund sure looked great! We believe that *Handbook* advertising is still informative. Besides, without the advertising revenue, the retail cost of the *Handbook* would be much higher. Getting ads into the *Handbook* requires creative production, precise placement and exact sizing of the advertising. This sales effort was led by Business Services Manager Deb Jahnke, K1DAJ, assisted by Commercial Artist Diane Szlachetka, KB1OKV, and Advertising Production Coordinator Zoe Belliveau, W1ZOE. The ARRL Lab staff also reviewed the ads for technical accuracy.

As *Handbook* content was written, edited and submitted, it fell under the watchful eyes of our Production department led by Production Supervisor Shelly Bloom, WB1ENT, along with Production Coordinator Maty Weinberg, KB1EIB, and Layout Artists Jodi Morin, KA1JPA, and Carol Michaud, KB1QAW. This department designed and typeset every page. Layout and typesetting were accomplished using Adobe *InDesign* software, which runs on powerful computer workstations supported by our Information Technology team.

While the *Handbook* is being produced, the job is sent out to bid. Once a printer is selected, the Production staff monitors the printing process for timeliness and reproduction accuracy. It takes about a month for the printer to complete his work. Then, thousands of *Handbooks* are shipped to us here in Newington where we must make room to store them in our warehouse. We anticipate the books arriving in early October.

As we wait for new *Handbooks*, however, all the necessary pricing, inventory and shipping information must be entered into our internal systems by our Accounting, Warehouse and Publications Sales departments.

And of course, our Marketing team led by Bob Inderbitzen, NQ1R, and Jackie Cornell, KB1PWB, has already been at work creating the catalog, online and promotional material to let everyone know about the new edition. (See the ad on page 122.)

In other words, just about everyone at ARRL Headquarters has been involved in the creation of the new *Handbook* at one point or another. We all hope that you'll find it both educational and informative, that you'll proudly place it on your bookshelf and that you'll refer to it often.

73,

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

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e-mail: qst@arrl.org

QEX — Forum for Communications Experimenters:
www.arrl.org/qex
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The American Radio Relay League, Inc. is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communication in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

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

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

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

Membership inquiries and general correspondence should be addressed to the administrative headquarters:
ARRL, 225 Main Street, Newington, Connecticut 06111-1494.

Officers, Division Directors and Staff

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

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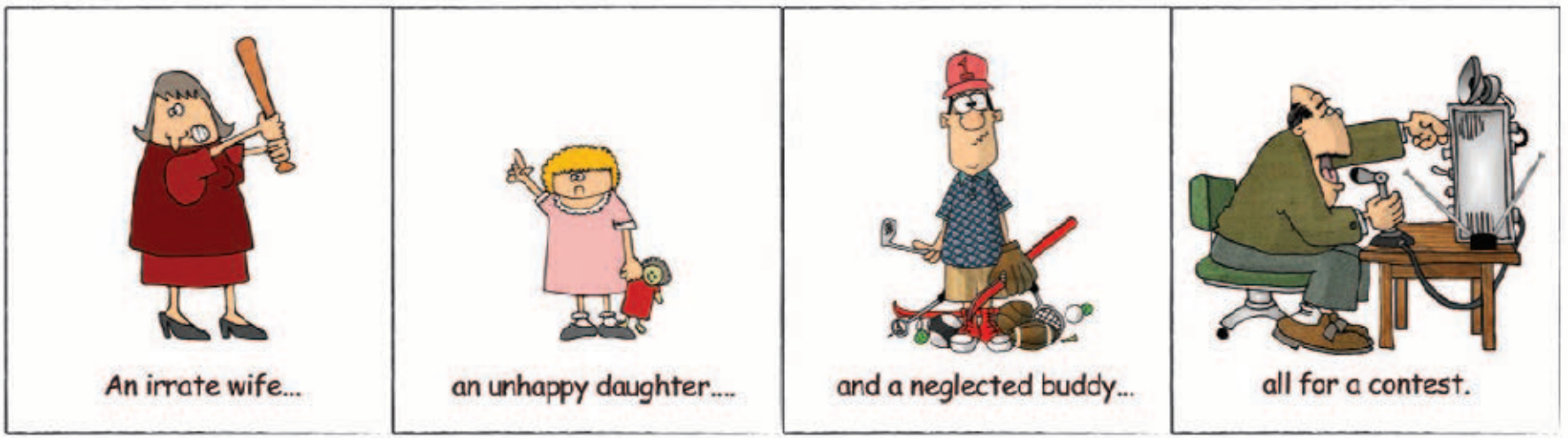

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Up Front in QST

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Club Offers Honorary Membership to USS *Hornet* Veterans

Jeffrey Heyman, KG6SVK

USS HORNET MUSEUM

The USS *Hornet* Amateur Radio Club (HARC) offers honorary membership to all USS *Hornet* veterans who are Amateur Radio operators. The USS *Hornet*, one of the most intact museum aircraft carriers in the country, is docked in Alameda, California, and is host to thousands of visitors each year. HARC operates a station aboard the ship, NB6GC. The call sign comes from the *Hornet's* original call, NBGC.

Founded in 2002, the club operates five Harris RF-350 transceivers for special events days, such as Museum Ships on the Air, Boy Scout Radio Merit Badge programs and public service activities. HARC operates radio merit badge contacts on Saturdays starting at 2100 UTC, usually on 7263 kHz; 14,363 kHz or 28,263 kHz, a Monday night net on the Oakland Radio Communication Association's WB6NDJ repeater (1900 local, 146.880 MHz, PL 77.0) and will shortly be conducting HF nets and using IRLP-linked repeaters as well. Once the HF net and the IRLP get started, any *Hornet* vet who makes contact with NB6GC and sends in a QSL card will get a colorful HARC honorary membership packet.

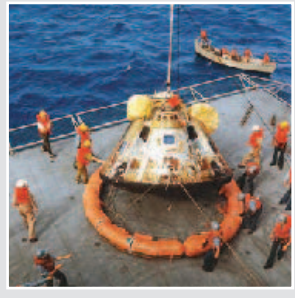
The offer to grant honorary membership to *Hornet* veterans grew out of a fascinating contact NB6GC had with Bob Deal, K5PPP, during a Radio Merit Badge event. K5PPP, a *Hornet* vet, was excited to hear his old ship on the air and called to make contact. K5PPP, who was calling the ship from his home in Truth or Consequences, New Mexico, was invited to join in the contact with the scouts. As he told his story of duty on the *Hornet*, after tours in Vietnam and on the USS *Coral Sea*, the scouts — not to mention their adult leaders — were riveted to the radio. It's easy to imagine how fascinated the scouts were with Bob's story.

HARC's Radio Merit Badge Program is a regular part of the USS *Hornet*'s activities and many of the scouts have indicated that they want to follow up and become Amateur Radio operators. If you're a *Hornet* vet and would like to get involved, please contact HARC at its Web site, **www.qsl.net/nb6gc**.

JEFF HEYMAN, KG6SVK

The USS *Hornet* Amateur Radio Club met recently aboard the carrier with special guest East Bay Section Manager James R. Latham, AF6AQ. The club operates a number of Harris RF-350 transceivers and other equipment.

USS HORNET MUSEUM



The Apollo 11 command capsule is placed on the deck of the USS *Hornet* after its historic July 1969 flight to the moon. One *Hornet* veteran, who was a shark sharpshooter on the capsule recovery mission, engaged in a QSO with HARC and Boy Scouts working on their radio merit badge.

DEREK WOOLEY, KD5UBL

Potato Power: **The article in the March 2009 issue on the W4SSY Spudgun inspired one of our club members, Bob Giese, AJ4ON, to experiment with the concept. The only change was replacing the electronic switch with a manual pressure release valve. The club tested this out on Field Day with great success. Everyone was so impressed that we held a workshop in August to build more Spudguns. People came out to the club meeting by the masses to build their own. We built a total of 17 and got the cost down to $32 each. —*** ***Derek Wooley, KD5UBL, vice president, Cleveland (TN) ARC***

JOHN LIU, KM8Y

New ham: **Gabrielle Kaili-May Liu, then just finishing 2nd grade, receives her CSCE from T. K. "Butch" Smith, N4TK, of the Nashville Volunteer Examiner Team. Proud dad John, KM8Y, an electrical engineer, earned his first license at age 13. Kaili-May is known on the air as KJ4MXC.**

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CORRESPONDENCE

MOBILE OPERATION NOT A DISTRACTION

♦ I think most Amateur Radio operators let the other stations that we are working know we are mobile. While I am operating someone mobile, I expect there will be times when the other operator has their hands full trying to avoid accidents and that their response may be delayed while negotiating traffic. This, and the fact that there is nothing obstructing our view while operating, are just two factors differentiating two-way radio from cell phone use. In a cell phone call, the folks at the other end want an immediate response. I am grateful the ARRL's Policy Statement on Mobile Amateur Radio Operation makes reference to the fact that radio-based mobile communications has been going on for decades with no affect on the accident rate.

HUGH WARDLAW, WB4SLI
Bartlett, Tennessee

Editor's Note: For more information on operating Amateur Radio while mobile — and the ARRL's views on the subject — please see Happenings, beginning on page 70. You can also view the ARRL's Policy Statement on Mobile Amateur Radio Operation online at **www.arrl.org/govrelations/MobileAmateurRadioPolicyStatement.pdf**.

THE MAGIC AND MYSTERY OF AMATEUR RADIO

♦ The evening of June 1, 2009, I had a QSO with a Yuri Yashin, RA9MP, near Omsk, Asiatic Russia; he was calling CQ DX on 14.020. Yuri was not a 35 WPM speed demon so characteristic of so many DX stations, just a calm, moderately paced CQ DX, CQ DX, DE RA9MP. So I answered him, and he responded. After the normal RST, he gave his name, Yuri, and his QTH, near Omsk. I came back to him with my RST and my QTH. Yuri greeted me and wished me and my family good luck, then said 73. I gave him my usual response to Russian speakers: *Speciba, tovarich*. *Do svidaniya*. Thank you, comrade. Good bye.

As I filled out my log, I sat back and reflected on what had occurred. Here I was, in the basement of my home in Pennsylvania with a gadget slightly larger than a shoebox, communicating with people half a world away. My window to the world is a lowly piece of wire a mere 52 feet long strung between my house and a tree in my back yard; it's barely visible. With the power of a light bulb, I meet and communicate with real people with real names, living in remote corners of the world

I understand radio waves, F2 layers, sunspot cycles and all that stuff. But somehow, the technical explanation seems cold and unsatisfactory. It's really a bit mysterious, bordering on magic. The telephone and the Internet are easy to understand; there are wires and cables leaving the house that are somehow connected to more wires and cables, stretching all the way from here to over there. Nothing mysterious about that! Yet, this little box and a piece of wire evoke a different set of emotions, a feeling of satisfaction, accomplishment and yes, magic. May it always be so.

ALFRED GRUENKE, KB3JPP
Wescosville, Pennsylvania

A COMPELLING REASON

♦ I just made a visit to the Cover Plaque Poll Web page [**www.arrl.org/members-only/qstvote.html**] on the Members Only portion of the ARRL Web site for the first time ever. I was compelled to do so after reading "Measuring Radio Frequencies" by Bob Shrader, W6BNB [Sep 2009, pages 36-39]. I was fascinated by his wonderful and clear discussion of the historical approaches to the measurement of radio frequencies. The illustrations and the text provided just the right mix of background and technical details to maintain my interest and make me feel that I truly understood what might easily be a complex topic. I kept waiting for the point in the article where I would be totally lost, but it did not happen. I was not surprised at all when I finally read the Author's Biography at the end of the article and discovered that Mr Shrader is a professional educator. A lot of people have the ability to understand complex ideas; only a select few can successfully explain them to others.

KEN CARR, KB1AWV
Coventry, Rhode Island

OLD DOG, NEW TRICKS

♦ The letter by John Davis, WA8YXM ["Correspondence," Sep 2009, page 24], about the Amateur Radio "candy store" struck a terrific personal response, and I suspect there are lots of Old Timers out there who have felt the same way. I entered the hobby at age 13 in 1946, and have gone through several cycles of inactivity and re-activation. I am now 76 and find Amateur Radio *still* provides the excitement and stimulus for learning that it had when I was a teen. I have been deeply grateful for the help of those Elmers who got me started; they enabled me to work my way through college and their push colored my entire career. Fairly recently, in need of some tactile therapy, I built several modern kits, like the Elecraft K2, and re-activated my operating activity, only to "discover" several digital modes and be captivated by their efficiency. As a result, I became aware of the whole field of SDRs, clearly being somewhat of a late bloomer in that respect. Problems with interfacing led me to seek help from my peers; I found that there are still the same warm, helpful Elmers out there, willing to help an old geezer learn new tricks, or at least willing to listen to tales of woe! It is a spectacular population of people in a wonderful hobby, and I laud them all.

JOHN RAGLE, W1ZI, ARRL Life Member
Hadley, Massachusetts

ENJOYING AMATEUR RADIO AT ANY LEVEL

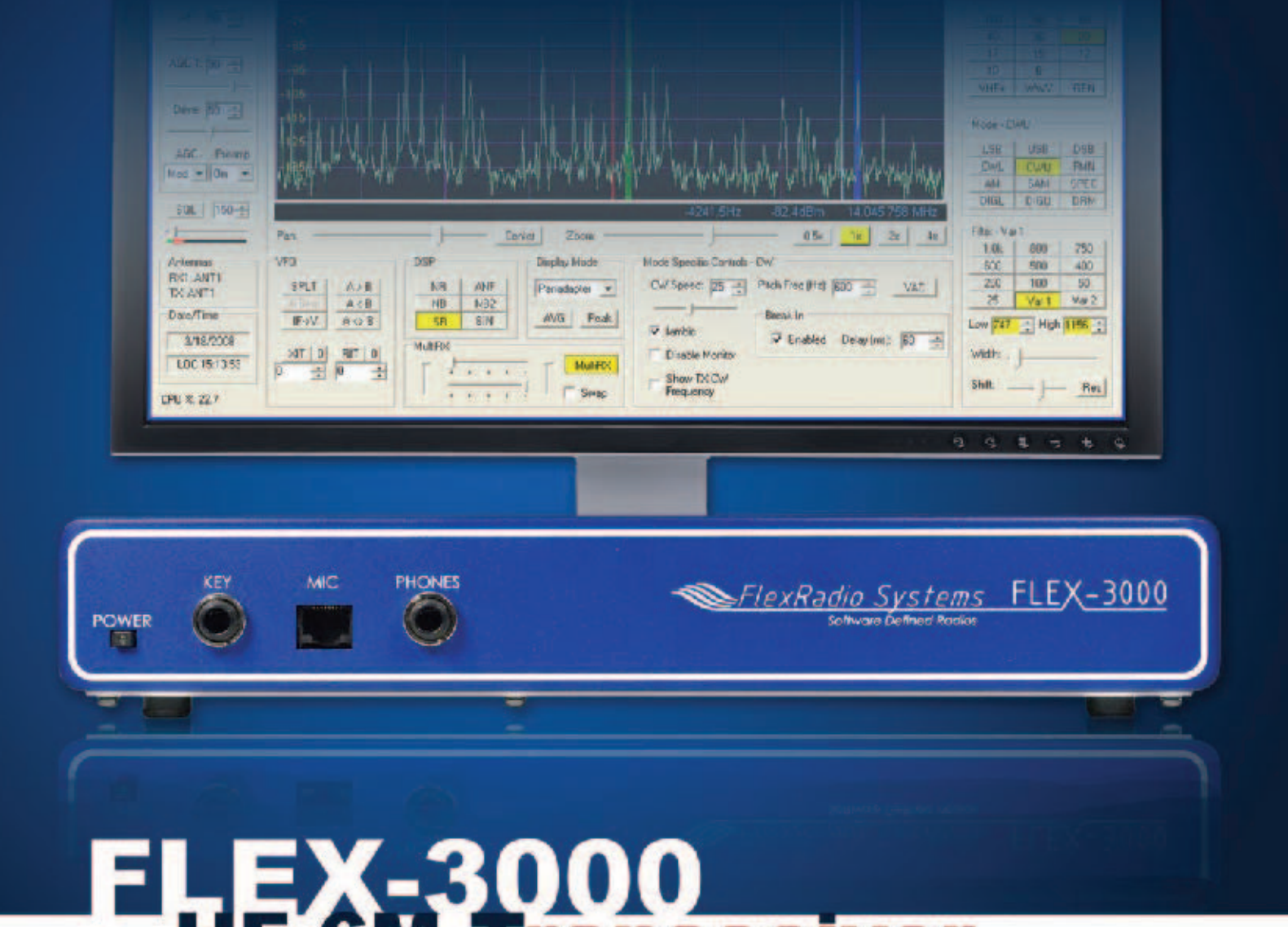
♦ I have never written a "Letter to the Editor" before, but the letters by Alan Sherman, W2NIR [Jul 2009, page 24], and Mike Kitsko, K6VGQ [Aug 2009, page 24], have prompted me to do so. I have been a ham since I got my Novice license at the age of 12 in 1953. I am a technical type and built my first transmitter described in the then-current version of *How to Become a Radio Amateur*. I love to tinker, design and build and am a retired engineering manager.

One thing I have come to realize is that Amateur Radio had something to offer everyone. It's a wonderful hobby that you can take to any level. You don't have to be a technical person to enjoy a hobby that provides fellowship, recreation and enjoyment. Had I had the resources, I would have probably purchased commercial equipment and I have finally realized my goal of having Collins equipment being the proud owner of a complete S line, including speakers and 30L1 linear (it does take some expertise to keep 50 year old gear running). This is my choice. I also have a modern solid state HF transceiver and VHF transceiver.

It does not matter if you like to operate the equipment or want to build the equipment. Add to this the public service aspect where you do not need be a tech type to operate. There is a place for all of us to enjoy. If you *really* want to get technical, there are tons of ARRL publications to take you to any level. *QST* with its new format does indeed have something for everyone; I read it from cover to cover in between reading *QEX*. Enjoy!

TED DRELL, W5HEU
Pineville, Louisiana

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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The Quadrifilar Helix as a 2 Meter Base Station Antenna

Here's an easy to build VHF base-station antenna that works equally well toward the horizon or overhead.

John E. Portune, W6NBC

Designed for spacecraft use in the early days of space exploration, the quadrifilar helix (QFH) antenna has not gained much popularity on the ham bands. Yet, as a general-purpose base-station antenna, here for 2 meters, it's hard to beat. It's almost an omnidirectional antenna in both planes, like the mythical *isotropic* radiator. No matter what direction signals come from, or whether the polarization is vertical or horizontal, the QFH works them. It's good for overhead satellites, such as the International Space Station, for horizontally polarized 2 meter SSB simplex stations on the horizon and also for vertically polarized mobile and repeater stations. No, it isn't a gain antenna — no true omni can be. The joy of a QFH is it always gets out.

The QFH is often used by hams for receiving weather satellite pictures from the 137 MHz NOAA automatic picture transmitting (APT) satellites in low polar orbit. Its omnidirectional and circular polarization characteristics accommodate the constantly changing direction and polarization of the APT satellite signals. I have built several for this service. Three of these weather birds still fly by every day — NOAA 15, 17, 18 and 19. (Pictures available at **w6nbc.com**.)

My primary objective here, though, is to tame the QFH as a 2 meter base station antenna, using local hardware store materials and easy construction methods. I also will dispel some of the antenna's technical mysteries. Many existing published QFH articles feature difficult to build designs or too much unnecessary technical jargon.

Picturing the QFH

Take two vertical full wavelength rectangular loops with open feed points *at the top*. Now place them on the same vertical axis, but with one loop rotated 90° horizontally (quadrature). Also, you need to make one loop slightly larger than the other. This creates a phase shift at the feed point to compensate for the physical rotation of the loops. Next, twist both loops horizontally a quarter turn into helices. Finally connect the feed points in parallel. Voilà — you have a quadrifilar helix antenna.

The curious egg-beater-like configuration of the QFH has useful characteristics — an almost perfectly spherical radiation pattern as well as circular polarization throughout the pattern. This version is right-handed. For left, twist the loops in the opposite direction. For our general purpose 2 meter base station antenna, the twist direction does not matter. And yes, there is a small loss working linear polarized signals (vertical or horizontal) with a circularly polarized antenna, but it is quite acceptable. Commercial broadcast antennas often use this very technique to accommodate both mobile (vertical) as well as home antennas (horizontal).

Next question: Is the QFH a critical design? After building several, I've decided that it's not. The published articles made me initially think otherwise. But after experimenting ham style with square loops and tall versus thin rectangular ones, and the small size difference between the two loops as well as the amount of twist, I have concluded that the QFH is a dimensionally tolerant design. The performance changed little with all these variations. I'll say more about modification concepts later, but for now let's just build a QFH. That's the tricky part for most hams.

Building a QFH

Obtain a 4 foot length of common inexpensive 2 inch ID schedule 40 ABS pipe, the black pipe used for drains, and 16 feet of ⅜ inch soft aluminum tubing. Drill four pairs of $^{13}/_{32}$ inch holes through the ABS pipe, opposite each other horizontally, for the ⅜ inch aluminum tubing as shown in Figure 1. Carefully note that the vertical distance between the top and bottom hole pairs must be ½ inch less than the actual length measured along the helix of the loops as given in Figure 1.

Drill the top hole pairs 1 inch below the top end of the ABS pipe. This is to allow for an ABS pipe cap. Also, always keep in mind that the bottom of each loop is rotated a quarter turn compared to the top, to form the helix.

Take care to position these holes accurately. The easiest way is to wrap a sheet of paper snugly around the ABS pipe, keeping the edges square. Mark the circumference on the paper and then fold the paper circumference in quarters. You now have an accurate drilling guide. Use a center punch or scratch awl to transfer the hole positions to the ABS pipe.

Next mark the ⅜ inch aluminum tubing with the dimensions given in Figure 1. Cut the two sections to length with a tubing cutter. There is no need to compensate for the bends; this has been accounted for in the dimensions given. Next insert one of the yet-unbent lengths of aluminum tubing through the appropriate opposing bottom holes in the ABS pipe, centering the aluminum tubing in the bottom (8 inch) segment.

For the corners bends, these are most easily made by first flattening the tubing at the bend points. Pipe elbows, as specified for some QFH designs, are difficult to implement. To flatten the tubing, simply adjust the jaws of a pair of clamping pliers to gently make the flat spots. Do so directly over the marks, but only for one bend at a time, right while you are assembling the antenna. The biggest advantage of this method is that it eliminates separate loop segments, any need to solder (difficult with aluminum) and having to make adjustments in loop circumference for the bends.

Make your first bend upward at the bottom of only one loop. Now, on the same side, but this time at the top, again flatten and bend the tubing. Think carefully about the direction the tubing must bend to enter the top hole. This bend will be roughly 90° from the bottom bend. Then, after inserting the loop end into the ABS pipe, gently form that side of the loop into a smooth quarter-turn helix. It should end up with 90° bends top and bottom. The aluminum tubing will easily bend in your fingers.

Next form the other half of the loop, following the same procedure, beginning again at the bottom. Once again, before flattening and bending, consider the direction the aluminum tubing must bend. Also, keep the distance between the vertical sides of the loop roughly constant (8 inches), top to bottom. Again, form this half of the loop into a smooth helix and then repeat the procedure for the second loop.

Lastly, drill four 5/32 inch holes vertically through the ends of the loops, roughly ⅜ inch from the end of the tubing, at the connection end. Remember: The feed point is at the top of the antenna. Do this with the loops installed on the ABS pipe. These holes will accept #12 × ¾ inch stainless steel sheet metal screws for connection to the feed coax. Screw them in temporarily at this time to form threads and to hold the loops in place.

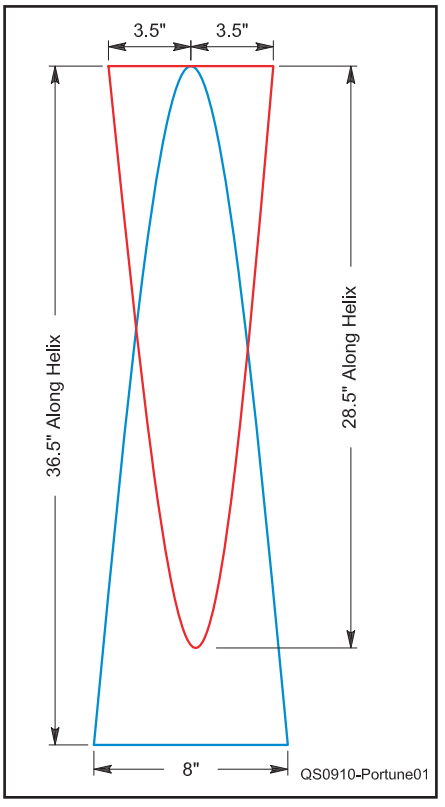


Figure 1 — Loop dimensions. Note the vertical distance between top and bottom holes is ½ inch less than the length along the helix.

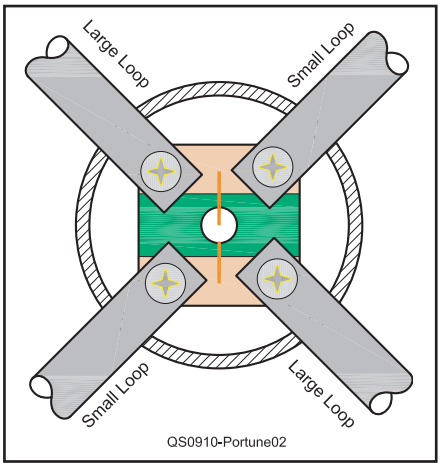


Figure 2 — Electrical connection to the loops. Observe the phase of the connection.

The Feed-Point Connection

The simplest way to connect the loops in parallel to the coax at the feed point is to fabricate the small 1⅜ × 1⅜ inch printed circuit board shown diagrammatically in Figure 2. Its exact dimensions and hole positions are not critical. But be sure to remove the copper foil from the center third. This little PCB provides mechanical rigidity as well as solder points for the feed coax. Carefully note the orientation of the copper-foil strips and the loops.

It is essential to use a balun with a QFH. Without a balun, the common mode coax current will compromise the unique radiation pattern of the QFH. The easiest type is a choke balun simply made up of several turns of the feed coax wrapped around a ¾ inch PVC pipe coupling. It is located inside the ABS pipe, just below the feed point. Simply fill the coupling with as many turns as will conveniently fit, securing the turns of coax through holes near the end of the coupling. Leave roughly 6 inches of coax free above the balun for connection to the loops. You do not need to be precise with any of this.

Assemble the balun and prepare the end of the coax for soldering. Pass the coax through the hole in the PC board from the bottom and solder it. I do not bother with weather proofing. If you wish, apply some silicon RTV sealant. With the ABS pipe cap on top, the 137 MHz QFH I've had in service for two years now shows little signs of weathering at the connections.

For final assembly, drop the balun, coax and feed-line assembly into the ABS pipe from the top. Lower the whole assembly until the balun is below the ends of the loops, but the PC board above them. Install the four #12 × ¾ inch stainless sheet metal screws into the holes in the loop ends through holes in the PC board. Pay attention to the orientation of the copper strips on the PCB compared to the loops, Figure 2. There are two possible ways, one right (as shown) and one wrong. The coax passes out through the bottom of the ABS tube. Finally place a 2 inch ABS pipe cap on top. Do not glue it on; you may wish to get back into the connection point later.

I mounted my antenna with a common antenna vent-pipe clamp and a second short piece of 1½ inch ABS pipe. Plastic is preferable to metal. The finished antenna slips down over the smaller pipe, permitting easy installation and removal.

Modifying the QFH

The existing published articles tend to make one think that the loops of a QFH must be highly precise in dimension, relative size, shape and twist. On spacecraft, where specifications must be accurately known, I suppose these are appropriate. But in my ham experience, and also in APT weather satel-

lite service, I have found that a QFH is just as tolerant to variations as any antenna.

If one makes the loops roughly square, for example, the radiation pattern approaches spherical (in free space). If the loops are taller and thinner, but still a full wavelength in circumference, the antenna will begin to exhibit some horizontal gain, and a proportionate decrease in overhead gain. For ham and APT satellite use, this is actually desirable. One normally wants more gain toward the horizon than upward. How much off-square can QFH loops be? Frankly — almost any reasonable amount. There is no specific proportion. The radiation pattern changes only slowly as the antenna gets taller and thinner.

The only practical limit to tall and thin is feed impedance. It decreases as the loops get thinner, but again only slowly. Conveniently, QFH antennas come naturally close to 50 Ω. Additional matching is rarely required. This 2 meter version exhibits acceptably low SWR over the entire 2 meter ham band as shown in Figure 3.

Similarly, the amount of helical twist can be varied. Most designs specify 180°, a few 90°. Multiple turns are also possible. My experience is that all twist variation work much the same. The degree of circular polarization does change somewhat, but not enough to matter. I chose 90° mainly for ease of construction. Also, I find a half turn QFH more aesthetically pleasing.

The QFH on Other Bands

A QFH scales as easily to other bands as does a dipole. I was able to predict the change of size from 137 to 146 MHz merely from the frequency ratio. One only needs to make the total circumference proportional to the wavelength of operation.

In practice, the loops for a QFH antenna of this proportion and made of tubing of roughly this size, need to be roughly 5% larger than the classic metric formula — 300 divided by frequency — predicts. By cut-and-try, I found that the circumference of my smaller loop needed to be physically an actual full wavelength, as given by the formula, and the larger loop 1.1 wavelengths. Electrically, the small loop turns out to be tuned slightly high and the large loop slightly low of the operating frequency. My MFJ-259 antenna analyzer shows two nearby SWR minima, one for each loop as shown in Figure 3.

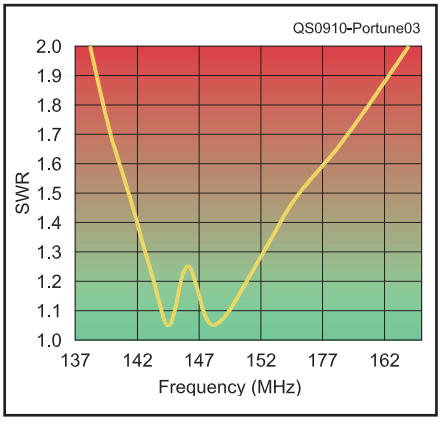


Figure 3 — Measured SWR plot of my 2 meter QFH mounted low over an aluminum carport roof.

Actually having two slightly off tuned loops yields an advantage. With one loop electrically high and the other low, the bandwidth of the antenna ends up larger than one would expect from a single loop. Theoretically, the ideal frequency difference is one that causes a 90° phase shift between the loops at the feed point. But as with all other characteristics, one does not need to be highly precise here either. A rough 10% difference in loop size is fine for general ham designs.

Locating the Antenna

One of the more attractive features discovered in the original design phase for spacecraft use was the comparative insensitivity of a QFH to nearby objects. Many antenna types are worse. As one moves a QFH from free-space toward a ground plane, the pattern does change, but slowly and predictably. It becomes progressively cardioid shaped, with a shallow null downward. The upward pattern remains spherical, and the polarization does not change. This was quite convenient for spacecraft use. It is also good for ham applications. Both my QFH antennas are mounted only a short distance above a flat aluminum car port roof and neither exhibits strange characteristics.

A QFH won't make you the gain king of 2 meters, but as a general purpose base-station antenna it is hard to beat for versatility. For me it was an improvement over the vertically polarized J pole that I previously had in the same location, especially for horizontally polarized 2 meter SSB stations. It is much the same for vertically polarized FM mobiles and repeaters. But with the QFH, I am now also prepared to talk to the ISS overhead without losing the signal, as I would have with the J pole.

ARRL Member John Portune, W6NBC, received a BSc in physics from Oregon State University in 1960, his General Radiotelephone license in 1961 and his Advanced class amateur license in 1965. He spent five years in England as G5AJH and upgraded to Amateur Extra class in 1985. John retired as a broadcast television engineer and technical instructor at KNBC in Burbank and then from Sony Electronics in San Jose, California.

John is active on many bands and modes, predominantly from his HF RV mobile station. He has written a number of articles in QST, Ham Radio *and* Popular Electronics *magazines and remains active as a VE team leader, ham license teacher and Web site designer. You can reach John at 1095 W McCoy Ln #99, Santa Maria, CA 93455, or at* **jportune@aol.com**.

New Products

JETSTREAM 222 MHz MOBILE TRANSCEIVER

♢ The JT220M from Jetstream is a 50 W mobile FM transceiver for the 222 MHz band. Features include three power levels (10/25/50 W), 99 memory channels, a large display and VFO knob, and tone encode and decode built in. The JT220M is computer programmable with an optional cable and free software available online. Price: $259.95. For more information, see your favorite dealer or visit **www.jetstream-usa.com**.

MFJ TRANSCEIVER SURGE PROTECTOR

♢ The MFJ-1163 is designed to protect transceivers and other station equipment from damaging power surges. It uses capacitive decoupling and metal-oxide varistors (MOVs) for protection. The MFJ-1163 has four grounded ac outlets for equipment and a 5.5 foot power cord. Price: $69.95. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**

Simple Mobile Transceiver Protection

Automatic turn on and turn off for your mobile transceiver.

Richard Hensel, N8WLC

I like to have my mobile transceiver on all the time while I'm in my car, but I don't want to have to remember to turn it on and off. In addition, I have always worried about transients and spikes when I start up my car.

The Solution is Simple

I came across a simple application of the 555 timer integrated circuit that has made my life easier. The timer is wired as a *delayed turn on*. That is, after a fixed time the output will go high and stay high. This relieves me from having to remember to turn the radio off when I leave my car and turn it back on after I start it up. It also protects the radio from voltage spikes during starting.

As you can see in Figure 1, the circuit is simple and can be completed with point to point wiring; layout is not critical. I chose perforated prototype board from RadioShack. My board measured ¾ × 1¾ inches. The parts count is low and most of them can probably be supplied from a well stocked junk box. Figures 2 and 3 show my layout.

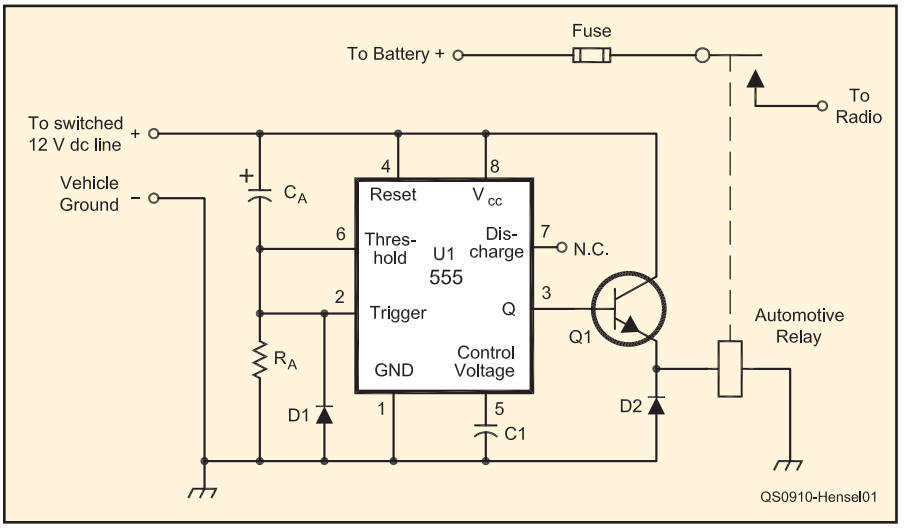


Figure 1 — Schematic diagram and parts list for transceiver protection circuit. Digikey parts are available at www.digikey.com.

C1 — 0.01 µF ceramic capacitor (Digikey 1460PH-ND).
D1 — 1N4148 (Digikey 1N4148FS-ND).
D2 — 1N4001 (Digikey 1N4001DITR-ND).
F1 — Fuse appropriate for radio load.
Q1 — MJ 3055 (Digikey 497-2573-ND).
Q2 — 555 timer integrated circuit (Digikey 497-1963-5-ND).
Perf board — ¾ × 1¾ inches cut from RadioShack # 276-148.

Setting the Time

The timing is determined by R_A and C_A using the formula t(seconds) = 1.1 × R_A × C_A / 1000, where R_A is in kΩ and C_A is in µF. Table 1 shows some common values for a 6 second delay.

The output of the timer is amplified by an NPN transistor that supplies current to operate an automotive type relay. The relays come in several current ratings; be sure to get one that can switch the current needed to operate your radio. I found a number of 30 and 40 A models at a national auto parts chain.

I used an MJ 3055 transistor in a TO-220 case because that is what I had in my junk box, but any NPN transistor that can comfortably source 200 mA should work here. I measured several relays from the auto parts

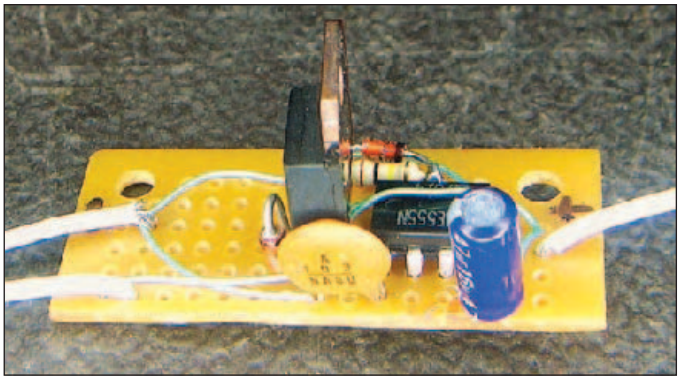


Figure 2 — Oblique view of the assembled unit.

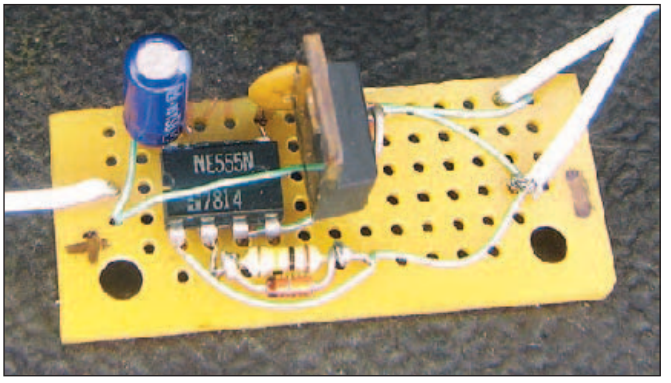


Figure 3 — Top view of the circuit assembly showing parts locations.

store and they all ran less than 140 mA coil current. Diode D2 is there to protect the output transistor from voltage spikes created by the magnetic field in the relay coil collapsing, and may be placed directly across the relay coil.

In practice, connect the positive lead of the timer to a circuit in the car that comes on only when the ignition is on, and ground the negative lead. I chose the power to the car's stereo radio. After the delay time, pin 3 of the 555 timer will go high turning on the NPN transistor and sourcing the current to pull in the relay. I mounted the relay under the hood in a convenient spot near the battery so I can supply the radio directly from there. As soon as the ignition is turned off, power to the timer and relay are removed, shutting off the radio.

I have had one of these in my car for several years and have never had a problem with my radio. The timer can be adapted to any use where a simple delay on is required.

Table 1
Timing Resistor and Capacitor Values for About 6 Second Delay

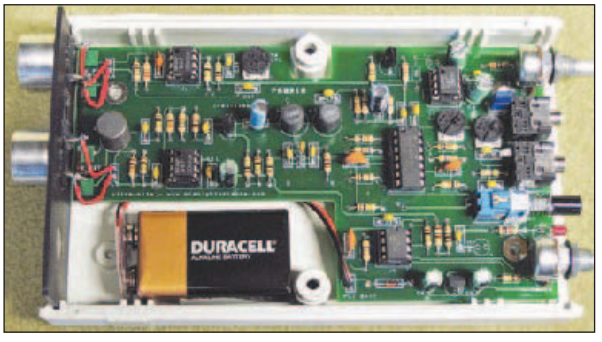
C_A (µF)	R_A (kΩ)
470	12
220	24
100	56
47	120
22	240
10	560
4.7	1200

ARRL member Richard Hensel, N8WLC, was first licensed in 1992 and currently holds an Amateur Extra class license. He has worked in the telecommunications business for 37 years. Richard is a member of the Inter City Amateur Radio Club in Mansfield, Ohio. He enjoys tinkering with electronics and building small projects. He is also a private pilot and enjoys operating aeronautical mobile. You can reach Richard at 715 Joselyn Ave, Lexington, OH 44904 or at **n8wlc@arrl.net**. QST

New Products

ULTRASOUND CW TRANSCEIVER KIT FROM THE XTAL SET SOCIETY

◊ The Ultra-TR40 from the Xtal Set Society is an ultrasound transceiver kit that is similar in concept to direct conversion transceiver kits for the amateur bands. The receiver section shifts 35-45 kHz ultrasound down to the human hearing range and uses a 10 kHz wide audio bandwidth for wide spectrum listening. The transmitter converts a 40 kHz electrical wave into a 40 kHz pressure wave using 3 mW of electrical power. A CW note can be heard by another Ultra-TR40 or Ultra-RX1 receiver (also available as a kit) at distances of 100 feet or more. The transceiver includes near-full break-in CW operation enabled by a PIC microcontroller. The PC board measures 5.68 × 3.16 inches and fits in a plastic clamshell case along with a 9 V battery. Transmit and receive piezo transducers mount on the front panel. The back panel features frequency tuning control, power switch with LED, key jack, headphone jack and volume control. The manual includes step-by-step assembly and testing instructions. A volt-ohm meter (VOM) is needed for measurements. Price: $99.95. For more information or to order, visit **www.midnightscience.com**.



MFJ FILTERED OUTLET FOR DC POWER LINES

◊ The MFJ-1142 is a compact, filtered dc outlet that connects between your transceiver and dc power supply. It is designed to reduce RF interference and noise from alternators, fuel pumps, power windows or other motors. The MFJ-1142 works with 12 to 24 V power sources and includes binding posts and Anderson Powerpole connectors for input and output connections. Price: $59.95. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

Feedback

◊ In "Hamspeak" [Aug 2009, p 103] the correct explanation of **Horizontally polarized** is — Orientation of wave front in which the electric field is horizontal.

◊ In "Product Review — Antenna Accessories from Array Solutions" [Sep 2009, p 47-49] the equation for V_{PEAK} on p 49 should be $V_{PEAK} = \sqrt{2} \times 1670 = 2360\ V_{PEAK}$.

◊ In the 2009 "January VHF Sweepstakes Results" [July 2009, pp 80-83], the Nacogdoches ARC was inadvertently placed in the Local Club category. They are a Medium Club. The winner of the Local Club category is the Eastern Connecticut ARA.

◊ In the "2009 ARRL DX CW Contest Results" [August 2009, pp 77-80], the following errors in the Oceania Continental Leaders table are noted: Single Operator 40 Meters was incorrectly listed as VK2IA; the correct winner is ZM3A. Single Operator 80 Meters was incorrectly listed as VK2CCC (LY1F, op); the correct winner is ZL1AZE. Single Operator Assisted was incorrectly listed as YB3MM; the correct winner is ZL1ANH. The winner of the Multioperator Two Transmitter category was omitted; the winner was ZM1A

◊ In our Short Take review of the PIEXX SO2Rxlat USB to Serial Translator [August 2009, p 59], we incorrectly stated that microHAM America, LLC was a subsidiary of microHAM, s.r.o. of the Slovak Republic. This is not the case. microHAM America, LLC is an independent dealer. Also, the microHAM Control Protocol is the intellectual property of microHAM, s.r.o. and is available only to authorized application developers. Finally, the SO2RXlat without a case or display sells for $85; the model with the case but no display sells for $105.

An Inexpensive 12 V dc Power Distribution Box

Bring some order to your station 12 V wiring with this handy distribution box.

Jack Morgan, KF6T

Figure 1 — The completed distribution box. Note that the terminals are secured by the edge of the (covered) box as well as by the screw.

It seems like everything in my shack runs off 12 V dc these days. Running all these wires back to my common power supply connectors creates quite a mess.

I needed a cleaner way to distribute power in my shack console. I found the popular "plug in" systems get expensive by the time you buy their box, connectors and a crimper to do the job. I don't really need the ability to quickly plug and unplug connectors in my station. In addition, I don't like the thought of a connector pulling out by mistake when a buried console cable is tugged on.

A Better Way

I made a trip to the local RadioShack to see if they had something that would solve my needs. I came away with an 8 position dual row barrier strip (274-670), an 8 position jumper strip (274-650) and a 4 × 2 × 1 inch project box (720-1802). So for about $7 plus shipping, I had the parts I needed to make the distribution box shown in Figure 1. I found some insulated forked crimp lugs at a local car parts store that would accept #10 wire and also fit the barrier strip terminals.

This design has one power supply input and three outputs (1 × 3) with all the wires on one side. You could use both sides of the terminal strip to increase the number of outputs to seven (1 × 7). The second side might use smaller terminals (for lower power accessories) to make it all fit in this sized box. Make sure you don't exceed the current rating of your power supply, however. My power supply cable is fused, as are the cables going to the radios.

Construction

I cut the jumper strip in half as shown in Figure 2. This allows one half to be "positive" and the other half to be "negative." The terminal strip is raised off the bottom of the box using spacers. You want the top of the terminal strip to be near the top of the box.

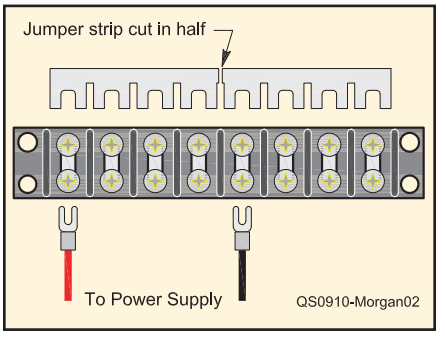


Figure 2 — Details of cutting jumper strip making the left four sets of terminals interconnected for positive connections, and the right four for negative.

Accurately mark the location of the terminals on the lip of the box. Put the cover on and drill the eight wire access holes along the seam between the cover and the body. If you clamp the box and cover in a drill press vise (and use a drill press), it makes the job a lot easier. The holes you made in the cover lip will have to be notched so the cover will fit over the wires.

The terminals are crimped on the wires and then soldered for reliability. You may have to cut off some of the plastic "hood" at the back of the terminal to make it fit inside the box (do this before you crimp and solder!). For the best connection, you may also have to bend the forked end of each lug slightly so that they lie flat under the terminal screw.

Once the cover is on, the wires are captive and protected and then the box can hide until you buy that next 12 V radio or accessory.

ARRL member Jack Morgan, KF6T (ex-W1FEA), was first licensed in 1955 and currently holds an Amateur Extra class license. Jack started working at the ARRL designing projects for The ARRL Handbook *while working toward his BS and MSEE degrees. He subsequently worked at Eimac and Varian before starting his own Silicon Valley company. After retiring from that, he started teaching computer technology at a local high school. He also pioneered competitive snowboarding as a high school varsity sport in California. Jack is currently the president of the Northern California Contest Club. You can reach Jack at 2040 Pheasant Hill Ln, Auburn, CA 95602 or at* **jackmorgan.usa@gmail.com**. QST

Squeezing the Next Lower Band Out of Your Big HF Loop

A simple change can move your loop down to cover one more band.

Dave Robertson, KE5QWP

After a decade of procrastination, I finally caved to my feelings that I'd probably enjoy ham radio as an older guy even more than I did in my teens. I got my first ticket as VE3HHR while I was young. I had fun operating and building until well into my teens, at which time I got busy with school, then a career. I don't quite know why I got going again in 2007, but I'm very happy to be back.

My current call, KE5QWP, was a necessary result of a career based move to Texas in the '90s, which is all that is relevant to my ham story between the '60s and 2007 (I was out of Amateur Radio for more than three decades). When I did get started again, I found myself in a neighborhood with a homeowners association that had not dealt with outdoor antennas and a home in which the only logical choice for my ham station was a second floor bedroom.

Making it All Come Together

The good news was the availability of a pretty big attic above, and also a run of unused cable TV coax from the attic, right to the ideal place for my radio — so no holes to drill or visible cables to an attic antenna. The bad news was that the second floor location meant "a long way to ground" making stealth end fed wires a tough proposition. That, the size of my attic, and the desire to have multiband capability got me interested in big loops, which are well-known for their ability to enable operation on several bands and can operate independently of a ground connection.

The attic space was such as to make a 40 meter full wave loop fairly easy to install. From the get-go, I knew it would be an odd shape, sloped not planar and constructed from wire segments of various random lengths. I just tried to maximize the enclosed area and avoid doubling back. The various articles I read said this would all be somewhat okay (every multiband attic antenna is going to be a compromise). I fed it with a 40 meter half wave (λ/2) of nominal 450 Ω window line to the TV coax and

cut the coax to λ/2 as well. This made the transmission lengths and impedances of the line not very important at 40, 20, 15 and 10 meters. This worked well for me for a while. Every once in a while, though, I'd be fighting with 40 on a noisy winter evening and do a little listening on 80 meters, jealously observing a quieter place I'd like to visit, on occasion.

Moving Down a Band

My first approach toward 80 meters was to try to double the length of my loop. This involved getting to some more obscure places in the attic. That strategy abruptly came to a halt as my foot went through the kitchen ceiling. I decided to stay out of the attic and see if I could not make better use of the existing wire.

I read what I could find about loops that were only λ/2 and the popular wisdom seemed to be to cut a gap in the middle, opposite the feed point, to avoid the complex high impedance feed problem associated with a closed λ/2 loop. The thought of wiring a relay up in the attic or to be going up and down whenever I wanted to switch bands was not very appealing, so I started to try to dream up a way to face the ugly impedance problem of the λ/2 loop, head-on. I succeeded and have since used the same technique to design a 20 meter vertical delta loop for my little place in Canada (the home of my original VE3HHR call) that I use very successfully on 40 meters.

Conventional wisdom says that a vertical loop is a great single frequency antenna (where it is 1 λ in circumference) and not much good at harmonic frequencies. I've found that true, but find great satisfaction at using it quite successfully at ½ the optimum frequency — without breaking the loop.

Finding a Way

In my initial loop designs, I'd learned to use the demo version of *EZNEC* that came in the CD provided with *The ARRL Antenna Book*.[1,2] This antenna analysis software allowed me to analyze my attic loop to determine the pattern and evaluate the impedance, so I knew I could easily match it to my transceiver. *EZNEC* confirmed the convenient, mostly real, impedances between 50 and 200 Ω I'd observed on 40 meters and above. *EZNEC* also predicted the horifying 300 + *j*8000 Ω impedance I'd be faced with using the same loop on 80 meters.[3]

The cottage 20 meter delta loop, about 28 feet on the base and 21 feet on each of the sides, provided a happy 50 Ω on 20 meters, but had a modeled impedance of 800 + *j*8500 Ω on 40 meters. Please note that I simulated these at exactly ½ of the loop resonant frequency. The impedances peak much higher at slightly higher frequencies.

These high complex impedances are not convenient values to match to a transmission line or to tune with most antenna tuners. I then found that as long as the real part is not too small and the imaginary part is not too large, there is hope for success with a reasonable matching network. My thoughts at this point were inspired by a number of articles on Zepps, J-poles and the general art of voltage feeding high impedance loads using a λ/4 transmission line section.

This magic length can transform a high antenna impedance to a manageable impedance at the radio.[4] The punch line follows: I

[1]Notes appear on page 38.

Traipsing Around the Smith Chart

The 450 Ω normalized values of the λ/2 loop impedances take you to the ugly high R and high X region on a Smith Chart.[A] The first indicator of hope, though, is any daylight whatever between that plotted impedance point and the perimeter of the unit reflection coefficient circle. Something like 2 + *j*20 Ω (I' m just using 900 + *j*9000 Ω as a representative value in the range I needed to work in) looks bad on a Smith Chart, but is still workable. Figure A shows a simplified Smith Chart along with the typical trajectory. This is why I wanted to use transmission line with the highest characteristic impedance I could source. A 50 Ω Smith Chart would put the same antenna impedance so close to the perimeter circle as to remove hope. The resulting SWR would just mean way more coax loss than I'd prefer to deal with.

The λ/4 transmission line takes you to a point of low impedance, on a line through the center of the Smith Chart, opposite the starting point. Since we want to just stick some components in parallel to create a match, we next want to go to a reciprocal (admittance) Smith Chart; again just a matter of reflecting through the center. The result is exactly at the same physical location that the original normalized antenna impedance was plotted. So the same point is actually the correctly plotted admittance of the antenna plus λ/4 transmission line contribution (the reciprocal impedance of the radiator/line part of the solution).

When you are sitting at a place like 2 + *j*20 Ω on the Smith Chart, it quickly becomes clear that adding just a couple of feet of additional ladder line will cross you into the zone of 2 – *j*20 Ω. Moreover, as you add and subtract small amounts of line, you move through a whole range of attractive real components, if the imaginary part can just be eliminated with a parallel component. The reason I wanted to take the imaginary part into the negative region (remember, this is an admittance chart, at this point), is that a parallel capacitor is all that is required to cancel out that imaginary part. I did the simple math and found the capacitance I needed was in the vicinity of 1000 pF. I ended up using an old AM radio air variable (365 pF max) in parallel with a 500 V, 500 pF mica capacitor (both picked up at a local surplus store). A similar calculation for the 20 meter delta yielded mathematically similar results and exactly the same component worked for both antenna systems. The added transmission line sections were a little shorter for the higher frequencies, of course. This ease of getting a great solution with two such different loops also helped to convince me that my solution was actually pretty robust and repeatable. I hope it serves others as well as it is serving me!

Just to complete the final math steps, once the parallel capacitor got rid of the – *j*20 part, we're left with a real admittance of 2 (the solution need not be exact; there are lots of short transmission line additions plus parallel capacitor combinations that will yield a pretty good match). Going back to the impedance version of the Smith Chart inverts this to 0.5, still in a 450 Ω reference space. So the net impedance is around 225 Ω and the 4:1 balun does the rest of the work to create a near-perfect match to the transmitter. In my case, the extra λ/4 of TV coax gave me a better match for some configurations, since it is just another impedance transformer on the way to the final 50 Ω coax span. For some in band frequency changes, just a little tweaking of the variable capacitor brought the match back to what was needed.

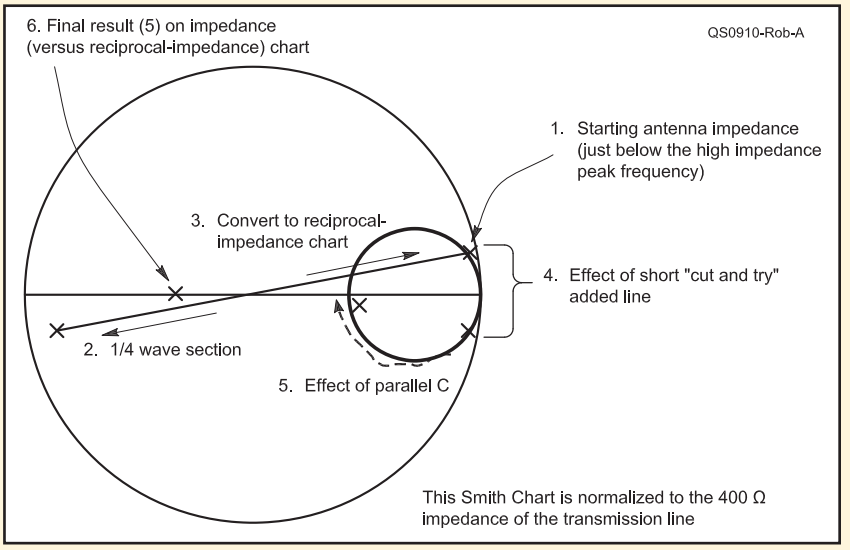


Figure A — Simplified Smith Chart illustrating matching mechanics as the impedance is transformed through a λ/4 section of mismatched line.

[A] D. Walraven, K5DVM, "Understanding SWR by Example," *QST*, Nov 2006, pp 37-41.

squeezed the lower band out of my attic loop and the delta using the same technique and even the same components. While writing this article, I also decided to do a 10 meter half loop, which would be small enough so that the total system solution could be captured in one photo — as shown in the lead photo.

The solution ended up being the use of a λ/4 section of 450 Ω window line at the frequency at which the loop is λ/2. I found it best to cut the λ/4 section for the lower part of the band. As it works out, this meant I could use the section of transmission line I already had between the attic loop and the TV coax. The 75 Ω step-down became just an additional system variable. The piece of line I used for the 20 meter delta loop (for operation on 40 meters) was half that length and easy to travel with.

I then fabricated a very simple, clip-on, discrete matching capacitor at the rig-end of the λ/4 (plus a little extra length) section. I had no idea how easy it would be to design this until I stared at a Smith Chart for a few hours and realized how sweet the high (reciprocal) R and X sector is for matching with a simple combination of a short length of transmission line, that changes the algebraic sign of the reactive components, and a parallel capacitor. A 4:1 balun is then used to connect the ladder line to coax section. I also tried a 1:1 balun and was able to make it work, but the SWR bandwidth was not as wide.

In order to dream this up and, later, fine

tune component values and line lengths, I needed to work through a little Smith Chart calculation. This was more to guide directional thinking and derive rough capacitance requirements, as precise calculation was not necessary, once I got the hang of it.[5] The details of my Smith Chart machinations are described in the sidebar.

A Few Other Details

I stay at around the 100 W level when I transmit. The λ/4 transmission line transforms some high antenna voltages down to way lower voltages at the location of the matching components. I had no problems with capacitor arcing; but I did choose components I thought were good to a few hundred volts. I would not recommend going to the lightweight little components one once found in pocket transistor radios and would look at even heftier parts to go much above 100 W.

My tuning kit consists of a parallel capacitor combination providing the capacitance range I needed, around 1000 pF. I ended up using an old AM radio air variable (365 pF max) in parallel with a 500 V, 500 pF mica capacitor (both picked up at a local surplus store). I used a pair of small alligator clip jumpers for quick attachment, when required. I also put alligator clips on two 1 foot and two 2 foot lengths of 450 Ω transmission line so I can experimentally add from 1 to 6 feet of line between the λ/4 transmission line and the capacitor.

I add these sections in by trial and error to find a place where the capacitors will allow me to get a match, at the lower end of the band. Obviously for this component juggling I have located the end of the quarter wave section at an accessible location. The match is not that touchy, so I usually just try capacitor setting at intervals of 20% mesh (20, 40, 60%) and look for a good SWR. At the higher end of the band, I find I can approach a point where it's a stretch to get a match with the capacitors and added line. This is because the original λ/4 section is naturally quite a bit longer (electrically) than λ/4 at the higher frequency. So if I have trouble matching at the high end of the band, I take out all added sections and tend to get a match with the capacitor directly at the (minimum length) junction point.

As another point of interest, I found that at the full wave loop frequency and its harmonics, I had the option of leaving the 4:1 balun in place and tuning up with the same capacitor configuration with different capacitor values and inserted line lengths.

In these cases, the added transmission line (this time extending λ/2 or a multiple) pushes the resultant impedance slightly into the inductive region. The reciprocal impedance then ends up in the same general Smith Chart region as the half loop solution and the same tuning techniques apply. Some experimentation gave me a contained list of inserted line sections and capacitors settings I could use to address 80, 40, 20, 15 and 10 meters. Actually, I have been able to stretch the solution enough to cover all bands, 80 through 10. I do, however, need a "cheat sheet" to remind me of the required capacitance and clipped on line lengths.

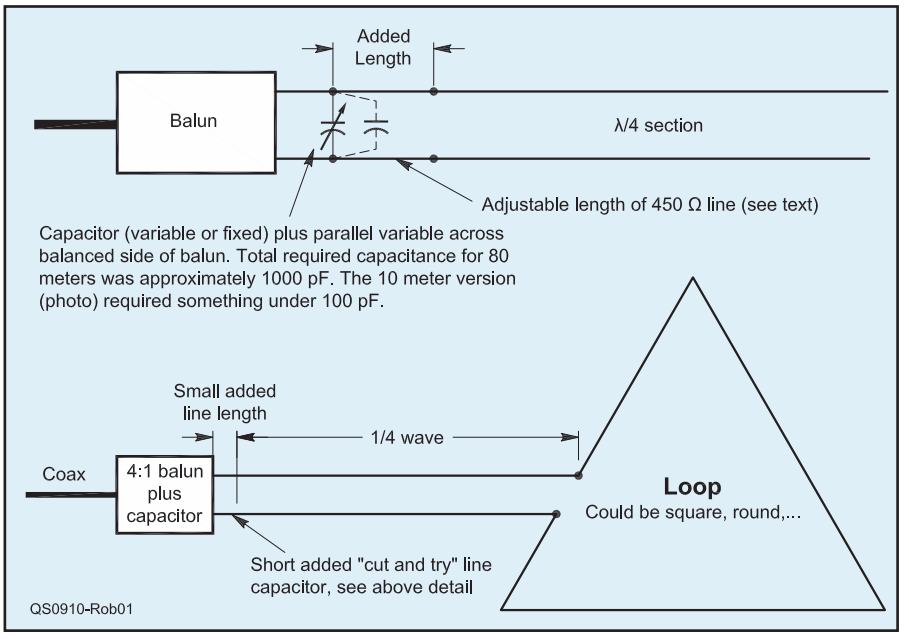


Figure 1 — Details of the matching network arrangement for the two band loop antenna.

Back to one of the original points; A 20 meter vertical delta loop, fed this way on 40 meters (this is the configuration for my Canadian cottage) operates almost like a strange sort of a vertical dipole. It does not need a ground and has a pretty reasonable radiation pattern. This configuration forces a current maximum to occur opposite the feed point. For a classic side-fed delta loop, this places a nice current standing wave on the side opposite the feed, yielding some strong low angle radiation components. I like to think I managed to put a dent into the reputation of the vertical delta as good for one band only. I wouldn't have guessed that going down in frequency could be as good a solution as it is, but I can tell you I've been truly happy with the operating results. There is little doubt, for example, that the 20 meter delta (which I prototyped outdoors for a night, in front of my Dallas home), tuned for 40 meters as described above, outperformed my full wave 40 meter attic loop, hands-down.

Notes

[1]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.

[2]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**.

[3]Engineering notation for a complex impedance of 300 Ω resistance in series with 8000 Ω of inductive reactance.

[4]J. Hallas, W1ZR, "The Quarter Wave Matching Section Revisited," *QST*, Mar 2007, p 57.

[5]D. Walraven, K5DVM, "Understanding SWR by Example," *QST*, Nov 2006, pp 37-41.

ARRL member and General class licensee Dave Robertson, KE5QWP, received his first US call sign in October 2007, after multiple decades away from the hobby. His original experience with ham radio occurred during his teens in the early 1970s using his original Canadian call, VE3HHR.

Dave has a Bachelor's degree in Electrical Engineering from the University of Waterloo and a Master's in Electronics Engineering from Carleton University, Canada. Dave has over 25 years of experience in the Internet and telecommunications industries.

*He joined ZixCorp (**www.zixcorp.com**), a provider of secure, hosted e-mail encryption and electronic prescribing and decision support services, in March 2002 and currently serves as Vice President, Engineering.*

Dave lives in Richardson (near Dallas) with his wife of 25 years and two teenage daughters. He enjoys skiing and fishing when he's not trying for DX. You can reach Dave at 3906 Sharp Ln, Richardson, TX 75082 or at **drobertson@zixcorp.com**. QST

The KL7CE No Holes Mobile Installation

Your vehicle may be somewhat different, but there are good ideas here for anyone who wants to go mobile.

Gene Gregory, KL7CE

I have always wanted to have a factory style installation of a full ham radio station in my vehicle. Unfortunately, vehicle manufacturers are funny about accommodating the wishes of the amateur community (and others, I suppose). I had been bitten by the mobile radio bug pretty badly and was interested in doing public service (ARES® and EmComm) work as well. I wanted to be able to satisfy as many wants and needs as my wallet could afford. And it all had to fit out of the way and be as clean as possible. I had recently read Jonathan Taylor's product review of sound cards in *QST* and felt that light bulb flip to on.[1] There in the article was the final piece of the puzzle, a USB sound card for my laptop PC. Now to begin.

My wife finally came to her senses, after just a bit of whimpering on my part, in letting me get another truck: "Honey, it has room for the dogs and the kids." So it came to pass that I drove home one day with a newer full sized, four door 4 × 4 as shown in Figure 1. It is amazing how much room there truly was inside. Why, a VHF/UHF rig could go a here, an HF rig there and, hey, a fella could even have room for a dedicated laptop as well.

But wait, how could I possibly drill holes into my new baby? What was I thinking? In my mad rush with a dream of rigs dancing in my head, I forgot one of the cardinal rules for new babies (trucks, that is, and real babies, too, I guess): "Thou Shalt Not Drill." Now what? Well, I have had lots of experience installing stuff in trucks and cars of all sorts. There had to be a way.

Figure 1 — My latest ham radio platform, just waiting for the next trip.

So, What Did I Want?

The list of things I was looking for in a mobile station included:

- V/UHF transceivers with PC connectivity.
- HF and 6 meter transceivers with PC connectivity.
- Antennas that work.
- Computer for running it all.
- USB connectivity.
- Sound card interface for digital mode operation.
- Internet access.
- HF and V/UHF digital modes.
- Global Positioning System (GPS) satellite navigation and reporting.
- Terminal node controller (TNC) for RMS Packet, *Airmail* and AX.25 packet.
- Printing capability.

We live in an amazing age. Thanks to Moore's law, electronic and radio equipment have become cheaper, small and more feature laden compared to those of earlier generations.[2] And the Internet is available in my pocket, now. There had to be a way to put it all together.

And so there is! The first task was to pick out the radio equipment to use for the project. It was real pain having to look at all those rigs and evaluating options. What was critical? HF or VHF/UHF? Well, I really wanted it all — or as much as could be packed into a rig or two.

Then, I needed to save space. To me that means radios with a removable control head option. That cut my search down to about 15 or 20. How was I going to use the equipment? Did I want to operate *Airmail*, Packet, PSK31, RTTY, RMS Packet, SSB or CW? How about all of the above?

For an HF transceiver, I chose the Yaesu FT-857D. The FT-857D is very small (small is good in a vehicle) and it has a remote control head, too. It also has the option of a very compact antenna system, the ATAS-120. I decided to go with the Yaesu FT-7800R for my V/UHF transceiver. I considered a VHF transceiver with a built-in TNC, but it was twice the cost and I had a TNC. Oh well. I did need to be able to keep the dogs in kibble and myself out of the dog house.

Now, how about computing and networking? Well this was pretty easy. I ordered an entry level HP laptop. Now, these days, an entry level laptop is a thing of beauty and power. Dual processors, 3 GHz clock speed, lots of memory, DVD burner, built-in wireless and an 80 GB hard drive. All this for my truck — this thing has more processing power than the space shuttle!

For getting it all online, I used a cellular network card that can be configured either for my laptop or, if I need to provide a Wi-Fi hotspot for a remote emergency operations center (EOC), for example, I

Figure 2 — Connections to the vehicle battery. Note the heavy fuse holder on the positive lead.

[1]Notes appear on page 41.

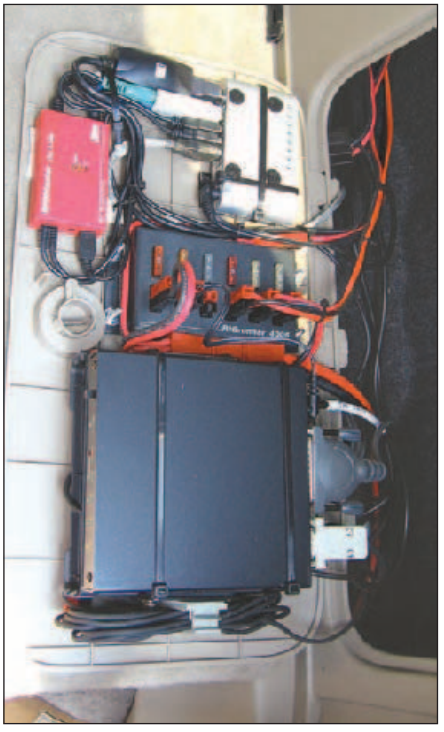


Figure 3 — V/UHF transceiver body, RIGrunner and digital accessories all mounted on cargo door.

Figure 4 — The main operating position offers convenient access to all systems.

can use a dedicated cellular Wi-Fi router and connect several PCs to the Internet.

Where Will It All Go?

Now comes the fun part. How to install all the equipment without drilling any holes. First, it pays to look at the interior spaces of your vehicle. What can you pull off or replace easily? How can you run wire? Where will all this stuff fit? Most modern full sized pickup trucks have an enormous amount of room to work in. There are lots of places to hide radios and run wire that are not visible to the passengers. There is no need to drill holes in the cab. There is no need to drill holes in the dash, in the firewall or in the floor. You do, however, need to drill holes in the storage doors behind the rear seat (my truck has storage behind the rear seats). But, and this is important, you can replace the doors later if needed. The main criteria for my installation was that it could be undone and no one would be the wiser. After all, I may need to sell or trade it in someday.

Figure 5 — Detailed view of the laptop mounting arrangement.

There are several ways to mount radio and computing hardware, but I chose to use commercial off the shelf (COTS) mounting brackets. I found that by judicious searching online, one can find a mount for almost anything. I found that other mobile electronic mounts can be repurposed to work here. I used two different GPS mounts for the control head mounting brackets on the dash. I used a no-drill mount for the laptop. Also, I used a commercial truck accessory rack as an antenna mount. It is worth noting that commercial brackets will look more like a factory install, as well.

Now for the Ripping and Tearing

First, the rocker covers were pulled up from all four doors to give access to the wire trough that is in this area. Then the kick panels under the dashboard in the foot wells were removed. Next I removed the doors to the storage space in the rear of the cab behind the rear seats. This left a lot of room for the equipment.

Two 6 gauge power wires were routed from the battery, through the firewall and along the driver's side rocker panel to the storage area behind the left rear seat and into a West Mountain Radio RIGrunner 4005 power distribution block. Make very sure that the positive side of the cable is fused as close to the battery as possible. I used a 40 A fuse holder from a high end car stereo amplifier for this. And it looks good, too (see Figure 2). Note that this fuse is to protect the vehicle from wiring shorts. Also keep the fuses in both sides of the cable at the radio end to protect the radio.

I located the FT-7800R radio body, TNC, RIGblaster Plug and Play, four port industrial 12 V dc USB hub, Turtle Beach Audio Advantage sound card adapter and a serial adapter on the cargo door on the driver's side as shown in Figure 3.

The FT-857D HF transceiver was mounted on the passenger side. I then ran the separa-

Figure 6 — Antenna mounting details. Note the positions for an HF antenna above the side rail and VHF and UHF antennas on the upper support.

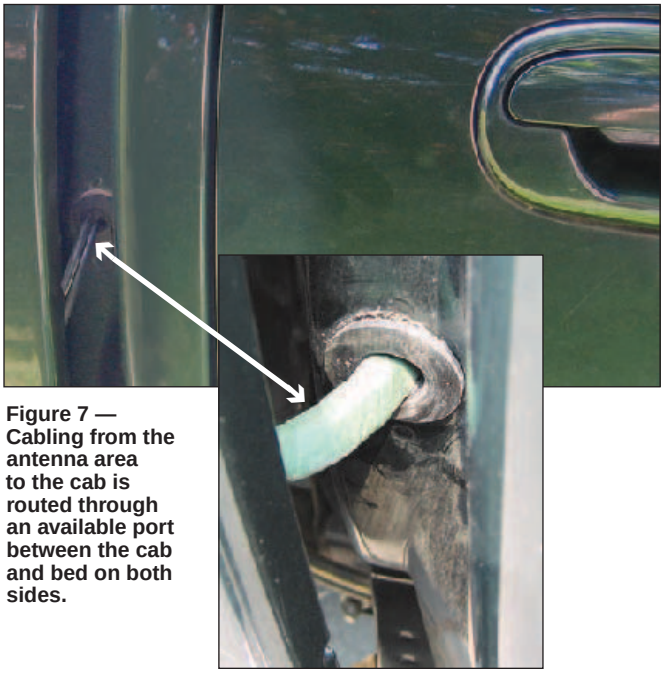


Figure 7 — Cabling from the antenna area to the cab is routed through an available port between the cab and bed on both sides.

tion kit wires along the passenger side rocker panels along with the other low voltage wiring to be run to the front of the truck for the speakers connections.

Bracketron mounts were used for both the remote speakers (under the dash) and the detachable control heads (top and front of dash).[3] It was a tight fit for all this stuff, as shown in Figure 4, but it did all fit. Take care to allow for vibration — don't install USB connectors upside down as they fall out. Make sure that no connectors are under strain and that there is no interference with the storage bay doors as they close.

The laptop was probably the easiest item to install. I purchased a RAM no-drill mount and installed it in front of the passenger seat as shown in Figure 5.[4] There is plenty of room for the passenger and I can still use the laptop from the driver's seat — while parked of course. The power for the laptop is obtained from the RIGrunner 4005.

The laptop is configured to provide GPS tracking, and automatic packet/position reporting system (APRS) using the TNC and the FT-7800R. The laptop is also used to control the FT-847D for digital modes including PSK31 and RTTY. The soundcard adaptor is part of the USB network that is installed in the truck, so that audio cables are not running all over the place; the audio cables stay right next to the radio. If needed, a printer can be set up very quickly by plugging into the USB hub and a 120 V ac inverter. Just one USB cable from the laptop to the USB hub and I am in business.

Antenna System

The final piece of the station is the antenna system. A Backrack rack from Truck Champ solved the mounting issues.[5] This rack has optional mounts for antennas, lights and other truck equipment. I had made a custom mount for the ATAS-120 but used accessory mounts for everything else (see Figure 6). As for feeding the antennas, there was no need to drill a hole again. Most full size truck manufacturers have openings in the cab at various spots.

A wire raceway was available on each side of the cab to run coax, GPS and any other cables right into the cab as shown in Figure 7. After grounding everything in sight with ground braid and with a proper water seal to the cab, we were done.

How Does It All Play?

Well, I have participated in a few events including the 2007 Simulated Emergency Test (SET), 2008 ARRL Field Day as well as a few emergency drills. In each, the setup worked like a champ. It was very easy to pass *Airmail* traffic. The ability to print on the go was an outstanding plus. Working CW is straightforward, and my key fits into the armrest while not in service. No, my station may not have the biggest signal out there, but I can move to higher ground pretty fast if I need to get stronger. I have made many DX contacts and have been very active on PSK31 with this setup. For EmComm, ARES® and ARRL Field Day, the ability to provide a network connection was very useful.

Now if I can just fit that kW linear amplifier under the spare tire.

Notes

[1]J. Taylor, K1RFD, "Product Review — Computer Sound Cards for Amateur Radio," *QST*, May 2007, pp 63-68. Available on the ARRL Members Web site, **www.arrl.org/members-only/prodrev/**.

[2]See **en.wikipedia.org/wiki/Moore's_law**.

[3]Bracketron mounting solutions for mobile electronics, **www.bracketron.com**.

[4]**www.e-mount.com**.

[5]**www.truckchamp.com**.

ARRL and AMSAT member and Amateur Extra class licensee Gene Gregory, KL7CE, was first licensed as a Novice in 1973 at the tender age of 14. He was introduced to Amateur Radio by long time friend and school chum Kelly McClure, AL7DM. They are still friends 40 years later. After moving to California in 1986 he was inactive for many years.

In 2001 Gene got back into the hobby with help from his old friend Kelly. He is very active on PSK31 and satellites and is involved with the Candlewood Amateur Radio Association, a local club. He currently lives in Connecticut with his lovely and patient wife Shawn and their two kids Katie and Chris.

Gene works and travels world wide for Johnson Controls as a Senior Field Support Engineer working on and designing security control networks and systems. While traveling, he tries to bring the hobby with him. On regular visits to Alaska, Grand Cayman and elsewhere, he will pack a station along. In Grand Cayman, Gene is licensed as ZF2CE. You can reach Gene, at 4 Hillview Dr W, New Fairfield, CT 06812 or at **kl7ce@arrl.net**. *No trucks were harmed in the making of this article.* QST

An Ideal Plastic for Amateur Radio Projects

Not all plastics are created equal — check out all you can do with polycarbonate.

Joe Wonoski, N1KHB

There are many uses for plastic products in ham radio homebrewing. Insulators, enclosures and structural components, to name a few, can be easily fabricated from such materials. I will provide an overview of the features of my favorite plastic material that is easy to use, relatively inexpensive and, when worked correctly, will perform even better than you may have expected.

My Favorite Plastic

Acrylic may be familiar to many of you. It is sold under various trade names such as Plexiglas and Perspex. Acrylic is widely available and has some desirable properties. There is, however, another plastic that may be a little less familiar, but which I believe is better suited to many ham radio applications. This material is polycarbonate. One trade name under which it is sold is Lexan.

Polycarbonate has some definite advantages over acrylic and usually costs only a little more to purchase. The main advantages of polycarbonate are better ultraviolet resistance for improved durability in sunlight, considerably higher strength and it is far less brittle than acrylic. It also has better low temperature characteristics — important for projects subjected to colder climates. A variant of polycarbonate has become used as a bullet proofing material, a testimony to its strength. If aesthetics are important, polycarbonate won't scratch as easily. In addition, if you're familiar with working with acrylic, you will find similarities when working with polycarbonate materials.

But Wait — There's More!

The advantages of polycarbonate don't end there — it also shares some characteristics with sheet metal that leaves acrylic in the dust. Along with the common drilling and sawing operations used for acrylic, polycarbonate can be bent at room temperature in a sheet metal bending brake, round holes can be made with sheet metal punching tools,

Figure 1 — View of antenna support L bracket antenna mount made from 0.50 inch thick material. The two 0.25 inch holes in the base section are for potential use with bolts and nuts.

Figure 2 — Another view of the L bracket. Note the 0.50 inch square cross section reinforcing brace glued to the inside corner of the upright section/horizontal base. This was added after the mount had been in successful service for some time, as insurance against high winds.

and it can even be sheared with hand or machine shop shear tools in thicknesses up to around 0.125 inches.

Sawing polycarbonate can best be done with either a portable or stationary circular saw. Carbide blades cut cleaner and last longer, but whatever you have for woodworking can work as long as the blade is sharp. Tooth count can be in the middle range. If I am using a portable saw, I advise clamping the work piece and using a saw guide to make straight clean cuts. If using a table saw, use a pusher to keep hands away from the blade. A steady moderate pressure along a rip fence, just as with lumber, is all that is needed for cutting. Plastic can occasionally kick back while cut on a table saw, so be prepared — another reason that clamping is useful with a portable saw.

Band saws can also be used, but the cut edge quality will be poorer. Save the band saw for irregular shapes if possible. Results with a saber saw (sometimes incorrectly called a jig saw) will be poor. The usual result is a lot of melted plastic forming behind the blade. Cuts made by a stationary jig saw may also be as poor, as with a saber saw, but I haven't owned or had access to one in many years, so I am unable to confirm that.

Drilling can be done with ordinary twist drill bits or with flat blade style wood bits. As with saw blades, all tools should be sharp. If drilling larger holes with twist drills, gradually enlarge a hole in reasonable size steps. Keep the work temperature down. If you smell plastic, stop the work and let things cool down. Use moderate pressure and don't linger. Drilling too slowly can lead to excess heating just as can drilling too fast. Again, a clamped work piece is a safer work piece. Don't forget to wear eye protection during any power tool operations.

Some lubricant can go a long way to reduce frictional heating. Drip some oil into the twist drill grooves so that it will

continue to self-feed into the cut as work progresses. Mineral oil from the drugstore is a good lubricant because it is easier to clean up. You can wash off the oil residue afterward with ordinary soap and warm water. Threaded holes can also be made with ordinary taps used for threading metal. Just clear any accumulations of chips as you progress with the threads so that the tap won't jam. A forward and then slightly backward rocking of the tap is all that is usually needed to loosen chips. As with metal, through holes are easier to thread than blind holes.

Gluing Polycarbonate Parts Together

One of the nice things about working with polycarbonate is the ability to join pieces with a minimum of effort. If you want to make a right angle bracket to use as an antenna base for deck railing or picnic table portable use, for example, you need to make a base piece to use as a horizontal component for clamping to the table as well as a vertical piece to mount the antenna, as shown in Figures 1 and 2.

The raw cut edge that results from being worked with a portable circular saw or table saw will often be good enough for gluing. If any deep defects are present, the edge can be sanded by laying a piece of medium grit sandpaper on a flat surface and carefully drawing the plastic edge back and forth while keeping the cut edge parallel to the sandpaper. Wipe away excess plastic dust before gluing.

The correct adhesive is important, but easy to obtain. It can usually be obtained from plastics dealers, but you can use liquid cement meant for plastic models, obtainable from hobby shops. Every liquid cement brand that I've tried has worked well, but test any new samples for strength yourself. Do not use the squeeze-tube variety. Liquid cement works by partially dissolving the plastic surfaces. As the cement evaporates from the glued area, the joint becomes effectively welded together as if originally made from a single piece of material.

Let the joint cure for at least a few hours even though it will become immobile rather quickly. Full strength is usually achieved in 24 hours, depending on the surface area and depth. If you can legally obtain a medical syringe and needle, you'll be able to deliver the precise amount of adhesive exactly where it's needed, but you can also do an effective job by using the brush that usually comes with the cement. Either way, just apply adhesive along the joint and the adhesive will wick inward. A beveled edge will aid in adhesive application by forming a channel with the adjacent piece.

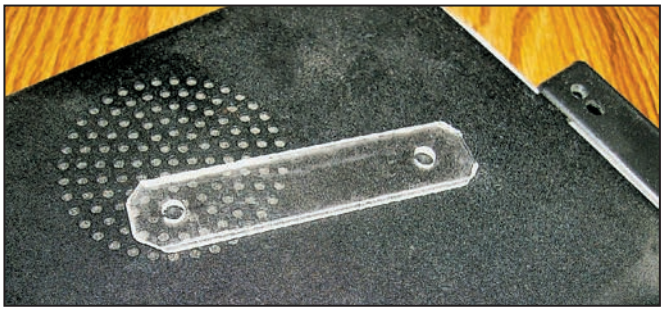


Figure 3 — Antenna end insulator made from 1 inch wide by 0.063 inch thick material. The hole edges are chamfered.

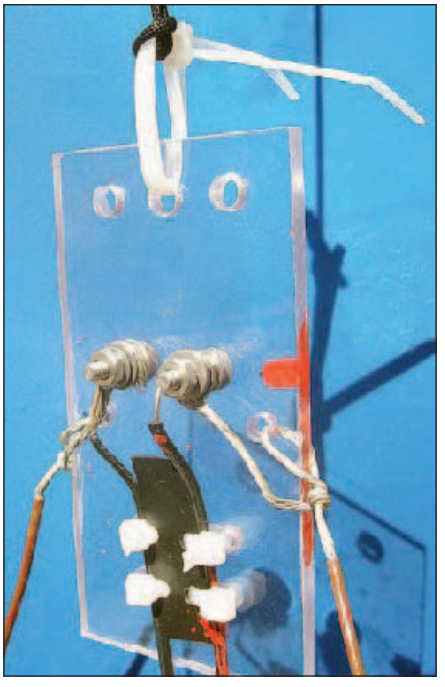


Figure 4 — Antenna center insulator ready to be hoisted up.

Figure 5 — Mobile radio mounting bracket made from 0.188 inch thick material. The upper angle brackets swivel to accommodate possible mounting surface curvatures, such as found on a vehicle dashboard.

Surprisingly little liquid is needed, but apply an ample amount to effect a good bond. Using too much, however, can weaken a joint. You'll instantly witness correct application because the joint will turn clear as the adhesive wicks and the two surfaces fuse together. Some small "misses" will occasionally appear. If they do, just increase the flow of the cement. Wider dimensions will be the most likely to fall short of 100% coverage. Gaps are hard to fill later, but as long as most of the bond area is covered the joint will still be strong.

Add a brace to the design if things go badly rather than attempting to disassemble. Some light to moderate clamping pressure can help, but it's most important to pay attention to initial alignment of parallel surfaces and to not fuss with a joint very much once adhered. The more the joint moves during the cure process the weaker it will be. Depending on sizes and geometries of any given project, some assemblies can benefit from temporary bracing to keep things aligned during the initial adhesion process.

Practice with some scrap pieces and experiment with technique in order to gather experience and gain confidence. These practice pieces can be subjected to some stress test experiments of your own in order to show just how strong this method really is. By becoming skilled at this joining method, you will have mastered the most important aspect of working with polycarbonate materials used in multiple piece projects.

Bond line adhesives including epoxy and RTV can be used for low strength applications such as weather sealing, but shouldn't be depended upon for much structural strength. Again, experiments can offer information as to the amount of strength supplied by any given adhesive. Don't think of experiments as a waste of material. Some of the successful ones can become parts of future projects.

If You Have It, You'll Use It

A small inventory of sheet stock, the most commonly used form, can be kept on hand for any future projects. I suggest starting with either 12 × 12 or 12 × 24 inch pieces of 0.125,

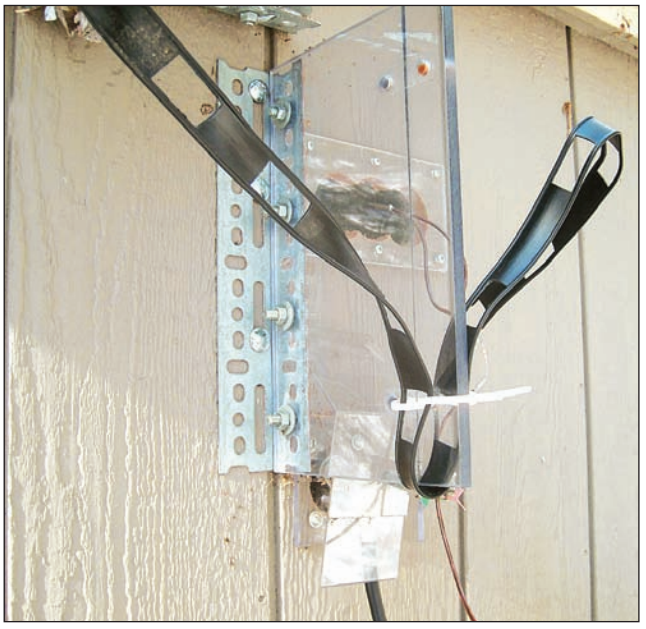


Figure 6 — Flat vertical antenna support bolted to garage wall with slotted angle steel stock. Without any additional support of any kind, not even guys, this 0.50 inch thick mount previously supported a 23 foot long aluminum homebrew vertical antenna for several years in all sorts of Northeast weather. It's presently serving much lighter duty as a feed line anchor point.

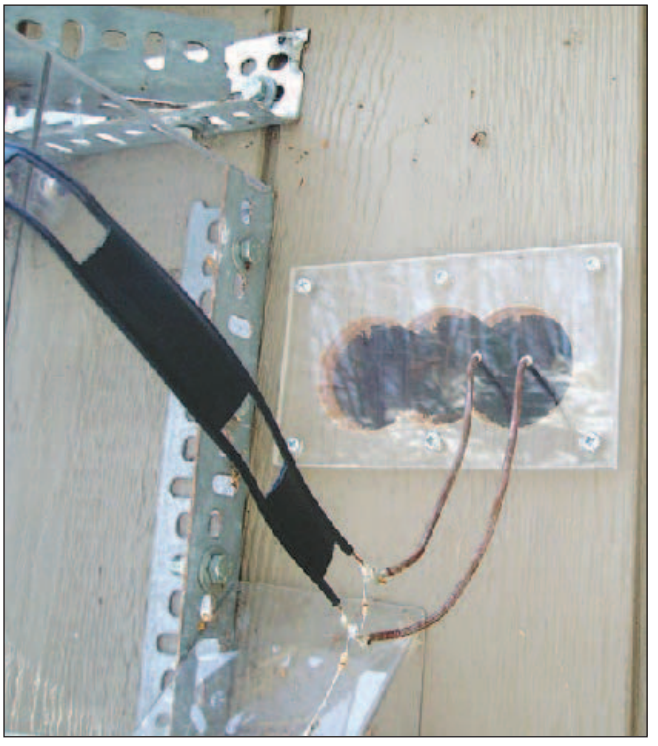


Figure 7 — A 0.25 inch thick plastic window centers the conductors of parallel line in the feed through holes.

0.25, 0.375 and 0.50 inch thicknesses for a versatile assortment, good for many different kinds of projects. One should note that thicknesses are nominal and the material received may deviate somewhat from the stated size.

Obtaining polycarbonate can be as easy as looking in the *Yellow Pages*. There may be local dealers. Mail order and Web sources are also plentiful. My personal favorite is McMaster-Carr (**www.mcmaster.com**) an industrial hardware supplier. They are friendly to individual purchasers of small quantities and have excellent customer service with no minimum purchase. They sell many convenient shapes and sizes of material.

Give Polycarbonate a Try

Plan a project using polycarbonate. You can try an antenna bracket, a project enclosure, or even just a component support. Once you become comfortable with the basic techniques, you'll be able to imagine many other possibilities. Figures 3 through 8 provide some examples of projects I've made with polycarbonate — perhaps they will provide food for thought.

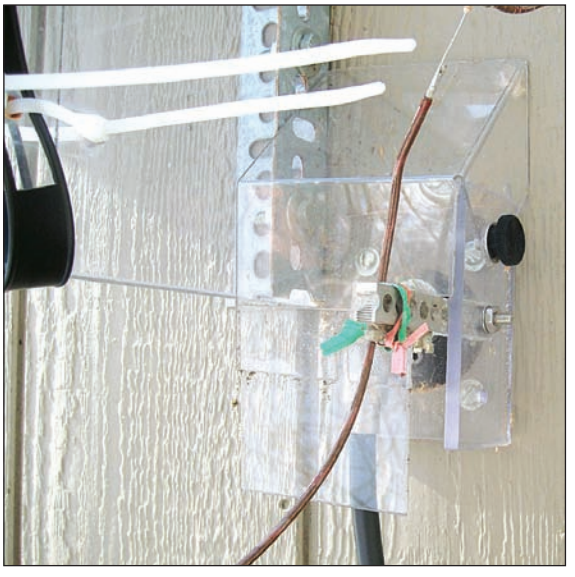


Figure 8 — Entry point for a single coax cable. The removable "greenhouse" cover is made from a single piece of 0.063 inch thick material bent to shape in a sheet metal bending brake. A single black thumb screw holds the cover to the threaded base.

Photos by the author.

ARRL member and Advanced class licensee Joe Wonoski, N1KHB, is an ARRL Connecticut Section Technical Coordinator, an ARRL Instructor and an ARRL VE. Joe retired from Yale University after more than 35 years as a research and development support staff member. You can reach Joe at 1121 West Lake Ave, Guilford, CT 06437 or at **n1khb@aol.com**.

Strays

QST congratulates…

♢ARRL member Tom Cash, KI4VFV, Madison County ARES® volunteer, winner of the Alabama Association of Emergency Managers (AAEM) 2009 Volunteer of the Year award. Tom serves the county in a variety of disaster preparedness and response organizations as an Amateur Radio operator, a Community Emergency Response Team (CERT) member, a stream monitor for flooding conditions and a volunteer for the Be Ready Family program. — *Greg Sarratt, W4OZK*

♢ARRL charter life member Reynold L. (Fritz) Nitsch, W4NTO, on the occasion of his 90th birthday. Fritz is the last surviving founding member of the Spartanburg ARC. — *Dan Donovan, KF4VIS*

I would like to get in touch with…

♢ a person to take over my 10 year old KIDS CLUB project. For more information, please look up my call sign at **www.qrz.com**. — *Duane Wyatt, WAØMJD*

PRODUCT REVIEW

FlexRadio Systems FLEX-3000 Software Defined HF/50 MHz Transceiver

Reviewed by Steve Sant Andrea, AG1YK
Assistant Editor

The FLEX-3000 is a software defined radio (SDR) that uses a minimum of hardware/analog components to produce a working HF/50 MHz, 100 W all mode transceiver. As with previous FlexRadio offerings, the radio is only a third of the actual system. It must be combined with a computer and software.

The computer is a significant factor in the purchase of a FLEX-3000, as the quality of the computer greatly affects the overall system performance. When considering the FLEX-3000, check FlexRadio's Web site for information on computer requirements. For this review, the ARRL purchased a Dell Inspiron 530 running an Intel Core 2 Quad CPU at 2.83 GHz with 3 GB of RAM memory. The operating system is *Windows Vista 6.0.6001 SP1*. An IEEE 1394 (FireWire) 400 MB/s interface connects the computer to the radio.

The software, FlexRadio Systems *Power SDR*, is freely downloadable from FlexRadio's Web site. This is the same software used with other FlexRadio transceivers we've reviewed. It's regularly updated to improve performance and add features — one of the big attractions of an SDR.

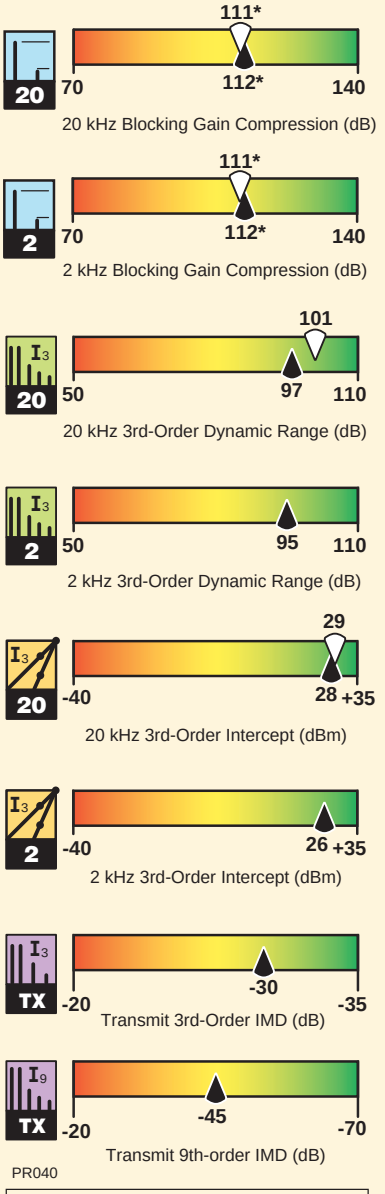
Sibling Rivalry

The FLEX-3000 is the little brother of the FLEX-5000, which *QST* reviewed last year.[1] The '3000 has been designed as an entry-level SDR for those who are curious about how these radios actually "play" but may not want to spend the additional $1000 or so for the advanced capabilities of the FLEX-5000. It's also smaller and easier to

[1]R. Lindquist, WW3DE, "FlexRadio Systems FLEX-5000A HF/50 MHz Transceiver," *QST*, Jul 2008, pp 39-45. *QST* Product Reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

Figure 1 — Rear panel connections are straightforward — dc power, antenna, computer, amplified speakers, TR and amplifier switching and FlexWire I/O for accessories.

Key Measurements Summary



PR040

Key:
80 M
20 M

Dynamic range and intercept values with preamp off.

Intercept values were determined using -97 dBm reference

* Blocking level exceeds the threshold of ADC clipping.

Bottom Line

The FLEX-3000 is a compact software defined radio (SDR) in the mid-range price class. It can be used at home or paired with a notebook computer for operation on the go. Although it gives up some features compared to the FLEX-5000A, it doesn't give up much performance.

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use for portable operation — a good match for a notebook computer.

The FLEX-3000 lacks some of the fancier bells and whistles of its larger kin, and the FlexRadio Web site has an extensive chart comparing the features of the various FlexRadio models. Many of the differences between the two are in the areas of antenna and transverter capabilities and input/output connections. The FLEX-5000 has three separate RF antenna connectors that can be configured for specific band/mode/antenna combinations. It also has two BNC receive antenna inputs that can be configured to allow insertion of preamps, filters or preselectors into the receive path. The FLEX-3000 has only one antenna connection. The FLEX-3000 does have a built-in antenna tuner, an option on the '5000.

The FLEX-5000 can accept an optional second receiver and 2 meter transverter. It also has several rear panel interfaces to allow the insertion of external transverters via low level connectors and manage their control directly with software. The FLEX-3000 has neither provision. The FLEX-5000 also has more extensive provisions for controlling external amplifiers. The '5000 offers cross-band/cross-mode capability and its panadapter covers a wider frequency range.

If you have a large station with multiple antennas, or if you do a lot of contesting or DX work on the low bands and/or the VHF/UHF arena, then the FLEX-5000 is probably the better choice. For hams with more limited operating interests and capabilities, the FLEX-3000 will be a good fit. Its performance is excellent for transceivers in this price range, and its range of standard features is impressive.

Table 1
FlexRadio FLEX-3000, serial number 1709-0037

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03-65 MHz; transmit, 1.8-2.0, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54 MHz.	Receive and transmit, as specified.
Power requirement: 13.8 ± 10% V dc; receive, 3.5 A (max audio); transmit, 23 A (100 W out).	13.8 V dc; receive 2.8 A (max audio); transmit, 18 A typical (100 W out).
Modes of operation: SSB, CW, AM, FM, RTTY, Packet.	As specified.

Receiver

SSB/CW sensitivity: 500 Hz bandwidth, 14 MHz MDS, preamp off/on: –123/–133 dBm.

Noise figure: Not specified.

AM sensitivity: Not specified.

FM sensitivity: Not specified.

Spectral display sensitivity, preamp off/on: Not specified.

Blocking gain compression: Not specified.

Reciprocal Mixing (500 Hz BW): Not specified.

Receiver Dynamic Testing

Noise Floor (MDS), 500 Hz filter:

	Preamp off	*Preamp on*
0.137 MHz	–123 dBm	N/A
0.505 MHz	–126 dBm	N/A
1.0 MHz	–125 dBm	N/A
3.5 MHz	–118 dBm	–122 dBm
14 MHz	–120 dBm	–135 dBm
50 MHz	–114 dBm	–137 dBm

14 MHz, preamp off/on: 27/12 dB

10 dB (S+N)/N, 1 kHz, 30% modulation:

	Preamp off	*Preamp on*
1.0 MHz	3.63 µV	N/A
3.8 MHz	7.15 µV	4.36 µV
50 MHz	12.6 µV	0.72 µV

For 12 dB SINAD:

	Preamp off	*Preamp on*
29 MHz	3.63 µV	0.23 µV
52 MHz	6.38 µV	0.32 µV

–125/–140 dBm.

Gain compression, 500 Hz bandwidth*:

	20 kHz offset	*5/2 kHz offset*
	Preamp off/on	*Preamp off*
3.5 MHz	111/107 dB	111/111 dB
14 MHz	112/105 dB	112/112 dB
50 MHz	109/104 dB	109/109 dB

20/5/2 kHz offset: better than 114 dBc.**

ARRL Lab Two-Tone IMD Testing†

Band/Preamp	*Spacing*	*Input Level*	*Measured IMD Level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz/Off	20 kHz	–17 dBm	–118 dBm	101 dB	+34 dBm
		–13 dBm	–97 dBm		+29 dBm
14 MHz/Off	20 kHz	–23 dBm	–120 dBm	97 dB	+26 dBm
		–14 dBm	–97 dBm		+28 dBm
		0 dBm††	–13 dBm		+7 dBm
14 MHz/On	20 kHz	–40 dBm	–135 dBm	95 dB	+8 dBm
		–37 dBm	–97 dBm		–7 dBm
14 MHz/Off	5 kHz	–24 dBm	–120 dBm	96 dB	+24 dBm
		–15 dBm	–97 dBm		+26 dBm
		0 dBm††	–13 dBm		+7 dBm
14 MHz/Off	2 kHz	–25 dBm	–120 dBm	95 dB	+23 dBm
		–15 dBm	–97 dBm		+26 dBm
		0 dBm††	–13 dBm		+7 dBm
50 MHz/Off	20 kHz	–22 dBm	–114 dBm	92 dB	+24 dBm
		–13 dBm	–97 dBm		+29 dBm

The Hardware Part

The '3000 is a very small radio measuring 1 foot square and standing about 2 inches tall. The left and right sides are perforated for ventilation to allow sufficient air flow on both sides of the radio.

The front panel has only a power switch, ¼ inch jacks for CW key and headphones and an RJ-45 microphone jack wired to match the Yaesu MH-31 microphone pinout. Optional microphone cables, headsets and accessories are available.

The rear panel (Figure 1) is a little busier, but not much. It has a Molex connector for dc power, a ground screw, BNC antenna connector, FireWire interface and external PTT connection for a foot pedal or hand switch. A keying line is also provided for control of a power amplifier or other external equipment. A line level audio output is included for connecting to powered speakers. Finally, the rear panel has a FlexWire I/O interface for use with FlexRadio accessories.

For the basic configuration all you need is power, ground, antenna, FireWire cable, speakers or headphones and a microphone. Hardware connections are minimal; hookup is the usual, plug this here, plug that there. No big deal. As tempting as it may be, don't power up the FLEX-3000 until you complete the software installation, though.

The Software Part

To put the '3000 on the air, first you have to get *PowerSDR* (*PSDR*) properly installed. When we received the '3000, version 1.18.0 was current. As is common today, FlexRadio provides a hardcopy *Quick Start Guide*. The *QSG* separates the installation process into four parts: hardware hookup, IEEE 1394 FireWire driver installation, *PowerSDR* installation and driver/*PowerSDR* configuration.

To install *PSDR* v1.18.0, we also needed

Manufacturer's Specifications	Measured in the ARRL Lab
Second-order dynamic range: Not specified.	Preamp off/on: 14 MHz, +98/+78 dB; 52 MHz, +107/+93 dB.
DSP noise reduction: Not specified.	Variable, 10 dB maximum.
Notch filter depth: Not specified.	Auto notch: 60 dB, attack time: 300 ms.‡
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, preamp on: 29 MHz, 62 dB; 52 MHz, 55 dB. 10 MHz channel spacing: 52 MHz, 85 dB.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 49.7 μV; preamp on, 49.7 μV.
Squelch sensitivity: Not specified.	At threshold, preamp on: SSB, 0.11 μV; FM, 29 MHz, 0.11 μV; 52 MHz, 0.35 μV.
Receiver audio output: –10 dBV at 600 Ω	As specified (fixed level on rear jack; uses external amplified speakers).
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth)‡: CW (500 Hz): 266-795 Hz (529 Hz). Equivalent Rectangular BW: 516 Hz. USB: (2.4 kHz): 112-2611 Hz (2499 Hz). LSB: (2.4 kHz): 108-2613 Hz (2505 Hz). AM: (6 kHz): 35-3003 Hz (5936 Hz).
Image rejection: >70 dB (160-6 m amateur bands)	14 MHz, 96 dB; 50 MHz, 71 dB.

Transmitter	Transmitter Dynamic Testing
Power output: 1-100 W PEP CW, SSB; AM, 1-25 W.	HF: CW, SSB, RTTY, packet, typically 0-104 W, FM, 0-42 W, AM, 0-37 W. 50 MHz: CW, SSB, RTTY, packet, 0-100 W, FM, 0-42 W, AM, 0-35 W.
Spurious-signal and harmonic suppression: >55 dB on HF,>65 dB on 50 MHz.	HF, 54 dB; 50 MHz, 60 dB. Meets FCC requirements.
SSB carrier suppression: 55 dB.	>70 dB.
Undesired sideband suppression: 55 dB.	65 dB.
Third-order intermodulation distortion (IMD) products: >33 dB below PEP at 14.2 MHz	3rd/5th/7th/9th order (worst case): HF, –31/–36/–43/–48 dB PEP; 50 MHz, –30/–44/–44/–48 dB PEP.
CW keyer speed range: Not specified.	1 to 54 WPM.
CW keying characteristics: Not specified.	See Figure 3.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 66 ms.
Receive-transmit turnaround time (tx delay):	SSB, 48 ms; FM, 44 ms.
Composite transmitted noise: Not specified.	See Figures 4 and 5.

Size (height, width, depth): 1.8 × 12.3 × 12.3 inches; weight, 7.3 pounds.

Price: $1599

*Blocking level exceeds the threshold of ADC clipping.

**No reciprocal mixing occurred up to the threshold of ADC clipping.

†ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using a –97 dBm reference.

††IMD level exceeds the threshold of ADC clipping.

‡Default values; adjustable with DSP.

to install the '3000 firmware, the *Windows* FireWire device driver, Microsoft *.Net 1.1* and Microsoft *.Net 1.1 SP1*. The installation did provide some "challenging" moments but we were able to get the '3000 up and running with a few hours work and some downloads from FlexRadio. In particular make sure you download and install the *.Net* software, if you don't already have it, before attempting the installation. (FlexRadio includes the appropriate .NET libraries on the installation CD with radios that are currently shipping.)

The FireWire driver and *PDSR* have mutual settings that need to match for optimum performance. Follow the instructions and configure them as indicated. Finally, be sure to configure the *Audio Mixer*, which controls the audio inputs and outputs to the FLEX-3000.

The Inevitable Upgrade

During the course of this review, Flex Radio made available the next release of *PowerSDR* — version 1.18.2. This upgrade adds no new features to version 1.18.0 and consists mostly of bug fixes and some performance enhancements.

To upgrade to v1.18.2, you must first install Microsoft *.NET Framework 3.5 SP 1*, then the *FLEX FireWire driver*, v3.4.0.5254 and finally firmware 1.2.5.5 before installing *PowerSDR* v1.18.2. Okay, you ask, where do I get all this stuff? Starting at the FlexRadio home page you will see a box titled CURRENT VERSIONS OF SOFTWARE AND DOCUMENTATION. Click on the POWERSDR REL NOTES 1.18.2 link. This will take you to the release notes for a description of the changes in the new release. There you will find a list of the additional software that is required.

To download *.NET Framework 3.5* you need to go to the Microsoft Web site.[2] For the *FireWire driver* and firmware upgrades, click on the DOWNLOADS button at the top of the FlexRadio page. This will bring you to a list of available downloads that includes the ones needed for the upgrade. Download the appropriate installers and then *stop right there*.

It is a wise computer user who, before installing new software or upgrades, runs a backup, sets a restore point and starts the *Add New Software* tool resident in *Windows*. Done? Okay, now you can start the upgrade.

Front Console and Spectrum Display

Opening *PSDR* displays the Front Console (FC, see Figure 2) in an inactive state. Clicking the START button at the upper left will get the action going. The FC is a busy window composed of buttons, text boxes, sliders and numerical controls all grouped around the main display in the center. Frequency controls are along the top. Metering, band, mode and filter controls are along the right side. On the left side are audio, AGC, squelch, transmit control and date/time functions. Along the bottom are VFO, DSP, display and mode specific controls.

On the display area in the center of the screen, real time signal information can be viewed in nine different formats. The parameters of the various formats are all configurable.

The *Panadapter* format shows signal activity across the IF passband (see Figure 2). The selected main receive and transmit filters may be superimposed on this broad display of band activity. The red line running down the

[2]Go to **www.microsoft.com/net** and click on DOWNLOADS then navigate to the *.NET Framework 3.5* page.

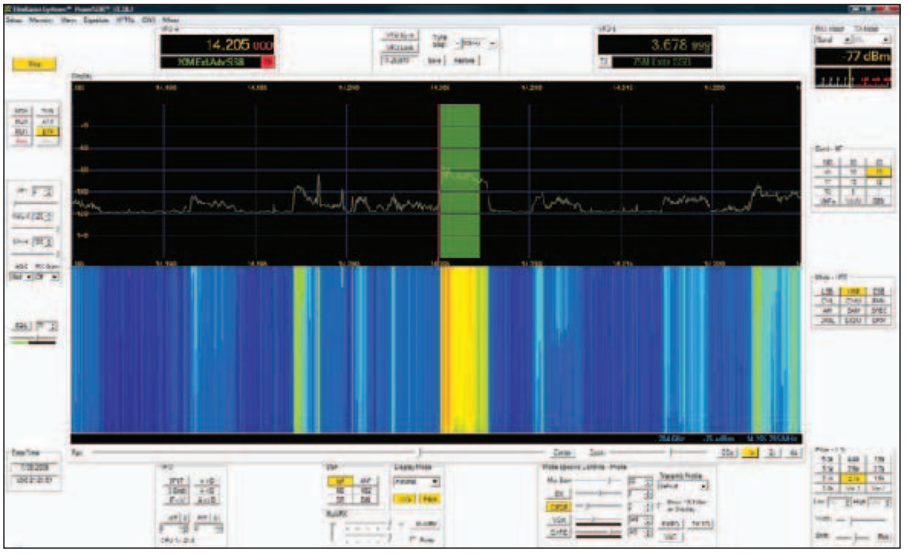

Figure 2 — The *PowerSDR* front console screen includes all necessary radio controls as well as a prominent spectrum display that offers several distinct modes. See the text for a detailed description.

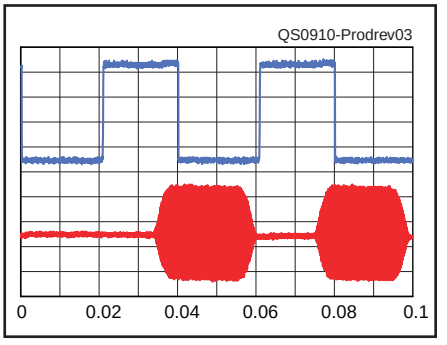

Figure 3 — CW keying waveform for the FLEX-3000 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

center of the Panadapter is the VFO frequency. The green rectangle represents the filter passband. The X-axis of the grid is frequency and the Y-axis is signal level, here from –160 to –20 dBm.

The *Waterfall* shows a colorized view of signal strength as a function of frequency for all frequencies within the current passband. Signal levels, timing and color are all configurable. The *Panafall* is a combination format with a traditional panadapter screen on the upper half of the display and a PSK31 style waterfall on the lower half. This format is useful for locating weak signals that are not obvious with the panadapter alone.

The *Scope* format shows a classic oscilloscope display of whatever signal is within the filter passband. Interestingly, I found the Scope was able to "print out" the code of a CW signal. The feature could be useful for the hearing impaired. The *Panascope* format shows both the Panadapter and Scope.

Spectrum displays signal levels within the selected filter's bandwidth. Signal activity in the IF passband outside of the filter bandwidth is not shown. The *Histogram* display is essentially a colorized version of the spectrum display. Blue represents the signals levels within the filter passband that are below the average level. Red represents those that exceed the average level and green is a peak reading function.

The *Phase* format maps the I and Q channels to the X and Y axis of the display. The I and Q channels represent the incoming signal split into two components separated by 90°. These displays are useful for testing.

In the Spectrum, Panadapter, Waterfall and Histogram formats you can add an averaging function, a peak hold function or a combination of both. In particular the averaging function was useful with the Panadapter. I found that normal band noise caused the Panadapter display to be so variable that only strong signals were visibly evident. Weak signals are buried in the visual static more effectively than in the audio static. In tuning across the band I was often surprised to hear a low level signal from the speakers that I could not make out on the display.

Applying the AVG filter reduces the display's visual agitation and causes signals to become more evident, but the general agitation caused by noise still tends to cover weaker signals. Appling the PEAK filter tends to dampen the visual noise and causes weaker signals to become more evident, but the level tends to rise over time and static crashes tend to "lift" the entire baseline, which then disguises many weak and even moderate signals.

I am predominately a phone operator and I found the Panadapter and Panafall displays the most useful and the Spectrum and Histogram displays the least useful. For general operating the Panadapter allows you a view of a broad swath of the band. You can identify not only the frequency but also, to some extent, the type of signal.

On the Panadapter I was unable to distinguish between the visual display of the noise and a weak signal. The Panafall display helps here in that a weak signal is more evident on the waterfall display. I wouldn't go so far as to say that your ears are obsolete, though. If you are looking for weak ones, slow tuning with the mouse wheel and a good set of headphones is probably the best solution.

Frequency Control

The '3000 has two separate VFOs, A and B. These VFOs are represented by two text boxes. Each VFO text box is divided into two rows and has a TX button. The upper row indicates the frequency down to 1 Hz. The bottom

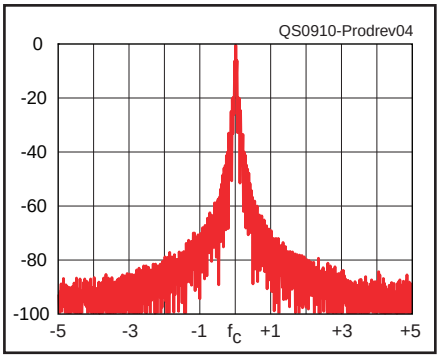

Figure 4 — Spectral display of the FLEX-3000 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

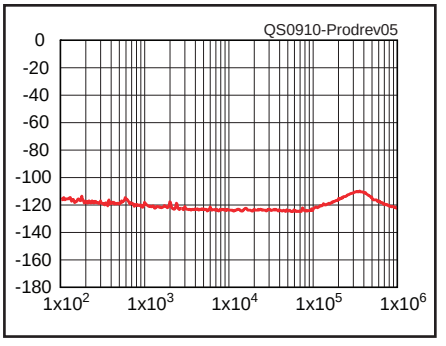

Figure 5 — Spectral display of the FLEX-3000 transmitter output during composite-noise testing. Power output is 100 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

row displays a legend indicating which band and subband (for US licensees) you are in. The TX button selects that VFO frequency to be used for transmit, and selecting TX on VFO B places the rig into SPLIT mode.

Between the two VFOs is another text box that displays the tuning controls. These buttons allow you to synchronize both VFOs, lock both VFOs to prevent inadvertent frequency changes and set the VFO tuning step (1 Hz to 10 MHz in 13 steps). This box also contains a frequency *scratchpad* to save the current frequency, mode and filter settings. You can then change frequencies or bands, and a click on the RESTORE button will bring you directly back to the scratchpad frequency and that pileup you want to have another shot at. Another box directly below VFO A has buttons to operate split using VFO B, swap frequencies between A and B or to synchronize A and B. An additional control, IF>V, is used when you shift the filter from its base frequency in order to trim some adjacent noise from a desired signal. This button resets the VFO to the new filter center frequency. Finally, both receive and transmit incremental tuning are located here.

Band Control

On the right side of the FC just below the multifunction meter is the BAND control box with buttons for 160 to 6 meters. It also has band buttons for 2 meters and VHF+, for use with transverters. The WWV button cycles through all the WWV frequencies. The GEN button is for general coverage receive. Each button represents a set of stacking memories for that band (the default is three but that can be changed). Each memory retains frequency, mode and filter settings.

Tuning

The '3000 has seven — yes seven — ways to tune the transceiver. Say you are using the panadapter and are looking for a special event station on 20 meters. Across the panadapter are a number of SSB signals, any of which could be your target. Four of the tuning methods use the mouse.

1) *Drag tune*. Place the pointer on a signal then left button drag it to the green rectangle that represents the receive passband. This will "tune" that signal in. Once in the passband, you can fine tune the signal using the mouse wheel. I found that I could drag the signal to the filter a lot faster than the software could follow, but once everything settled down the signal was in the filter passband and ready for fine tuning. Go slow.

2) *Mouse wheel*. Roll the wheel forward or backward and for each detent you will move the target signal. Setting the tuning step to 10 kHz allows you to move across any band rapidly. Steps of 250 Hz and 25 Hz permit fine tuning of SSB and CW signals, respectively.

3) *Click tuning*. Place the pointer on the target signal and press the right mouse button. A set of yellow crosshairs appears representing VFO A. Set the yellow crosshairs on the signal and left click. The signal will be shifted into the receive passband. Once there, fine tune with the wheel.

4) *Mouse wheel hover*. Set the frequency directly into the active VFO by placing the pointer on a digit of the VFO and use the mouse wheel to change that digit. Just "dial" in the target frequency.

There are three methods for tuning using the keyboard.

1) *Direct entry*. When you enter a value into the *numeric* keypad the value is transferred to VFO A.

2) *Digit mapping*. The '3000 lets you map keys to specific VFO digits. Once configured the keys will change their respective digits of the VFO frequency. This is essentially the same as the Mouse Wheel Hover method.

3) *Arrow keys*. The arrow keys can be used to change frequency by holding down CTRL and pressing the ↑ key to increase the frequency and the ↓ to lower the frequency. Pressing the CTRL together with the ← and → keys increases or decreases, respectively, the tuning step.

This arrow key arrangement is opposite to what most of us are used to. When changing frequency we tend to think of right or clockwise to mean increasing frequency and left or counterclockwise to be decreasing frequency. In fact, that is how the display behaves. I often found myself hitting the ← and → keys automatically to change frequency and ended up changing the tuning step instead. The first few times I did this I automatically changed to pressing the "correct" key but, having changed the tuning step I ended up in the twilight zone. You do pick it up, but swapping these around would have been more intuitive for me.

Figure 6 — The FLEX-3000 is tiny compared to a desktop PC. It's a natural for portable operation with a notebook computer.

Memory

PSDR includes a database feature that can store records containing mode, frequency, filter, tuning step, call sign, squelch, AGC, group and some comments. The number of these records is limited only by the amount of hard disc space available on your computer, meaning that the FLEX-3000 has virtually an unlimited number of memories. This database memory is over and above the scratchpad memory and the band memories, which are meant to be quick and easy operating aids rather than long-term storage of important frequency information.

Scanning

The FLEX-3000 doesn't have a scan function. The keyboard arrow tune feature can take its place in a limited way. When using the arrow keys to scan, there is a noticeable lag between the position of the frequency scale and the location of signals on the Panadapter trace. In use, the trace will freeze after covering a short frequency range and when you release the keys the frequency jumps about 60 kHz.

AGC

The AGC employs seven separate settings to control six AGC operating modes. The AGC drop down menu allows selection of FIXED, LONG, MEDIUM, SLOW and CUSTOM AGC modes. The AGC-T control is effectively an RF gain control. The LONG AGC function tends to smooth out the noise while the FAST AGC tends to sharpen the noise and also the signal. I found the LONG setting distinctly better for listening to weak phone signals. When you are using headphones, care should be taken when switching to FIXED as the audio

volume can increase dramatically.

Modes

In the MODE box you can select upper and lower sideband (for phone, CW or digital operation), double sideband phone, AM, synchronous AM, narrow FM or full spectrum mode. Digital Radio Mondiale (DRM) requires a separate software demodulator application.

The MODE SPECIFIC CONTROLS box provides access to a variety of adjustments for CW, phone or digital modes. Depending upon what mode you select, the specific adjustments in the box will change.

For voice modes, the FLEX-3000 has sliders for mic gain, speech compression, VOX and a noise gate control. The noise gate is a kind of digital squelch for audio. Say you have a noisy fan in your shack. Adjust it to the fan's noise level and only sounds louder than the fan will be transmitted. Note that this is separate from the VOX function. The TRANSMIT PROFILE is a stacking memory that contains settings relevant to transmitter output settings (microphone gain, compressor level, transmit filter, etc). You can use the supplied profiles or create your own. Finally the phone mode specific controls box has a button to access equalizers for both receive and transmit audio. The VAC button activates the Virtual Audio Cable, which is a third party program used for digital modes.

In the CW box you will find controls to adjust the internal CW keyer speed (1-60 WPM), select iambic or straight key, adjust break in delay (10 ms minimum), set the tone, control the monitor and even indicate the transmit frequency on the display.

When a digital mode is selected you have controls for adjusting receive and transmit gain, sampling rate and mono/stereo control. The digital mode control is primarily designed to operate using the VAC to interface with third party software.

Filters

Our current uncooperative sun has caused a lot of activity to be pushed down below the 15 meter band. Things can get very crowded on 20 or 40 meters these days and a good set of filters is invaluable in separating the DX from the local ragchew. The FLEX-3000 has 10 mode dependent filters and two variable filters that give you a large amount of control over what gets through your IF.

Each mode has a preset collection of fixed filter widths. The fixed CW filters run from 25 Hz to 1 kHz, the fixed SSB/digital filters run from 1 to 5 kHz and the fixed DSB/FM/AM filters run from 2.4 to 16 kHz. These filters come preset by the factory but, as with just about everything on the '3000, the values are adjustable.

There are also two variable filters available in each mode group. The maximum and minimum sizes for these variable filters are also configurable. In use, you can change the width of the variable filters using either the LOW or HIGH up/down boxes or the WIDTH slider. The LOW and HIGH boxes permit the adjustment of the individual edges of the filter while WIDTH affects both edges simultaneously. The SHIFT slider moves the filter's center frequency with respect to the VFO frequency. Variable filter settings are saved until changed.

In PANADAPTER mode you can also use the mouse to drag the receive filters along the frequency axis of the display to align it with a signal and also to vary the width of the filter by dragging its edges. *Very* handy.

DSP Noise Control

The '3000 has four available digital signal processing (DSP) noise reduction functions:

New Product Review Tests

You may notice a few extra lines in the Product Review data (Table 1) this month. Here at the ARRL Lab we strive to make our test procedures relevant to current technology and to new features common on today's transceivers. We continue to research ways to improve our testing and to develop new tests that will benefit our members.

Receiver Sensitivity (MDS) at 137 and 505 kHz

Several countries now give amateurs permission to operate at and around 137 and 505 kHz. In the US, there is activity on 495 to 510 kHz by more than 20 stations around the country operating under the ARRL sponsored WD2XSH experimental license. In addition, there are other Part 15 experimental licensees operating in this range. The WD2XSH stations are on the air regularly, gathering propagation data. They are always looking for signal reports. To read more about these and several other experimental stations, check out **www.500kc.com**.

With many of today's transceivers and a suitable antenna, you can listen for these experimental stations and submit reception reports via the Web site. The new Product Review tests will help identify transceivers suitable for use on these frequencies. With equipment built over the last 25 years ago or so, I've noticed a wide variety of available sensitivity, from terrible to quite good. Many receivers tune to 137 and 505 kHz; not all are proficient at receiving signals there. For you "lowfers," this measurement is for you.

Spectral Sensitivity

Spectral sensitivity is the weakest signal that can be "seen" on a visual display of spectrum above and below the operating frequency. Often called a spectrum scope or panadapter, this feature is included on many of today's mid-range and high-end transceivers. This data represents the level, in dBm, at which the operator can see a signal poke up out of the display noise floor. Although the measurement is somewhat subjective, it works out to be about 3 dB above the noise floor at the bottom of the display when the scope is adjusted to show 100 kHz of spectrum. With SDR receivers, such as the FLEX-3000, the sample rate is set to the highest setting.

Audio Output THD at 1 V RMS

One of our technical advisors has asked, "Who ever listens to their receiver at full volume?" We have tested and reported audio output power and THD (total harmonic distortion) at the specified load impedances as specified by the manufacturer. Generally the specification is at or near the maximum audio output the receiver is capable of. If severe hearing loss isn't an issue, we normally listen with the VOLUME control set to around the 9 o'clock to 11 o'clock position on most transceivers and not with the control cranked to maximum.

Distortion at normal listening levels is an important factor, especially when you are listening for an extended period of time. High levels of distortion can make signals more difficult to understand and add to fatigue. We'll continue to measure and report how audio output power and THD compare to manufacturer's specifications, but we have added a new test intended to show distortion at more typical volume levels.

After testing several radios for comfort, I picked 1 V RMS as an output level for the new test. It's an easy figure to remember. We will now also report THD at this level. Note that this test will appear with the next transceiver reviewed because the FLEX-3000 has only a low-level audio output and is dependent on external, user-supplied devices to amplify the audio to normal listening levels.

I hope you will find these new measurements useful in evaluating and comparing transceivers. — *Bob Allison, WB1GCM, ARRL Test Engineer*

noise reduction (NR), automatic notch filter (ANF) and two noise blankers (NB, NB2). The NR and the ANF functions have the most complex adjustments. Both use three different software parameters to set the level of action. Using the default values, I found the NR function to be effective in *flattening out* the noise on a signal sufficiently to improve readability. I was disappointed that there is little explanation of how to juggle the controlling parameters to get the most effective action for a given band noise condition. The ANF was very effective at removing heterodynes with the default settings.

The two noise blankers are designed to work on ignition type noise, that is, short, powerful noise pulses. The NB blanker is a software version of the traditional blanker; it shuts off the passband for the short duration of the pulse producing a "hole" in the passband. The NB2 blanker uses an interpolation function to fill in the hole with the software's best guess as to what the signal would have looked like had the noise pulse not occurred. In testing I never had noise conditions that allowed me to evaluate the blankers.

ARRL Lab Results

In the Lab we found the FLEX-3000's performance to be comparable with the FLEX-5000A in many respects. Sensitivity varied slightly, but between 1 MHz and 50 MHz the two receivers were within a few dB of each other. Differences in blocking gain compression were more significant, with the FLEX-5000A testing about 10 dB better. The two-tone IMD testing results tended to favor the FLEX-5000A by several dB, but the '3000's performance is still excellent. On the transmit side of things the FLEX-3000 did a significantly better job of carrier and undesired sideband suppression than the '5000A. The worst-case transmit intermodulation distortion figures were not as good.

We found that if the FLEX-3000's supply voltage dropped to the low end of its range, 12.4 V dc, the radio's RF output dropped to 85 W at 14 MHz. If you use a battery supply system for your radios, then consider adding a booster regulator.

During both lab testing and my in-shack operating we found that the *Spur Reduction* feature (to cope with spurious signals in the receiver) is of little value. Activating it sometimes makes the spurs worse and at other times it only causes them to shift in frequency, which can get them out of the way of a target signal. In my operating I found spurious signals to be more prominent on the higher bands.

Initial testing revealed two issues. CW keying with an external keyer was limited to about 37 WPM before encountering errors in the output waveform. The internal keyer worked fine. In addition, there was a transient signal at the start of the transition from transmit to receive. We reported these issues to FlexRadio Systems, and they were able to address both of them in the latest release of the *PowerSDR* software.

The Manual, Hard and Soft

The FLEX-3000's *Owner's Manual* is supplied as a PDF file on the CD. The manual contains extensive information about all of the features. Almost every control has one or two configuration screens attached to it and explanations of the great variety of configurable parameters that are lurking in the software behind them.

Where the manual falls short is that it doesn't provide the user with much practical guidance in how best to adjust these settings. Case in point: The noise reduction feature has three settings, TAPS, DELAY and GAIN. The manual explains what they are but offers no process for adjusting them to obtain maximum benefit. I believe the manual would benefit from having a flowchart describing how the software actually works as the modern equivalent of supplying a schematic and theory of operation that was common in the vacuum tube era. This would aid the user in the inevitable tinkering that the '3000 invites.

Chapters 3, 4 and 6 contain the most necessary procedures and settings needed for the day-to-day operation of the '3000. You will find yourself referring to these chapters frequently, so consider printing them out for easy reference. In addition, I would strongly suggest you watch the videos linked into the FlexRadio Web site. The videos, by Burt Fisher, K1OIK, and Matt Youngblood, KD5FGE, are very helpful.

Operating Experience

As seen in Figure 6, the FLEX-3000 takes a tiny amount of desk space, and the main focus is the companion PC. In my time with the FLEX-3000 I found the front console, its graphical user interface, to be an inefficient design. From a practical usability standpoint, the majority of the elements displayed don't need to be visible for normal operation.

I'd like to see an "operational" console that includes the display, VFO control elements, pseudoanalog meter, DSP and audio volume. An adaptation of the memory form laid out more like a log book and less like a VFO control would be a practical improvement. Adding a search function and the ability to export memory data in a format that could be used by other applications would be a great aid to normal day-to-day hamming. The remaining controls could be moved to a feature tree that could be opened when needed and then closed. This would leave a lot more space for the display area and a lot less distraction for the eye.

On the Air

I had not operated an SDR prior to working with the FLEX-3000. All in all, my experience ranged from being extremely impressed to extremely confused. For example, I was impressed when the superb filtering ability of the FLEX-3000 allowed me to draw out a weak South Dakota special event station from the splatter of another station 1.5 kHz up. But I was confused in trying to figure out how to optimize the DSP features or just what to do with all these different memories and AGC settings. The incredible flexibility left me dazzled and bewildered simultaneously.

I found the Panadapter and Panafall displays a tremendous help in seeing just what is happening on the band, but found navigation by mouse less effective than the Big Knob at getting around the band. FlexRadio does offer an optional tuning knob if you prefer a more traditional approach.

In fairness, I must point out that I only had the radio for a month and my experience with it was more akin to a brief encounter. Those of you out there who purchase your own FLEX-3000 will be forming a long term relationship with it. You will be able to get a much better feel for the radio and, over time, become more comfortable with it than I was able to.

Conclusion

The FLEX-3000 is a highly capable and flexible radio. FlexRadio has forged a path through the jagged peaks of fast Fourier transforms and complex programming that typified earlier software defined radios. Upon emerging from those mountains we find ourselves now faced with a forest that needs to be explored. The '3000 begs to be "fiddled" with. In this review I have only scratched the surface of the wide variety of tools and configurable elements available for experimentation.

Out of the box the FLEX-3000 is a very effective radio, but it is not quite plug-and-play. FlexRadio has made great strides in making software defined radios accessible to the general ham community, but considering the endless variation in computer configurations it is impossible for PDSR to accommodate all of them perfectly.

On that point, I found the *PSDR* software to be very stable. While it does exhibit quirks and glitches, at no time during my testing did the software crash or experience anything I would term a serious failure. This includes an unexpected momentary power failure at my shack that brought down the whole system. I was able to restart and pick up where I left off without a hitch.

If you want to dive into the future of radio and are not afraid of a little homework and experimentation, the FLEX-3000 is a great rig to start with.

Manufacturer: FlexRadio Systems, 13091 Pond Springs Rd, Suite 250, Austin, TX, 78729; tel 512-535-5266, fax 512-233-5143, **www.flex-radio.com**.

TECHNICAL CORRESPONDENCE

DAIWA CN-801 HP WATTMETER MODIFICATION

◊I note with interest the Product Review of HF/VHF wattmeters in the March 2009 issue of *QST*. Since Christmas 2007, I have owned the Daiwa CN-801 HP model. (It was a present from my beloved wife!) The Review mentioned, and it was noted many times on the Internet — most notably on **www.eHam.net** — that the meter does not indicate reflected power when in PEP mode.

I was also surprised that I could not find a mod on the great World Wide Web to correct this issue, especially because it is so simple to rectify!

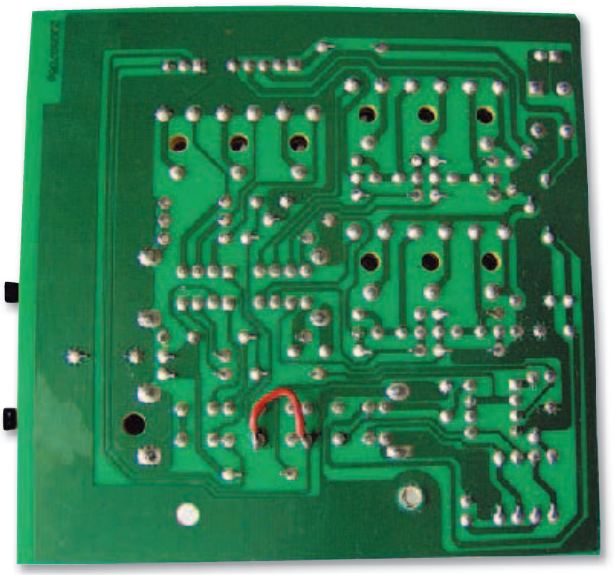

Figure 1 — By adding a short jumper wire across the 4th and 6th bottom pins of the AVG/PEP switch, MØBOL modified his Daiwa CN-801 HP HF/VHF wattmeter to display average reflected power while reading forward PEP.

So, here is my answer. First I will point out that you should *not* refer to the circuit diagram that appears to be widely available on the Internet, because it seems to contain several errors! There may, of course, also have been circuit board re-issues, so I make no claim that this modification will work for all versions if there are other circuit boards.

To correct the problem, it is simply necessary to bridge the two switch contacts that disconnect the output from the reflected power detector when in PEP mode. Simply solder an insulated wire jumper across the 4th and 6th bottom pins of the AVG/PEP switch (holding the circuit board the right way up and counting the bottom row of pins from left to right). See Figure 1.

Of course, the meter will only indicate average reflected power, but this is entirely satisfactory, as I really only want the reassurance that my antenna hasn't blown away in the gales while I am talking! I actually find it beneficial that the meter reads average reflected power at all times, because it means I don't have to keep switching from PEP to average every time I want to tweak my antenna tuner!

I hope other operators will find this information useful. — *Kind regards, Rob Rose-Round, MØBOL, 16 Forshaw Ave, Layton, Blackpool, Lancashire, FY3 7PW, England*; **m0bol@aol.com**

WHAT'S THE BEST HEIGHT FOR MY HF BEAM? (May 2009 *QST*)

◊I was pleased to see Steve Hunt's (G3TXQ) article relating antenna height to HF performance in the May 2009 issue of *QST*, particularly since he wrote about a topic that has been near and dear to my heart for at least the last 30 years.

Steve used as the basis for his "Height Figure of Merit" algorithm the elevation-angle statistics that have been included with *The ARRL Antenna Book* for the last four editions.[1] G3TXQ declared: "Statistics such as these can form the basis for objective decision making about antenna height." Obviously, inquiring minds on both sides of the Atlantic want to know how height affects the performance of their HF antenna systems!

Original "Figure of Merit"

I must point out that Height Figure of Merit is not a new concept. Pete Smith, N4ZR, described this technique in the January 2001 issue of *NCJ* (*National Contest Journal*) magazine. That article by N4ZR was entitled "'Scoring' Your Antenna System — a Quantitative Evaluation of Changes in Antenna Height and Other Characteristics." (Pete later described an improvement to his algorithm in the September 2001 issue of *NCJ*, after correspondence with several people, myself included.)

In 2003 I incorporated the N4ZR Figure of Merit algorithm into my own ray-tracing program, *HFTA* (High Frequency Terrain Assessment). This software, as well as updated elevation-angle statistics for more than 150 locations around the world, was bundled with the 20th Edition of *The ARRL Antenna Book*. (The latest elevation-angle statistics for 170+ locations are on the ARRL Web site at **www.arrl.org/notes/9876/index.html**. These latest data benefit from more robust computing algorithms and considerably higher computing horsepower.)

Flat Ground versus Real-World Terrain

In dozens of public lectures and presentations around the US over the last dozen years, I've often stated words to the effect: "Flat ground is easy! Real terrain is bumpy." Indeed, real-world terrain can have a *profound* effect on the launch of HF signals into the ionosphere. The Figure of Merit computations presented by G3TXQ are limited, however, to flat ground.

Now, I will agree that many hams do live on flat, or mostly flat, ground. Many other hams, however, choose to live on hills, or even on mountaintops. Some less-than-fortunate hams live in canyons. There are some very strong advantages in choosing hilltop locations for DXing and contesting, and some real disadvantages in choosing to live in canyons!

The *HFTA* program computes the effects of reflection and diffraction for real-world terrain. Internally, it is a very complex program, with a computational core of about 10,000 lines of Visual Fortran code, and with a Visual Basic graphical user interface wrapped around that core. *HFTA* uses terrain data from on-line USGS topographic databases, at least in the USA, where such data is public-domain information.

Here are some quick examples of the effects of real-world terrain. Figure 2 shows the *HFTA* terrain profiles for two locations in the direction of Europe. The red upper trace is for terrain going uphill, where at a distance of about a half mile from the tower base, the peak is at an altitude 162 feet higher than

[1]R. Dean Straw, N6BV, Ed, *The ARRL Antenna Book*, 21st edition, 2007, ARRL. ARRL Order No. 9876, $44.95. ARRL publications are available from your local ARRL dealer or from the ARRL Bookstore. Telephone toll free in the US 888-277-5289, or call 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.

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

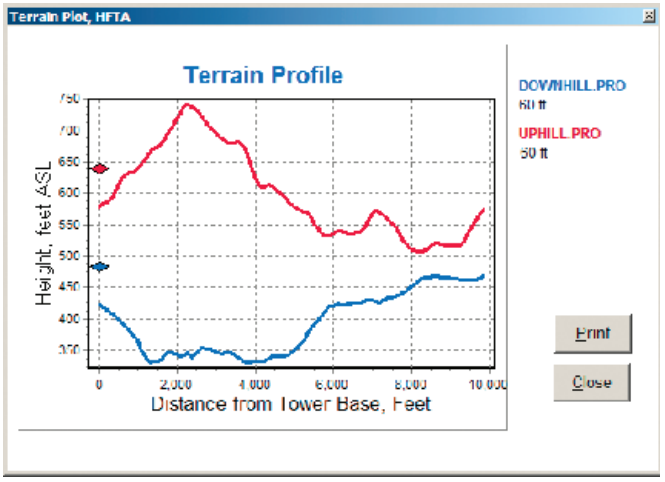

Figure 2 — Two terrain profiles towards Europe, one uphill (red) and one downhill (blue).

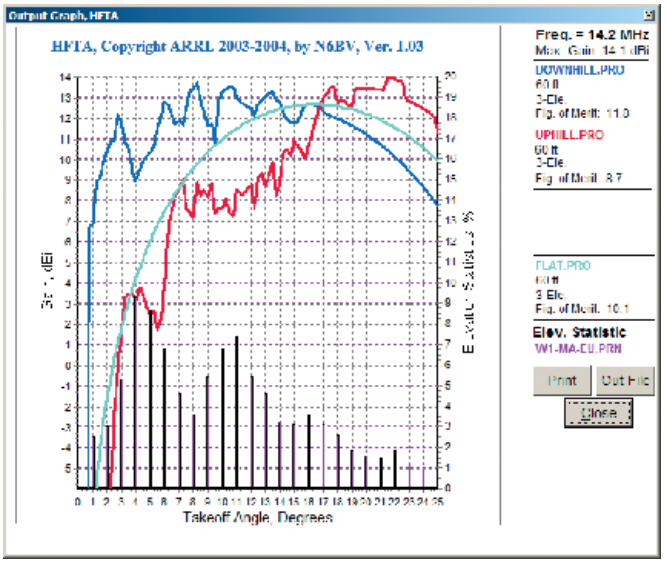

Figure 3 — Comparison of elevation-angle responses at 14.2 MHz towards Europe from New England for uphill (red) and downhill (blue) terrain profiles for 60 foot high, 3 element Yagis. For reference, the response over flat ground is also shown (cyan).

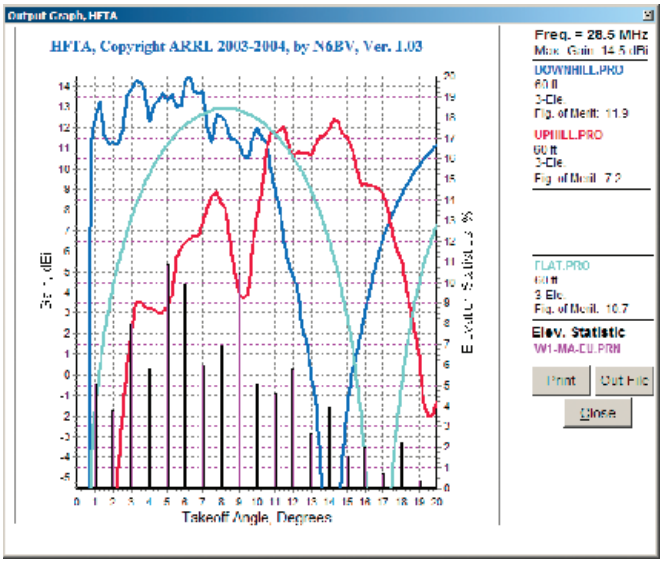

Figure 4 — Comparison of elevation-angle responses at 28.5 MHz towards Europe for 60 foot high, 3 element Yagis.

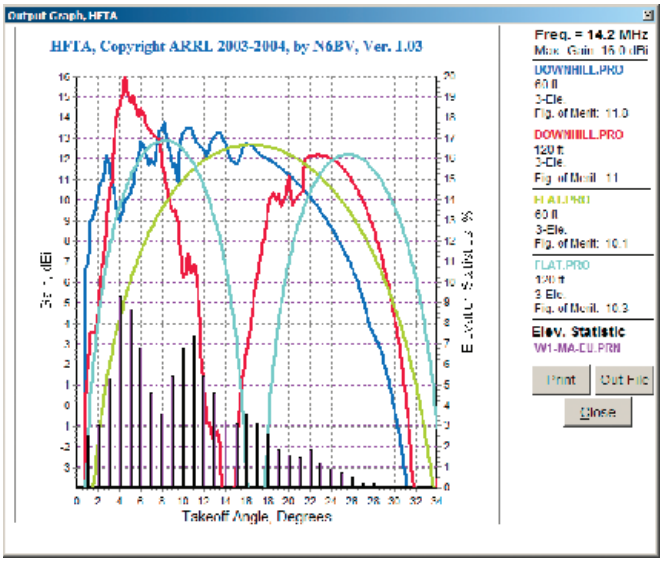

Figure 5 — Over downhill sloping ground, it is quite possible for an antenna to be too high. Here, the 120 foot high Yagi is inferior to the 60 foot high Yagi because of the effects of sloping ground. On the other hand, comparing the Figure of Merit numbers for flat ground would favor the 120 foot over the 60 foot height.

the tower base. Note that the height of the 3 element Yagi is set to 60 feet above the tower base, as indicated by the red diamond. The bottom blue trace is for a downhill terrain profile, where the ground gently slopes down 100 feet at a distance of 600 feet out from the tower base.

Figure 3 shows the elevation patterns that *HFTA* computes for these two terrains at 14.2 MHz, over the range of elevation angles from 1° to 25°. For reference, the response over flat ground is also shown in the cyan curve. The elevation-angle statistics data for W1 (Boston, MA) to the entire continent of Europe are shown by the violet bar-graph columns in Figure 3.

The right-hand legend in Figure 3 shows the "Figure of Merit" (FOM) values computed for each terrain profile, with the downhill terrain being a clear winner at 11.8 dBi average gain, compared to 8.7 dBi for the uphill scenario, a difference of 3.1 dB. The flatland FOM is 10.1 dBi.

Figure 4 compares the responses for the terrains, but this time at 28.5 MHz. Now the disadvantage for the uphill terrain (red line) becomes even more striking compared to the downhill terrain (blue line). The computed FOMs are 7.2 dBi for uphill and 11.9 dBi for downhill, a difference of 4.7 dB, with the flatland FOM coming in at 10.7 dBi.

Too High

Let's see what happens if we raise the 20 meter Yagi up to 120 feet (red) instead of 60 feet (blue), over the downhill terrain profile. See Figure 5. Now, the 120 foot high Yagi has an FOM of 11.0 dBi, while the 60 foot high antenna displays an FOM of 11.8 dBi, 0.8 dB stronger on average to Europe.

Note that the situation is exactly reversed for the 60 and 120 foot high Yagis over flat ground: 10.1 dBi for 60 feet (green), and 10.3 dBi for 120 feet (cyan). On the basis of these flat-ground FOMs alone, you would have chosen the higher antenna as being "optimum." It turns out that the 120 foot high Yagi on the hilltop would actually be less effective than its 60 foot high brother. On top of a hill, a tall Yagi can easily be "too high" for good overall coverage.

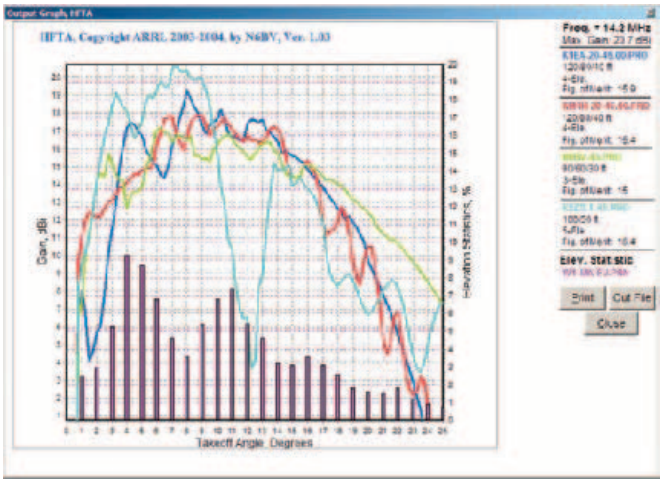

Figure 6 — A "horse race" between contest stations in New England toward Europe, with actual station terrain profiles and antenna types.

Horse Races!

Figure 6 shows what I call a "horse race" between four 20 meter stations located in the same general area in New England on the US East Coast, toward the all-important continent of Europe. The stations in this comparison are K1EA (blue), KM1H (red), N6BV/1 (green) and K5ZD/1 (cyan). The N6BV/1 station was dismantled 10 years ago, when I moved back to California, but I still have fond memories of running Europeans for hours on end from there! The comparisons in Figure 6 are for an azimuth of 45° into Europe, using the actual terrain profiles for each station in that direction and the actual stacked Yagis used at each station.

It's not hard to see why Randy, K5ZD, consistently achieves such great results into Europe, particularly at the opening of the 20 meter band, when the takeoff angles tend to be low. Sometimes, however, Randy has to switch to his single 5 element Yagi at 50 feet when the 20 meter band goes high angle, typically up to about 12° around 1800 UTC, in the New England afternoon. The ability to select a lower antenna at certain times of the day becomes part of the planning process when putting together a competitive station.

In my public presentations about planning an HF station, I caution against relying too heavily on a single sort of "snapshot" such as the Figure of Merit. FOM tends to be rather one-dimensional in nature and concentrating on FOM alone can potentially lead the operator down the wrong path, so to speak, if the complex shapes of the response curves over the real-world terrain are not taken into account.

Conclusion

While the analysis presented by G3TXQ is useful for generally flat terrain, I suggest that a more appropriate title to describe the effect of height in the real world would be: **"What's the Best Height for my HF Beam — for my Specific Terrain?"** — *R. Dean Straw, N6BV, Retired editor of The ARRL Antenna Book (17th through 21st Editions)*; **n6bv@arrl.net**

◊In "What's the Best Height for My HF Beam," in the May 2009 issue of *QST*, Steve Hunt, G3TXQ, really caught my attention. Steve gives a very interesting and thought provoking analysis of "best height" for horizontally polarized antennas, which got me thinking. There is an argument, however, for an overall optimum antenna height for elevated horizontally polarized antennas that can be made by including path loss in the analysis as well as constructive and destructive interference from a ground reflection; averaging over arrival angle can obscure the interference between the direct and ground paths. In a variation on Steve's analysis, given a frequency, we can calculate the vertical interference pattern for the antenna over ground. The "source" is a distant point on the ionosphere viewed at some arrival angle from the antenna. The antenna sees the direct path from the ionospheric point and a ground reflected path (via a reflection point, which is typically within a few 100 m of the antenna). This is similar to, but not the same as, the *EZNEC* results that G3TXQ found. Hence, we can find a vertical interference pattern versus antenna height.

The arrival angle can also be related to the path distance for an ionospheric bounce, so we can relate arrival angle to path loss for a given distance. The higher the angle, the shorter the path. My rough calculations show that there is something like a 3 dB increase in signal for each 6° increase in the arrival angle because of this relation to path distance. Thus, we can find a "height gain" (constructive and destructive interference between the direct and ground reflected paths) as well as a "path loss" for antenna heights corresponding to the optimum arrival angle. Both low arrival angles and higher path losses correspond to DX paths. If we care about balancing performance between nearby (high arrival angle) paths and DX (low angle) paths, then it is possible to calculate a "Gain Merit" in decibels, which considers the effect of the interference pattern due to ground reflections, as well as the relative path loss for distances associated with the arrival angles. Such an analysis reveals that at any given frequency the "Gain Merit" increases with antenna height up approximately 1.7 or 1.8 λ in height. Higher than that, the interference pattern becomes destructive and performance suffers.

The entire result roughly scales with frequency, resulting in an optimum antenna height that depends on the frequency. If the antenna tower configuration permits, we can choose to use monobanders at their optimum heights: approximately between 12 to 26 m for 28 MHz, 18 to 42 m for 14 MHz and 26-72 m for 7 MHz respectively by this analysis. If multiband antennas are chosen and all of the bands are deemed equally important, then the height corresponding to the highest frequency is the optimum height. This tends to validate the popular 60 to 70 foot tower as a good choice for multiband horizontally polarized Yagi antennas that include the 10 m band! For heights below the optimum, the "Merit Gain" drops off at a rate of 1 to 2 dB per 10 feet of decrease in height, which is consistent with the 10 and 20 m band Oceania curves G3TXQ found. For both our results, the DX performance dominates the universal optimum height selection. A similar analysis reveals that the optimum height for a vertically polarized antenna over sea water is at sea level, hence a good choice for many DXpeditions.

There are many factors still not considered here. While still simplistic, this analysis adds relative path loss and ground reflection effects but does not average over arrival angle compared with the G3TXQ result. Hence, in this analysis an optimum height related to constructive interference from a ground reflection can be clearly identified. Steve's tag line still applies, "Height matters if you want the optimum angle of radiation from horizontal antennas." — *73, Kai Siwiak, KE4PT, 10988 NW 14 St, Coral Springs, FL 33071*; **k.siwiak@ieee.org**

W1ZR

THE DOCTOR IS IN

Q Doug Nielson, N7DGN, asks: I have a question that I have been wondering about for a number of years. I have seen a few movies or TV shows that are either about, or portray the use of spy radios, particularly during World War II. They show someone going into a hotel or apartment building — some covert location — and setting up a transceiver to communicate with their headquarters. Occasionally, information is given about the transceiver setup — perhaps the frequencies or transmitter power. It seems like they never talk about the antenna setup! I think for HF it would have to be a challenge for covert operation. Any thoughts.

A Your doctor was never in that line of work, even though I was in the Army Signal Corps during part of the cold war. Actually, most such operations were more vulnerable to detection by enemy spectrum analyzers and location by radio direction finders than by visual sightings of antennas. The typical clandestine radio setup was designed to operate into antennas of opportunity.

The set in Figure 1, a 5 to 10 W HF CW set from the cold war period, included an antenna tuner, part of the transmitter on the right, designed to work into a random anything. It could be a bedspring, a wire tossed out the window, a metal clothesline or any convenient conductor fed against a radiator or water pipe ground. This radio system has a special jack for a then classified device that would record the Morse message at normal speed and then transmit it at a much higher speed in order to minimize the time on air and hence the likelihood of a successful RDF fix.

The clandestine operator relied on the capabilities of the receiving station, usually not very far away, and the skill of its operators to extract the message.

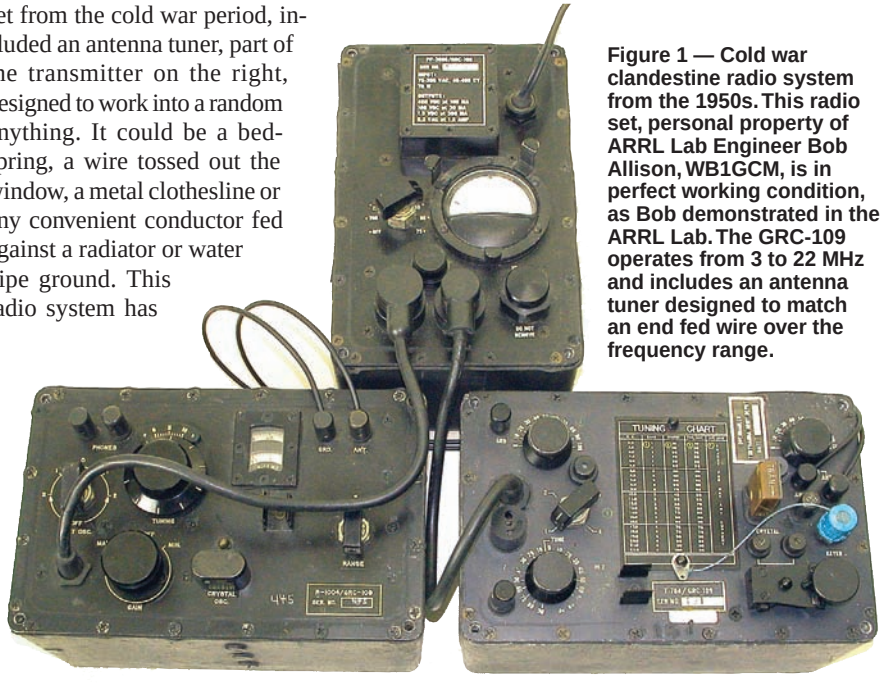

Figure 1 — Cold war clandestine radio system from the 1950s. This radio set, personal property of ARRL Lab Engineer Bob Allison, WB1GCM, is in perfect working condition, as Bob demonstrated in the ARRL Lab. The GRC-109 operates from 3 to 22 MHz and includes an antenna tuner designed to match an end fed wire over the frequency range.

Q Dave, KO4KL, asks: I am considering putting up a vertical monopole antenna so was very interested in your answer to the question: "What's the big deal with 43 foot vertical monopole antennas," in the column for June 2009 (p 58). Although I appreciated your answer, when I laid out a table of vertical radiator lengths for the 40 through 10 meter bands with lengths of ¼, ⅜, ½, ⅝ and ¾ wavelengths long, I found that a 33 foot length gave the best low angle radiation on the most bands including 40, 30, 20, 17 and 15. If this really is true why is a 43 foot radiator more popular than a 33 foot one?

A A 33 foot monopole will work fine on the 40 through 17 meter bands, On 15 and 10 meters, however, the main lobe is well off the horizon so it is not optimum for low angle coverage. On 40 meters, the 33 foot monopole can be hooked directly to coax, which is handy.

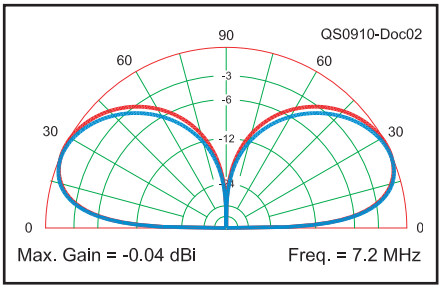

Figure 2 — Comparison of elevation patterns of a 43 foot (blue) and 33 foot (red) vertical on 40 meters.

The 43 foot length is optimum for low angle radiation on 20 meters, and also works well on 80, 60 and 40 meters with the proper loading or matching. It needs matching of some sort on every band, so I agree that it's a bit less convenient than the 33 foot length is on 40 meters.

On 40 meters, the difference is not great, as shown in Figure 2, but the 43 footer is somewhat better. The elevation peak is about 2° lower, and the gain is just a bit higher. The benefit on 40 meters is probably not worth the trouble, but it is "free" if you are doing it for the other bands anyway.

So it all depends on what you are trying to achieve. As I noted, many folks can get horizontal antennas high enough to work well on the higher bands, where significant earth reflection gain, as well as directivity, make a big difference. Where they need help is on the lower bands, and a 43 foot monopole provides better performance than the 33 foot vertical on all bands from 20 through 160 meters.

Q David, AI4VA, asks: What does an amateur operator mean when says he is "running barefoot"?

A It means that he is transmitting with just his transceiver or transmitter (typically at 100 W or lower power output) and is not using an external power amplifier (typically increasing to 500 to 1500 W PEP output).

Q Mark, KG4UDL, asks: I run my 5 W HF transceiver through an external antenna tuner and a separate SWR and power meter as shown in Figure 3. The transceiver also has an internal SWR

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

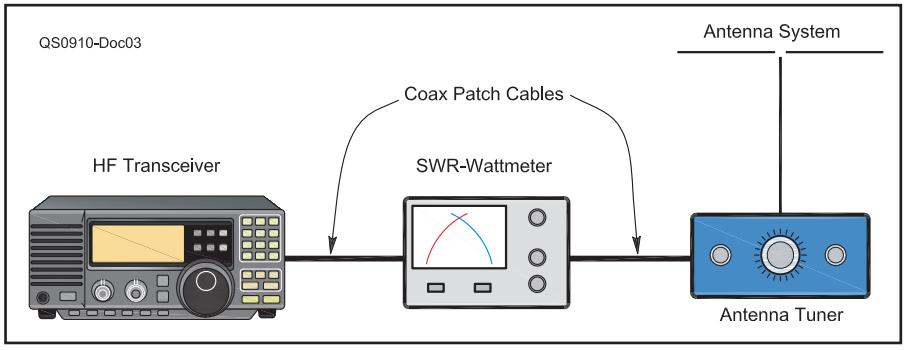

Figure 3 — KG4UDL configuration of transceiver and external wattmeter and antenna tuner.

meter. Why is it that I can adjust the tuner for minimum SWR on the radio's internal meter and read an SWR of 3:1 or more on the external meter? Also, when I obtain this reading I am showing a full 5 W output. I thought that high SWR and high power to the antenna were mutually exclusive — that high SWR indicates low antenna efficiency. I have had great success with the system, by the way, including multiple European contacts during the recent ARRL International DX Contest.

A To answer your more general question — SWR is just a reflection (pun intended) of the impedance match at the interfaces between the two systems where your measuring device is located. It really has nothing to do with antenna efficiency, and an antenna with a high SWR can radiate very well as long as you can couple power into it and you have low loss in the transmission line.

Many transceivers *fold back* or reduce power if the SWR is higher than a certain level, often 2:1. This is done to prevent excessive voltages or currents from damaging transmitter components. This is often a major issue — so even if the antenna could work fine, if the transmitter reduces power, your signal will be weaker.

The concept of *reflected power* is a mathematical way of considering the standing waves on a transmission line. If you have a 1:1 SWR and put 5 W into the line, you will measure 5 W forward power and 0 W reflected power. If you have a 3:1 SWR (in the usual 50 Ω system, that could be a 16.6 or 150 Ω resistive load, or an infinite combination of reactive loads, for example), you will have a reflected power of 25% of your forward power. If your transmitter could put out a full output into a 3:1 SWR, you would see a forward power of 6.67 W and a reflected power (at 25%) of 1.67 W. The net actual power going to your antenna would be the difference between the forward and reflected, 6.67 – 1.67 = 5 W.

Your wattmeter is in the right spot to read the same as the radio's SWR meter — unless the coax between the two is not of 50 Ω (75 Ω RG-6 or RG-59 are two examples). I have found that many patch cables purchased at hamfests, for example, are not really 50 Ω. If other than 50 Ω, there will be an impedance transformation in them so that the impedance at each end (and thus the SWR) will be different.

Note that this really doesn't cause any harm or significant loss — it just confuses the measurement process. The difference will be a function of electrical length and would be most significant with a cable that is a quarter wave long, around 6 feet on 10 meters, for example. If so if the load at one end is 50 Ω, the other end would see 100 Ω and vice versa. If this were the situation between your external meter and your radio, a 1:1 SWR at the external meter would result in a 2:1 reading at your radio.

One way to find out what's happening is to put a good 50 Ω dummy load right at the transmitter and see what SWR it reads. Then move it to the end of the patch cord and repeat. If the cable is 50 Ω, the reading should be the same.

Another possibility is that the SWR/wattmeter is providing an erroneous reading. This is not uncommon, although most show 1:1 when matched. The readings away from being matched are not always as accurate. See any product review on wattmeters in *QST*. There was one in March 2009, for example.

If in doubt, tune with the meter in the radio. The SWR, as measured by that meter, is what determines the amount that the transmitter will "fold back" and reduce power. Thus, that's the important place — *if the transmitter ain't happy, ain't nobody happy!* to borrow a phrase.

Q Harold, AE6OU, asks: Now that the TV broadcasters in most areas have moved to higher frequencies in the changeover to digital broadcasting, do we still need to keep our trusty low pass filters in our antenna feed lines?

A We still are required to maintain a level of spurious signals, including the harmonics that low pass filters are designed to reduce, as low as possible per good engineering practice. That being said, there has never been a specific requirement that we have any particular kind of filtering outside the radio equipment, which has a specific requirement to have spurious responses down 53 dB below the carrier.

Thus, in the absence of any interference to other services above the HF range, I would not think that a low pass filter (see Figure 4) is as important as it was in days of the over-the-air VHF TV. Do keep in mind, however, that many other services could be affected by spurious responses — FM broadcast, public service communication, aircraft and others.

My low pass filter has very low passband loss, around 0.5 dB, as I remember, so the downside of keeping it in is small, assuming that it is in the line to an HF only radio. A complication of recent HF transceivers is that most current models cover not just HF, but MF, HF and 6 meters. A signal on 6 meters will not pass through a filter with the usual 30 MHz cutoff frequency (trust me, I've accidentally tried it many times), and thus some switching may be needed. Some filters did have a cutoff at 52 MHz, avoiding that problem.

Figure 4 — Assortment of typical low pass filters — not as important as they once were.

Do you have a question or a problem? Ask the Doctor! Send your questions (no telephone calls, please) to "The Doctor," ARRL, 225 Main St, Newington, CT 06111; doctor@arrl.org; www.arrl.org/tis/. QST

West Mountain Radio's RIGblaster duo

By Pete Smith, N4ZR
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Over the decade since the original RIGblaster appeared (*QST*, October 2000), West Mountain Radio has steadily evolved and broadened its line of computer-to-transceiver interfaces. What began as a relatively simple, though thoughtfully designed audio device has steadily added new features. In 2003, the RIGblaster Pro added the ability to use hardware serial ports for rig control, CW keying and PTT switching. 2007 saw the advent of the RIGtalk USB interface, a tiny USB-to-serial converter expressly intended for rig control.

Now West Mountain Radio has put most of that together in the RIGblaster duo. As duo designer Del Schier, K1UHF, explains, the unit is primarily intended as a station management console, allowing you to use two radios with only one microphone, one pair of speakers or headphones (it offers two built-in 3 W stereo amplifiers), and one computer. The basic purpose of the unit is to simplify and systematize the maze of cables and "little boxes" that can clutter up a typical two-transceiver ham station, and to enable more efficient operation. It can be used with two HF radios, or with HF and VHF transceivers.

Out of the Box

Opening the box, the first thing that struck me was the completeness of the package, with no fewer than twelve cables provided, and even color-coded adhesive labels to identify them. The RIGblaster duo itself is very nicely packaged in a powder-coated aluminum cabinet, and all of the controls and connectors are first-class. Looking inside, the printed circuit board appears of similar quality.

Even if you don't intend to connect a computer, the duo will do a good job of switching audio inputs and outputs to two radios. Setup is straightforward, step-by-step, well explained in the manual, and the unit works fine. It is particularly convenient to have both headphone and master audio level controls, as well as transmit level control, all available on one control panel.

Some users will want more, in particular the ability to operate digital modes using computer-generated audio. The duo provides this capability through your computer's built-in sound card, and another set of easy-to-connect cables. Since the first RIGblaster, West Mountain Radio's emphasis has been on the digital modes, and the included CD bundles a wide variety of software, including some for digital modes I'd never heard of! As they say on the CD, it's always a good idea to check on the Internet for the latest revision of any software that interests you, but the versions on the disk will get you going.

Hooking it Up

Consistent with past RIGblaster design philosophy, microphone cable configuration is selected by jumpers. Two cables are provided with 8-pin standard microphone connectors on the radio end, and one with an RJ-45 modular plug for smaller radios that use that type; as a result, you should not have to buy or fabricate new cables when you change radios. Instructions on setting the jumpers for most brands are clear and well illustrated.

Some users will be looking for still other capabilities. In particular, linking computer logging programs to your radios has become a popular way to make sure your QSOs always get logged on the right band and mode. When I saw the USB connection, I expected that the RIGblaster duo would provide serial ports for rig control. In fact, there are *two* CI-V/CAT TTL converters that you can use with ICOM, Ten-Tec and certain Yaesu transceivers. If your radios require a standard RS-232 serial connection (such as late Kenwoods, the Elecraft K3 and some Yaesus), you will have to make those connections yourself, using either two hardware serial ports or two USB-to-serial converters. West Mountain Radio's Schier explains this as primarily a cost-driven decision, since the unit was slotted for a price bracket well below existing two-radio controllers, and USB-to-RS-232 converters are readily and cheaply available.

All necessary cables are supplied for CW and audio modes (AFSK, PSK, etc), but you will need to purchase optional interface cables (or make up your own) for the TTL-level control signals going to your radios, and for FSK if you choose to use that option.

West Mountain Radio has chosen not to use any sort of router software with the RIGblaster duo, in the interest of simplifying the setup procedure. The only software installed specifically for the duo is a driver for the virtual serial ports used with the USB connection; installation is easy and well explained in the manual. For selecting various receiver audio routings and other options, the duo relies on several "feature selection jumpers" that are also on the PC board, which are intended to be set up once and not touched again until something changes in your basic setup. One of these, called "Virtual COM Port Serial Select," puzzled me at first. It lets you select which of two virtual ports will provide CW keying, PTT (push-to-talk) and FSK, for "real" RTTY with those radios that support it. You can enable CW, PTT and FSK on dual ports and manually switch them between radios.

Lives Up to Its Promise

To the bottom line, then — the RIGblaster duo does what it says it will, and does it well. Its pricing places it in a niche well above the typical single-radio interface units, but well below that of do-everything two-radio controllers, where it should appeal to many of us with multiple radios in the shack.

Manufacturer: West Mountain Radio, 34 Smith St, Norwalk, CT 06851; tel 203-853-8080; **www.westmountainradio.com**. *$349.95.*

NØAX

HANDS-ON RADIO

Experiment #81 — Synchronous Transformers

Why are these transmission line sections *synchronous*? Synchronous has multiple definitions, but the one that applies here is: *going on at the same rate and exactly together; recurring together* — from *syn* (together with) + *chron* (time) + *ous* (possessing or having the quality of). In this case, time refers to phase. Specifically, the phase of waves in the transmission line used to make up this month's project!

Quarter Wave Transformer (Q section)

The best-known example of a synchronous transformer in Amateur Radio is the *quarter wave transformer*, also known as a *Q section*, shown in Figure 1. The Q section creates an impedance match between two impedances, Z_1 and Z_2, by inserting between them a quarter-wavelength of transmission line with a characteristic impedance that is the geometric mean of the impedances to be matched, $Z_Q = \sqrt{(Z_1 \times Z_2)}$.

That deceptively simple equation represents what happens as the result of an infinite series of reflections occurring at the junctions of the three sections of transmission line. Figure 2 illustrates the first few steps. Let's follow along. Beginning in Step 1, as the electromagnetic wave in Line 1 encounters transmission lines with impedance different than that in which it's traveling.

From transmission line theory, we know that some of the incident wave's energy will be reflected at the impedance discontinuity (Step 2), generating a reflected wave. Viewing the waves in terms of voltage, the incident wave is E_{I1} and the reflected wave is E_{R1}. The ratio between the incident and reflected voltages is the *reflection coefficient*, $\rho_1 = E_{R1} / E_{I1}$. That means $E_{R1} = \rho_1 \times E_{I1}$.

If the wave encounters an infinite or zero impedance (an open or short circuit, respectively), $\rho = 1$. If the impedance the wave encounters is the same as the impedance of the line it's traveling through, such as a matched load, there is no reflection and $\rho = 0$. For any other value of impedance encountered, ρ is between 0 and 1. (The full representation of ρ includes phase, meaning that ρ is really a complex number of the form $|\rho| \angle\theta$, but for the purposes of this discussion, we will consider the magnitude and phase of ρ separately.)

The reflected wave, E_{R1}, travels back along Line 1 in the opposite direction from the incident wave. The remaining energy that wasn't reflected continues on in Line 2 with a new voltage, E_{I2}. Whatever generated the original wave, E_{I1}, will eventually see the reflected wave, E_{R1}, return.

That might be the end of the story, but there is another change in impedance a little further along where Line 2 meets Line 3, and another set of reflections is generated (Step 3), with E_{I3} continuing on in Line 3. If the reflection coefficient at the second discontinuity is ρ_2, then another reflected wave, E_{R2}, is generated with a voltage of $\rho_2 E_{I2}$, traveling in the same direction as E_{R1}. It encounters the initial discontinuity

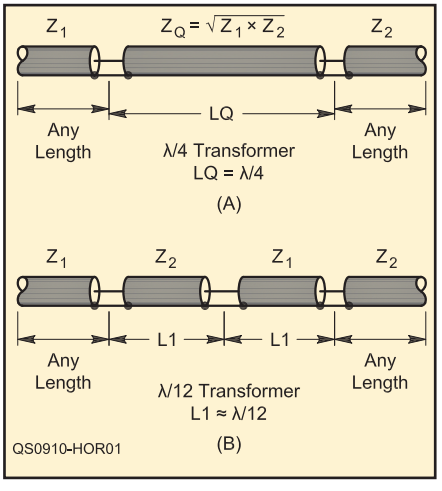

Figure 1 — The ¼ wave and 1/12 wave synchronous transformers. A series of carefully phased reflections create an impedance match.

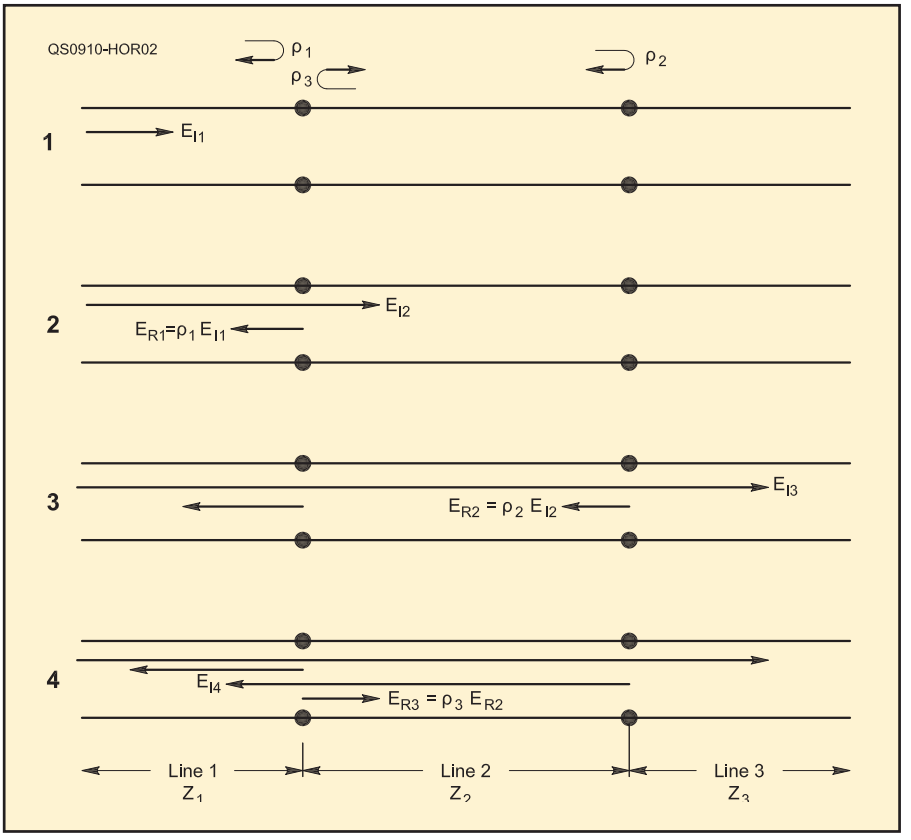

Figure 2 — The initial sequence of reflections generated by a ¼ wavelength section of transmission line inserted between lines of different characteristic impedances.

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(Step 4) while traveling in the opposite direction as the original incident wave, E_I, and generates another pair of waves, E_{I4} and E_{R3}, according to reflection coefficient ρ_3.

We now have three waves adding together in Line 1 — E_{I1}, E_{R1} and E_{I4}. E_{R1} is smaller than E_{I1} and E_{I4} is smaller than E_{R1}. The resulting voltage sum, however, depends on the relative phase of all three waves. The phase difference between E_{I1} and E_{R1} depends on the relationship between Z_1 and Z_2: if $Z_2 > Z_1$, then E_{R1} is in phase with E_{I1}, and out of phase if $Z_2 < Z_1$. (We are assuming all three impedances are purely resistive, so no additional phase shift due to reactance occurs.) E_{I4} differs in phase from E_{R1} by twice the electrical length of Line 2 because the wave has to travel through Line 2 once in each direction before returning to the junction of Lines 1 and 2.

You can see that more reflections will occur as E_{R3} travels back to the junction of Line 2 and Line 3 and generates another pair of waves. This happens forever, until the incident wave E_{I1} ceases. (We are also ignoring any reflections created at the unseen ends of Line 1 and Line 3.) As each set of increasingly smaller reflected and incident waves are combined, the result eventually converges on a steady-state value for the voltages of the waves traveling in each direction in all three segments of transmission line.

In Line 1, this combination of voltages means that whatever is generating the incident wave, E_{I1}, will be presented with an impedance different from Z_1 and the SWR will be greater than 1:1. Or will it?

Given fixed values for Z_1 and Z_3, we can still control how the waves add up in Line 1 by adjusting both the impedance and electrical length of Line 2. Skipping to the punch line, if Line 2 happens to be 90° long and its impedance is the geometric mean of Z_1 and Z_2 as noted earlier, all the reflections in Line 1 cancel, the impedance at the input to Line 1 is Z_1, and the SWR will be 1:1. Behold — the quarter-wave impedance transformer!

The impedance match results from the cancellation because of the precisely timed (thus synchronous) reflections that all add together to cancel all waves traveling in the direction from which E_{I1} comes. Not only that, but the same set of wave mechanics create a match in the other direction, too, so the SWR looking toward the Q section from Line 3 is also 1:1! (Note that I have glossed over a significant amount of mathematics in developing this explanation.[1] You're welcome.)

An exact match occurs only at the frequency for which Line 2 is ¼ wavelength long (or some odd integer multiple of ¼ wavelength) and if losses in Line 2 are low enough that they have an insignificant effect. Nevertheless, the Q section provides an excellent match over several percent of bandwidth — good enough to use for a whole band at and above 7 MHz. Let's make one!

[1]R. Lay, W9DMK, "A Transient Analysis of an Impedance Transforming Device (The Quarter-Wave Transformer)," **www.qsl.net/w9dmk/qrtrwav4.pdf**.

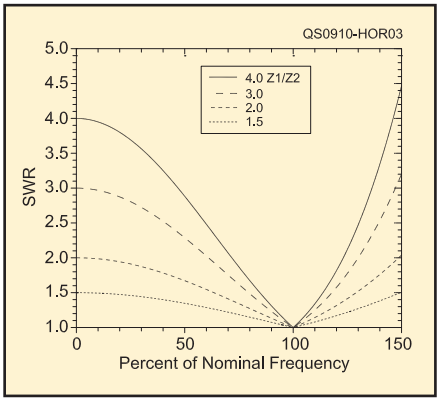

Figure 3 — The bandwidth of the ½ wavelength transformer. The resulting SWR for frequencies from dc to 1.5 times the design frequency and resistive impedance mismatches up to 4:1 (from Note 3).

Making a Q Section

The hardest part about making a Q section is often just coming up with the odd impedance transmission line! However, there's no need to obsess over getting an exact match — any impedance within 10% of the exact value will give good results. We'll use 75 Ω coax (RG-59) for our Q section with a design frequency of 14.15 MHz, the middle of the 20 meter band.

The length of a quarter-wave piece of transmission line in feet is VF × 246 / f (in MHz), where VF is the *velocity factor* for the line. Cable with a solid polyethylene dielectric has a VF of 0.66. If your cable has a foam dielectric, the VF is 0.78 to 0.83 (check the manufacturer's Web site for the data sheet). Calculate the length of cable you need (for solid dielectric, that would be 11.5 feet) and cut it about 5% long, or 12.05 feet.

Tune the Q section by shorting one end of the cable (twist the center conductor and shield braid together) and attaching the other end to your antenna analyzer. Ignore the SWR value and tune down in frequency from 28 MHz. Find the lowest frequency at which resistance is a minimum. This is the frequency at which the line is ½ wavelength long, so divide by two to get the ¼ wavelength frequency. Trim an inch or less at a time and repeat until the section is ¼ wavelength long at close to 14.15 MHz.

A Q section using 75 Ω line will match 75^2 / 50 = 112.5 Ω to 50 Ω, so terminate one end of the Q section with two 220 Ω resistors in parallel using reasonably short leads. Verify that the SWR at the other end of the Q section is close to 1:1. Vary the frequency and find the Q section's *SWR bandwidth* — the range of frequencies over which SWR is 2:1 or less. Substitute different values of terminating resistance to find out how much the termination can vary in either direction before SWR at the other end exceeds 2:1. Try the Q section at a frequency where it is ¾ wavelength long and again at ⅝ wavelength.

Twelfth Wave Transformers

The Q section is really a special case of series section matching.[2] There's no restriction (other than complexity) that there be just one matching section. In fact, the two section variation shown in Figure 1B is quite handy for matching two different impedances of transmission line, such as 50 Ω coax and 75 Ω hardline.[3] Best of all, it doesn't require any special transmission line impedances, only sections of line with the same impedances that are to be matched!

This configuration is referred to as a *twelfth wave transformer* because when the ratio of the impedances to be matched is 1.5:1, as is the case with 50 and 75 Ω cables, the electrical length of the two matching sections between the lines to be matched is 0.0815 λ, quite close to λ/12 (0.0833 λ). As the lowest line in Figure 3 shows, the SWR bandwidth of the transformer is quite broad, but decreases as the ratio of impedances to be matched increases. You can use this trick to make good use of surplus low loss 75 Ω CATV hardline between 50 Ω antennas and radios!

Parts List

- Coaxial cable, 20 feet of RG-59.
- Resistors, 2 each, 220 Ω, ¼ W carbon composition (non-inductive).

Recommended Reading

Quarter-wave transformers are the basis for non-reflective optical coatings. As you read through **en.wikipedia.org/wiki/Optical_coating** you may recognize several similarities between optics and transmission lines. ARRL members should also download the referenced *QST* articles from the *QST* Archive.

Next Month

How high should it go? Isn't higher better? Find out next month as we do a virtual experiment using antenna modeling software to observe the effects of height above ground on antennas.[4]

[2]F. Regier, OD5CG, "Series-Section Trans mission-Line Impedance Matching," *QST*, Jul 1978, pp 14-16.

[3]D. Emerson, AA7FV, "Try a Twelfth-Wave Transformer," *QST*, Jun 1997, pp 43-44.

[4]Previous Hands-On Radio columns and a complete parts list for all experiments are available to ARRL members at **www.arrl.org/tis/info/HTML/Hands-OnRadio.** QST

AG1YK

HINTS & KINKS

A MOBILE ANTENNA TRANSPORT TUBE

◊ Carrying any of the popular fiberglass shaft antennas (Hamstick, MFJ, Outbacker, etc) unprotected in a car or as a portable antenna for use in the field can easily result in damage. Here is a fast, easy and inexpensive way to protect them.

You can make antenna transport cases using PVC pipe, end caps and foam pipe insulation. The cost is minimal and the protection is great.

To make two PVC transport tubes obtain the following parts:

- One 10 foot section of PVC pipe 1.5 inches in diameter
- Two glue-on PVC end caps
- Two screw-on end caps and two matching glue-on threaded adaptors
- One 10 foot length of foam pipe insulation
- Four medium sized (1.5 inch) felt stick-on pads for chair/table legs
- One can of general purpose PVC cement

I recommend you read through this procedure carefully and look at Figure 1 before you start to cut and glue:

1. Cut a PVC pipe to fit the length of the antenna. If you use a "quick disconnect" for your mount and whip make sure you allow for this extra length when you cut the pipe. Measure twice — cut once.
2. Put a 1.5 inch self sticking felt pad on the inside of each glue-on cap and one on the inside of each screw-on cap. This will protect the antenna from hitting the two ends as it slides back and forth inside the tube.
3. Cement the glue-on end cap on one end of the tube. This is the bottom of your transport tube.
4. *Caution*: Do not screw the cap on before, during or after this step for about 10 minutes. This will allow the cement to dry completely, preventing the screw-on cap from being cemented in place. If you do get glue on the cap and it touches the threads, the glue will bond instantly and permanently and you will have to start over with new materials.

With the screw-on cap removed, cement the screw-on adaptor on the other end of the tube.

5. Insert the foam pipe insulation in the PVC tube and cut it to fit the length of the tube.
6. After checking to *insure* there is no wet PVC cement on the screw-on threads or the end cap, gently screw on the end cap to see how it all fits. That's it; the construction of your transport tube is complete.

Finishing Touches

- Using a permanent marker, mark the tube side and screw-on end cap to identify the antennas the tube is for, such as "40 M, 20 M" etc.
- Mark your antenna tips for the band and overall length for storage. White tape wrapped around the antenna tip will indicate how far to slide the tip into the antenna shaft for each antenna.
- You can also paint your transport tubes, but if you do, be sure and use PVC approved paint or the paint will likely flake off. Camouflage paint or tape looks sharp, but it can also help you lose a tube or end cap in the field. Instead, try a bright color paint (orange?) or leave them white and add decals. Also, it's a good idea to write your call sign and name on the tube.
- A discarded shoulder strap, sling or web strap from a sports bag, backpack, etc, makes a good carrying sling or carrying handle.

Note: Do not glue the transport tubes directly together as a cluster for carrying as it makes the screw-on end caps hard to manipulate. If you have two or three transport tubes and intend to always carry them together, you might consider placing a couple of 3 or 4 inch pieces of PVC tubing between the transport tubes as spacers and use PVC cement to glue these in place to make a 'cluster' for ease of transport. After you cement these in place, you can run a strap thru these short pieces for your carrying handle. As always in ham radio, add, delete, change or modify these ideas to suit your needs. Enjoy. — *73, Bob Patterson, K5DZE, 110 Charles Givens Dr, Dry Ridge, KY 41035,* **k5dze@arrl.net**

BOB PATTERSON, K5DZE

Figure 1 — A completed travel tube for a 15 meter Hamstick.

FIXING AND REPLACING FIBERGLASS-TUBE ANTENNA INSULATORS

◊ The two fiberglass tube insulators on my Titan DX 80/20 vertical antenna were failing. Zeke Zeanon, KJ4ASG, an engineer with expertise in fiberglass pipe, built the replacements and gave me additional advice on future failure prevention. The first of two failures I experienced was sun, rain and snow had caused the fiberglass to "bloom" in which the glass fibers separate resulting in a drop in strength. The solution is periodic application of latex paint, reflective white preferred, to seal the fiberglass from the weather.

The second failure was the lip on the two aluminum bushings that fit into each end of the tube was smaller than the outside diameter of the tube. That's a design error by the manufacturer. It eventually crushes the ends of the tube loosening them and causing the antenna to wobble in the wind. The solution was a washer with an inside diameter that fit over the bushing and an outside diameter larger than that of the fiberglass tube. I measured the outer diameter of the smaller end of the bushing and then looked for a washer with an inside diameter of that size. In my case a "USS 1⅛" would work with some burring to enlarge the inside diameter. The fastenings expert at a local hardware store

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BRUCE MACALISTER, W4BRU

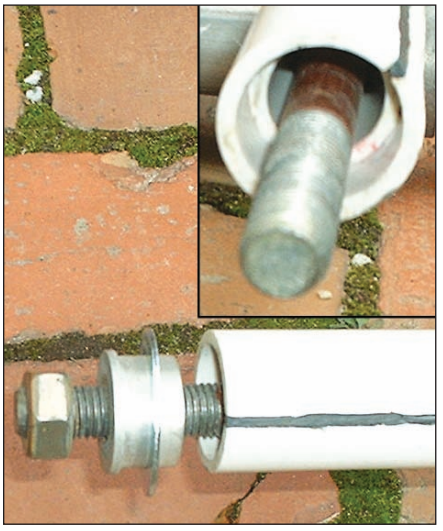


Figure 2 — The assembled components ready to be tightened onto the insulator.

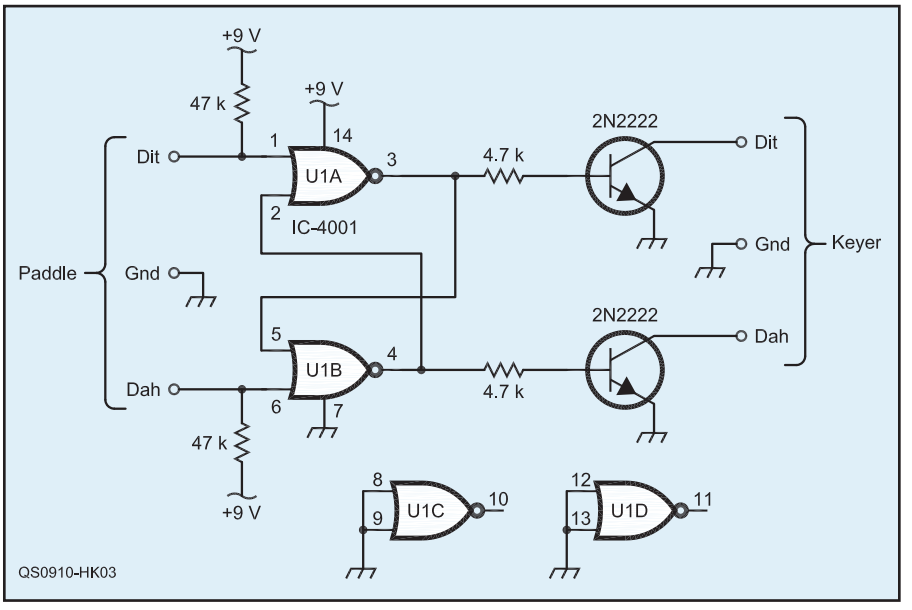


Figure 3 — The multivibrator circuit to make an iambic paddle act like a single paddle key.

took my bushing and found a washer with a perfect fit, no burring required.

There was no way to repair the original tubes so they fit into the cast aluminum clamps on the Titan DX. The fix was a two layer schedule 40 PVC pipe replacement. A piece of PVC with a slightly larger outside diameter than the original fiberglass was split down its length. A second piece of PVC small enough to fit inside the larger split piece was forced inside and the outer, split piece "welded" together with PVC rod. The result is seen in Figure 2; the new double-layered PVC insulator, the original through-bolt and bushing and the new larger washer.

PVC pipe seems to be a good RF insulator, but there is a way to check the piece you buy. Put a small piece of the PVC and a cup full of water in the microwave oven. Run the microwave for a minute. The water should be hot and the PVC not, indicating there is no metallic content in the PVC that might conduct RF. — *73, Bruce MacAlister, W4BRU, 1805 Grove Ave, Richmond, VA 23220*, **w4bru@arrl.net**

SINGLE PADDLE OPERATION WITH IAMBIC PADDLES

◊ My first electronic keyer was primitive by today's standards. It used 6SN7 tube(s) and had 300 V on both sides of the paddle. It worked well but conditioned me such that I've never been able to master the iambic feature. The availability of non-iambic paddles is very limited and they're costly. I found that it's possible to find good, inexpensive, used iambic paddles for sale.

So I thought, could I make an iambic paddle behave like a single paddle? I developed a circuit (see Figure 3) that converts an iambic paddle to non-iambic operation. It uses an SR flip-flop to prevent both keyer inputs from being active simultaneously. It's simple, the cost is minimal and the size is small. I used a CMOS CD4001 because of its low current requirements and the life of a 9 V battery should be close to its shelf life eliminating the need for a power switch. A 7402 TTL (transistor-transistor logic) chip should work just as well but would require an external 5 V power source plus the pull-up resistors on the inputs should be reduced to 4.7 kΩ and the pins will have to be adjusted.

My paddle is now comfortable to use with my CMOS-III keyer. — *73, Larry Winslow, WØNFU, 4500 Whitman Ave N #4, Seattle, WA 98103-6664*, **w0nfu@arrl.net**

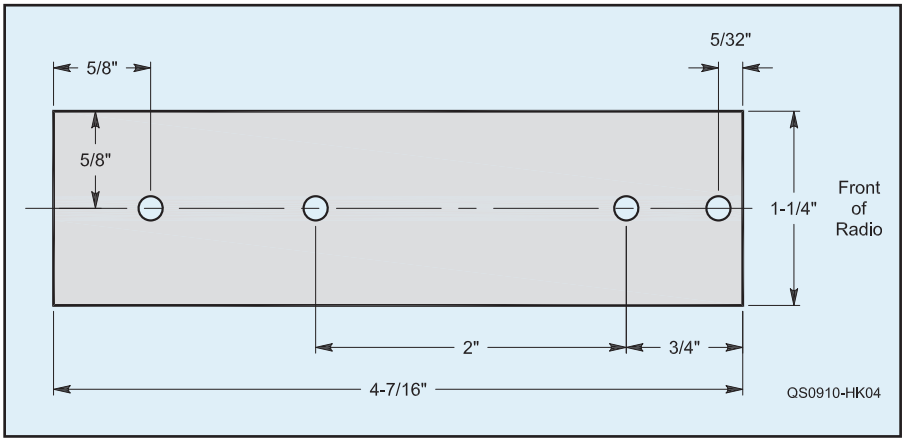


Figure 4 — Mechanical layout of the adapter bracket.

A QUICK RELEASE MOUNTING BRACKET FOR THE YAESU FT-857D

◊ Recently I decided to add HF capabilities to my 1999 Ford F-150 pickup. Being a frugal ham, as most of us are, I wanted to use the radio both in the truck and in the shack. I eventually selected the Yaesu FT-857D. The only disappointing thing about the FT-857D is it did not have a quick release mount.

In the truck, I was using a Yaesu FT-7100 radio, which uses the Yaesu MMB-60 quick release mount. My first thought was to see if the same mount could be used for the new radio. Unfortunately, the mounting arms are too short for the FT-857D. Searching the close-out clearance items on several of the online Amateur Radio stores, I found a Yaesu MMB-67 quick release mount for the discontinued FT-100, so I ordered it to try. When it arrived I found that the slide mount itself was the same as for the FT-7100 and the mounting arms were just the right length to hang the new radio at the proper distance below the mount. As Murphy would have it, the mounting holes did not match plus the FT-857D is approximately ¼ inch narrower. It was time for some good old ham ingenuity.

After careful measuring, I determined

GARY MONTGOMERY, KA8ULI

Figure 5 — The new mounting arms and brackets attached to the radio and ready to slide into the truck's mount.

that making a pair of adapter brackets would allow me to use the MMB-67 mounting arms on the new radio. To make the brackets I used two pieces of flat steel 1¼ inch wide by ⅛ inch thick by 4⁷⁄₁₆ inches long; four hex head metric bolts, M4 × 12 mm; four split-ring lock washers, 4 mm; four flat washers, 4 mm; four countersink head bolts, 8 × 32 × ½ inch; four 8 × 32 nylon insert lock nuts.

Figure 4 shows the dimensions of the adapter bracket and location and size of the four holes needed. Note that I used a larger drill bit to countersink the holes for the bolts that hold the adapter bracket to the mounting arms on the back side so it mounts flat against the radio cabinet when installed. I then primed and painted the adapters to match the radio and assembled the adapters and arms together using the countersink head bolts with the nylon insert lock nuts. I used the upper holes in the mounting arms to position the radio at the height I desired.

Figure 5 shows the mounting arms with the new adapters mounted to the radio using the hex head bolts with split lock washers and flat washers. (*Caution:* Be sure you do not use bolts longer than 12 mm as they will touch the circuit board inside and possibly damage the radio.) I can now use either radio in the truck. Additionally, I use the MMB-67 at my operating desk, so I can use either radio inside as well. For only a few dollars and a couple of hours work, I now have a great rig that I can use in the shack or on the road. — *73, Gary Montgomery, KA8ULI, 206 Hernandos Loop, Leander, TX 78641,* **ka8uli@arrl.net**

MORE ON THE ICOM IC-27/37/47

◊ Lynn Bisha, W2BSN, wrote to me about the recent hint concerning audio problems in the IC-x7 series of mobile rigs.[1] He learned that it is still possible to obtain replacement volume and squelch controls from ICOM. Lynn had to bypass the parts department and contact technical support in order to get the correct part numbers but the following are direct replacements:

- Volume pot/switch, p/n 7210000250
- Squelch control, p/n 7210000230

Thanks Lynn for doing the legwork on this.

RECEIVE INDICATOR

◊ Working with emergency communications as the Nantucket county RACES Radio Officer and ARES® emergency coordinator I have found it difficult to identity which one of my several active radios is receiving a transmission. This is especially important when working with Police, Fire, Coast Guard or any of the first responders.

To help correct the confusion, speed up communications and avoid mistakes I have installed external speakers for each radio. These are placed near its associated microphone with this circuit installed inside the speaker case. Each circuit has a red LED mounted to the speaker's front. When a signal is received the LED turns on for about 2 seconds, turns off for a fraction of a second to check the received signal and then repeats the process if the signal is still present.

This circuit needs 13.8 V dc at about 20 mA. Some radios have this voltage available at the mike connector. If using this source, check the specifications to be sure this doesn't overload the radio's circuit. This wire should also be fused for about ¼ A.

Since most radios use one speaker lead as ground this lead will also work as the circuit ground. Simply connect the circuit in parallel with the speaker. The volume control must be advanced slightly to fire the LED.

The circuit (see Figure 6) operates as a one-shot multivibrator. In the resting state Q1 is off and Q2 is on. When audio is detected, Q2 is turned off, Q1 and the LED turns on until the 100 µF capacitor discharges. At that time Q2 turns on again and looks to see if the signal is still present. If the signal is still present the process is repeated. If no signal is detected, Q1 and the LED stay off. Note that the LED will flash off as it checks. The on-time can be changed by increasing the value of the 100 µF capacitor. With values shown, LED on-time is about 2 seconds, off is a fraction of a second.

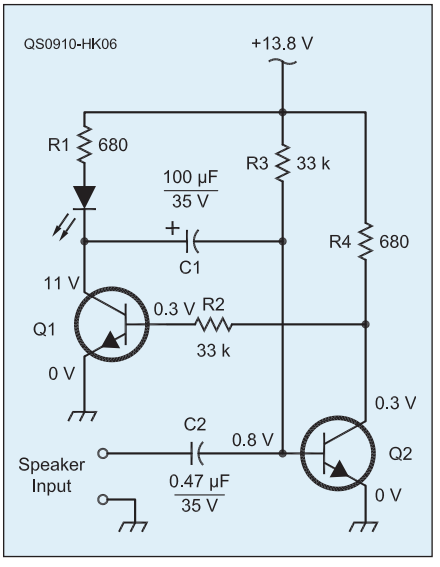


Figure 6 — The circuit for the receive indicator.

Parts List

(2)	MPSA20 NPN transistors (ECG123AP) (NTE 123AP)
(2)	680 Ω, ½ W resistors
(2)	33 kΩ, ¼ W resistors
(1)	0.47 µF 35 V capacitor
(1)	100 µF 35 V electrolytic capacitor
(1)	LED (RadioShack 276-041)
(1)	circuit board

— *73, George Allen, N1NBQ, PO Box 727, Nantucket, MA 02554-0727,* **n1nbq@arrl.net**

WINDOWS SOUNDS — ANOTHER APPROACH

◊ Rather than get rid of the *Windows* sounds that are produced by the operating system and other pieces of software that annoy the average digital operator, let them be heard — by yourself. Many people have several pieces of software on their computer that alert them to what is going on and don't want to mute the sounds in fear of missing an alert that may be of true importance.

The easiest way to fix this issue is to have two separate sound cards on your computer — one a default soundcard for all your *Windows* sounds and another that is dedicated to your HF rig. This instantly solves the headache of changing cables around and swapping settings everytime you want to run a digital mode. *Windows* and several digital packages allow you to select which sound card receives certain sounds. This is configured in the *Windows Control Panel* and in the settings of your digital software. Most computers that were built to run *Windows XP* and *Vista* have multiple USB ports. This allows the digital user to add an external sound card to a USB port. These can be found on the Internet for under $10. This is a simple fix that will keep the world from knowing when you have new e-mail. — *73, Dave Eagle, KB8NNU, 3780 Leeside Ln, Traverse City, MI 49686-8923,* **kb8nnu@arrl.net**

[1]T. Bogusz, "Help Your ICOM IC-27/37/47 Regain Its Voice," *QST*, Jul 2009, p 56.

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

Board Discusses Inappropriate Use of Amateur Radio, Strategic Planning at Second 2009 Meeting

The ARRL Board of Directors makes plans to navigate the future of Amateur Radio.

S. Khrystyne Keane, K1SFA

The ARRL Board of Directors held its Second Meeting of 2009 July 17-18 in Windsor, Connecticut, under the chairmanship of President Joel Harrison, W5ZN. International Amateur Radio Union (IARU) President Tim Ellam, VE6SH/G4HUA, and Radio Amateurs of Canada (RAC) Vice President for International Affairs Daniel Lamoureux, VE2KA, were guests of the Board. On Friday, the Board considered and acted on a number of organizational and Field Organization issues, as well as regulatory and operating matters. Saturday was devoted to reviewing and revising the ARRL Strategic Plan that was adopted in October 2006.

Organizational Issues

The Board authorized the President to appoint an ad hoc committee to prepare guidelines for use by the amateur community and others to identify inappropriate uses of Amateur Radio, while preserving our role of providing communications during times of disasters and for public service events. The Board felt that there are concerns about ambiguity in certain regulations applicable to the Amateur Service and that it would be helpful for the amateur community and others to understand the ramifications of providing Amateur Radio communication services. The committee, which was directed to report their findings to the Executive Committee within 30 days, is studying the issue and preparing guidelines identifying inappropriate uses of Amateur Radio for use by the amateur community and others.

The Board voted to appoint ARRL International Vice President Rod Stafford, W6ROD, as IARU Secretary, effective October 1, 2009. Stafford is retiring from full-time employment as of that date and will be available to serve as a volunteer in this capacity. The Board also directed the ARRL Secretary to cast a vote in favor of IARU Proposal No 245, concerning the admission of Union des Radioamateurs du Congo (URAC) to IARU membership.

DAVE PATTON, NN1N

Three new Vice Directors — Jeff Beals, WA4AW (Southeastern), Jim Tiemstra, K6JAT (Pacific) and John Thomason, WB5SYT (West Gulf) — attended their first Board meeting.

A group from Hartford-based Web developer Fathom, led by President Brent Robertson, KB1PYY, presented an update to the Board, detailing the redesign of the ARRL's Web site. Fathom, which has been working on the redesign since last year, expects the new Web site to launch by the end of 2009. The site will have a totally new look and feature improved navigation and search functions. ARRL members will also be able to customize the new Web site to focus on their Amateur Radio interests.

The Board defeated a motion that would have added language to the Articles of Association allowing the President to vote only in instances of a tie at Executive Committee meetings. The Board considered, but ultimately declined to adopt a motion to establish an Emergency Communications Advisory Committee.

The Board formally accepted the financial statements, including the annual audit, for the year ending December 31, 2008. The Board also authorized the President, Chief Executive Officer, Treasurer and Chief Financial Officer to establish one or more deposit accounts and additional accounts from time to time. These officers have the authority to designate from time to time persons to operate each account. The Board also authorized the ARRL Controller as a signatory on the ARRL operating check account. In order to reduce spending, the

JOEL P. KLEINMAN, N1BKE

Fathom President Brent Robertson, KB1PYY, updated the Board on the progress of the League's new Web site.

Summary of Major Board Actions

The *Minutes* of the 2009 Second Meeting of the Board, Moved and Seconded, are published only on the ARRLWeb at **www.arrl.org/announce/board-0907**. If you do not have Internet access, you may request a written copy of the *Minutes* by writing: ARRL Secretary, 225 Main St, Newington, CT 06111.

Minute	Purpose	Action
Organizational		
16	IARU Secretary *Appointed ARRL International Affairs Vice President Rod Stafford, W6ROD, as IARU Secretary, effective October 1, 2009.*	Appointed
27, 43	Establishment of an ARRL Emergency Communications Advisory Committee *This would have created an advisory committee similar to the CAC and the DXAC.*	Defeated
29	Establishment of Study Committee *This committee will study, research and consider developing a plan to move the US amateur community to narrowband channel spacing.*	To President
35	IARU Election *Instructed Secretary to cast an "aye" vote admitting the Union des Radioamateurs du Congo (URAC) to IARU membership.*	To Secretary
37	Addition to *Articles of Association* *Defeated a motion to add language to limit the President to voting only in instances of a tie on the Executive Committee.*	Defeated
38	Audited Financial Statements *Formally accepted the financial statements, including the auditors' opinion letter, for the year ending December 31, 2008.*	Accepted
39, 44	Establishment of Ad Hoc Committee *This ad hoc committee will study and prepare guidelines for use by the amateur community and others to identify the inappropriate use of Amateur Radio.*	To President
Field Organization		
26	Establishment of Emergency Liaison Station Appointment *This national level appointment will utilize VoIP to amateur HF or VHF linking to W1AW.*	Approved
Regulatory		
25	Modifications to Volunteer Consulting Engineer Program *Changed the terms of reference for the Volunteer Consulting Engineer to expand participation.*	Approved
Awards and Recognitions		
21	*2008 Hiram Percy Maxim Award* to Jason Hatfield, KD8FDD	Conveyed
22	*2009 ARRL Technical Service Award* to Geoff Haines, N1GY	Conveyed
23	*2009 Technical Innovation Award* to Dan Smith, KK7DS	Conveyed
24	*2009 Herb S. Brier Instructor of the Year Award* to Brian Short, KCØBS	Conveyed
28	*Joe Knight Distinguished Service Award* to Bill Thompson, W2MTA	Conveyed
30	Establishment of the George Hart Distinguished Service Award *To be given to an ARRL member whose service to the ARRL's Field Organization is of the most exemplary nature.*	Adopted
31	*Joe Knight Distinguished Service Award* to Susan Swiderski, AF4FO	Conveyed
32	*2009 Philip J. McGan Memorial Silver Antenna Award* to Nate Brightman, K6OSC	Conveyed
33	Modifications to the Bill Leonard, W2SKE, Professional Media Award *Established three categories and changed the terms of the honorarium associated with this annual award.*	Adopted
34	Modification to the Hiram Percy Maxim Award *This annual award is now limited to ARRL members.*	Adopted
40	*2008 Doug DeMaw, W1FB, Technical Excellence Award* to John Stanley, K4ERO	Conveyed

Summary prepared by S. Khrystyne Keane, K1SFA

Board decided to deliver the annual budget electronically in PDF format to all Directors, Vice Directors and Officers. In the past, the budget was sent via courier only to Directors.

Field Organization

ARRL Midwest Division Director Bruce Frahm, KØBJ, announced that the Programs and Services Committee (PSC) will create an ad hoc subcommittee to study the Amateur Auxiliary/Official Observer program and recommend any possible changes by the 2010 Annual Meeting of the Board of Directors. Frahm is the chairman of the PSC.

The Board voted to establish an Emergency Liaison Station. This national level appointment, made by ARRL Headquarters, will utilize Voice over Internet Protocol (VoIP) to amateur HF or VHF linking in order to bring W1AW presence into emergency nets and drills.

Regulatory Matters

The Board directed the President to appoint a study committee for the purpose of research and to consider developing a plan to move the US amateur community to narrowband channel spacing in the VHF/UHF bands. The Board felt that since the FCC has mandated that commercial radio move to narrowband channels by 2013, those companies that manufacture Amateur Radio equipment usually follow commercial practice. The VHF/UHF bandplan currently uses 15 and 20 kHz FM channels. Amateurs are using narrowband equipment outside the repeater sub-band because there is no real place to fit narrowband pairs.

The Board voted to modify the Terms

JOEL P. KLEINMAN, N1BKE

Southeastern Division Vice Director Jeff Beals, WA4AW (left), confers with Chief Operating Officer Harold Kramer, WJ1B.

JOEL P. KLEINMAN, N1BKE

Directors and Board officers listen to a presentation at Friday's Board meeting session.

of Reference for the Volunteer Consulting Engineer (VCE) Program. Expanding on the current terms, a VCE "must be a registered professional engineer by the appropriate department of state government" and "should be able to provide expert testimony and information on issues such as, but not limited to, structure wind loading, guy anchor requirements for given soil conditions, antenna height effectiveness and data on antenna structure safety and consistency with local building codes, radio frequency interference, grounding and electrical safety."

Strategic Planning

On Saturday, the Board devoted a full day to reviewing and updating the three year old ARRL Strategic Plan. Last year, the Board invited ARRL members to comment on the League's future direction. These comments were read and considered by the Board. Before turning the comments over to the Executive Committee, they added some thoughts of their own. The Executive Committee started drafting ideas for the new Strategic Plan at its March 2009 meeting.

The review process at the 2009 Second Meeting included breakout sessions to develop possible strategies to address each of six goals that will guide the ARRL for the next three to five years; the results of the breakout sessions were then reported back to the full Board. The complete output of the planning session will be reported back to the participants for e-mail discussion and then considered by the Executive Committee at its next meeting in October. The Executive Committee will refine the document.

The complete minutes of the 2009 Second Meeting of the ARRL Board of Directors are available at **www.arrl.org/announce/board-0907**. Committee reports are also available online at **www.arrl.org/announce/reports-2009/july**. The next meeting of the ARRL Board of Directors is scheduled for January 15-16, 2010.

S. Khrystyne Keane, K1SFA, is the ARRL News Editor. She can be reached at **k1sfa@arrl.org**.

ARRL Board Names Award Recipients for 2008-2009

S. Khrystyne Keane, K1SFA

The ARRL Board of Directors named eight hams recipients of seven awards at its July 17-18 meeting in Windsor, Connecticut: The 2008 Hiram Percy Maxim Award; the 2009 ARRL Technical Service Award; the 2009 Technical Innovation Award; the 2009 Herb S. Brier Instructor of the Year Award; the Joe Knight Distinguished Service Award; the 2009 Philip J. McGan Memorial Silver Antenna Award, and the 2008 Doug DeMaw, W1FB, Technical Excellence Award.

The Hiram Percy Maxim Award

The recipient of the 2008 Hiram Percy Maxim Award is Jason Hatfield, KD8FDD, of Grafton, West Virginia. Hatfield, 15, became interested in Amateur Radio through the Boy Scouts and obtained his Technician license in January 2007, upgrading to General in December 2008. Hatfield earned the Radio merit badge in 2006; he now serves as a mentor and instructor to his fellow Scouts, helping them obtain their Radio merit badge. A Life Scout, he is presently working toward his Eagle Scout rank where his project is to establish a local radio network to be dedicated as a part of the SKYWARN system in North Central West Virginia.

ARNETTA HATFIELD, KD8GKQ

Jason Hatfield, KD8FDD

Hatfield has helped to equip and install antennas at the Boy Scout Winter Camp at Camp Mahonagan in Upshur County, West Virginia. He is a member of the Stonewall Jackson Amateur Radio Association in Clarksburg.

Hatfield, an ARRL member, will be a sophomore at Grafton High School where he plays the saxophone for the high school band. Some of his hobbies include camping, biking, boating, hunting and computers. He also is an avid NASCAR and Indy car fan.

The ARRL Technical Service Award

Geoff Haines, N1GY, of Bradenton, Florida, was named recipient of the 2009 ARRL Technical Service Award. The

AUDREY HAINES

Geoff Haines, N1GY

Board cited the 12 articles he has written for *QST*, including "Hints & Kinks," product reviews and full articles on such subjects as dual band antennas, an easy-to-make desk microphone and cell phone headset adapters for Amateur Radio. Saying that Haines has "a clear ability to document his work in a way that reaches a lot of hams," the Board also noted his many club presentations as benefits to the amateur community.

Haines, an ARRL member, currently holds several League appointments in the West Central Florida Section, including Assistant Section Manager, Technical Coordinator, Technical Specialist, Official Bulletin Station, Net Manager, Official Emergency Station and Official Relay Station. He is a member and Past President of the Manatee Amateur Radio Club, a member of the Manatee ARES® group, the Yale University Amateur Radio Club and the Meriden (Connecticut) Amateur Radio Club, among others. He serves on the Board of Directors of the West Central Florida Group Inc, operators of the NI4CE linked repeater system.

COURTESY DAN SMITH, KK7DS

Dan Smith, KK7DS

The ARRL Technical Innovation Award

The Board selected Dan Smith, KK7DS, as the recipient of the 2009 ARRL Technical Innovation Award. Smith, an ARRL member, skillfully advanced the capabilities of D-STAR through D-STAR Digital Voice, D-RATS and other add-ons. His open source code has benefitted the Emergency Communications community in more effectively deploying D-STAR in public service work, and his receptivity to user suggestions makes his programming work all the more effective.

Smith, an ARRL member, holds an MS in Computer Science and is a software engineer for IBM's Linux Technology Center. Originally licensed in 2004 in his native state of North Carolina, he now lives in Oregon and holds an Amateur Extra class license.

Herb S. Brier Instructor of the Year Award

Brian Short, KCØBS, of Olathe, Kansas, is the recipient of the 2009 Herb S. Brier Instructor of the Year Award. He has brought 450 new hams into the hobby, 80 of them under 18, and 50 under the age of 13. Short, an ARRL Life Member, Philip strives to interest everyone in Amateur Radio, with a focus on getting young people interested and involved in the hobby.

COURTESY BRIAN SHORT, KCØBS

Brian Short, KCØBS

As a student at the University of Kansas, Short became active in the KU Amateur Radio Club, serving as president for three years. His time at KU ignited in him a love of contesting, DX, tower climbing, repeater building and club leadership — activities that still occupy a majority of his time today. He is president and frequency coordinator of the Kansas Amateur Repeater Council, and Coordinator for **kcAPRS.org** where he actively promotes APRS to hams and served agencies and helps others install *UI-View*. Short is president of the NEKSUN/KØHAM group that maintains 23 repeaters and 28 APRS digis throughout the Midwest. He currently serves as the Johnson County ARES® EC and is an active Level II spotter for Johnson County ECS (SKYWARN); he is also vice president of the Metropolitan Emergency Coordinating Council.

The Joe Knight Distinguished Service Award

This year, the Board named two recipients of the Joe Knight Distinguished Service Award: Bill Thompson, W2MTA, and Susan Swiderski, AF4FO.

COURTESY BILL THOMPSON, W2MTA

Bill Thompson, W2MTA

Thompson, of Newark Valley, New York, was recognized for his guidance and Elmering of the Field Organization as Sec-tion Manager of Western New York for two decades. An ARRL Life Member, he also served as Eastern Area Staff Chairman of the National Traffic System (NTS) for many years.

MIKE SWIDERSKI, K4HBI

Susan Swiderski, AF4FO

Swiderski, an ARRL member who lives in Norcross, Georgia, has been the ARRL Georgia Section Manager for nine years. During her tenure, her organizational skills, management style and commitment to Amateur Radio have aided both the membership and the Field Organization.

COURTESY NATE BRIGHTMAN, K6OSC

Nate Brightman, K6OSC

The Philip J. McGan Memorial Silver Antenna Award

Nate Brightman, K6OSC, of Long Beach, California, was honored with the Philip J. McGan Memorial Silver Antenna Award. Brightman, 92, has demonstrated outstanding volunteer public relations success on behalf of Amateur Radio at the local and regional levels, and in his stewardship of station W6RO on the *Queen Mary*.

Brightman, an ARRL member, wrote the television script for *The Story of the Queen Mary and W6RO*, a DVD video, also enhancing the promotion of Amateur Radio; he has been involved in the project since before the ship even arrived in California, was instrumental in establishing the permanent Amateur Radio station aboard and has been faithful to this project since 1979.

The Doug DeMaw, W1FB, Technical Excellence Award

The 2008 Doug DeMaw, W1FB, Technical Excellence Award was awarded to ARRL long-time Technical Advisor John Stanley, K4ERO, of Rising Fawn, Georgia, for his article "The Beauty of Spectrum Analysis" that appeared in the June and July 2008 issues of *QST*. This is the second year in a row that Stanley has been honored with the Technical Excellence Award.

RUTH STANLEY, WB4LUA

John Stanley, K4ERO

After 50 years of hamming and a 45 year career in electronics, Stanley is looking forward to spending more time passing along what he has learned to the next generation. In the past year, he and his wife of 40 years, Ruth, WB4LUA, have spoken to several groups, including the SEDXC in Atlanta, and the SWODXA dinner at the 2009 Dayton Hamvention. John has written and Ruth edited many tutorials on various RF-related topics in *QEX*, *QST* and *The ARRL Handbook*. Stanley graduated from MIT with an SB EE in 1962. He has taught in several universities and done practical training for the staffs of many radio stations. His interest in Amateur Radio has both enhanced his work experience, and in turn, benefited from the work environment and the access it has provided to huge antennas and sophisticated technical equipment. QST

The Happy Marriage of HF Transceivers and Computers

It's time to play matchmaker between your computer and radio.

Steve Ford, WB8IMY

Just about every HF transceiver on the market today is capable of being connected to a computer. It's just a matter of choosing the right device for the job.

Sound Card Interfaces

If you'd like to try your hand at the huge variety of sound-card-based digital modes such as RTTY and PSK31, you'll need an interface that allows your computer to switch your radio between transmit and receive. There are many interfaces available, ranging from simple to complex. Check the Web sites of *QST* advertisers and you'll see what I mean. Many of these interfaces not only switch your transceiver, they also provide isolation for the audio going to and from your computer sound card. Some interfaces even include their own sound devices — just plug them into a computer USB port and you're good to go.

Control Interfaces

Using a sound card interface with your transceiver is fine as far as it goes, but you can do much more. Most modern HF transceivers provide some form of computer control interfacing. *This isn't to be confused with sound card interfacing*. Instead, we're talking about a digital conversation taking place between the silicon brains that inhabit the radios and the computers. When such a dialog is underway, the computer can read information from the radio (frequency, signal strength, etc) and send specific instructions. It can command the radio to switch frequencies, change operating modes, adjust AF and RF gain, and so on.

Some transceivers are equipped with RS-232 serial ports, USB ports and, in a couple of instances, even Ethernet ports to make it easy to connect computers directly. However, some use proprietary schemes that require interfaces that function as data "translators." A number of manufacturers sell such interfaces and many even market devices that combine the control and sound card interfaces in one package.

The microHAM Interface III includes its own sound device and provides radio control capability.

The Timewave HamLinkUSB radio control interface.

With your transceiver and computer speaking directly, you can use logging and contest software that automatically reads and saves the exact frequencies and modes for every contact. The same software can even "speak" to your antenna system to switch from one antenna to another, or rotate an antenna to a different direction.

There is also software that will not only communicate with your radio, it will extend the control capability to the Internet. You simply log into your computer from a remote location and operate! This functionality is becoming popular as more hams find themselves living in antenna-restricted environments. If one person can set up a station and make it available on the Internet for remote access, several of that person's antenna-restricted friends can sign in and use it.

More Challenge = More Fun

I don't know about you, but I'm always looking for ways to do new things with my station, whether it's playing with a new antenna or trying a new mode of operating. Marrying your computer and your radio expands your experimental horizons substantially. It isn't always an easy marriage. Some computers are fickle; so are radios. But overcoming obstacles and experiencing the pleasure when it all finally comes together makes the effort worthwhile.

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

Strays

HAM MUSIC

♢Alternative rock band Green Day's new album, *21st Century Breakdown*, includes a song called "American Eulogy: Mass Hysteria/Modern World." ARRL Assistant Production Supervisor Jodi Morin, KA1JPA, heard some Morse code at the end of the song that turned out to be CLASS OF 13, a reference used in other songs on the CD. — *Carol Michaud, KB1QAW*

♢I recently saw the singer/songwriter Raul Midon in concert. I heard what sounded like Morse code in one of his songs, and bought his album — lo and behold, there was his call sign, KB5ZOT, right there on the album art. His Wikipedia entry mentions that he is an avid Amateur Radio operator [and he's an ARRL member]. Midon has been blind since infancy. — *Brooke Allen, N2BA*

Introducing the 2010 ARRL Handbook

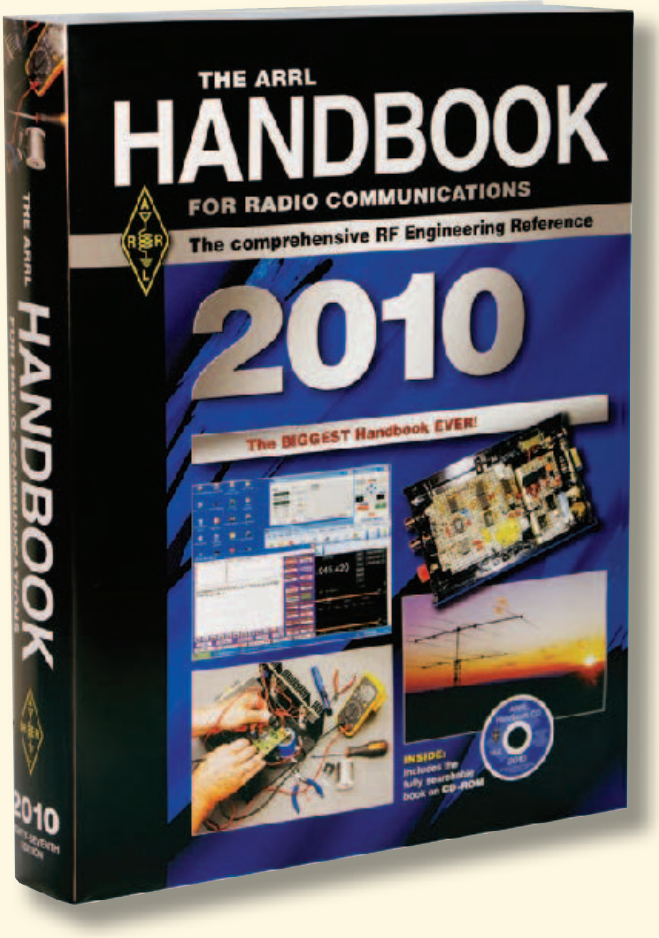


Table of Contents

Your new favorite edition.

Ward Silver, NØAX

You only have to say "the handbook" and another ham will know that you mean *The ARRL Handbook for Radio Communications*. While the media for technical resources have evolved in the past century — from paper pamphlets to CD-ROMs and Web pages —*The Handbook* retains its immediacy and accessibility, whether on the workbench, in a library or on a shelf at the operating position. It's been an invaluable part of Amateur Radio since 1926.

Longtime *Handbook* fans recognize that its content and mission evolve, too. The very first edition (see the sidebar) was part technical guide and part operating manual. As *The Handbook's* audience and the technology they use changed, so did *The Handbook* — sometimes following, often leading. Longtime readers will also know that "every so often," *The Handbook* gets a makeover with new material, new projects and a new organization. This year's edition — the 87th — is just such an edition.[1]

Technically, Amateur Radio finds itself in the middle of both technical and demographic change. Digital modes, the growing hybridization with the computer and the rapid adoption of digital signal processing (DSP) are changing the means by which we communicate. We're using a wider range of frequencies and techniques, in more varied activities than ever. The scope and breadth of Amateur Radio are expanding at an accelerating rate.

How can a single book satisfy a diverse and demanding readership that counts among its number veterans of more than a half-century's know-how and last week's new licensee building a first station? The amateur community exhibits a vast span of technical expertise, from state of the art designers and innovators, to rank beginners. Yet the desires of amateurs to experiment, build and learn remain as strong as ever. Thus, *The Handbook* must both teach and be a reference. With that in mind, coeditor Mark Wilson, K1RO, and I decided to embark on a journey of renewal.

[1]The *ARRL Handbook for Radio Communications*, 2010 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 1462 (hardcover) or 1448 (softcover). Telephone 860-594-0355, or toll-free in the US 888-277.5289; **www.arrl.org/shop**; **pubsales@arrl.org**

Evolving Mission

We started with the mission of *The Handbook*. Author F. E. Handy, W1BDI, states in the foreword to that 1926 edition: "Written first of all for the beginner, such an amount of useful and up-to-date information has been added that the *Handbook* in its present form is equally valuable as a compendium of information for the experienced brass-pounder and the beginner alike." That seemed an admirable goal.

To that end, you'll find *The Handbook* chapters reorganized into five major sections: Fundamental Theory, Practical Design and Principles, Antenna Systems and Radio Propagation, Equipment Construction and Maintenance, and Station Assembly and Management. Each chapter has been designed to be either an "encyclopedia" (providing descriptive overviews of current practices and technology) or "practical handbook" (focusing on techniques, designs and projects). In either case, we tried to insure that there was enough introductory material to get the newcomer started, as well as plenty of in-depth discussion the experienced amateur will expect.

With so many topics to cover, not everything fits into a printed book — even with more than 1250 pages for this edition. Where supplemental material beyond the scope of *The Handbook* was available, we included it on the CD-ROM that accompanies each book. The CD-ROM also includes a searchable and printable PDF version of the entire text, as well as software relevant to some sections of the text.

There is too much new material in the 2010 edition to list here, so let me give you a taste of the new elements:

★ A full suite of new or revised chapters addresses the burgeoning digital modes: Modulation (by Alan Bloom, N1AL); DSP and Software-Defined Radio (also by N1AL); Digital Modes (by Scott Honaker, N7SS, and Kok Chen, W7AY) and Digital Communications (by Steve Ford, WB8IMY). There's also a new section on D-STAR digital repeaters by Pete Loveall, AE5PL, and Jim McClellan, N5MIJ.

★ The ever-popular chapter on RF Power Amplifiers has gotten a thorough refreshing by experts John Stanley, K4ERO (vacuum tube technology) and Dick Frey, K4XU (solid-state amplifiers). You'll find new software, expanded design examples and a new 250 W solid-state amplifier project to get you started toward that bigger signal.

★ Power Supplies, a chapter that every ham turns to occasionally, received the attention of world-class authority Rudy Severns, N6LF. As a result, there is a detailed introduction to switch-mode power conversion — arguably the most common power supply technology in the world and for which coverage was long overdue in *The Handbook*.

★ Ferrite materials and applications have deserved more coverage for many years and we are pleased to have contributions from Jim Brown, K9YC, based on his popular online tutorial. You can find out how ferrites do what they do, then use them more effectively in dealing with EMI, in circuit design and in your antenna system as chokes and baluns.

★ New resources for experimenters include a chapter on "Computer-Aided Circuit Design" by Dave Newkirk, W9VES. The "Component Data and References" chapter received needed updates to the information on component characteristics and surface mount devices by Paul Harden, NA5N.

★ In recognition of the growing range of operating modes and activities, we've updated and expanded chapters on "Space Communications" (satellites by Steve Ford, WB8IMY, and EME by Joe Taylor, K1JT) and "Image Communications" (ATV by Tom O'Hara, W6ORG, and SSTV by Dave Jones, KB4YZ).

That is by no means the end of the new material. Of the 32 chapters in the 2010 edition, 16 have been extensively revised or are altogether new and another 12 have been updated. About 70 percent of the book is new or changed in this edition, including about 50 percent new illustrations.

Also new are small, practical touches you'll like. Readers of past editions told us that material was sometimes hard to find. To help address that, each chapter has its own stand-alone "Table of Contents" and a three-level section numbering scheme to make navigating easier. The index was completely regenerated from scratch, taking the approach, "How would a ham look for this term?"

At this point, *The Handbook* team is hoping you're saying to yourself, "Wow!" We sure did as the project started to come together. I can think of no better way to "advance the state of the radio art," a key element of the FCC's Part 97.1 "Basis and Purpose" of our service. To grow and prosper, Amateur Radio relies on contributions such as these with the goal of making the 2010 version your "favorite edition."

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

The First Edition — Read All About It

The initial edition of *The Handbook* was published in 1926 as *The Radio Amateur's Handbook*. (A reproduction was included as a special order with the 2005 *ARRL Handbook*.) It was edited by F. E. Handy, W1BDI, the League's Communications Manager. The book consisted of 176 pages of text and was about one-fifth the volume of current editions. The "Index" was followed by 35 pages of advertising ("Radio Tubes — Standard Since 1906," "Radio Needs Trained Men!") and a table of international prefixes.

It began with an overview of Amateur Radio before diving into electrical fundamentals (the term "electronics" wasn't in common use at the time) and radio circuit theory and construction. Because the book's intended purpose was to get an amateur on the air with a good quality signal, it focused on a limited number of designs and techniques.

The first edition of *The Handbook* was written by F. E. Handy and published in 1926.

Following the station-building instructions, attention turned to what is now part of the *ARRL Operating Manual*. In 1926, relaying messages was standard operating procedure for most hams. In fact, with the limited range of early equipment and using wavelengths not known for DX propagation, relaying messages was required.

It is clear that *The Handbook* was intended to be a total instruction guide to the beginning and would-be amateur. In that sense, it was similar in tone and style to the popular *Understanding Amateur Radio* of the 1970s that served as a bridge from the simple licensing study guides to *The Handbook*. Over the years, the original *Handbook* grew in scope until the *ARRL Antenna Book* and *ARRL Operating Manual* were created.

The purpose of that original text remains vital today — teaching the beginner and student how radio works so that even the greenest beginner will discover enough about radio and Amateur Radio to satisfy their needs and improve their skills. Along the way, they'll also discover just how broad and interesting the hobby is, becoming like so many of us, lifetime hams.

ARRL: Mobile Amateur Radio Is Not Distracted Driving

To ensure that Amateur Radio is not an unintended victim of the growing public debate over what to do about distracted drivers, ARRL President Joel Harrison, W5ZN, wrote a letter to the National Safety Council (NSC) in August, highlighting issues regarding the use of Amateur Radio emergency communications devices in vehicles. Many states have outlawed the use of cell phones while driving; some states with these laws use ambiguous wording (such as "mobile communication devices" or "mobile electronic devices") that can confuse the issue of using Amateur Radio while driving.

According to their Web site, the NSC is "on a mission" to "alert the American public that different kinds of distractions have different levels of crash risk. Talking on a cell phone and sending text messages are much higher risk activities that occur for longer durations and with more people than most other actions engaged in while driving." They also seek to "lead a change in our nation's cultural norms, so people come to view cell phone conversations and text messaging while driving as unsafe and socially unacceptable. Calling for a legislative ban on these activities is the first step in a long-term process to educate Americans to their risk and change the culture."

Harrison explained to NSC President Janet Froetscher that Amateur Radio operators provide essential emergency communications when regular communications channels are disrupted by disaster: "Through formal agreements with federal agencies, such as the National Weather Service, FEMA and private relief organizations, the Amateur Radio volunteers protect lives using their own equipment without compensation. The ability of hams to communicate and help protect the lives of those in danger would be strictly hindered if the federal, state and local governments do not ensure that Amateur Radio operators can continue the use of their mobile radios while on the road."

According to ARRL Chief Executive Officer David Sumner, K1ZZ, it boils down to the difference between *simplex* — when only one message can be sent in either direction at one time — and *duplex* — a communications mode, such as a telephone system, that provides simultaneous transmission and reception in both directions. Harrison, citing Sumner's 40-plus years of experience as an Amateur Radio operator, put it this way in his letter: "Simplex, two-way radio operation is simply different than duplex, cell phone use. Two-way radio operation in moving vehicles has been going on for decades without highway safety being an issue. The fact that cell phones have come along does not change that."

COURTESY PAUL OKA

Many states currently have legislation on the books or pending regarding texting and using cell phones while behind the wheel. A 2009 experiment with *Car and Driver* magazine editor Eddie Alterman that took place at a deserted air strip showed that texting while driving had a greater impact on safety than driving drunk. While legally drunk, Alterman's stopping distance from 70 mph increased by 4 feet; by contrast, reading an e-mail added 36 feet, and sending a text added 70 feet.

Harrison attached a copy of the ARRL's *Policy Statement on Mobile Amateur Radio Operation* to the letter to the NSC. "Amateur Radio mobile operation is ubiquitous, and Amateur Radio emergency and public service communications, and other organized Amateur Radio communications activities and networks necessitate operation of equipment while some licensees are driving motor vehicles," the Policy Statement reads. "Two-way radio use is dissimilar from full-duplex cellular telephone communications because the operator spends little time actually transmitting; the time spent listening is more similar to, and arguably less distracting than, listening to a broadcast radio, CD or MP3 player. There are no distinctions to be made between or among Amateur Radio, public safety land mobile radio, private land mobile radio or citizen's radio in terms of driver distraction. All are distinguishable from mobile cellular telephone communications in this respect. Nevertheless, ARRL encourages licensees to conduct Amateur communications from motor vehicles in a manner that does not detract from the safe and attentive operation of a motor vehicle at all times."

The ARRL has acknowledged the numerous and increasing instances of state legislative proposals — and occasionally municipal ordinance proposals — to curb the use of cell phones while operating motor vehicles; these can range from prohibitions on handheld telephones to prohibitions on all forms of electronic devices. The Policy Statement maintains: "These statutory proposals would supplement the more generalized motor vehicle code requirements that exist in various forms in virtually all States, which require operators of motor vehicles to pay full time and attention to the operation of the vehicle while driving."

Saying that the League understands that driver inattention is a leading cause of automobile accidents, the Policy Statement reads: "it is not unreasonable to be concerned about substantial distractions to drivers of motor vehicles. Given the necessity of unrestricted mobile Amateur Radio communications in order for the benefits of Amateur Radio to the public to continue to be realized, the ARRL urges state and municipal legislators considering restrictions on mobile cellular telephone operation to (I) narrowly define the class of devices included in the regulation so that the class includes only full duplex wireless telephones and related hand-held or portable equipment; or alternatively (II) specifically identify licensed Amateur Radio operation as an excluded service."

Asserting that the ARRL is aware of "no evidence that [mobile] operation contributes to driver inattention...radio amateurs are public service-minded individuals who utilize their radio-equipped motor vehicles to assist others, and they are focused on driving in the execution of that function."

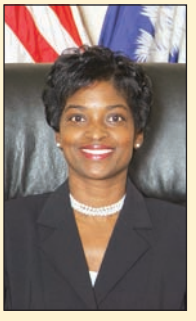
S. Khrystyne Keane, K1SFA ♦ ARRL News Editor ♦ k1sfa@arrl.org

FCC News

♦**Meredith Attwell Baker, Mignon Clyburn Sworn in as FCC Commissioners — Now There Are Five**: The Federal Communications Commission now has its full complement of five Commissioners: On July 31, Meredith Attwell Baker joined Chairman Julius Genachowski, Robert McDowell and Michael Copps. On August 3, Mignon Clyburn came on board.

Baker's term will expire June 30, 2011, while Clyburn's term will expire June 30, 2012. Baker will join Robert McDowell as a Republican on the Commission. Chairman Julius Genachowski and Michael Copps are Democrats, as is Clyburn. Only three sitting Commissioners may be members of the same political party.

FCC Commissioner Meredith Attwell Baker



FCC Commissioner Mignon Clyburn

Baker was sworn in by Chairman Genachowski in a private ceremony in the Chairman's office. "I am grateful to President Barack Obama for nominating me — and the United States Senate for confirming me — to this important position and I look forward to rolling up my sleeves and working on policies and programs that will help build a 21st century communications infrastructure that can provide sustained economic growth, opportunity and prosperity for the nation, and for all telecommunications users," Baker said.

Clyburn was sworn into office by Senior District Judge Matthew J. Perry Jr in her home state of South Carolina. "I look forward to working with the Administration, Congress, Chairman Genachowski, my fellow Commissioners and the incredibly talented FCC staff, to ensure that all Americans enjoy the tremendous benefits offered by modern communications. This is an exciting and challenging time in our nation's history. I am eager to hear from and work with all stakeholders to carry out, along with my colleagues, communications policies that protect consumers and encourage robust competition and innovation."

Pointing out Baker's "broad and deep experience" and Clyburn's "years of state-level and private-sector experience," Chairman Genachowski welcomed both women to the FCC. "At this critical moment in history, I look forward to collaborating with my fellow Commissioners on ways that the agency can improve the lives of all Americans through communications."

ARRL RESPONDS TO FCC'S PROPOSED ALLOCATION FOR MEDICAL DEVICES IN 70 CM BAND

ARRL General Counsel Chris Imlay, W3KD, on behalf of the ARRL, filed comments on August 11 regarding a *Notice of Proposed Rule Making* (*NPRM*), ET Docket 09-36, issued by the FCC in March 2009. In the NPRM, the FCC proposed to allocate spectrum and adopt service and technical rules for the utilization of new implanted medical devices that operate on 413-457 MHz (70 cm). According to the Commission, these devices — called implanted neuromuscular microstimulators — would greatly expand the use of functional electric stimulation to restore sensation, mobility and function to those persons with paralyzed limbs and organs; they would be implanted in a patient and function as wireless broadband medical micro-power networks (MMNs). These devices would be used on the 70 cm band on a secondary basis as part of the Medical Data Radiocommunication Service in Part 95 of the FCC rules. The Amateur Radio Service has a secondary allocation in the 70 cm band.

Researchers with the Alfred Mann Foundation — a leading medical research organization located in Santa Clarita, California — have developed a wireless medical micro-power network to tie together tiny devices implanted in victims of paralysis, creating an artificial nervous system to restore sensation, mobility, and function to paralyzed limbs and organs. "The Mann Foundation argues that the frequency range just above 400 MHz is optimum for their application, which requires no more than 1 mW of RF spread across about 5 MHz of bandwidth," ARRL Chief Executive Officer David Sumner, K1ZZ, wrote in "It Seems to Us," published in the June 2009 issue of *QST*. "However, recognizing the presence of a variety of incumbent radio services in that range, specifically including the amateur service, they have proposed four channels for flexibility in avoiding localized interference. Two of the four channels are 426-432 and 438-444 MHz; the other two are above and below the 420-450 MHz band."

In its comments to the FCC regarding the *NPRM*, the ARRL said it believes that the choice of frequency bands for MMNs as proposed is "unfortunate and unnecessary" and that "the WMTS [Wireless Medical Telemetry Service] offers a far more suitable solution than does the 413-457 MHz band for MMNs."

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

In its comments, the ARRL made note of the fact that there is Part 90 spectrum above 450 MHz available for low-power biomedical telemetry, but "the Alfred Mann Foundation argues that bands between 450 and 470 MHz are unsuitable due to the fact that the band is 'congested and populated with commercial, high-power transmitters that could preclude reliable operation of lower-power, wireless medical implant devices.'" This, the ARRL said, "is a very worrisome contention, and not the argument that should be made by the proponent of a new service that is secondary to other incumbent licensees. ARRL contends that if the 450-470 MHz band hosts services that are incompatible with reliable operation of MMNs, then the 420-450 MHz band, and especially the segment proposed for MMNs at 438-444 MHz is equally incompatible with MMNs."

Pointing out that Amateur Radio television transmitters and repeaters and FM voice repeater input and outputs operate in this segment in particular, "the potential for interference to MMNs is on the same order, or worse, than would be the case if MMNs were to operate in the Part 90 biomedical telemetry band between 450 and 470 MHz," the ARRL told the FCC. "In the segment 426-432 MHz, amateur television stations transmit on a wide bandwidth basis. Amateur Radio stations are permitted to operate at power levels up to 1500 W PEP output, and the RF environment at 420-450 MHz, with primary government radiolocation facilities and highpower amateur facilities is no more conducive to reliable MMN operation than would be the 450-470 MHz band."

Imlay and ARRL Technical Relations Manager Brennan Price, N4QX, met with the Alfred Mann Foundation in February 2009,

but Imlay said that so far, they have not responded to the ARRL's request to "cooperate in a firm statement that their devices would not malfunction in the presence of nearby RF signals from Amateur Radio stations. Failing that, these comments reflect our continuing concern about the effect on implant patients from unpredictably close Amateur Radio station operations. Other radio services affected, both above and below the 430-450 MHz band, are taking similar positions."

The ARRL DXCC Desk has approved credit for the 7O1YGF DXpedition from Yemen.

7O1YGF OPERATION APPROVED FOR DXCC CREDIT

On August 12, ARRL DXCC Manager Bill Moore, NC1L, announced that after more than eight years, the 7O1YGF operation in 2000 from Yemen has been approved for DXCC credit. Moore cited a review of "recently received information," as well as "additional dialogue" with the leader of the 7O1YGF DXpedition, as reasons for the approval.

Because so much time has passed since the DXpedition, Moore asked that those amateurs seeking credit for 7OYGF follow certain procedures.

If you are seeking credit for 7O1YGF *only*:

■ If you live in the US, send only the 7O1YGF QSL card with your application to DXCC; enclose a self-addressed, stamped envelope. If you live outside the US, please enclose return postage so we may return the card to you. DXCC will then process the card. Applicants will not be charged a submission fee.

■ Bring the card to a DXCC Card Checker. The card checker will forward the confirmation to the DXCC Desk for processing. Again, there will be no submission fee if this is a single card submission; however, you still must fill out an application form.

If you are submitting 7O1YGF with other QSL cards:

■ Applicants may include their 7O1YGF QSL card with their next QSL card submission and it will be handled as usual.

Moore said that the DXCC Desk will work with the 7O1YGF team to use Logbook of the World (LoTW), if possible. "Remember, the cutoff date for the 2009 DXCC Annual listing and Honor Roll list is December 31, 2009," Moore reminded DXers. "We encourage applicants to handle this sooner, rather than waiting until the last minute."

In Brief

• **FCC Expands ARRL's 500 kHz Experimental License**: On July 28, the FCC approved a modification that expands the ARRL's 500 kHz experimental license WD2XSH. According to Experiment Coordinator Fritz Raab, W1FR, the expansion allows for more frequencies, more stations and portable operations. "We can now operate between 495-510 kHz," Raab said. "We were previously limited to 505-510 kHz. We will not be using 500 kHz itself so as to ensure that there is no conflict with the heritage stations on that frequency. The expansion also gives us the opportunity to expand the number of participating stations. We can now have 42 stations, where before we were limited to 23." Raab said that the expansion will now let participants operate within 50 km of their designated stations. This was not allowed under the previous terms of the experimental license. "Some stations have reduced operating bands to ensure that they do not interfere with nearby non-directional beacons," he said. The FCC's Office of Engineering and Technology granted the WD2XSH experimental license to the ARRL in September 2006.

• **Special Bonus Section Added to *The ARRL Ham Radio Licensing Manual***: The most common question new radio amateurs ask is "Now that I have my license, what kind of radio should I get?" The ARRL, in an attempt to help newcomers to Amateur Radio answer that very question, has added a bonus supplement to *The ARRL Ham Radio License Manual*. "Choosing a Ham Radio: Your Guide to Selecting the Right Equipment" is aimed at the new Technician licensee ready to acquire a first radio, a licensee recently upgraded to General class and wanting to explore HF, or someone getting back into Amateur Radio after a period of inactivity. The guide features two main sections — one covering gear for the VHF and UHF bands and one for HF band equipment, including a VHF/UHF and an HF glossary of terms you will encounter. The guide also urges you to discover just what you want to do with Amateur Radio and where you want to do it from. Do you want to be a "big gun" HF contester? Do you want to ragchew on your local repeater system? Maybe you want to join your local ARES® unit and help provide communications support in times of emergency. This guide will help you select the right rig for what you want to do. Power, filters, digital signal processing, as well as special features commonly found on VHF/UHF and HF radios are also included in the guide. ARRL members who are logged on to the ARRL Web site can view the guide online at **www.arrl.org/members-only/choosingaradio**.

SECTION MANAGER NOMINATION NOTICE

To all ARRL members in the Eastern New York, Eastern Pennsylvania, Louisiana, North Carolina, Pacific, San Diego, South Dakota and Virginia Sections: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the Section concerned. Photocopied signatures are not acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms (FSD-129) are available on request from ARRL Headquarters but are not required. A sample nomination form is available on the ARRL Web site, **www.arrl.org/FandES/field/org/smterms.html#sample**.

We suggest the following format:

(Place and Date)

Membership and Volunteer Programs Manager, ARRL
225 Main St
Newington, CT 06111

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

(Signature___ Call Sign___ City_s_ ZIP__)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on December 4, 2009. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters on or before January 4, 2010, to full members of record as of December 4, 2009, which is the closing date for nominations. Returns will be counted February 23, 2010. Section Managers elected as a result of the above procedure will take office April 1, 2010.

If only one petition is received from a Section, that nominee shall be declared elected without opposition for a two-year term beginning April 1, 2010. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the April 2010 *QST*. A Section Manager elected through resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Membership and Volunteer Programs Manager. — *David Patton, NN1N, Membership and Volunteer Programs Manager* QST

Honoring the 60th Anniversary of the ARRL National Traffic System

The ARRL National Traffic System is celebrating its 60 year anniversary during 2009. Congratulations to all the participants and leaders. As reported 10 years ago in *QST*, "The ARRL-sponsored system, which conveys message traffic across the continent in an orderly flow through scheduled nets, is one of the longest-running public service programs in League history."

The *QST* Archives (**www.arrl.org/members-only/qqnsearch.html**) reveals the announcement of the National Traffic System (NTS) in September 1949 *QST*, in an article by George Hart, W1NJM, the principal architect and father of the NTS. At the time, Hart was the Assistant Communications Manager at ARRL Headquarters. This is how George introduced the new system of handling traffic in that 1949 article:

> During 1948, practically every section in the ARRL field organization had a net of some kind going, and 47 sections had nets devoted exclusively to traffic handling. If, in each section net, a certain station (or stations) was designated to take all traffic going outside the section, this station then to report into a later net having greater coverage, and the same procedure repeated funneling into still greater coverage areas, we would have a traffic organization of national scope capable of handling traffic to (and from) any point in the entire field organization, which includes the entire United States, most of its Possessions and most of Canada.
>
> This in briefest outline is the essence of the ARRL National Traffic Plan. It takes the already-existing section net as a unit and makes two larger unit categories, which are called "regional" and "area" nets. Each regional net covers a certain number of section nets (normally those within a certain call area), and each area covers a certain number of regional nets (normally those within a time zone). The area nets, of which there are four (one for each time zone), pass traffic around among themselves, and it then comes back down through regional and section nets again in the same evening. This requires organization and teamwork of no small dimensions, but it will work if we get together on it and push.

George summarized and highlighted the new "National Traffic Plan" with the following bullet points in that 1949 introductory article:

- Existing nets can continue unaffected
- Plan gives potential tie between each section net
- Adoption of plan contingent on your support
- All amateurs asked to send comments and suggestions after a trial.

The NTS certainly did pass its one year trial period after its official start date of October 1, 1949. For an overview of the history of the NTS, what preceded it, how it came about, who was involved and how the NTS has continued to evolve over the past several decades, please refer to the September 1999 *QST* article, "Golden Anniversary: A Look at Fifty Years of the National Traffic System," by Rick Palm, K1CE (pp 50-53).

Pride, service, tradition, innovation. These are the words that describe the character of the ARRL National Traffic System. In 1989, the League's Board of Directors chose this design created by Kyle Thompson, W6BNJ, of Oakdale, California, to serve as the ARRL NTS logo.

A Northwestern Perspective

William M. Smith, W7GHT, ARRL Idaho Section Traffic Manager, **w7ght@arrl.net**

It was in 1948, I believe, that we all were made aware that the ARRL Communications Manager, George Hart, W1NJM, was undertaking the tasks of revamping the traffic system. He developed the "layer" system within the Eastern, Central and Pacific Areas. These layers were identified as local and region levels.

The local state levels were assigned certain Regions. Idaho, Montana, Wyoming, Colorado, Utah, Arizona and New Mexico were assigned to and made up the Twelfth Region of the Pacific Area.

I had returned to college, following the War and was living in northern Idaho. Reliable 80 meter contact with the then 12th Region states, other than Montana, seemed impossible for me. I felt we should have been assigned to the 7th region, which then included Alaska, Alberta, British Columbia, Washington and Oregon.

In my capacity as "Route Manager" of Idaho, I began a campaign by alerting Idaho traffic handlers of the communications "dilemma." I also contacted the then Montana Route Manager, who agreed with me and he, too, conducted a campaign.

Ultimately, George Hart placed the two states, Montana and Idaho, with the 7th Region, where they have remained.

NTS for Nearly a Lifetime

William W. Thompson, W2MTA, ARRL NTS Manager, Region 2, Cycles 2 and 3, **w2mta@arrl.net**

Reflecting on the 60th anniversary of the NTS as I read the 1999 K1CE article in *QST*, much of my life spun before me, merging experiences from my aerospace vocation and my Amateur Radio avocation into one whirl of highlights.

In 1952 I was WN2MTA and in the US

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

STEVE EWALD, WV1X

The annual Traffic Handlers' Picnic has been a summer tradition enjoyed by radio amateurs and their families within the NTS Eastern Area for many years. The 2009 picnic, held on August 15, was hosted by Betty and Bill, W2MTA, Thompson at their home in Newark Valley, New York. From the left: Marcia Forde, KW1U, Chair, NTS Eastern Area Staff and TCC Cycles 1 and 2 Director; Phil "Pip" Sager, WB4FDT, 3RN, Cycle 4, Manager; Bill Thompson, W2MTA, 2RN, Cycles 2 and 3, Manager; Jack Bowles, N1OTC.

Marine Corps. During my tour, the NTS Transcontinental Corps (TCC) formed and flew, and the NTS Area Staff concept arose. When I returned home I started attending college about the same time the VHF traffic nets were started. In 1957, during the International Geophysical Year, Amateur Radio satellite mini-track stations (like our Project Moonbeam station in Endicott, New York) were erected for tracking space satellites months before the Sputnik and Vanguard satellites arrived. VHF traffic nets grew in the US populated areas.

My job tours of W9, W5, W4 and W2 land NTS nets in the early 1960s coincided with exciting tests, space launches and discoveries as we all grew. NASA's OAO (Orbiting Astronomical Observatory) satellite found the first black hole in space; the Alaskan Earthquake put us hams to the test. I became EAN (NTS Eastern Area Net) net control station in 1962 while on Long Island and I have now been EAN NCS for 47 years.

It has been an honor having managed the New York State (NYS) CW Net for 6 years and having been an NTS Official and Second Region Net Manager since 1974. It has been great with NTS Area Staff meetings and Traffic Handlers' Picnics' socializing. As Rick Palm, K1CE, said in the 1999 article, "The social aspect is what has made the NTS a truly great tradition of Amateur Radio… and there's nothing wrong with that."

Citizen Corps News and Information

This past summer, President Obama called on Americans to participate in our nation's recovery and renewal by volunteering in our local communities. To encourage individuals to volunteer and develop their own do-it-yourself projects that can help prepare communities for disasters, the Federal Emergency Management Agency (FEMA) and Citizen Corps have teamed up with the Corporation for National and Community Service to provide a *Community Preparedness Toolkit* on **www.serve.gov**.

Research conducted by FEMA on disaster preparedness shows that many people who believe themselves "prepared" for disasters often aren't as prepared as they think. Our nation's emergency managers, firefighters, law enforcement officers, EMT/paramedics and other emergency responders do an incredible job of keeping us safe, but they can't do it alone. We must all embrace our individual responsibility to be prepared, as well as assist our family and friends.

This new *Community Preparedness Toolkit* helps citizens create a service project to prepare their family, friends, neighbors and colleagues for disasters in their local community. For more information and to download the toolkit, visit **www.serve.gov/toolkits/disaster**.

FEMA's Citizen Corps grassroots community resilience movement and the Ready awareness campaign (**www.ready.gov**) work together to actively involve Americans in making themselves and their communities safer, stronger and better prepared to handle any emergency situation. Over 2300 local communities have created Citizen Corps Councils nationwide to strengthen collaboration between government and civic leaders and to educate, train and involve the public. For more information about Citizen Corps, visit **www.citizencorps.gov**.

NTS: A Way to Make Lifelong Friends

Phil "Pip" Sager, WB4FDT, stopped by ARRL Headquarters this past summer for a visit and to see friends. He was first licensed in January 1967 and while here, he reminisced a bit about the National Traffic System. Hailing from Baltimore, Maryland, he is the Manager of the NTS Region 3, Cycle 4, Net and also serves as net control on the Eastern Area Net and TCC representative on Monday nights.

"One of the nice things about NTS," Phil said, "is that you really make lifelong friends. You'll find that some folks who are inactive on the ham bands for a period of time will come back to the nets — sometimes many years later — because they remember the good times they had. NTS and NTS-affiliated nets are the place to find friends."

For example, Phil knows that Clayton Towers, K4RHQ, of Bridgewater, Virginia, has been the NCS for the Virginia Sideband Net on Saturday nights since 1965. "A lot of radio amateurs will check into this net on Saturday because they know Clayton is there."

Phil first started checking into NTS nets when he lived in Virginia. At first, he didn't really know much about the operators who held the call signs that he logged regularly. "I didn't know who they were, but the old timers on the net sure did. I remember, in the late 1960s, hearing W4FV check into the Virginia CW Net. I later learned that Ed had been Manager of the Virginia CW Net prior to World War II."

Mondays on the NTS Central Area Net used to be "old home night" for Phil. "There were a group of fellows that I knew from the Texas CW Net from the 1970s and from my time in Louisiana and Wisconsin. We all were on the Central Area Net on Monday nights representing our respective regions and we all knew each other. It was really something."

GEORGE HART DISTINGUISHED SERVICE AWARD

At its July 2009 meeting, the ARRL Board of Directors established the George Hart Distinguished Service Award to be given to an ARRL member whose service to the League's Field Organization is of the most exemplary nature. Minute 30 introduces this new ARRL Award:

> 30. Mrs. Craigie assumed the Chair at 2:25 PM. It was MOVED by Mr. Cox, seconded by Mr. Frahm, that the Board of Directors establish a new award to be known as the "George Hart Distinguished Service Award" with the following terms of reference:
>
> The George Hart Distinguished Service Award may be presented by the Board of Directors to the ARRL member whose

service to the ARRL's Field Organization is of the most exemplary nature. The Distinguished Service Award is named in honor of George Hart, W1NJM, long-time Communications Manager at ARRL Headquarters and chief developer of the National Traffic System.

1. Selection criteria include
2. Operating record with the National Traffic System; or
3. Participation within the Amateur Radio Emergency Service; or
4. Station appointments and/or leadership positions held within the Field Organization.
5. Procedure
6. Nominations shall be accepted from anyone.
7. Nominations shall be submitted to the Membership and Volunteer Programs Manager at ARRL HQ by November 1.
8. Nominations should document as thoroughly as possible the nominee's lifetime activities and achievements within the Field Organization. It is expected that nominated candidates will have 15 or more years of distinguished service.
9. The Programs and Services Committee will serve as the Review Committee.
10. The Board of Directors shall make the final determination at its Annual Meeting in January.
11. The award shall consist of:
12. An engraved plaque and cover letter.
13. Coverage in *QST*.

After discussion, on motion of Mr. Fallon, seconded by Mr. Bodson, it was VOTED to call the question, at which time the motion was ADOPTED.

STEVE EWALD, WV1X

George Hart, W1NJM, is shown at his 1989 Field Day station. George operated CW from inside his camper at the Newington Amateur Radio League's Field Day site.

Upon learning that the ARRL Board of Directors had established this award named after him, George, W1NJM, said in a recent telephone conversation that it was "a great honor."

Nominations for the George Hart Distinguished Service Award and any related supporting material and letters of recommendation may be sent to ARRL Headquarters to the attention of Dave Patton, NN1N, ARRL Membership and Volunteer Programs Manager (**nn1n@arrl.org**) or to Steve Ewald, WV1X (**wv1x@arrl.org**). The nomination period continues until November 1, 2009.

RESOURCE TYPING

Many of you have expressed the need for Amateur Radio resource typing to improve our capability to integrate into ICS and to create uniform standards for personnel and equipment. To quote the NIMS definition: "Resource typing is categorizing, by capability, the resources requested, deployed, and used in incidents. Measurable standards identifying resource capabilities and performance levels serve as the basis for categories. Resource users at all levels use these standards to identify and inventory resources." We have received some suggestions informally over the past few years and would like to formally solicit examples if resource typing has been applied locally in your area. Our goal is to develop uniform typing standards for ARES®, and your input will greatly assist us in accomplishing this. Please send this material to **k2dcd@arrl.org**. QST

NTS Resources on ARRL Web Page

The *ARRL National Traffic System Resources* Web page is a part of the Amateur Radio Public Service Web page. The specific link to the NTS Resources is: **www.arrl.org/FandES/field/pubservice.html#ntsr.** You'll find the ARRLWeb's *Amateur Radio Public Service* Web page (**www.arrl.org/FandES/field/pubservice.html**) when you scroll down the page and spot the NTS logo. The *2009 National Traffic System Net Reports* (**www.arrl.org/FandES/field/NTS-stats.xls**) link takes you to an *Excel* file that shows the available 2009 monthly NTS Area, Region Net and Transcontinental Corps statistics as reported by NTS officials.

On this Web page, you'll also find a link to the *NTS Methods and Practices Guidelines — NTS MPG* (**www.arrl.org/FandES/field/nts-mpg**). This is the working reference manual on traffic net and message handling procedures in the ARRL National Traffic System (NTS). It also serves as an appendix to the *ARRL Public Service Communications Manual* (**www.arrl.org/FandES/field/pscm**).

According to the *NTS MPG's* editor, Al Nollmeyer, W3YVQ, "the methods presented are a reasonably accurate snapshot of current practices. They are indeed practices, and not strict rules, but the beginner, Section, Region, Area and Transcontinental Corps net operators and management alike will find it beneficial to have a uniform protocol reference to be used by operators."

The *National Traffic System — An Introduction* is a *PowerPoint* presentation that provides an introduction to the National Traffic System (NTS) including an introduction to National Traffic System Digital (NTSD). Thanks to Greg Szpunar, N2GS (ARRL Official Relay Station and NTS Digital Relay Station) and to Dave Struebel, WB2FTX (ARRL Section Traffic Manager of Northern New Jersey and NTS Eastern Area Digital Coordinator) for writing and creating this program. To see and download the program, visit **www.arrl.org/FandES/field/NTS.ppt**.

Are you looking for a particular net? If so, you'll find a convenient link to the online ARRL Net Directory (**www.arrl.org/FandES/field/nets/client/netsearch.html**) that will help you find the kind of net that you are seeking.

An Instructors Guide to Training Traffic Handlers (**www.arrl.org/FandES/field/trainingTrafficHandlersGuide.pdf**) by Mark W. Rappaport, W2EAG, is also available on the NTS Resources Web page. This guide is written for the volunteers who are willing to train Amateur Radio operators about traffic handling. These volunteer instructors know that training is the answer to bringing new traffic handlers to the nets.

WB8IMY

ECLECTIC TECHNOLOGY

Audio Archiving

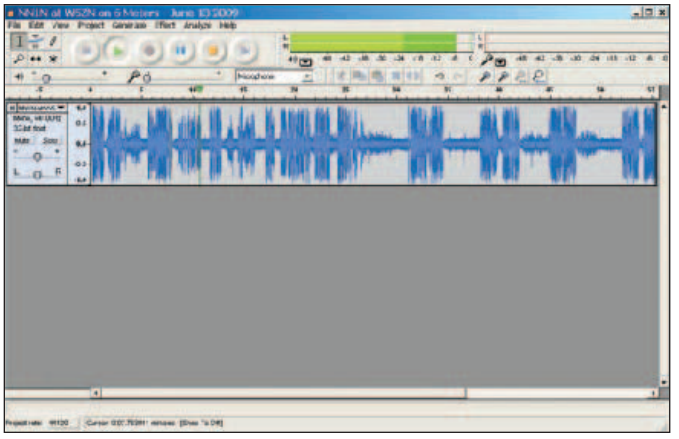
Hams have been recording their activities for as long as recording devices have been available. In the days when magnetic tape was king, some amateurs kept portable recorders at their stations, always ready to grab anything that might be of interest.

Thanks to digital technology, it is easier than ever to make audio recordings on the fly. All you need is an audio cable between your radio and the MIC or LINE input of your computer sound device. For best results when recording from my HF/VHF transceiver, I use the fixed-level audio available at the ACCESSORY jack on the back panel. Just about every modern HF rig has a fixed-level audio output. In fact, if you operate sound-card-based digital modes such as PSK31, chances are you are using this port already. Otherwise, a cable to your radio's external speaker or headphone jack will suffice.

There is abundant digital recording software out there, and much of it is free. *Windows* users will find the *Sound Recorder* application on their computers (look in the Entertainment folder under Accessories). *Sound Recorder* only provides 60 seconds of recording time, though. To make the most of digital audio archiving, my personal favorite is a free application known as *Audacity* at **http://audacity.sourceforge.net/**. This amazing software not only records, it edits in a variety of ways and even allows you to export the result as an easily transportable MP3 audio file.

With the proper cabling in place and software at the ready, I can pounce on any curiosity I may come across. During the ARRL June VHF QSO Party, 6 meters burst wide open between New England and the Midwest. I heard the ARRL Headquarters crew of Dave Patton, N1NN, and Sean Kutzko, KX9X, running a pileup from the station of the ARRL President Joel Harrison, W5ZN, in Arkansas. So, naturally, I had to record it! You can listen to my audio clip of Sean and Dave here: **www.arrl.org/files/qst-binaries/6meters.mp3**.

A number of groups are placing their audio archives on the Web (along with video archives). For a good example, go to the Web site of the KC VHF Grid Bandits at **www.kcvhfgridbandits.com** and click on the Audio Files tab. They have a superb collection of audio recordings made during various VHF band openings.



The free *Audacity* application at http://audacity.sourceforge.net/ not only records audio, it has the ability to edit and enhance.

Jerry Clement, VE6AB, works through OSCAR 51, the FM repeater satellite, with his ultra-light portable setup.

Ultra-Light Satellite

Jerry Clement, VE6AB, passed along some photos of his ultra-light approach to satellite operating. His technique is innovative to say the least. "The photo shows me working John, K8YSE, on AO51. I am uplinking to AO51 with a Yaesu FT-170 and a Diamond RH-205 whip. My downlink radio is an ICOM IC-R5 communications receiver and a satellite antenna that I built from plans provided by Juan, EA4CYQ, in the February 2009 *QST*. On my wrist is my Palm Tungsten E2 running *Pocketsat+*. This setup works amazingly well and it all can be carried in a small over-the-shoulder messenger bag."

Transistor Trouble

No doubt you know that transistors must be made from highly purified materials to function properly. Any defects can cause performance degradation and erratic operation. Engineers have recognized this for many years and they use a largely accepted theoretical model that identifies these defects and helps guide designers' efforts to mitigate them. The theory, known as the *elastic tunneling model*, predicts that as transistors shrink, performance degradation will correspondingly increase.

But Jason Campbell and his group at the National Institute of Standards and Technology recently discovered that even in nanometer-sized transistors the degree of performance degradation remains unchanged compared to their larger siblings. "This implies that the theory explaining the effect must be wrong," Campbell said. "The model was a good working theory when transistors were large, but our observations clearly indicate that it's incorrect at the smaller nanoscale regimes where industry is headed."

So what's the big deal? Well, the findings have implications for the low-power transistors found in many of the devices we use today, especially small digital products. Low-power transistors are becoming popular because using them on chips would allow devices to run longer on less power. (Consider a cell phone that could operate for a week on a single charge.) But in a puzzling twist, Campbell says the degradations his group observed grew more pronounced as the *power* decreased instead of the size. "This is a real bottleneck in our development of transistors for low-power applications," he says. "We have to understand the problem before we can fix it — and troublingly, we don't know what's actually happening." QST

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

This Month in Contesting

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

GOIN' MOBILE: ROVE, ROVE, ROVE!

With so many amateurs living with deed restrictions, in apartments or dealing with other factors that prevent them from installing outdoor antennas, today's amateurs need to be crafty. If the circumstances you find yourself in don't allow you to operate radio from home, consider taking your station — and your contesting enjoyment — on the road. VHF+ contests have an entry category called a *Rover,* an entry class that combines ham radio contesting with elements of a road rally. Many operators love being a Rover, enjoying the technical and logistical challenges the category brings to VHF+ contests. Plus, because this takes place on VHF/UHF frequencies, *any* class of license can operate in this fashion.

How a VHF Contest Works

VHF contests take place on frequencies above 50 MHz; the most commonly used bands in VHF+ contests are 6 meters, 2 meters and 70 centimeters. Most QSOs are made on SSB/CW, although there is some FM work found near high-population centers. As in HF contests, your score is the number of QSO points times the number of multipliers. VHF contests use grid squares as the multiplier. Each grid square is 1° of latitude high by 2° of longitude wide, or roughly 60 × 110 miles. The exact size of a grid square will vary depending on your exact location on the earth. See **www.arrl.org/locate/gridinfo.html** for more information on grid squares.

Rover QSOs

While a fixed station operates a VHF contest from a single grid square, Rovers travel to multiple grids and make QSOs in each of them. A rover can work the same station each time they transmit from a different grid square, as well. For example, say I'm participating as a Rover in the upcoming January VHF Sweepstakes in the New England area. I set up in grid FN31, just outside of Hartford, Connecticut and I work Dave, K1WHS, at his home station in FN43, in the southwest corner of Maine. I work several other stations, pack up my gear and drive to Rhode Island, in grid FN41. I set up my gear and hear K1WHS again in FN43. Dave and I can work each other again, because I'm now in a different grid than I was for our first QSO. If I were to drive back to FN31, I couldn't work K1WHS again, as I have already worked him when I was in FN31.

In addition to being able to make QSOs with the same station every time they enter a new grid, Rovers get additional multipliers for every grid they make a QSO from. If you make QSOs from five different grid squares, you can add five multipliers to your overall score.

The First Time

Roving for the first time can be very simple. There is a category in VHF contests called *Limited Rover* that limits you to low power (around 100 W) and a maximum of four bands. This is a great category in which to dip your toe in the Rover waters. A compact rig with 6, 2 and 432 takes up little space and is a nice all-in-one package. If you have a rig that can only cover one or two VHF bands, that's just fine; make do with what you have for your first efforts.

The next thing to consider is antennas. VHF+ contest SSB and CW QSOs are simplex (point to point) where the standard is to use horizontally polarized antennas. As many a new rover has discovered over the years, vertical antennas will prove ineffective due to a 20 dB difference when a QSO is made between a vertical to a horizontally polarized antenna. A simple dipole will work on 6 meters just fine, and small beams for 144 and 432 MHz are affordable or easy to construct yourself. There are numerous plans in *The ARRL Antenna Book* for VHF/UHF beam antennas.

The antennas will need to be elevated. Ten or 15 feet of telescoping mast will get your beams up to a respectable height. No need for a rotator — just turn the mast by hand. Secure the mast by lashing them to the roof rack on your vehicle or buy a mast support you can park on. There are several mast support methods; experiment with what works for your vehicle and budget.

Where Do I Set Up?

A major factor of Roving is planning where you will set up. Generally speaking, you will want to find the highest point you can in each grid you want to operate from. Many of the QSOs you will make, especially on 144 and 432 MHz, will be within 200 or 300 miles; being in a physically high location, above any other hills, buildings or other obstacles will improve your transmit and receive abilities substantially.

Some Caveats

As with trying anything new for the first time, there are some things to know in advance.

1) If you set up your rover station in a public place, the chances are good you will attract some attention, usually from the public, but occasionally from law enforcement. Bring a copy of your license with you, and be prepared to explain what you are up to. Most rovers say being friendly and inviting with your curious visitors is the best approach.

2) If you are going to set up on private land, get permission first.

3) Many Rovers in ARRL VHF contests turn in their logs as part of the Club Competition program, just as fixed stations do. However, only the QSOs made within the Club's circle may count toward the Club score. It is up to the Rover to indicate which QSOs were made within the Club circle and which ones weren't.

More Info

There is a lot of information available online for Rover wannabes. One of the best sites is a page by Bob Witte, KØNR, entitled, "So You Want To Be A Rover." You can find a link to it at **www.k0nr.com**. Another great source of help and info is a VHF club, where Web sites and operators that focus on roving will be happy to help. Check out the Northeast Weak Signal Group, Central States VHF Society, Southeast VHF Society, Pacific Northwest VHF Society or the Rocky Mountain VHF+ groups. Their Web sites can be found on the Web with your favorite search engine.

Roving is an excellent way to get involved in VHF+ contesting. If you don't have the ability to put antennas up at your QTH, or you're an HF contester looking to try something new, consider VHF+ contesting and roving; you might just discover something you love!

In the September/October "Contesting 101"

Station Integration. Kirk Pickering, K4RO, shows you how to integrate your shack's PC with your rig to maximize contest efforts and fun, too. *Contesting 101* can be found in the *National Contest Journal*, published six times per year. For subscription information, visit **www.arrl.org/ncj**.

Operating Tip of the Month

*"**Do The Math.**" Learn the truth about feed line matching, antenna loss, VSWR, directivity and gain. That means read and study. That means experiment. That means cut and try. Shrug off the myths embraced by the mediocre. Don't listen to people who tell you that 2:1 SWR is good enough because all the power goes somewhere eventually. (Thanks Tim, EI8IC)*

CONTEST CORRAL

in association with the *National Contest Journal*

OCTOBER 2009

Start and finish	HF	VHF+	Contest Title	Phone	CW	Digital	Exchange	Sponsor's Web Site
Oct 3, 0000Z - Oct 3, 2400Z	1.8-28	50	PSK Rumble - The Fall Classic			✘	Name and S/P/C	www.n2ty.org
Oct 3, 0000Z - Oct 13, 2400Z	3.5-28	50	Digital SSTV Contest			✘	Complete image exchange	
Oct 3, 0800Z - Oct 4, 0800Z	1.8-28		Oceania DX Phone Contest	✘			RS and serial	www.oceaniadxcontest.com
Oct 3, 1600Z - Oct 3, 1959Z	3.5-14		EU Autumn Sprint	✘			Both call signs, serial, name	www.eusprint.com
Oct 3, 1600Z - Oct 4, 2159Z	1.8-28	50,144	California QSO Party	✘	✘		Serial and state/prov/"DX" or CA county	www.cqp.org
Oct 4, 0700Z - Oct 4, 1900Z	21,28		RSGB 21/28 MHz Contest	✘	✘		Serial and UK district	www.vhfcc.org/hfcc/rules/2009/r2128.shtml
Oct 7, 7 PM - Oct 7, 11 PM		432	Fall VHF Sprints	✘	✘	✘	Grid square	www.svhfs.org
Oct 9, 1400Z - Oct 11, 0200Z	1.8-28		YLRL Anniversary Party	✘	✘	✘	Serial, RST, and section/province/country	www.ylrl.org
Oct 10, 0000Z - Oct 11, 2359Z		50-1296	ARRL EME Contest	✘	✘	✘	Both call signs, signal report	www.arrl.org/contests
Oct 10, 0000Z - Oct 11, 1600Z	3.5-28		Makrothen Contest			✘	Grid square	home.arcor.de/waldemar.kebsch
Oct 10, 0001Z - Oct 10, 2359Z	28		10-10 Sprint	✘	✘	✘	Call, name, 10-10 number, S/P/C	www.ten-ten.org
Oct 10, 0800Z - Oct 11, 0800Z	1.8-28		Oceania DX CW Contest		✘		RST and serial	www.oceaniadxcontest.com
Oct 10, 1200Z - Oct 11, 1200Z	14-28		Worked All Britain HF Contest	✘			RS, serial, DXCC entity or WAB area	www.worked-all-britain.co.uk
Oct 10, 1600Z - Oct 10, 2000Z	3.5-14		EU Autumn Sprint		✘		Both call signs, serial, name	www.eusprint.com
Oct 10, 1600Z - 12 Oct 2200Z	1.8-28	50,144	Pennsylvania QSO Party	✘	✘	✘	Serial and ARRL/RAC section	www.nittany-arc.net/paqso.html
Oct 10, 1600Z - Oct 11 2359Z	1.8-28	50,144	Arizona QSO Party	✘	✘	✘	RS(T) and AZ county or S/P/C	www.azqsoparty.org
Oct 10, 1700Z - Oct 10, 2100Z	3.5-28		FISTS Fall Sprint		✘		RST, S/P/C, name, FISTS number or pwr	www.fists.org
Oct 11, 0000Z - Oct 11, 0400Z	3.5-14		North American RTTY Sprint			✘	Both call signs, serial, QTH, name	www.ncjweb.com
Oct 11, 0000Z - Oct 11, 2359Z	3.5-28		SKCC Monthly Weekend Sprint		✘		RST, S/P/C, SKCC nr or power	www.skccgroup.com/sprint/wes
Oct 17, 6 AM - Oct 17, 12 PM		902+	Fall VHF Sprints	✘	✘	✘	Grid square	www.svhfs.org
Oct 17, 8 PM - Oct 18, 2 AM	1.8		Great Pumpkin Sprint			✘	RST and S/P/C	www.podxs070.com
Oct 17, 0000Z - Oct 18, 2400Z	3.5-28		JARTS WW RTTY Contest			✘	RST and age (YL may send '00')	www.edsoftz.com/JARTS/
Oct 17, 1200Z - Oct 18, 2400Z	1.8-28		QRP ARCI Fall QSO Party		✘		RS(T), S/P/C, QRP ARCI number or pwr	www.qrparci.org
Oct 17, 1400Z - Oct 17, 2300Z			Iowa QSO Party	✘	✘	✘	RS(T) and IA county, state/prov, or "DX"	www.wa0dx.org/iaqsoparty.html
Oct 17, 1500Z - Oct 18, 1500Z	1.8		Stew Perry Warmup Contest		✘		Grid square	web.jzap.com/k7rat/stew.rules.txt
Oct 17, 1500Z - Oct 18, 1459Z	3.5-28		Worked All Germany	✘	✘		RS(T) and serial or DOK code	www.darc.de/referate/dx/fedcg.htm
Oct 17, 1600Z - Oct 18, 2359Z	1.8-28	50	W/VE Islands QSO Party	✘	✘	✘	RS(T) and S/P/C or island designator	www.usislands.org
Oct 17, 2200Z - Oct 17, 2400Z	28		10-10-10 Feld-Hell Sprint			✘	RST, Feld-Hell nr, S/P/C, and 10-10 nr	www.feldhellclub.org
Oct 18, 0000Z - Oct 18, 0200Z	14-21		Asia-Pacific Sprint		✘		RST and serial	jsfc.org/apsprint/aprule.txt
Oct 18, 1700Z - Oct 19, 0100Z	1.8-28	50,144	Illinois QSO Party	✘	✘		RS(T) and IL County or S/P/C	www.w9awe.org
Oct 19, 1300Z - Oct 23, 2400Z	1.8-28	50+	School Club Roundup	✘	✘	✘	RST, class, S/P/C	www.arrl.org/SCR
Oct 24, 0000Z - Oct 25, 2359Z	1.8-28		CQ WW SSB Contest	✘			RS and CQ zone	www.cqww.com
Oct 24, 0001Z - Oct 24, 2359Z	28		10-10 Fall CW QSO Party		✘		Call, name, 10-10 number, S/P/C	www.ten-ten.org
Oct 24, 0001Z - Oct 24, 2359Z	28		10-10 Fall Digital QSO Party			✘	Call, name, 10-10 number, S/P/C	www.ten-ten.org
Oct 24, 2300Z - Oct 25, 0300Z		50	Fall VHF Sprints	✘	✘	✘	Grid square	www.svhfs.org
Oct 28, 0000Z - Oct 28, 0200Z	1.8-28		SKCC Monthly Straight Key Sprint		✘		RST, S/P/C, SKCC nr or power	www.skccgroup.com/sprint/sks

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

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

How to Win the ARRL Sweepstakes with 11 QSOs

Sometimes a win just takes being in the right place and a little perseverance.

John Kanode, N4MM

In November 1963, I was working for the Sandia Corporation at Camp Mercury, Nevada, the atomic bomb test site. I was assigned to the Seismic Instrumentation Department. I was stuck at the base with little to do and spotted a van on top of a hill that had lots of antennas around it. I wondered if it might be a Military Affiliate Radio (MARS) or Amateur Radio station. I knew the ARRL Sweepstakes was that weekend and I was looking for a place to operate.

I found out it was the Amateur Radio club station. I went to the motor pool and asked the desk clerk for the key. He was surprised that I wanted to use it because it had been more than 6 years since anyone had requested to use the station. I signed for the key and was off to the site.

Eruption of the Blue Fireball

Before attempting to open the door, I checked out the antenna situation. There was a small monoband beam on a 20 foot pole and dipoles for 40 and 80 meters. When I opened the door, a funky odor rushed out to greet me; like opening King Tut's tomb for the first time.

I found the main power switch and flipped it on. There was a hissing noise and after a few seconds the lights came on. After about 30 seconds went by there was a loud pop. A big blue fireball jumped out of one of the radios and a big puff of white smoke rose to the ceiling. This was not looking good.

There were several Hallicrafters receivers and transmitters in the van along with some E.F. Johnson gear. I turned the Hallicrafters gear on and it appeared to be working. I found where the antenna feed lines came in and as I was reaching for the coax cables to determine what went with which antenna, I saw a diamondback rattlesnake crawling back outside through the hole. Needless to say, I was very careful where I put my hands after that.

I hooked up the 40 meter dipole, tuned up the transmitter and K5UYF/7 was making contacts. It was slow since the only key I could find was an old J-38. After five QSOs the transmitter died. I hooked up another one and had to jerry-rig it to work.

After three more QSOs the receiver died. This was not my day. I found another receiver, hooked it up and made three more QSOs. The second receiver became insensitive to the point where it was useless. I tried several other pieces of gear in the van but they too, were non-operational, so I gave up, took my log with 11 QSOs in it and left. I sent the 11 QSO log in to the ARRL. At least my call would appear in *QST* although I would probably be at the bottom of the listings for Nevada.

I left Nevada in December and when *QST* came out with the Sweepstakes scores, I was amazed to see that I had won Single Operator for Nevada. There was only one other station on from Nevada and it was a Multi-operator entry from the Thunderbird Hotel in Las Vegas. As I type this story, I am looking at the certificate. I had 11 QSOs in 6 sections for a score of 165 points. And that is how to win the ARRL Sweepstakes with 11 QSOs.

John C. Kanode, N4MM, a life member of ARRL, was first licensed in August 1952 as WN4WSF and upgraded to Amateur Extra in December 1958. John was elected ARRL Roanoke Division Vice Director in 1981, Director in 1989, ARRL Vice President in 2000 and Honorary Vice President in 2003. John was inducted into the CQ DX Hall of Fame in 2000. He is at the top of the Honor Roll for DXCC, DXCC Challenge Award 2900+. He can be reached at 1741 Old Chapel Rd, Boyce, VA 22620-9718, **n4mm@arrl.net**.

WARD SILVER, NØAX

This certificate from the first Sweepstakes in 1930 awards the prize to W7AAT for the Montana section. Signed by K. B. Warner and F. E. Handy, it attests to Orville's nine QSOs.

Movin' to Montana

Winning a category with a few QSOs is not something new in the ARRL Sweepstakes. There are always a handful of rare sections. Oh sure, the "usual suspects" like VY1-VE8 and North Dakota are always tough, but sometimes events conspire to make a Clean Sweep harder than it "should" be. For example, one year I missed working an Orange County (ORG) station. Huh?

That's just the way it is and when it happens, stations in that section sometimes place higher than they expect. The photo shows a certificate from the very first Sweepstakes, attesting that W7AAT had won the Montana section. Surely that required a few log sheets worth of contacts? Nope — O. W. Viers had triumphed with only nine contacts in eight sections, over 2 weeks. It's a good thing he turned in that 144-point log. That's the fun part of the story — you, too, can surprise yourself by getting on the air and "playing around" in a contest like Sweepstakes. It being a domestic contest, you needn't have giant beams a mile in the sky. In fact, low and medium-height antennas work better on the high-angle propagation required by "short skip." All you have to do is ask the clerk for the key and have at it. — *Ward Silver, NØAX*

The Past, Present and Future of VHF Contesting

Where we've been and where we seem to be heading.

Kevin C. Kaufhold, W9GKA

VHF+ contesting activity has gone through tremendous changes over the years, and the cyclical nature of VHF log entries has been heavily discussed and debated within the contesting community. These discussions have resulted in a series of articles over the years, identifying the various factors impacting activity in both the ARRL and CQ VHF contests. This article brings all of these thoughts together into one place, presenting the material in a historical and chronological setting.

The Past

Trends Leading to the First Peak

Two main peaks in the ARRL VHF contests have occurred in the modern era of VHF contesting, as can be seen in Figure 1. Contest activity skyrocketed from 1948 to 1961, especially in the January VHF Sweepstakes. In his World Above 50 Mc column in July 1960 *QST*, Ed Tilton, W1HDQ, attributed this to the creation of the Novice and Technician classes in the 1950s. Two meter contest activity surged after the Novice class was created in 1951, with Novices initially being authorized usage of 2 meters. Six meter contest activity exploded immediately after Technicians were granted the use of that band in 1955. Two meter contest numbers took another jump when Technicians were given access to parts of the band starting in 1959.

From the very first ARRL VHF Sweepstakes in 1948, club activity was a critical factor. With clubs sponsoring many of the then-common AM activity nets, clubs were at the very center of VHF activity in much of the country. With the club competition only occurring in the January event, the ARRL VHF QSO Parties in June and September were almost an afterthought.

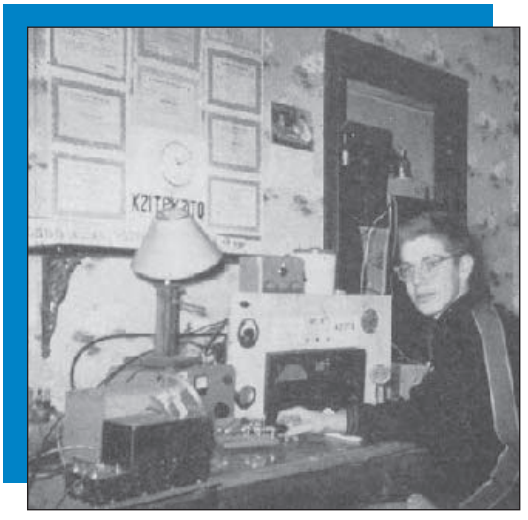
In 1961, log entries peaked in the January VHF Sweeps at 1563 logs. June peaked in 1962 at 558 logs. September's high occurred in 1960 at 494 entries. The first peak was so monumental that the 1961 January log totals have never been surpassed in any VHF contest (CQ or ARRL) to this day. It would take another 20 years before the June 1962 high would be broken, and another 32 years before the September 1960 high would be seen again.

Decline from the First Peak

With no adverse regulatory changes or major rules revisions, the three contests operated for years in much the same way as they originally did in 1948. Yet contest activity in all three ARRL VHF contests dropped significantly after 1961. A general loss of interest or license upgrading may be largely responsible for this contesting loss, as the first blush of enthusiasm by most newly created Novices and Technicians gradually wore off.

Then in 1968, Novices were prohibited from 2 meter phone, and this had a major adverse impact on contesting and general operating activities on 2 meters. Technicians were also restricted from 6-meter CW in 1968. Some loss in CW contesting activity was noted in contest write-ups. In November 1972, Novices lost all use of 2 meters. At the same time, Novices gained access to the 10 meter band. As the VHF frequencies were now completely off-limits to the entry classes of Amateur Radio, VHF contesting suffered greatly. In 1972, Technicians regained parts of the 2 meter band, and the authorization was expanded to most of the band in 1975. This gradual reentry of Technicians to 2 meters did not stop the slide in VHF contesting, until at least the mid-1970s.

FROM APRIL 1958 *QST*



Back in 1958, 17 year old Joe Taylor, then K2ITP (and his brother Hal, K2ITQ) made a record score in the January VHF Sweepstakes. Today, Joe is K1JT, Nobel prize-winning physicist and creator of the popular *WSJT* software suite, used by VHFers worldwide for EME and meteor-scatter communications.

CQ also sponsored a series of VHF contests between 1956 and 1967 (see Figure 2). These innovative events exhibited no peaks of activity, unlike the ARRL contests. This was possibly the result of several dramatic changes then occurring in the CQ contest structure, as well as the limited time period in which the CQ events were held.

By mid 1960s, SSB began to supplant AM on HF, and SSB became more prevalent on VHF by the late 1960s. The rise of FM repeaters

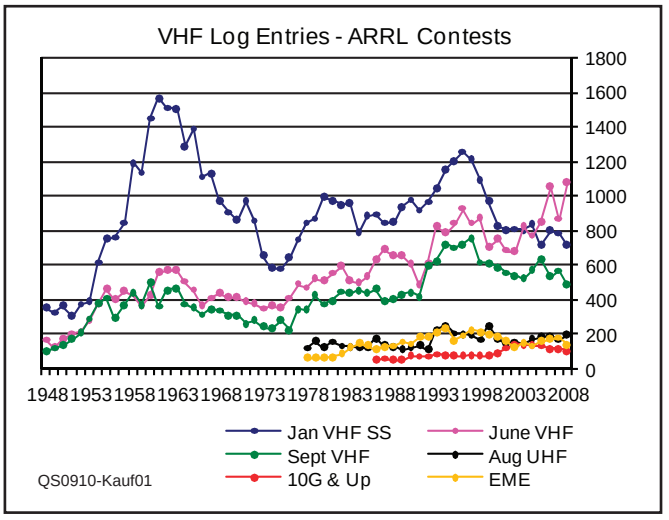


Figure 1 — ARRL VHF contest log entries.

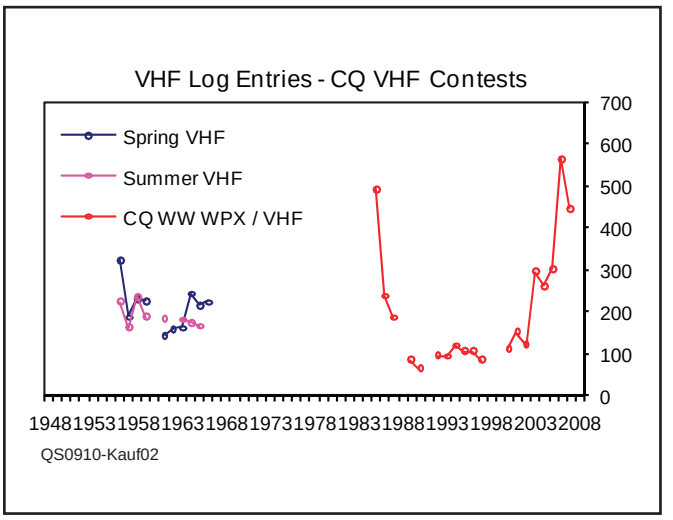


Figure 2 — CQ VHF log entries — both eras.

encouraged clubs to shift towards non-contesting types of VHF activity and support. VHF oriented clubs were also adversely impacted by the Technician and Novice regulatory changes through loss of club membership. Club contesting activity levels slid downward, both in absolute terms and as a percentage of overall contest population, as shown in Figure 3.

Contest activity was so bad that the League publicly floated the idea in the December 1971 *QST* of ending the September contest. The trail-off in contest activity was significant. By 1968, January logs were down a third. By the 1975 low, logs in January were down two-thirds from the peak in 1961. The January VHF Sweeps bottomed out at 573 logs in 1975, almost 1000 entries below the 1961 peak. The June 1973 contest had a low of 345 logs. September 1976's low was 223 logs.

Contesting Resurgence, Mid-1970s to 1991

Incentive licensing began in 1967. While being very controversial at the time, the new licensing structure may have significantly increased amateur ranks over the next twenty years. Several Novice restrictions, such as crystal control and low power limits, were also relaxed in this same time frame. In 1978, Technicians regained full access to the CW portions of the VHF bands, and were granted Novice privileges on 10 meter phone. These increases in Novice and Tech privileges have been credited with spurring growth in US operator numbers for the next 10 years. In fact, US operator licensee numbers rose distinctly from 273,000 in 1976 to 464,000 by 1990.

The numerous changes in contest rules that occurred in this period were designed to stimulate contest activity. The first major change in ARRL VHF rules since 1948 was implemented in 1978 when QSO points per band was added to the January contest. Restrictions on FM contest rules were experimented with beginning in 1975. The EME and UHF contests were developed in 1978. Local, Medium and Unlimited categories were first used in the 1979 Club Competition.

The Lindholm ad-hoc committee was established in June 1981 to "study some basic philosophical questions regarding ARRL vhf/uhf contests." In 1982, the committee recommended several rules changes. The January 1983 *QST* noted: "the Sept VHF QSO Party is making a comeback…recent rules and administrative changes on ARRL's part, coupled with an ever increasing number of commercially available vhf rigs, appear to have helped out toward this end…"

The introduction of grid squares in 1983 revolutionized VHF contesting and general operating activities. The ARRL's VUCC program was implemented at the same time, and was immediately a huge success. The QRP category was the first expansion in contest classes since 1954, and was implemented beginning in 1986. The ARRL 10 GHz contest started in 1986. Club membership and attendance rules were modified in 1988. By the mid to late 1980s, mobile contest operations were traveling to many grids, and were allowed to submit a contest entry from each new grid activated. A competitive Rover class was under consideration by the late 1980s.

In addition to incentive licensing and rules changes occurring, the development of the first generation of transistorized multi-modes further spurred activity levels on VHF.

Log entries in all three ARRL VHF contests slowly advanced from the mid-1970 lows. The June and September contests increased in comparative popularity after 1975, coming closer to January. This could have been the result of several factors, including the ability to work greater distances on VHF, greater geographical dispersion of VHF activities, and people grouping into "quasi clubs" by operating multis and mobiles in a coordinated fashion.

The Technician Explosion, 1991-1996

In February 1991, the code-free Technician license was developed. Over the next decade, the total number of Technicians exploded, from 158,000 before the regulatory change to almost 336,000 in 2000. This huge increase in a very short span was unprecedented in the entire history of US Amateur Radio (see Figure 4). With the newly created Technicians having VHF privileges, contest activity in VHF events surged through 1996.

In June 1991, Rover and Multi-Limited categories were developed after a series of articles in the *NCJ* galvanized popular support for the creation of these new categories. Rovers were immediately popular, especially since there was a good amount of mobile operating already occurring. The scoring system for the new Rover class proved to be controversial however, since it produced a "mega-scoring" potential by the rovers. This possibility was realized in the January 1993 contest, when the club competition was greatly affected by two sets of rover teams submitting entries for one radio club. To deal with the matter, rules changes occurred in 1993 and 1995. Things settled down somewhat after that, but the rover controversy never completely

died out. Indeed, rover rules were again recently revised in 2008, with pack roving operations restricted and three separate rover categories created.

After years of major contesting log entry increases, January peaked in 1996 at 1250 logs; June in 1996 at 923 logs; and September in 1997 at 752 entries.

The Present

Decline from the Second Peak to Possible Stabilization

Contest log entries declined in all three major VHF contests even as the number of Technician license holders continued to increase until 2000. This is the same pattern as was seen in the 1961 peak, and a loss of interest demographic factor may also be behind the decrease from 1996 highs.

In order to encourage more activity, club competition began in the 1999 September VHF, and then in the 2003 June VHF. Club log percentages in those contests have been climbing towards that of the January VHF Sweeps. The Single-Op category was split into low power and high power effective January 2000. The new category could not stop the erosion of contest log entries, and the continuing fragmentation of the SO class has not created a surge of new contesters. Club radius rules changed three times from 1998 to 2000, and then club meeting requirements were relaxed in 2002.

By early 2003, a concern was expressed of the all-inclusive nature of the three main ARRL VHF contests degenerating into "de facto" microwave events. Some also felt that the contest rules themselves were so entrenched in the minds of contesters that the rules were contributing to stagnation in the VHF events. The League authorized an ad-hoc committee in 2002 to look into the matter. In 2004, the committee recommended major changes in the June contest along with other proposals, including the elimination of the August UHF contest. The contesting community was highly critical of the proposals, and the committee withdrew most of the recommendations. Without making any changes in VHF rules, the League authorized a new advisory committee in August 2005 to look into the state of VHF contesting. The VHF/UHF Advisory Committee (VUAC) was then established. The committee recommended changes to the Rover rules in 2008, and has considered further revisions in various rules in 2009.

Regarding the *CQ VHF* contests, CQ has run its second era of VHF contests since 1985. These events have some interesting and unique features. The CQ contests once again showed no peak in their log entry participation, unlike the ARRL contests in the 1990s. This may be due to a variety of factors, including the fact that far fewer contesters submit log entries to the *CQ VHF* than in the ARRL events. As a result, any peaking of data in the *CQ VHF* contest may have been washed out by the lower log entry rates. *CQ VHF* also made a radical rules change in 2000, moving to a "two band only" format. More effort has recently been given to the consistency of contest administration, as well. Currently, the *CQ VHF* is enjoying a resurgence of popularity.

An age-wave of experienced and mature contesters and amateur population has been noted in the literature. There may also be personality issues and preferences involved, with many operators accustomed to a fast-paced style of HF contesting. Much of the 1960s era mystique of VHF propagation and operating abilities seems to have disappeared, being replaced by a preference among some operators for quicker operating activities. Economic and sociological factors also may exist. Many amateurs in urban areas are having increasing difficulty finding sufficient room or having enough economic resources to build large antenna systems. Restrictive covenants are having a major adverse impact on the ability to erect good antennas, and available land in densely populated areas is becoming very scarce.

Log entries in June 2002 dipped to 672 entries. September 2003 hit bottom at 520 logs, and thereafter has shown signs of stabilizing. January log totals have continued to slide, however, with 2008 log counts down to 710 logs.

Current and Future Trends

Some common themes emerge from this discussion. Regulatory changes have had huge impacts upon VHF contesting, both positive and negative. Changes in technology have also affected contesting levels to some extent. Club activity has greatly influenced VHF contesting, but in turn has been impacted by both regulatory and technological changes. A general loss of interest and other demographic considerations have likewise impacted log entries. While individual rules changes have not had much impact on log activity, the cumulative effect of a series of rules changes as well as more radical rules revisions may have affected participation in both ARRL and CQ VHF contests. Some rules changes have even had unintended and adverse side effects — witness the impact on the club competition from rover scoring provisions.

There is therefore no one, single cause responsible for the tremendous swings in VHF contesting levels over the last 55-plus

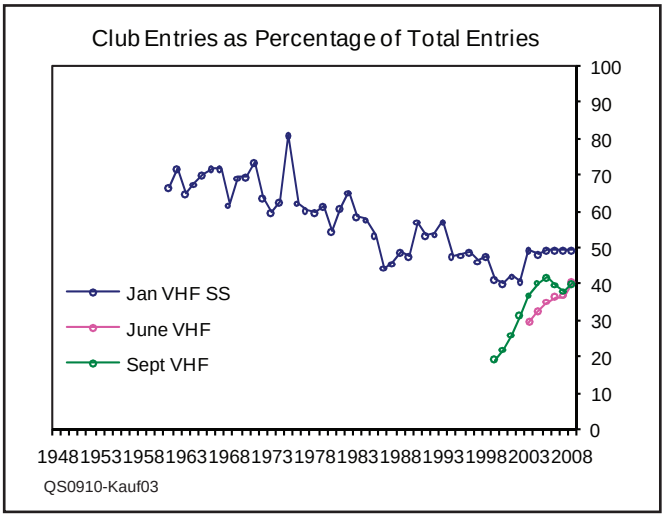


Figure 3 — Club activity in ARRL VHF contests.

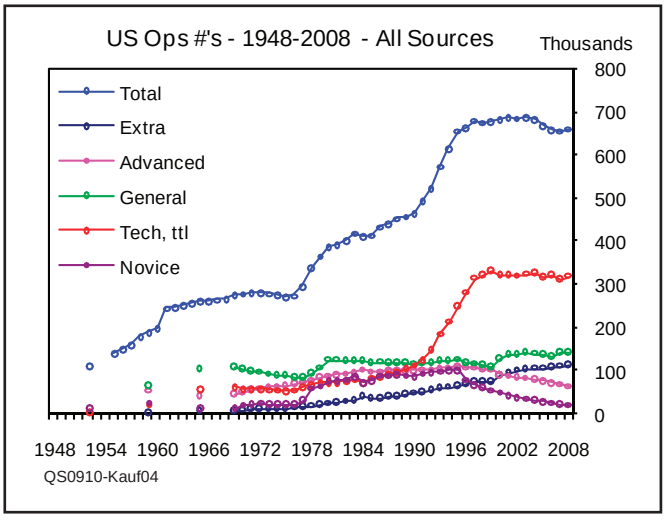


Figure 4 — The growth in US licensee totals.

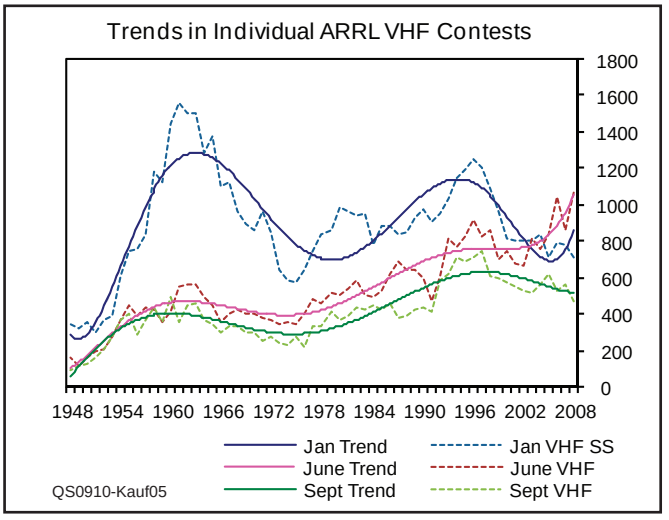


Figure 5 — Current trends in the Big Three VHF events.

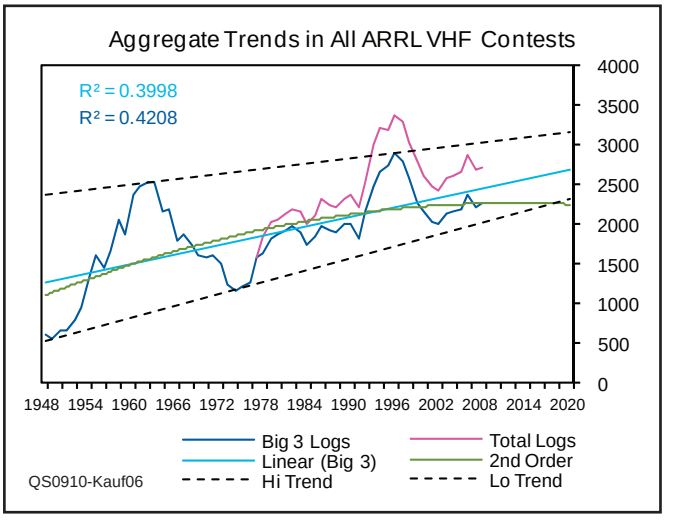


Figure 6 — Future trends in ARRL VHF events.

years. Instead, a complex mix of factors is thought to be behind the large variations in log activity.

Statistical analysis done on VHF log entry data indicates that regulatory changes and club activity levels are the biggest factors affecting contest log entries, but many other technological, demographic, social, and even economic factors are also involved.

If the 2002 log entry numbers represent a bottoming of contest levels, activity may actually be in fairly decent shape. September log entries are currently around the levels prior to the Tech explosion in the early 1990s, while June has surged far above its 1996 peak to reach new highs in both 2006 and 2008. As shown in Figure 5, trend-lines for June and September are generally positive, while the January trend is mixed. These trends infer that the June contest may regularly surpass the log entry totals of January. Indeed, the June event has now exceeded January in five of the last six years since club competition was instituted in June.

The aggregate log entry totals of the ARRL VHF contests are very useful in smoothing out the individual ups and downs of any one contest or any one year. Figure 6 shows the aggregate totals for the big three contests (in dark blue), and all six contests (in pink). Notice the uptrend in the cumulative data. The high and low trends are shown as dashed lines (in dark blue). Minimums are evident in 1949, 1974, and 2002. Maximums occur in 1962 and 1996. Of particular note, the 2002 low of the big three aggregate is 800 log entries higher than the 1974 low, while the 1996 peak had 350 more logs than in the first peak of 1962.

Projecting into the future, the linear trend-line in light blue in Figure 6 is the average trend in the historical data projected to 2020. The curve in bright blue is a second order polynomial trend-line of the same historical data. Interestingly, both trend-lines have a "goodness of fit" of 39 to 42%.

Conclusion/Implications

The central question becomes, which of the trend-lines are we following — the linear trend with its gradual upswing, or the non-linear trend of stagnation and possible decline?

Some believe that the contesting structure is completely broken, and is in need of major and radical shifts in the basic operation and style of the contests. This conclusion is often reached when many of the popular HF contests are compared against the cyclical patterns of the VHF contests. The curved trend-line best describes this view. Radical changes in the contesting rules, such as what was done with the *CQ VHF* starting in 2000, may be necessary to jump-start contest activity, with this belief.

Others feel that the contesting system is in a period of stabilization and return to normalcy, following the rapid peaking of contest activity in the 1990s. The linear, upward trend-line shown in Figure 6 is consistent with this position. With this perspective, a methodical and incremental updating of the rules structure should be deployed. The model to use would be the systematic, long-term effort at rules modernization that started in 1978 and continued into the early 1990s.

Still another belief is that contesting activity is largely a function of national amateur licensee numbers. Once the "age-wave" of current contesters leaves the airwaves, there may simply be fewer amateurs to take their place. The debate over radical versus incremental rules changes is rather irrelevant with this view. The critical issue becomes whether the US and VE amateur populations are growing or declining. Contest rules are not so critical, as much as taking deliberate efforts to increase amateur licensee totals.

Which belief is correct? That is the real issue facing us today. There may be no clear and definite path that lay ahead of us, only future trends with varying degrees of probabilities. We could end up on any of the projected paths, depending upon activity levels of individual contesters. One thing is certain, however: VHF contesting will improve if everyone gets involved. Each person can make a huge difference in the likely path that VHF contesting takes in the future. I will be looking for you in the VHF contests!

Kevin Kaufhold, W9GKA, has written numerous articles on VHF contesting and operating activities. He is very active in the VHF contests, having won Central Division awards and national Top Ten in the QRP category before moving up to Low Power. He has compiled statistical surveys for the ARRL's Fred Fish Memorial Award (FFMA) Yahoo Users Group, has compiled data on 2 meters 48 state terrestrial activity, and most recently has been moderating the VHF Distance Scoring Yahoo User's Group. Kevin also coordinates VHF activities for the Society of Midwest Contesters and writes VHF column for the SMC's Black Hole. He can be reached at **kkaufhold@yahoo.com**.

Multiop, Texas Style

My visit to a contesting superstation was an Oz moment.

Scott Straw, KB4KBS/5

As a newly transplanted resident of Houston, Texas, high on my list of priorities was meeting local Amateur Radio operators and getting involved in, or at least acquainted with, a local ham organization. To that end, and on the advice of a ham in the Atlanta area from where I had just moved, I contacted the Texas DX Society via their Web site, **www.tdxs.net**. A reply came quickly and I received an invitation to visit a contesting team at a Houston area multi-operator station. I was excited and warmed by the hospitality, but little did I know what I was about to experience.

I visited during the CW portion of the January 2009 North American QSO Party (NAQP) contest (**www.ncjweb.com**). The NAQP contests in January and August are a favorite for many because they are only 12 hours long (versus 24 to 48), and have a 100 W power limit. A single operator may work only 10 hours, so a 2 hour window for dining with the family or doing chores can be scheduled before, during or after the event. This convenience adds to the lure and draw of the contest. A team of operators, either sharing a single radio or using two simultaneously, may operate for the entire contest period with limitations that I'll explain later.

Figure 1 — The moon sets over four stacked 20 meter beams and a 3 element 80 meter beam — and this is only part of the NR5M antenna farm.

The "Shack"

I visited the shack of George DeMontrond, NR5M (**www.nr5m.com**). The term "shack" often refers only to a table in an unused bedroom, office or a corner of a basement or garage. Occasionally it is an entire dedicated room attached to a home or in an outbuilding. In the case of NR5M, it is a small house on a ranch populated with no less than eight 100+ foot towers flying both beam and wire antennas (see Figure 1). A large room of this house has been converted to a command center for full-on, aggressive radiosport contesting.

I arrived around 2 PM, after the contest had begun and was totally unprepared for what I was about to see. First of all, the idea of an entire house devoted to a contest station was a new concept to me. Granted, it was a small, 1600-1800 square foot building, but it was clear that it served one purpose — *radiosport contesting*. The living room was spartan but functional; several couches and recliners were strategically placed around the only major piece of nonham radio electronics — a large screen TV for watching football, NASCAR and other sports. The kitchen was a "come and go" facility for quickly grabbing nourishment during brief breaks in the contesting action.

The war room was beyond belief (see Figure 2). I had always read and heard about these places but I had never seen one. Even pictures I had seen in *QST* and on the Internet of other similar setups couldn't compare. There is a phrase that describes something that garishly larger than life — the term is *on steroids*. I find even that reference inadequate when comparing an average ham radio station to this one.

There were 10 fully functional, state of the art, top-of-the-line transceivers, each connected to a dedicated computer running contest logging software with two-way data exchange between the rig and the CPU. A flat-panel monitor above the radio displayed data about the radio — frequency, mode and other pertinent information. The computers were all networked so that each operator could see all of the entries in the contest log in real time, including the other operating position's frequencies and recent contacts.

Of course, there were a lot of other gadgets and accessories that connected the radios to the widely varied collection of antennas outside on "the farm." A larger 40 inch flat panel served as a master display at one end of the room, displaying each station's informa-

Figure 2 — The war room at NR5M. Two of the single-band stations. Each includes a separate transceiver and amplifier for running and sweeping. All stations are networked to share log information. This is the nerve center and front line for the NR5M team's radiosport action.

tion in side-by-side windows for quick reference and the amusement of spectators.

Operations Central

A pair of radios was dedicated to each of the HF contesting bands: 1.8, 3.5, 7, 14, 21 and 28 MHz, sharing a single transmit antenna. Operators sit side-by-side: one anchors on a frequency and CQs, inviting other contest participants to reply, while the other scans up and down the band for other CQing stations and contacts them. The ironic twist is that the anchored operator is called the *running* station. The other is called the *sweeper* or *search-and-pounce* (S&P) station. The exchange is dutifully logged by the contesting software.

The NAQP rules state that a maximum of two radios are allowed to transmit at any given time with only one signal per band, so each pair of radios has an electronic transmit lockout system. Even so, a set of predetermined hand signals and close attention is mandatory for the pair to cooperate successfully. In the space of 60 seconds, each radio in a pair may transmit 8 to 10 times, but never simultaneously. The two paired teams use this system to get maximum exposure while staying within the confines of the rules.

The running station normally takes precedence over the sweeper station, but it is not uncommon for both stations to make contacts with two different stations in a choreographed manner. This is facilitated by using preprogrammed messages stored in the computer. By pressing a function key on the computer keyboard, the computer sends the message to the radio, which then transmits it. It isn't totally automated, however. There is a keyer at each position that sees lots of use when the contacted station asks for repeats or information that can't be satisfied with the preprogrammed messages. Additionally, the decoding of the received signals is all done aurally. The most sophisticated computers and the most advanced software, even at their best, are no match for the ear of a top-notch CW contester.

The Bell Ringers

The first thing that hit me as I entered the room was the eerie silence. Four operators in two teams were positioned at radios, all with headphones on. It was obvious they were intently focused on listening. Their one hand was poised over the computer keyboard, the other on the CW paddle as their eyes were fixed on the computer monitor. One member of the symbiotic pair, as if he were a traffic cop, would wave his hand toward his partner signaling him to either proceed or halt transmitting (see Figure 3).

At a different position, a fifth operator was scanning up and down a third band, recording the frequencies of running stations. In time, when that list of new ones reached sufficient size, one of the duos would take a break so that an operator could join the fifth and begin an assault on the third band. In the meantime, another operator would begin tuning yet another band for new stations to work.

One noise that constantly interrupted the silence was the ringing of "the bell" (see Figure 4). Each time a new state, province or country was contacted, the news of the new multiplier was shared with the rest of the team by ringing this fire alarm-sized bell, similar to what would be found ringside at a boxing match.

Strategy and Tactics

One of the challenges is knowing when to abandon a daytime band and start tackling a nighttime band. This is a critical decision because the rules state that once you change to a different band and begin operating, you are committed to the new band for a minimum of 10 minutes. As the contest reached its midway point of 6 PM and the sun began to set, the band-switching decisions became critical. If you jump too soon because you hear a few stations on the new band, you are committed to it and stand the chance of missing some valuable stations on the band just vacated. If you wait too long, you've lost valuable time on the new band.

Because the NR5M station could have operating teams on any of the bands, they

Figure 3 — The 40 meter run station operator Bill, K5GA, signals sweeper Roy, AE5Q, to stand by. Close coordination allows "tag team" operation on a single band.

Figure 4 — The Texas-sized Mult Bell that spread the news when a new multiplier was captured.

began a carousel-like rotation through the six positions during this day-to-dusk transitional period. They would post two operators on the busiest band and put single operators on three of the marginal bands. These three would busy themselves making lists of running stations not yet worked on their respective bands, then alternate in 10 or 20 minute cycles of manning the second on-air station. In time, one of the bands would finally dry up. The operator of the now dead band would then transition to be the second operator on an opening band and the duo would voraciously attack it. The fifth operator would continue to troll through the other bands looking for stray multipliers to enhance the score.

Many more tactics were employed, some more subtle than others, but all were well within the limits of the rules. These contesters know that there are multitudes of opportunities to cheat in the game, but like golfers, they pride themselves in doing the right thing, even if it means accepting a self-imposed penalty. A win without honor is not a win. Besides, with a championship-caliber operating facility, there is no reason to cheat.

The Team and the Totals

Eventually, as the various operators "came up for air," I was able to meet them and found them all to be a likeable lot. The operators at this contest were (in no particular order) Bill, K5GA; Roy, AD5Q; OJ, K1OJ; Mike, K5NZ, and Dennis, NT5TU. George, NR5M, was the host, of course, and served as the able coxswain for this synchronized crew. Kenny, KZ5KJ, was the station's busy technical manager.

As the night wore down and the contest neared a close, the number of stations not previously worked began to dwindle dramatically. New multipliers became scarce and the bell rang less frequently. During the last minutes, finding "fresh meat" (any new contact) became a real struggle. Then, at the stroke of midnight, it was over.

The raw score for the team was astonishing with possible records being set for the number of contacts on several of the individual bands. The multiplier total was also respectable, if not a record itself. A spot check of the raw scores posted on "3830," an Internet "brag board," shows that this station was one of only two that claimed over 500,000 points. (See **www.contesting.com** for information on 3830 and browsing the score and comment archives.)

When I finally arrived back home at 1:30 AM, I realized that I had just experienced an *Oz* moment. I had been to someplace special and experienced an event that will forever change how I think about ham radio. I know that with practice and dedication my skill level will improve. I would consider it a high honor to be invited to fill a seat at this station some day, but based on level of mastery that I observed at this event, I know that it will be a long road.

All photos courtesy of the author.

Scott Straw, KB4KBS/5, an ARRL member, was originally licensed in 1983 and holds a General class license. He moved to Houston after living in Atlanta for 20 years because of a promotion within his company. He works as a Project Engineer for AVI-SPL, an audio, video and visual display solutions designer and integrator. He enjoys all radiosport contesting but prefers the team-contesting dynamic and camaraderie. He can be reached at 7511 N Linpar Ct, Houston, TX 77040-5169, **kb4bks@mindspring.com**. QST

QEX
A Forum for Communications Experimenters

In The September/October 2009 Issue:

■ Richard Chapman, KC4IFB shows how to use the Arduino prototyping board to design a project, and then gives us a lesson in programming the microprocessor to "Build a Low-Cost Iambic Keyer Using Open-Source Hardware."

■ W. G. Moneysmith, W4NFR, was a new repeater trustee needing a duplexer for a 70 cm repeater. He presents his solution in "A Homecrafted Duplexer for the 70 Centimeter Band."

■ Robert Zimmerman, VE3RKZ, describes one of his recent antenna experiments in "An Easily Erected 20 Meter Antenna for Emergency Use."

■ Gary Steinbaugh, AF8L, presents Part 4 of "A Cybernetic Sinusoidal Synthesizer." In this installment, Gary describes an RF power level control module for the synthesizer, and concludes with a 53.3 MHz low phase noise synthesizer using the 10 MHz reference signal.

■ Mike Hamel, WO1U, discusses "Phase Controlled Differential Drive for EER Amplifiers" in this presentation about envelope elimination and restoration as a way to achieve linear operation with high efficiency (such as Class E) amplifiers.

■ Bob Miller, KE6F, explains how you can use a surplus rubidium oscillator to build an "Atomic Frequency Reference for Your Shack." Bob presents information about the stability and accuracy of rubidium oscillators, as well as a number of practical applications for such a reference.

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The 2009 ARRL November Sweepstakes

ANDREW TEMME, KB7ESD

It's that time again! 2008 SS was such a great experience. Get on the air and let's make 2009 SS even better! Try to break your personal high score, earn a Clean Sweep or a Participation Pin, or even top honors in your ARRL Section or Division! Complete rules can be found at **www.arrl.org/contests**.

New Changes for 2009

■ Logs must be received at headquarters within *15 days*. Submission deadlines are:

CW: 0300Z Tuesday, November 24, 2009
SSB: 0300Z Tuesday, December 8, 2009

■ Scores will be tabulated and available online in *60 days*. Full write-ups will still appear in the May and June *QST*.

While paper logs will never be refused, submitting an electronic log in the Cabrillo format has never been easier. Learn how at **www.arrl.org/contests**. You can e-mail Cabrillo-formatted logs for CW SS to **sscw@arrl.org** and SSB logs to **ssphone@arrl.org**.

Can you feel the fun? Don't miss Sweepstakes 2009!

CW: 2100Z Saturday, November 7 – 0300Z Monday, November 9
Phone: 2100Z Saturday, November 21 – 0300Z Monday, November 23

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Sean's Picks

■ **State QSO Parties this month:** Arizona, California, Illinois, Iowa, Pennsylvania

2009 is the Year of the State QSO Party! Visit **www.arrl.org/ysqso** for details!

■ **10-10 Sprint (October 9):** Try your hand on 10 meters and collect as many 10-10 numbers as you can. Get more than 10 and you can apply for membership in Ten-Ten International.

■ **YLRL Anniversary Party (October 9-11):** Here's one for the ladies! YLs only; QSOs with OMs do not count. Exchange is a sequential QSO number and your ARRL section, Canadian province or DXCC country.

■ **QRP-ARCI Fall QSO Party (October 17-18):** 12 hours of CW fun with 5 W or less. If you've never tried QRP before, give it a shot; you will be amazed what you can work with "flea power."

■ **CQ Worldwide SSB Contest (October 24-25):** The largest DX contest on the planet. Serious competitors and casual operators cannot resist the amount of juicy DX to be found during this event. Do not sit on the sidelines for this one — get in there and experience it for yourself.

OCTOBER 2009 QUALIFYING RUNS

♦ W1AW Qualifying Runs are 10 PM EDT Friday, September 4 (0200Z September 5) (10-40 WPM) and 7 PM (2300Z) Wednesday, September 16. The West Coast Qualifying Run will be transmitted on 3581.5, 7047.5, 14,047.5, 18,097.5 and 21,067.5 kHz by station K6KPH at 2 PM PDT (2100Z) Saturday, September 19. Unless otherwise indicated, code speeds are from 10-35 WPM.

W3UR

HOW'S DX?

ZK2V 2009

Chris Tran, ZL1CT/GM3WOJ

The island of Niue (IOTA ref OC-040) is a raised coral reef 2200 km northeast of Auckland, New Zealand. Niue has no resident amateurs and has not been visited by any major DXpeditions, but is a popular destination for *holiday DXpeditions* usually lasting 1 or 2 weeks. Now semiretired from my career as a physics educator, I decided to go to Niue for a longer period to work as many stations as possible at this sunspot minimum. I had intended to go in February/March 2009, which would have given better propagation but circumstances beyond my control meant I visited Niue in May/June 2009.

Your first impression of Niue is heat. Everything is at the same temperature, whereas in New Zealand the air temperature might be +28°C but the ground temperature is only +15°C. In Niue everything is hot. Throughout the year the temperature varies over a surprisingly small range of +20 to +30°C. Humidity and air salt content are high, and corrosion of radios and computer hardware is a long-term problem. Niue is a virtually flat island, about 20 meters above sea level, so almost any location gives good take-off angles in all directions. I stayed at the radio-friendly Namukulu Motel, as used by several previous DXpeditions. Niue is an entirely cash society with no ATMs or electronic transfers, so we nearly ran out of New Zealand dollars toward the end of the DXpedition.

I have many years of experience with contesting and contest DXpeditions, both single operator and multioperator, so preparations were reasonably straightforward. I was very grateful to all the sponsors, both club and individual, who made it possible for me to stay for 5 weeks.

I learned my CW weak signal skills in a hard school — 70 MHz contests in the United Kingdom in the 1980s. The 70 MHz band has great tropo, but signals are often weak, with flutter and fading — I was determined to copy all the information accurately to earn these extra points, which paid off then and again at ZK2V.

Two parcels (9 kg) containing my spare transceiver, coax and some wire antennas were dispatched from New Zealand to Niue about a month before the DXpedition. This meant my sports bag containing the other gear weighed 21.5 kg. I arrived at the Air New Zealand check-in, ready to pay for the extra 1.5 kg, but was told "Oh, it's sports equipment (no argument from me — radiosport) in a sports bag, so you have 30 kg allowance, not 20 kg." Ouch — if I had known this in advance it would have made my planning easier and I could have taken more coax cable, which would have made band changing less time consuming. All of the equipment I took worked well especially the Tokyo HyPower 500 W amplifier that proved to be essential.

COURTESY CHRIS TRAN, ZL1CT/GM3WOJ

Chris, ZL1CT/GM3WOJ, operated as ZK2V from Niue Island for over a month between mid-May and mid-June making some 15,817 QSOs. Here is his DXpedition station.

I spent hours researching and testing antennas. I knew propagation was likely to be poor, so I wanted single band resonant wire antennas that would work well but be easily transported — no traps, coils, linear loading or antenna tuners, thanks. Have a look at the Web site antenna page (**www.zk2v.com**) for more details. The most successful antenna was the half-square, which I used on 20 meters and 17 meters. This largely neglected simple antenna is easy to construct and resonate and works really well for DX. I had two 12 meter Spiderbeam poles to support antennas and luckily there were also several suitable trees, which allowed me to have seven antennas available for use most of the time.

Propagation during the 5 weeks was good to Japan and the USA as you would expect, but patchy to Europe. 160 meters and 80 meters were very disappointing — strong local power line noise and tropical static made working any stations very difficult. I was surprised at how different from New Zealand propagation on 40 meters and 30 meters was, with good openings in the first week of the DXpedition, but poor afterward. Twenty meters and 17 meters were good for most of the 5 weeks. 15 meters was patchy and 12 meters was only open on 3 days in total. I obtained a special one week permit to operate on 60 meters, the first activity from Niue. My simple inverted-V antenna and high static levels resulted in only 55 QSOs on 60 meters in total. I did give Pete, NØFW, his DXCC entity #84 on this band.

The **www.zk2v.com** Web site was a great success. My daily diary of results kept everyone interested and I was able to rant about bad operating and other radio issues without fear of reply. One of the most popular pages was the log search. Michael, G7VJR, and Marios, 5B4WN, put a lot of effort into making the *leaderboard* software work with the CDXC Club Log Web site (**www.clublog.org**) in time for ZK2V. This meant that stations were able to compete against their friends (or rivals) to see who had worked ZK2V on the most band slots. The eventual winner was Jeff, N8CC, who worked 16 out of 20 possible slots.

I've never been a data modes operator, but enjoyed using RTTY for short periods. It was a contrast to the tough CW pileups. I used the Yaesu FT-840 transceiver instead of the Elecraft K2, which meant changing cables over each time I wanted to use RTTY, but this was not a big deal. The pileups on

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RTTY were huge. They spread over many kHz but generally it was easy enough to maintain a good QSO rate. By using CW reverse on receive, lower sideband on transmit and always working split, I could use the INRAD 250 Hz CW filter in the radio, which made separating the pileup stations easier. I made 1276 QSOs on RTTY and 18 QSOs on PSK31.

At an early stage I decided that I wanted all QSOs to be confirmed on LoTW as quickly as possible. The Internet connection proved good enough to do this daily or every second day, which made it easy for everyone to see whether their QSOs with ZK2V were valid for DXCC or not. Kathy, KA1RWY, at the ARRL LoTW desk issued me a certificate about 4 weeks before I left for Niue and I sent her a photocopy of my license as soon as it was issued to me.

Final QSO total was 15,817 QSOs. I had hoped to work at least 30,000 stations but it was not to be, this time. Overall, ZK2V was great fun despite disappointing conditions to Europe. The Niue TV crew visited me and I was on the nightly news, so everyone on Niue waved when they saw us out walking. I have arranged a new location for another ZK2V DXpedition in late 2010, if possible. My wonderful spouse, Pippa, made many friends in the Niue weaving community and is happy to go with me for 10 weeks next time. Thanks to all my sponsors and support team and to everyone who worked ZK2V. Please QSL via N3SL.

DX NEWS FROM AROUND THE GLOBE

3D2 — CONWAY REEF

The Conway Reef Web site is now up and running at **www.conwayreef2009.de**. The dates for the operation are October 1-10, with seven operators. Jan, DJ8NK, reports all is on schedule; the paperwork is done; the flights are booked; the boat, a catamaran, is chartered, and the "hardware is at hand." Tests of the antennas will be done during the next weeks, even at the beach on the North Sea, "under salt water conditions."

8Q — MALDIVES

Andy, G7COD, is planning to go back to the Maldives (AS-013) in October. He'll be QRV as 8Q7CQ from Embudu Island from October 12-25. Andy will be using an ICOM IC-7000 transceiver running 100 W into a "Carolina Windom CWS 160 Special antenna" hanging from a tree and an Inverted V dipole for 20 meters. Activity will be on 3.5 through 24 MHz on SSB and CW. Listen for him daily at:

0730-0830, 0900-1030, 1300-1500 and 1730-1800Z on the following frequencies (±10 kHz):

SSB — 3.795, 7.063, 14.147, 18.133, 21.253 and 24.953 MHz.

CW — 3.503, 7.003, 10.103, 14.003, 18.073, 21.003 and 24.893 MHz.

QSL via G7COD either direct to Andrew Kitchen, 4 Dairy Cottage, Newton Hall Farm, Bank Newton Skipton, North Yorkshire, BD23 3NT, England or via the bureau.

C3 — ANDORRA

Andorra has been a member of CEPT, Europe's Conference of Postal and Telecommunications Administrations, since 1995. Andorra has not implemented TR61-01, however, which would allow non-Andorran Amateur Radio operators to operate as C3/home call. Any C3/home calls are illegal reports Joan Manel Sauri, C31US, President of Unio de Radioaficionats Andorrans (URA; **www.ura.ad**). Members of the URA plan to operate in the 2009 CQ WW RTTY Contest (**www.cq-amateur-radio.com**) over the September 26-27 weekend.

CYØ — SABLE ISLAND

A three man team is heading to Sable Island this October. Team member NØTG says all is on target with pre-planning and preparation continuing. A challenge is to stay under the weight allowance. The charter aircraft limits the group to 1400 pounds total, which includes the three team members themselves, personal baggage, radio gear including antennas and computers plus food. NØTG says it looks like the low bands will be very productive at this point in this solar cycle. He is pleased and excited to have a Battle Creek Special 160 meter antenna to take along, with a lot of interest in Europe and elsewhere in working CYØ on 160. He says they are not experienced RTTY operators but have equipped their stations with the needed interfaces and software and are trying to learn how to do it before the expedition. They've been making contacts and feel all set up and ready. Northern California DX Foundation in particular has encouraged RTTY operation. Worldwide traffic on their Web site continues to increase. **www.CY0dxpedition.com**.

DL2FAG GOING TO THE SOUTH PACIFIC

Karl, DL2FAG, is heading to the Pacific for a three island holiday style operation lasting 6 weeks. First stop will be on Niue Island where he will be QRV from October 19 to November 7. He has already received his ZK2DL license from the Telecommunications Department of Niue. Plans are to use an ICOM IC-7000 transceiver, triple leg multiband antenna and dipoles for activity on 3.5 through 28 MHz, mostly on RTTY, PSK and SSB. His next operation will be from New Zealand's South Island for activity as ZL4/DL2FAG November 8-18 with expected QRV on 7 through 28 MHz on RTTY, PSK and SSB. Karl's final stop will be on Samoa where he will be QRV November 17-30 again on SSB, RTTY and PSK on 3.5 through 28 MHz. He has already received his 5WØKH license from the Office of the Regulator in Apia. Karl has a Web site with details and a log search for his upcoming ZK2, ZL4 and 5WØ trips at **www.qsl.net/dl2fag**. QSL via DL2FAG.

DX GATHERING

Tickets for the Southeast DX and Contesting Organization (SEDCO) are now available at **http://sedco.homestead.com**. SEDCO V event will be held on September 26, 2009.

FH — MAYOTTE

Willi, DJ7RJ, is heading to Mayotte. Look for him to be QRV September 22-October 21 with special call TO7RJ. Then from October 21-25 he will be operating as FH/DJ7RJ. Activity will be on 1.8 through 28 MHz and possibly 50 MHz on CW and SSB. QSL both calls via DJ7RJ.

FP — ST PIERRE AND MIQUELON ISLANDS

Tim, FP/MØTDG, and Martin, FP/G3ZAY, will be on Miquelon September 24-27. They plan to be on CW and SSB on the low bands. Equipment availability and baggage limits will be factors in their plans. QSL to their home calls. Martin will also try to get to McNutt's Island in VE1, NA-126, September 29.

FP — ST PIERRE AND MIQUELON ISLANDS

Eric, KV1J, tells us he is planning a return to St Pierre and Miquelon (NA-032) this month along with his brother Tom, W8TOM. The brother team will be QRV from Miquelon Island (grid locator GN17) as FP/KV1J and FP/W8TOM October 20-27. Activity is expected on 1.8 through 50 MHz. They will have an amplifier running about 700 W on 80 through 10 meters. The brothers will be on SSB, CW, RTTY and PSK. During the CQ World Wide SSB DX Contest (**www.cq-amateur-radio.com**) they will be in the multisingle category as FP/KV1J. For more details and up-to-date information, visit their Web page at **www.kv1j.com/fp/october09.html**. QSL via KV1J, direct, by the Bureau or LoTW.

J7 — DOMINICA

Babs, DL7AFS, and Lot, DJ9ZG, have announced their plans for their late September through mid-October DXpedition to Dominica. Look for J79ZG to be QRV on 3.5 through 50 MHz on SSB, CW, RTTY and PSK September 27-October 15. They have a Web page at **www.qsl.net/dl7afs**. QSL via DL7AFS.

LX — LUXEMBOURG

LX/PA6Z in Wiltz, Luxembourg, will be on the air October 4-10. The operators will be PAØJED, PAØTEN, PA1H, PA2AWU, PA2PKZ, PA4VHF, PA5CA, PA5R, PE2HG and PD9DX. They will be on CW, SSB and PSK31, 160-10 meters. They will also do some WSJT meteor scatter operation on 6 meters. QSL via PA9M direct or bureau. Their Web site is **www.pa6z.nl**.

N7OU HEADING BACK TO PACIFIC

Bill Vanderheide, N7OU, has announced his plans to go back to the South Pacific. This time for a solo DXpedition to Chatham Island and then Rarotonga, South Cook. He'll be QRV as ZL7/N7OU September 18-30 on 3.5 through 28 MHz CW only running 100 W and a vertical. Next he'll be operating as E51NOU October 5-30. Again on 3.5 through 28 MHz CW only with 100 W and a vertical. From Rarotonga he will be QRV in his spare time. QSL both operations via his home call N7OU.

TY — BENIN

Four Dutch hams will be in Benin signing TY1MS October 10-27. PA8AD, PA3AN, PA3AWW and PDØCAV will be in the CQWW SSB Contest. They will also be raising funds for a "Mercy Ships" project in Benin. QSL direct or via the Internet. Cards will go out near the end of the year. **www.benin2009.com**.

WRAP UP

That is all for this month. A special thanks to ZL1CT/GM3WOJ, KE3Q and *The Daily DX* for this month's news. Until next month, see you in the pileups! — *Bernie, W3UR*

W3ZZ

THE WORLD ABOVE 50 MHz

Two Meter E-Skip in July

I enjoy testing new 2 meter transverters. Every time I test a new one something unusual and interesting happens on 2 meters and above. In July 2004 while testing the Elecraft XV144 I encountered the best North American 2 meter E-skip (E_s) opening in years. In 2006 while testing the DEMI 144-28HP we ran into the largest X class flares ever recorded. In mid-July this year I was asked to test a homebrew 2 meter system. The transverter system was based on a low power DEMI transverter driving a 60 W solid state driver amplifier from a meteor scatter transmitter. It was for the K8GP contest station to be used as a driver for the backup amplifier and for digital communications. I had to wait less than 2 weeks — July 29 — for one of the best 2 meter E_s openings of this decade.

Two Meter E_s

For the detailed information indicated below, I am indebted to DXSherlock at **www.vhfdx.net**, the **dxworld.com** propagation reflector and to my many correspondents: KØAWU, KØSIX, KMØT, NØIRS, NØJK, NØLL, NØGZ, NØUK, WØDB, WBØULX, WDØT, WYØV, K1TR, K1WHS, KB1DSY, N1DPB, N1SZ/3, N1SV, W1ZC, K2OVS, WB2CUT, N3ALN, K4ZOO, N4LI, VE3KKL and KP3FT/W2.

As often happens, the major opening later in the day was heralded by a few E_s contacts at midday from 1529-1600Z between Florida and Ohio. The main event began several hours later at 2158Z with a contact between K1TR (FN42) and W9RM (EN52). Follow along in Figure 1 to see how the opening developed. The best evidence is that the center of reflection at the beginning of the major event had probably split into more than one piece. One center continued to reflect signals from Florida and the Gulf Coast either north or northeast. Another center reflected signals from the Northeast and Mid-Atlantic into the Southwest and the lower WØ areas. A third center propagated signals from the Northeast into the Upper Midwest (W9, WØ). This center eventually expanded to support contacts from the Mid-Atlantic and the Carolinas northwestward.

Contacts were made over a very wide area extending from DN94 and DM98 to the west, southern Florida to the south, almost the entire East Coast, east barely to FN53 (reported by K1WHS) and north to EN18 (west) and FN35 (east). The reflecting cloud(s) tend to drift from southeast to northwest with time in most E_s events but it is not clear that was the case this time. More likely based on the appearance of more southerly stations late in the opening, the wide variation in ionization made it appear that the clouds were drifting when in reality signals were just dropping in and out. This particular opening occurred very late in the E_s season. It was long in duration for North America, had an orthogonal star shaped pattern typical of the big European openings and sharp changes in ionization leading to very short openings, which produced loud signals sometimes lasting only tens of seconds.

Several significant events occurred during this opening. The July 2008 column was devoted to one of the most extreme challenges in VHF radio, working all 48 continental United States by terrestrial propagation, a feat then accomplished by only 11 different stations, although KMØT

This Month

*October 4	Moderate EME conditions
October 7	432 MHz Fall Sprint
October 10-11	ARRL International EME Competition
*October 11	Moderate EME conditions
October 17	Microwave Fall Sprint
October 23-24	2009 Microwave Update
October 23-24	50 MHz Fall Sprint

*Moon data from W5LUU

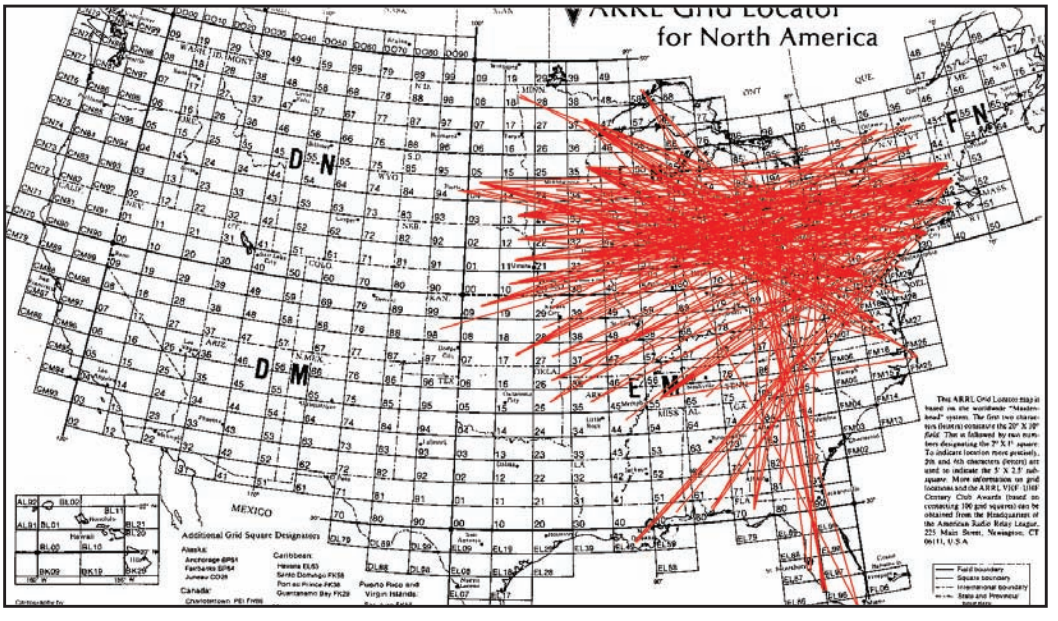

Figure 1 — The 2 meter E_s opening of July 29, 2009. Note the intensity of the opening as demonstrated by the starburst pattern and the appearance of more than one reflecting center.

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Table 1

Representative Long Distance 2 Meter E_s Contacts on July 29

Distance (km)	*Contact*
2549.6	NØYK (DM98mg) — K1TR (FN42iu)
2549.5	NØYK — WA1T (FN42it)
2340.3	WDØT (DN94vj) — K1WHS (FN43mj)
2180.1	WBØULX (EN04vn) — K1WHS
2197.8	WBØULX — W1UF (FN42kh)
2131.9	WBØULX — W3EP (FN31vp)
2110.5	WBØULX — K1MAA (FN31tv)
2061.8	KMØT (EN13vc) — WA1T (FN43ob)
1993.3	WDØT — W3ZZ (FM19jd)
1964.2	WØDB (EN11ud) — VE2JWH (FN35pj)

JON JONES, NØJK

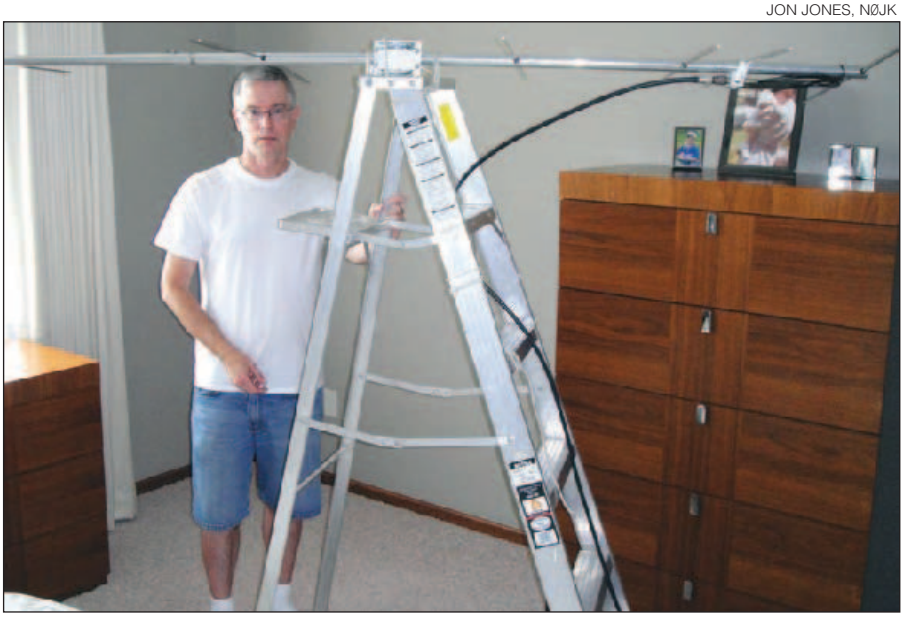


Figure 2 — Band open and you live in an antenna restricted neighborhood? Jon, NØJK, has an effective solution. Just don't get too close to the antenna.

did it twice. Since then Phil, NØPB, has completed this difficult task and the July 29 E_s opening provided number 13, Larry Lambert, NØLL (EM09os) at the extreme western end of the "feasibility" box defined in that column at the maximum meteor scatter range of 2400 km.

In Larry's own words: "TNX to NØJK who phoned I was here for the exciting contact at 2343z with K1WHS in Maine for state #48 on 2m. Hard to believe after 33 years on weak signal 2m. All non EME and no digital. Kevin W9GKA says it is the 13th time an op has worked all 48 via non EME and I am the furthest west station to do it. Been 11 years since #47 was worked W1AIM in VT and that was in the Leonids shower of 1998, which was the best meteor shower ever experienced here. K1WHS was in and out for 20 minutes. Station here is an IC251a to pr 4CX250, about 600 W and old 9913 to 14 el CC beam at 52 feet. 2½ of its elements have been broken by the birds. Boy it was exciting. I was shaking pretty good."

Dave Olean, K1WHS (FN43mg) comments: "Highlight of the evening was finally getting NØLL for his state #48 on 144 terrestrial modes. That is a huge accomplishment for NØLL and congratulations are in order for him. Rig here is a HB KW and 4 x 17 elements at 136 ft. I used the LVA for some of the southern QSOs below about 250 degrees azimuth." This contact took real perseverance as Larry and Dave have had many unsuccessful MS schedules with partials but no complete QSO. Jon, NØJK, reminds me that it has been 29 years since Kansas and Maine have been heard and worked on 2 meters via non-EME means (July 17, 1980-July 29, 2009).

While short contacts of less than 1000 km were not particularly common, long distance contacts abounded. A look at Table 1 indicates that Chad's, NØYK (DM98mg) two contacts into FN42 were the ODX for this opening. A distance of 2500 km is normally at the extreme end of single hop E_s propagation. Active 2 meter VHF stations in the DM/DN 90s and 80s are quite rare; I have worked less than half a dozen in the last almost 30 years. Quite a few contacts were made in the 2000 km range in addition to the ones noted in the table. The lack of short range contacts is probably responsible for only two contacts being reported on 222 MHz so far even though many stations [K1WHS, KØAWU, NØPB and many others] were constantly looking for an MUF >222 MHz with hopefully someone active and looking at the other end.

There are more individual stories that we have space to recount in this column. How good was this opening? That depended on your location. Peter, N4LI, at the edge of the opening in EM55 said "It was a great opening, but in no way rivaled the great VHF event of July, 2004." If you were in the middle of it you might disagree. Fred, N1DPM (FN32) notes: "This was one of the best E_s events on 2 meters I can remember (although I have missed a number of them)." Those in the lower southwest in Texas were shut out completely as were stations from the Front Range to the West Coast. Many like me found the opening later when alerted by friends (thanks Andy, K1RA).

When I reminded Bill, KØAWU, that I had worked him on 2 meters E_s one other time in 1982, he recalled: "The E_s opening in 1982 was *a life time* high point. We worked at 20:34 CDT July 11th 5-5 and 5-9. I had 109 QSOs that night — unreal. Similar area for this opening, but E_s also for single QSOs into Texas and Utah in 82. The 82 opening here lasted from 18:34-21:30 CDT there was little 'dead air' — almost all back to back QSOs."

Some like Dave, K1WHS, ran high power with large antennas but others worked people with much more modest stations. Jeff, KP3FT/W2 (FN22jr) worked 1900 km with 5 W and a hastily erected WA5VJB cheap Yagi. Jon, NØJK (EM17jr) worked five stations with 50 W and the antenna shown in Figure 2, with an ODX of ~2000 km. Finally, you have to talk fast when the MUF varies so rapidly. I heard Mike, KMØT, for no more than 10 seconds; had he talked slowly there would have been no contact.

222 MHz E_s

One of the rarest forms of VHF propagation is 222 MHz E_s. While some of the most intense European 2 meter E_s openings are over distances that indicate an MUF in excess of 222 MHz according to the calculator at **http://g7rau.demon.co.uk/default.aspx?menu=25000** or downloadable at **http://g7rau.demon.co.uk/default.aspx?menu=5000**, there is no 222 MHz band in Europe (Region 1). In the past decade here in the US we have encountered this phenomenon only five times (see Table 2). Note that only one was during the minor E_s season (February). Also the paths were not orthogonal except for the major opening in July 2004.

Given the intensity of the July 29 episode lots of people, including your conductor, were looking for a 222 MHz opening, but as of the deadline for this column I have heard of only one who was successful. John Kjos, W9RPM (EN43) worked two stations, one

Table 2

Previous 222 MHz E_S Openings During the Past Decade

Date	*Representative Contacts*
February 14, 2000	W5UWB (EL17) — W6QIW/N6HKF (DM04)
July 8, 2001	K5LLL (EM10) — VE3AX (FN03)
June 17, 2003	AA7A/W7RV (DM43, 35) — CN85, 87, 96; K7ICW (DM62) — DN13
July 6, 2004	Many contacts; see "The World Above 50 MHz," *QST*, Oct 2004, Figure 3, p 86
June 15, 2008	W5UWB — KAØJGH (EN10)

in EM95 and one in EM94 at 2231Z and 2233Z respectively, both on CW.

So this opening was like all the others except the one in July 2004, very short time duration and very narrow geographically. John says that further CQs for the next 45 minutes yielded no results. From the 2 meter map it is clear that a highly ionized path in that direction was a real possibility although paths ending somewhat farther north on the eastern end appeared to be somewhat more densely occupied. 222 MHz openings are of historical interest so I would be most appreciative of any reports of other 222 MHz E_S contacts during this opening.

Two Meter E_S in Europe

We have had some fine 2 meter E_S openings this summer in North America. But it's nothing compared to the frequency and duration of such openings in Europe. Thanks to the Make More Miles on VHF Web site at **www.mmmonvhf.de** we can provide a summary of the summer through July 31 on 2 meters. E_S was observed for ~1 hour (3 days) in May, ~24 hours (23 days) in June and ~11 hours (10 days) in July. Major openings occurred on June 15 and 21 and on July 4.

This year was notable for an emphasis on southern Europe; almost nothing occurred in northern Europe or Scandinavia. There were many openings from CT/EA into England and western and central Europe and many openings along the Mediterranean. At least 11 days had propagation into EA8 from the mainland or the British Isles and CT3 was worked or beacons heard on July 8, 9. Several extremely long contacts were made to EA8, most probably double hop E_S. These included EA8AVI (IL28fc) — UT5JCW (KN64sn) 4687 km on 6/8 and FØAJW (IN78wj) heard RU4AN (LO20qg) 3537km.

ON THE BANDS

Other 2 Meter E_S. There was plenty of 2 meter E_S besides the big July 29 event. On July 1 DXSherlock reports QSOs from central Midwest into northern New England and VE1. California (CM97) worked into VE6 (DO21). On July 2 Vic, WB4SLM, reports that KØRI (DM78) worked into EM75. DXSherlock reports CO into EM74 and 65. In a bigger opening on July 6-7 Dave, K1WHS, worked stations in EM13, 32, 46, 51, 55 and 65. Bobby, N3LL (EL86) found openings into EN21, 33, 34, 42, 50 and EM28. Al, W5LUA (EM13) says his contact with Dave was 2505 km. Ed, VP9GE (FM72) worked stations in FL EM87, 96, 97 and the Carolinas FM03, 04 with 90 W and a 12 el Yagi. DXSherlock noted VE1/2 into EM55, 63; the Northeast to Texas and the Gulf Coast and the Mid Atlantic to MO.

On 7-8 most of the contacts were from FL and the Gulf Coast to the Upper Midwest but there were a few orthogonal from TX to the Carolinas. Skip moved out west on the 9th from CA to VE6 and DO21 to DM97, 98 and EM09. On the 10th Al, W5LUA, worked stations west to DM42 and 52. Marshall, K5QE (EM31) worked into DM33 and 43. On the 11th KØGU (DN70mg) worked into CN87. July 15 Bobby, N3LL, had propagation into TX (EL09 and EM00, 10) and later in the day to FN25 on a different cloud.

DX Sherlock shows one contact from FL to OH on July 17. On July 23 the band opened from FL to the Northeast and VE3. Finally on July 28 Ray, K4ZOO (FM08) reports contacts into TX (EM20, EL19, 18) the latter at 2087 km distance. KS and MO were into FL at that time. All in all we had a July about as good as Europe on 2 meters, an exciting and unusual time.

6 Meters. Six meters continues to excel in the south, spin off some long contacts inland and be less good than normal in the Northeast to Europe. Thus Joe, W5HNK, describes the summer: "Whatever the cause, it has produced for me in EL29 an historic 6 meter experience." This includes Europe 7/21 days; all continents except Oceania in a 7 day period ending July 4; and both Asia (JA) and Europe (CT) in less than 2.5 hrs on July 12. While sending a 2 meter E_S report, Al, W5LUA (EM13) comments: "Plus a bunch of multihop stuff on 6 M to Europe."

Long distance contacts abounded. The Pacific Northwest had two rare openings to Europe. Johnny, KE7V (CN87) worked GM, DL, ON and PA on July 3 and S5 on July 8. Dave, N7DB, notes good conditions from the PNW to the south (9Z4BM, V79JKV) the first week in July. Steve, VE7SL (CN89) reached OA4TT on the 6th and Bob, K6QXY (CM88) worked Jack July 10. Meanwhile in CA, K6QXY and Chip, K7JA (DM03) worked CT1HZE on the 2nd and Chip repeated on the 15th. Hawaii was much in evidence throughout the country. Jon, NØJK, worked KH6 on the 5th and on the 6th it was Owen, K3CB (FM18), Dan, K3ZXL (EL87), Bob, W4VQ (EL98) with 5 KH6s, K6QXY and Leo, KJ6HI (DM03) along with WB6NOA and K7JA.

After a slow June east of the Mississippi Japan made its way to the East Coast. Al, K3TKJ (FM28) worked Tak, JA7QVI along with W3UR (FM19), N1BUG (FN55), W3CMP (FN10) and VE2DFO (FN25). Bill, KØHA (EN10) worked 29 JAs including Okinawa JR6 on the 6th and notes two propagation peaks to JA from his location in NE: a short one at JA sunrise soon after 22Z and one 1.5-2 hours later, which is usually longer when it occurs. Tom, K1IM (FN31) sends me a *.wav* file of him working Tak on July 8 along with W1JJ (FN41), W1VHF (FN41), K1MS (FN42) and AA1QD (FN43). K3TKJ worked Han, JE1BMJ, on the 16th, an opening that yielded only 5 W4s and a W8 in 2 hours for Han.

California continued to be well represented in Japan. Bob, K6QXY (CM88) worked JA on July 3, 6, 9, 10, 22, 17, 19 and 20; K7JA worked some on the 18th. Bob, K6QXY, notes Caribbean/South America on July 3, 8, 10 and 13. Finally OX, not always a common summer visitor, appeared on two different days: July 16 (K3TKJ, N3DB and W3UR) and July 20 (K3ZXL and WB4SLM).

I am indebted to my correspondents noted above and to N4DTF, W5AJX and WAØKBZ not otherwise mentioned for the details on these openings.

Tropospheric Ducting. K6QXY notes that the Hawaiian duct reached northern California July 7 and again on the 16th on 144, 432 and 1296 MHz. N6HY (DM04), KJ6HI (DM03) and N6CA (DM12) worked KH6HME on July 7 (tnx K6LMN).

HERE AND THERE

2009 ARRL International EME Competition. The first full 48 hour period covers 50 through 1296 MHz from 0000Z to 2359Z October 10-11 on both analog and/or digital modes. Note the rules change for this year: No form of active or passive assistance is allowed in this contest below 2.3 GHz. Be sure to read the full set of rules at **www.arrl.org/contests/rules/2009/eme.html**.

Microwave Update. The North Texas Microwave Society will host Microwave Update in Dallas, October 22-24. This is the best opportunity to get the latest in microwave technology and to meet active microwave operators including many from outside the US. More details are available at **www.microwaveupdate.org** or by contacting any of the convention staff listed at the bottom of the site page.

Fall Sprints. These are continued from last month. The 432 MHz Sprint is held October 7, 7-11 PM local time; the Microwave Sprint is October 17 from 6 AM local time; and the 50 MHz Sprint starts 2300Z October 23 and ends 0300Z October 24. See **www.svhfs.org/fall_sprint_rules.htm** for complete information.

Information technology note. Starting in the past few months some e-mail addressed to me at **w3zz@arrl.org** has been bouncing. Since my ISP has outsourced its IT to some foreign country, there is no contact point to fix this. If you get a bounce from **w3zz@arrl.org**, send the message to my real address — *ezimmerm [at] erols.com*. Replace the [at] with @ and eliminate the spaces. Make sure to get those first 8 letters correct — they stand for ezimmerman without the "an" at the end.

Errata. In the September column I miscopied both the name and the call of the farthest west station in the US to work C37NL. It was Arne, N7KA, in DM65 who has that honor. QST

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Sep 9-Oct 9, 0001Z-2359Z, Kingston, NY. Overlook Mountain Amateur Radio Club, N2H. 400th Anniversary of Henry Hudson's discovery of the Hudson River. 80-10 m SSB CW PSK 6 m 2 m 70 cm SSB FM CW PSK. Certificate. Via bureau or direct to Donald Koeppen, N2WCY, 54 Windwood Ln, Woodstock, NY 12498. **www.omarclub.org**

Sep 12-Sep 13, 1500Z-0000Z, Coopersville, MI. Michigan DX Association, W8DXI. The RF Express — Railroad and Radio Friends. 14.240 14.050 7.240 7.050. Certificate. Michigan DX Association, 1652 Rossman SE, Grand Rapids, MI 49507. **mdxa1.org**

Sep 13, 1400Z-2100Z, Berkshire, NY. QCWA Chapter 28, W2VDX/2. Heritage Day Community Hall Restoration. 14.232 7.232. QSL. Robert Fuller, 640 Jewett Hill Rd, Berkshire, NY 13736. **jbfuller@htva.net**

Sep 19, 1400Z-2100Z, Fort Worth, TX. Tri-County Amateur Radio Club, WC5C. Greer Island Activation TX058L. 14.250 7.250. QSL. Greer Island 2009 TX058L, c/o David Johnson, KB5YLG, 820 Wood Ln, Azle, TX 76020. **www.wc5c.org**

Sep 26, 1500Z-2100Z, Herkimer, NY. Ft Herkimer Amateur Radio Association, W2FHA. Town of German Flatts 10th Anniversary Living History Weekend. 14.280. Certificate. Christopher L. Bouck, 28 W State St, Dolgeville, NY 13329. **www.fhara.net**

Oct 2-Oct 11, 1400Z-1800Z, Albuquerque, NM. High Desert Amateur Radio Club of NM, Inc, N5B. Albuquerque International Balloon Fiesta 2009. 21.280 14.260 7.260. QSL. HDARC of NM, Inc, 4972 Turquoise Dr, Rio Rancho, NM 87124. **fwarrensr@earthlink.net** *or* **www.nm5hd.com**

Oct 3, 1200Z-2100Z, Harlem, GA. Columbia County Amateur Radio Club, W4O. The Oliver Hardy Festival Special Event Station — W4O. 28.360 21.260 14.260 7.260. QSL. W4O Special Event Station, PO Box 800, Evans, GA 30809. **ccarc.hamradioman.com/index.html**

Oct 3, 1300Z-1700Z, Anamosa, IA. Jones County Amateur Radio Club, WØCWP. 21st Annual Pumpkinfest and Weigh-Off. 14.260. Certificate. Jones County Amateur Radio Club, 304 S Ford St, Anamosa, IA 52205. **pumpkinfest.anamosachamber.org** *or* **www.qsl.net/kc0lgb**

Oct 3, 1300Z-2000Z, Forest, VA. Lynchburg Amateur Radio Club, N4J. 200th anniversary of Thomas Jefferson's retirement as President and his first visit to Poplar Forest, his retreat home and farm in Bedford County, VA. 14.070 PSK 14.263 7.260. QSL. Dick Hiner, W4HMK, 3977 Waugh Switch Rd, Big Island, VA 24526. **www.k4cq.n4kss.net**

Oct 3, 1300Z-2300Z, Hahira, GA. South Georgia United Methodist Amateur Radio Society, WG4UM. 28th Annual Hahira Honey Bee Festival. 146.520 28.400 14.252 7.225. QSL. SGUMARS, 2548 E Park Ave, Valdosta, GA 31605. **www.hahira.ga.us/honeybee.html**

Oct 3, 1400Z-2000Z, North Judson, IN. Starke County Amateur Radio Club, W9JOZ. Radioville, IN — The Town that Never Was. 14.240 7.240. QSL. Stark County ARC, 7495 S 500 W, North Judson, IN 46366. **www.w9joz.org**

Oct 3, 1500Z-2100Z, Robbinsville, NC. Smoky Mountains Amateur Radio Team, N4GSM. Opening of Cherohala Scenic Skyway. 14.242 7.242. Certificate. SMART, PO Box 983, Robbinsville, NC 28771-0983. **w4fmf@arrl.net** *or* **www.main.nc.us/graham/smart**

Oct 3-Oct 4, 1500Z-2300Z, Pittsburgh, PA. Rotarians of Amateur Radio, K3R. Public demonstration of amateur radio-emergency preparedness. 14.230 14.155 7.180 7.130. Certificate. Bob Mente, 305 Ewing Rd, Carnegie, PA 15106-1509. *Listen on the 20 and 40 m bands.* **www.nu3q.com**

Oct 4-Oct 31, 0001Z-2359Z, Philadelphia, PA. University of Pennsylvania Amateur Radio Club, W3KZ/100. Celebrating 100 Years of Amateur Radio at Penn. 14.260 10.115 7.030 3.530. QSL. R. R. Miller, 1507 Wilson Ln, West Chester, PA 19380-6334. *W3ABT/100 will also be on-the-air from Alumni Club members' stations.* **www.seas.upenn.edu/~uparc/history.html**

Oct 10, 1300Z-2000Z, Townsend, TN. Smoky Mountain Amateur Radio Club, W4OLB. 75th anniversary of the founding of the Great Smoky Mountains National Park. 14.310 7.070. QSL. Carroll Peabody, W4PCA, 2054 Independence Dr, Maryville, TN 37803. *Operating from the Smoky Mountain Visitor Center.* **www.smokymountainarc.org**

Oct 10, 1400Z-2200Z, Chillicothe, OH. Scioto Valley Amateur Radio Club, W8BAP. Celebrating the club's 50th anniversary. 28.420 21.365 14.265. QSL. SVARC, 306 E 4th St, Waverly, OH 45690. **grandpaguitar@hotmail.com**

Oct 10, 1400Z-2200Z, Kings Mountain, NC. Cleveland County Amateur Radio Service, NA4CC. The Battle of Kings Mountain fought October 7, 1780. 14.260 7.260. Certificate. CCARS — Special Events, PO Box 864, Shelby, NC 28151. **www.nps.gov/kimo** *or* **ki4rak@arrl.net**

Oct 10, 1600Z-2359Z, San Diego, CA. USS *Midway* (CV 41) Museum Radio Operations Room, NI6IW. US Navy Birthday 1775. SSB 14.320 7.250 PSK-31 7.070 CW 14.060 7.055 D-STAR 2m/70cm SOCAL rep. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **kk6fz@arrl.net**

Oct 10-Oct 11, 1200Z-1800Z, Athens, GA. Athens Radio Club, Northeast Georgia Amateur Radio Club and Oconee County Amateur Radio Society, K4UGA. 30 years of support to the University of GA and the Red Cross by local hams. 14.330 7.230 3.930 1.830. QSL. Athens Radio Club, PO Box 782, Athens, GA 30603-0782. **k4uga30.worldpress.com**

Oct 10-Oct 11, 1500Z-2100Z, Warren, CT. Northville Amateur Radio Association, W1W. The 48th Annual Warren Fall Festival. 21.300 14.245 7.225. Certificate. Mike Walters, W8ZY, 32 Chapin Rd, New Milford, CT 06776. **www.na1ra.com**

Oct 10, 1600Z-2000Z and Oct 11, 1300Z-2200Z, Burlington, NC. Alamance Amateur Radio Club, K4EG. 150th Anniversary of Cape Lookout Lighthouse. SSB 28.450 21.250 14.250 7.250 CW 28.055 21.055 14.055 7.055. QSL. Gary Hills, KA4KJI, 1931 Malone Rd, Burlington, NC 27215. *Will also monitor 18.081 and 10.110.* **home.roadrunner.com/~n4mio/AlamanceHam/AARC/aarc.shtml**

Oct 12-Oct 18, 1500Z-2000Z, Seney, MI. Lake Effect Amateur Radio Club, N8W. National Wildlife Refuge Special Event from Seney NWR. 14.235 14.070 7.235. QSL. Lake Effect ARC/NWR2009, 36 Southfork St, Marquette, MI 49855. **www.lakeeffectarc.info/n8w-seney**

Oct 16-Oct 18, 2300Z-2300Z, Morgan City, LA. Thibodaux Amateur Radio Club, W5YL. Power boat racing returns to Morgan City after 30 years. 14.250 7.250. QSL. Richard Barrett, 4140 Southdown Mandalay Rd, Houma, LA 70360. **www.w5yl.org**

Oct 17, 1300Z-2000Z, East Freetown, MA. US Coast Guard Auxiliary 013-06-05, K1K. Commemorating USCG Auxiliary 70th Anniversary. 28.360 21.375 14.278 7.258. QSL. USCGA-65 K1K, 80 Middle St, Fairhaven, MA 02719. **k1k.73@comcast.net**

Oct 17, 1300Z-2000Z, Media, PA. US Coast Guard Auxiliary, K3G. 70th Anniversary of the US Coast Guard Auxiliary. 21.330 14.270 7.270 IRLP 4790. QSL. Daniel F. Amoroso, 196 Dam View Dr, Media, PA 19063. **a0530407.uscgaux.info/SED2009.html**

Oct 17, 1300Z-2200Z, Merritt, NC. USCG Auxiliary Dist. 5 Div 20, W4C. 70th Anniversary of the USCG Auxiliary. 28.360 21.345 14.320 7.280. QSL. KB2NNC, 35 Bayview Dr, Merritt, NC 28556. **a0542003.uscgaux.info**

Oct 17, 1300Z-2100Z, Sayreville, NJ. USCG Auxiliary Flotilla 21, K2N. 70th Anniversary of the United States Coast Guard Auxiliary. 28.373 21.358 14.273 7.252. QSL. K2N Special Event, 165 Main St, Sayreville, NJ 08872. **a0140201.uscgaux.info/index.html**

Oct 17, 1300Z-2100Z, Swampscott, MA. US Coast Guard Auxiliary 1st. Northern Region, K1G. 75th Anniversary US Coast Guard Auxiliary. 28.485 21.285 14.285 7.285. QSL. Dr Gary G. Young, K2AJY, 1 Sutton Pl, Swampscott, MA 01907-2609. **gyoung@worcester.edu**

Oct 17, 1300Z-2100Z, Taunton/Kingston, MA. Taunton Area Communications Group, KC1TAC. 52nd Jamboree-on-the-Air from Camp Norse Kingston, MA. 147.225 14.290 18.140 7.190. QSL. Don Burke, KB1LXH, 81 Fremont St, Taunton, MA 02780. **www.freewebs.com/kc1tac/jota.htm**

Oct 17, 1300Z-2200Z, Virginia Beach, VA. US Coast Guard Auxiliary 054-05-07, W4Z. 70th Anniversary of the Coast Guard Auxiliary. 21.410 14.262 7.250. QSL. Robert Dunnington,

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

KI4VCT, 1110 Atlantic Ave, Virginia Beach, VA 23451. **QE@flotilla57.com**

Oct 17, 1400Z-2200Z, Buchanan, TN. USCG Auxiliary Flotilla 8-10 8ER, N4U. Commemorating USCG Auxiliary 70th Anniversary. 28.335 21.370 14.285 7.242 PSK31 20 m. QSL. USCGA Flotilla 8-10 8ER, 4156 Barge Island Rd, Benton, KY 42025. **ab4eg@eplus.net**

Oct 17, 1400Z-2200Z, Cartersville, GA. USCG. Auxiliary Flotilla 2-2 D-7 Lake Allatoona, W4A. 70th Anniversary of the USCG Auxiliary. 28.380 21.375 14.275 7.275. QSL. Jim Farley, KG4FXV, PO Box 641, Smyrna, GA 30081-0641. **jimfarley@att.net**

Oct 17, 1400Z-2100Z, Des Moines, IA. US Coast Guard Auxiliary Flotilla 4 8WR Div 33, KØG. Commemorating USCG Auxiliary 70th Anniversary. 28.405 21.405 14.345 7.240. QSL. John Halbrook, 6300 Stanmore Ct, Johnston, IA 50131-2842. **www.flotilla4.org**

Oct 17, 1400Z-2200Z, Duluth, MN. US Coast Guard Auxiliary, 091-08-04, WØD. Commemorating USCG Auxiliary 70th Anniversary. 28.352 21.352 14.252 7.252. QSL. John R. Whelan, 6924 W Van Rd, Duluth, MN 55803-9359. **k0jrw@arrl.org**

Oct 17, 1400Z-2100Z, East Syracuse, NY. Coast Guard Auxiliary, W2W. Auxiliary 70th Birthday. 28.345 21.385 14.338 7.238. QSL. Jan K. Just, 7537 Myers Rd, East Syracuse, NY 13057. *JOTAs welcomed.* **cgauxr92@aol.com**

Oct 17, 1400Z-2100Z, Flowery Branch, GA. USCG Auxiliary Flotilla 29 Lake Lanier, W4L. Celebrating the 70th year of the US Coast Guard Auxiliary. 21.365 14.295 7.293 145.370. QSL. Dave Wall, NQ5E, 2110 Oakpointe Ct, Buford, GA 30519. **nq5e@bellsouth.net**

Oct 17, 1400Z-2200Z, Freeport, NY. US Coast Guard Auxiliary, K2R. Commemorate 70th Anniversary of USCG Auxiliary. 28.395 21.395 14.282 7.247. QSL. Ron Tomo, KE2UK, 1049 Barbara Ct, North Bellmore, NY 11710. *From USCG Station Jones Beach, NY.*

Oct 17, 1400Z-2100Z, Jacksboro, TN. Flotilla 08E-12-05 US Coast Guard Auxiliary, K8A. 70th Anniversary of US Coast Guard Auxiliary. 21.330 14.342 7.240. QSL. Pete DeWitt, 393 Clover Cir, Jacksboro, TN 37757-4643. **petedewitt@hughes.net**

Oct 17, 1400Z-2100Z, Jacksonville, FL. US Coast Guard Auxiliary, W4W. Anniversary of the US Coast Guard Auxiliary. 28.385 21.340 14.268 7.278. QSL. Joe Mac Ivor, 12632 Blue Eagle Way, Jacksonville, FL 32225. **w4wlz@aol.com**

Oct 17, 1400Z-2200Z, Little Rock, AR. United States Coast Guard Auxiliary, Flotilla 1508, W5G. USCG Auxiliary 70th Anniversary. 14.280. QSL. WA5OFT, 9921 Echo Valley Ct, Little Rock, AR 72227.

Oct 17, 1400Z-2100Z, Omaha, NE. US Coast Guard Auxiliary, NØC. US Coast Guard Auxiliary 70th Anniversary. 28.400 21.400 14.247 7.267. QSL. Doug Eubanks, 607 W 15th Ave, Bellevue, NE 68005. **ka0o@cox.net**

Oct 17, 1400Z-2100Z, Trinity, AL. US Coast Guard Auxiliary, W4U. 70th Anniversary of the US Coast Guard Auxiliary. 28.450 21.290 14.250 7.210. QSL. Joe Kleri, N8ESI, 105 Meadowview Dr, Trinity, AL 35673. **n8esi@arrl.net**

Oct 17, 1600Z-2200Z, Canon City, CO. Royal Gorge Amateur Radio Club, KBØTUC. Operating from the World's Highest Suspension Bridge. 14.260. Certificate. Chuck Ward, 1011 Harrison St, Canon City, CO 81212. **n0kyb@bresnan.net** *or* **www.qsl.net/rghc**

Oct 17, 1600Z-2300Z, Yorba Linda, CA. US Coast Guard Auxiliary 11S 15-08, W6A. Commemorating the 70th Anniversary of the US Coast Guard. 28.407 21.362 14.292 7.268. QSL. Roy L. Lay, 219 Beal Ave, Placentia, CA 92870-2539.

Oct 17-Oct 18, 1430Z-2130Z, Stanton, TN. Haywood County Amateur Radio Group, W4H. National Wildlife Refuge Week. 146.550 28.420 7.210 3.890. Certificate. Dwayne Duncan, PO Box 355, 5 N Main St, Stanton, TN 38069. *From Hatchie National Wildlife Refuge.* **ki4bxi@comcast.net**

Oct 17-Oct 18, 1600Z-1600Z, San Francisco, CA. San Francisco Amateur Radio Club, W6PW. 20th Anniversary of the Loma Prieta Earthquake. 14.250 3.805 7.030 (CW) 7.185 (PH). Certificate. Tony Dowler, KM6DA, PO Box 1749, Pacifica, CA 94044-6749. *We will be operating from the Marina District, one of the most damaged areas of the city during the quake.* **www.sfarc.org**

Oct 17-Oct 18, 1700Z-0100Z, Arleta, CA. US Coast Guard Auxiliary, W6W. 70th Anniversary of US Coast Guard Auxiliary. 14.300 14.250 14.230. QSL. Howard Levine, 9482 Urbana Ave, Arleta, CA 91331. **w6cga@yahoo.com**

Oct 17-Oct 18, 1700Z-0004Z, Los Gatos, CA. Loma Prieta Amateur Radio Club, K6K. 20th Anniversary Loma Prieta Earthquake. 14.325. Certificate. David M. Katinsky, N2RDT, 25570 Radonich Rd, Los Gatos, CA 95033. **www.lparc.org**

Oct 18-Oct 19, 1800Z-0600Z, Anchorage, AK. Alaska DX Club, KL5O. Celebrating 50 years of Alaska Statehood on Alaska Day. 14.250. QSL. Ron G. Lago, AC7DX, PO Box 25426, Eugene, OR 97402. **al1g_ak@yahoo.com**

Oct 24, 1300Z-1700Z, Randleman, NC. Tri-County Amateur Radio Club, NC4AR. Annual NASCAR Days Festival. 14.278 7.210. Certificate. NC4AR, PO Box 747, Trinity, NC 27370. **www.qsl.net/nc4ar**

Oct 24, 1400Z-1900Z, Helena/Karnes County, TX. Radio Operators of South Texas, W5ROS. Historical Society's Indian Summer Heritage Festival. 14.265. Certificate. Andy Meyer, KD5TNI, PO Box 175, Hobson, TX 78117.

Oct 25, 1700Z-2100Z, Sandy Hook Lighthouse, NJ. Roseland Amateur Radio Club, K2A. Fort Hancock Establishment Day. 14.270 7.270. QSL. Roseland Amateur Radio Club, 300 Eagle Rock Ave, Roseland, NJ 07068. **www.qsl.net/k2gq**

Oct 29, 1400Z-1800Z, Sturtevant, WI. Gateway Technical College Amateur Radio Club, N9GTC. GTC celebrates 98 years, the 1st Tech College in WI. 21.275 14.275 7.275. Certificate. N9GTC ARC, 2320 Renaissance Blvd, Sturtevant, WI 53177. **engtech.gtc.edu/n9gtc**

Oct 30, 1400Z-1800Z, Sturtevant, WI. Gateway Technical College Amateur Radio Club, N9GTC. GTC celebrates 98 years, the 1st Tech College in WI. 21.080 14.080 7.080. Certificate. N9GTC ARC, 2320 Renaissance Blvd, Sturtevant, WI 53177. **engtech.gtc.edu/n9gtc**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9 ×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's Web site.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form, at **www.arrl.org/contests/spevform.html**. A plain text version of the form is also available at that site. You can also request a copy by e-mail or send a self-addressed stamped envelope (SASE) (Special Requests, ARRL, 225 Main St, Newington, CT 06111; write "Special Events Form" in the lower left-hand corner). Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Dec** *QST* would have to be received by **Oct 1**. In addition to being listed in *QST*, your event will be listed on the *ARRLWeb* Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through August 10. You can view all received Special Events at **www.arrl.org/contests/spev.html**. QST

VHF/UHF Century Club Awards

Compiled by Sharon Taratula
Administrative Manager

The ARRL VUCC numbered certificate is earned by amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceding call signs indicate total grid locators claimed. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from June 1, 2009 to July 31, 2009. The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/awards/vucc**. An SASE to ARRL is required if you cannot download these forms. Send questions relating to VUCC to **vucc@arrl.org**.

50 MHz
100

1682	KQ6K
1683	W1ZE
1684	LA2CQ
1685	AB5GU
1686	K5QE
1687	K5GZR
1688	W5DQ
1689	KJ5OA
1690	KB7BSA
WP4NEG	175
WAØGUD	200
LA2QM	225
W7ZSL	250
K8VFV	275
W5AJX	275
WB4KTF	300
WA5KBH	400
N4HN	425
K5UR	1150

144 MHz
100

696	K5QE
W3ZG	150
KC6ZWT	275

222 MHz
50

139	K5QE

432 MHz
50

325	K5QE

902 MHz
25

42	K5QE

1296 MHz
25

157	N4TUT
158	K5QE

3.4 GHz
5

79	K5QE

Satellite
100

182	XE1AO
WA5KBH	225

QST

K2TQN

VINTAGE RADIO

Memoirs of Old Timers

Hams have always enjoyed sharing information about themselves and photos of their stations. The Internet has provided a great venue for doing this today. The best online example I can think of is **www.qrz.com**. Hams can look up names and addresses, and if the ham in question has posted a photo, one can see their station or smiling faces.

Owned and operated by Fred Lloyd, AA7BQ, **qrz.com** is located in Phoenix, Arizona. There is no storefront, no office building, no receptionist and no paid staff. This low cost operating structure has enabled them to remain continuously online and free to the ham community since 1992.

W1BB — Stew Perry, 36 Pleasant St., Winthrop, 52, MA. Licensed 1917, Ham since 1912. Professional Engineer - Worthington Corp. Mechanical Engineering. Attended MIT. Member SA, MS, MSPE, Masonic, Winthrop Yacht Club. Service Record: USCGR WW-II. Married: 2 married sons. Hobbies: Sailing, Photo. Hold only WAC ever awarded on 160 meters (1953) Radio Officer - town of Winthrop - RACES. [Most of Stew's station is on exhibit at the New England Wireless and Steam Museum, www.newsm.org. — *Ed.*]

So what did hams do before they had the Internet? Well, most of us used the well-known *Callbook* to look up our friends. This provided an alphabetical listing of ham calls with addresses by district and countries, like a huge telephone book. For photos, hams had to rely on prints and the US Mail, or had QSL cards printed with photos on them.

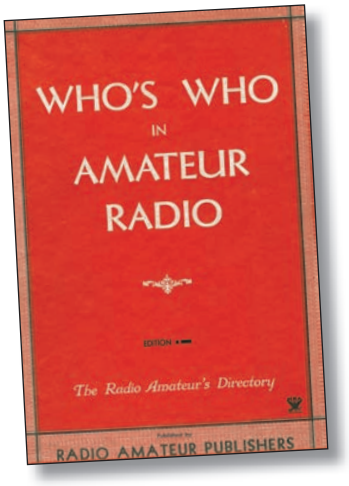
Who's Who

The "Who's Who" column was first published in *QST* in the earlier years. It highlighted well-known hams from around the country. Each column usually featured two hams.

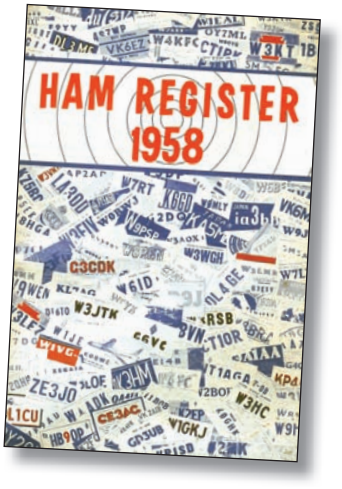
Around 1934 a New York based company called Amateur Radio Publishers came up with an idea to publish a callbook where hams could tell about their stations and other interests and also put their photo in it. They called it *Who's Who in Amateur Radio*.

They advertised that, "There is no charge for this listing of your writeup. Just send in complete details concerning yourself and the rig, — the kind of useful chat you enjoy reading about fellow hams. If you want your photo included, ask us for Form A."

Who's Who featured some advertising; most of it was from companies located on Radio Row in New York City. They promised future editions would appear semiannually. I own editions A and B, 1934 and 1935. I have not seen a later edition. To see typical page layout, please visit my Web page, **www.k2tqn.com**.



W4ZB — W. Pat McVickar, 718-74th St., N. St. Petersburg, FL. Licensed 1912 "DM" (prior to 1912), 3CE, 3VR, 4VR. Radio Designer, Radio Engineer, Electrical Engineer - Retired. Ship & Shore Station Wireless operator 45 years or more ago [written 1958 — *Ed.*] Worked in such stations as "HV" Havana Cuba, "SD" Santo Domingo, etc., sailed under 5 flags.



John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

W3WW — Paul Keller, 1246 West Lehigh Ave., Philadelphia 33, PA. Licensed 1915 - 3WW, Ex 3SM, 3DL. Sales Engineer Almo Radio Co. Clubs: P. Pres. Phila High Freq. Club, Radio Amateur Society, QCWA, OOTC, ARRL, Radio Square Club, Shrine. [Shortened — *Ed*.] Hobbies: Jazz Record Collection, old wireless apparatus and photos of Ham conventions and banquets. Began as Ham 1909.

W2JR — Earl Westfall, 95 Cadman Drive, Williamsville 21, NY. Licensed 1913 - 8JM until 1917. Auto service – for DeSoto – Plymouth Dir. Asst. Service Mgr. Member Occidental Lodge 766 F&AM, Zuleika Groto, QCWA, Radio Assoc. Western NY, Inc., Old Timers. Family: XYL & self.

W2GTB — Warren Ford, 1491 Parkwood Blvd., Schenectady, NY. Licensed 1917, Ex 1HAB, 1BEA, 2DAA. Electronic and Mechanical Design Engineer - General Electric Co. College RPI. IRE Senior Member, OOTC. Service: US Navy. Built my first radio receiver 1908, first transmitter 1910, call was "WF."

W2PU CARLOS M. BERNSTEIN
1539 East 48th St., Brooklyn, N. Y.

Special agent, 45 Elks, IRE, ARRL, International Identification Association, National Geographic Society. "Lover of the great outdoors, and study of photography, criminology and mechanics. With only a layman's knwledge of the short wave radio, he uncovered the first unlicensed SW station seized in U. S. He finds a very capable assistant in his son, Carlos R., as operator No. 2." SF, 3, 7100. SW3, SW45. Fx, Dx.

Carlos R.

A typical 1934 *Who's Who* listing. It is interesting reading.

Ham Register

Around 1957 Arthur Lewis, W3VKD, came up with a similar publication called *Ham Register*. Their listings were similar, but did not include photos. I own the 500 page 1958 edition.

Finding History Within

These two publications are very valuable to me when I need to research an early ham. Since the information came directly from the ham, I consider it to be mostly accurate. It provides an insight into their lives and interests, as well as their address at the time. Many in this 1958 edition were early wireless pioneers reaching the end of their lives and they talked about their history. It may be the only place to learn something about them. I was looking up information on some photos I recently picked up and decided to share them with you. All were listed in the 1958 edition and most of them were well-known early pioneers. We will print as many as we have room for.

I would like to encourage everyone holding photos, biographies or information about earlier hams, no matter how vague, to share good scanned copies with as many radio museums and radio historians as possible. Spread them around. Many small pieces make a story as they come together. And by sharing them with many locations, some of the information will be preserved forever. — *K2TQN*

All photos courtesy of John Dilks, K2TQN. QST

W1GHZ

MICROWAVELENGTHS

Homebrew Microwave Transverters

The past two Microwavelengths columns discussed the design and assembly of microwave transverters. My assumption was that most hams would use commercial or surplus modules and components, doing the system design and connecting the pieces together. But what if you really wanted to homebrew a transverter from scratch?

Why would someone homebrew a transverter? To improve on commercial units would require some time, as well as some expertise and test equipment. However, many active microwavers and VHF/UHF contest stations and rovers operate on a number of microwave bands. Acquiring equipment for six microwave bands with reasonable activity, between 902 MHz and 10 GHz, might require a significant investment — probably more than most of realized starting out. Anyway, rolling your own is fun and educational, and provides a real feeling of accomplishment.

So, how can someone get started in microwaves at reasonable cost? I've been working on a series of simple, low-cost transverters with moderate performance that use readily available parts, rather than the exotic and expensive parts traditionally used for microwaves. To date, I've been successful on the lower four microwave bands: 902, 1296, 2304, and 3456 MHz.

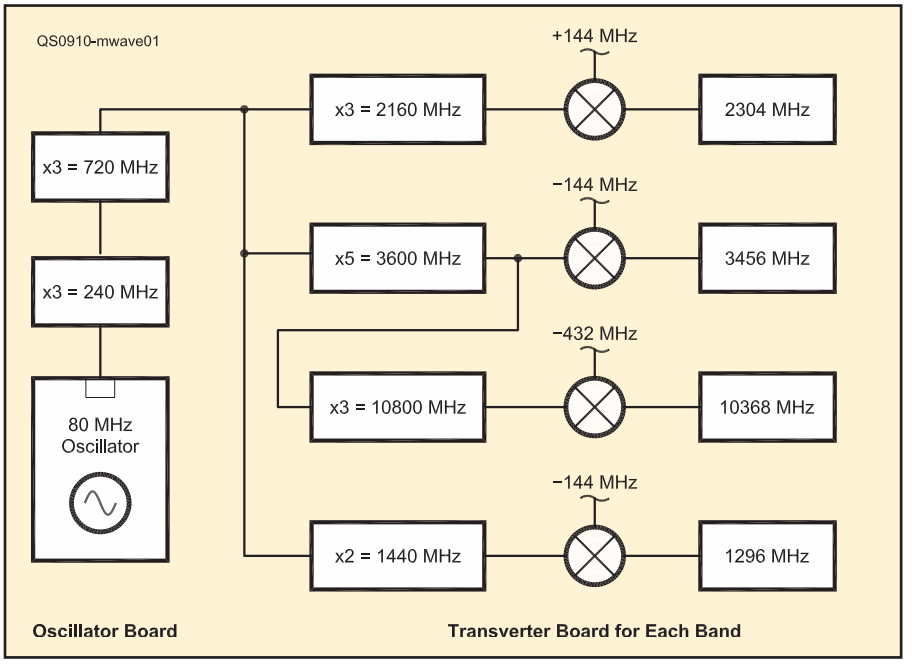


Figure 1 — Multi-band frequency scheme.

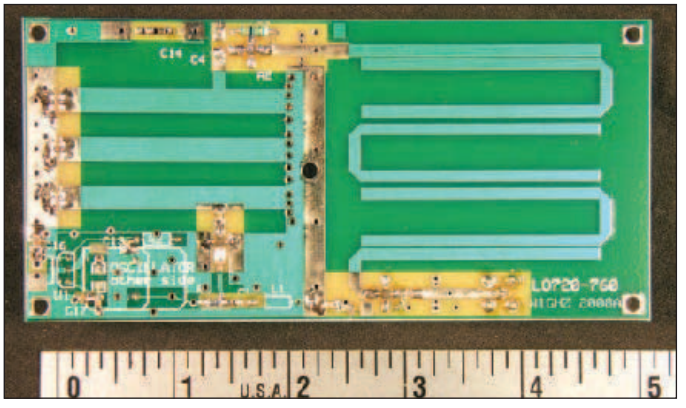


Figure 2 — Local oscillator board for multi-band transverters. Oscillator and dc wiring on reverse side.

Local Oscillator

The role of a transverter LO (local oscillator) is to mix with the incoming RX signal and produce a signal in the tuning range of an IF rig. (For example, we might want to convert 1296.100 so that it appears at 144.100 — that would require an LO of 1152 MHz.) If the math for the RX path works, the TX path will work too.

One of the harder problems with microwave transverters has always been a good local oscillator. Good crystals have gotten quite expensive and have long lead times, and many crystal oscillator circuits are temperamental. Packaged crystal oscillators for computers, on the other hand, are cheap and readily available — for a limited number of frequencies.

So the first step was to find available oscillator frequencies that would provide an IF frequency in an amateur band, preferably 2 meters or 432 MHz.

Even better, I was able to come up with a scheme to produce several bands from one common oscillator, at 80 MHz, which is multiplied to produce a microwave LO source frequency at 720 MHz. This is then further multiplied to provide an LO for 1296, 2304, 3456 and 10,368 MHz, with normal 2 meter and 432 MHz IF frequencies. Figure 1 shows the overall frequency scheme; each transverter includes the final multiplication needed for a particular band.

Harmonics of 720 MHz end up at 1440, 2160, 3600 and 10,800 MHz, conveniently 144 MHz away from 1296, 2304 and 3456 MHz, and 432 MHz away from 10,368 MHz.

That means the calling frequencies

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(1296.1, 2304.1, and 3456.1) show up on the IF rig's dial at 143.9, 144.1 and 143.9. This presents three minor inconveniences on the 1296 and 3456 bands. First, the calling frequency is out of the normal 2 m tuning range. Fortunately, most of the common choices for IF rigs can be coaxed into tuning outside of the amateur band. Second, the translated frequency on 1296 and 3456 is "upside down" so the IF rig must be set to LSB to receive and transmit a USB signal. Finally, the tuning is "backwards": to go up in frequency, the operator must turn the dial counterclockwise.

Gain is Cheap

The basic design philosophy is that today, *gain is cheap*. Traditional microwave engineering worked to minimize losses because gain was hard to come by. Today, we don't need to use exotic parts to keep losses down, because MMICs provide cheap gain — less than 25 cents per dB — so if we give up a dB to use an ordinary, readily available part rather than an expensive microwave part, it is a reasonable tradeoff. We start with the PC boards, using ordinary epoxy-fiberglass board rather than Teflon-based microwave material. The loss is perhaps a dB per inch higher, but fabricated boards are readily available without exorbitant lot charges (professionally fabricated boards have plated-thru holes, needed for consistent and reliable grounding). For capacitors we use ordinary chip capacitors, at a few cents each, rather than microwave capacitors costing a dollar each. The final tradeoff is to try and limit the number of different part values, using multiples of each value rather than many different values, since prices are much more reasonable in quantities of 100. Finally, commodity parts that will continue to be readily available are preferred.

With cheap gain, we can use printed filters on ordinary PC boards. They are somewhat lossy, but very reproducible, so no tuning is required. The PC board for the 720 MHz LO shown in Figure 2 uses two printed filters, a combline filter at the left and a hairpin filter on the right. The combline filter is tuned with chip capacitors — I found that two ordinary chip capacitors in parallel have lower loss than an expensive microwave chip capacitor.

At the higher frequencies, 2304 and 3456 MHz, printed filters had too much loss and not enough selectivity, so in these transverters I used pipe-cap filters, made from ordinary copper plumbing fittings from the hardware store. These do require tuning, but can be tuned for either band, so the same PC board design works for both bands. Figure 3 shows a transverter with pipe caps on one side, circuitry and components on the other. The white rectangle is an inexpensive mixer.

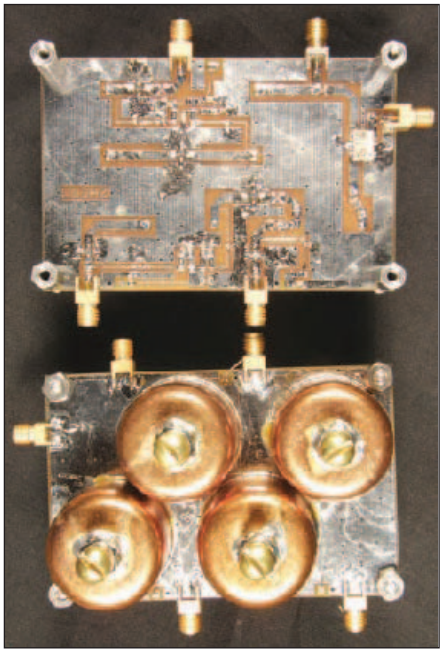

Figure 3 — Transverter board for 2304 or 3456 MHz, showing pipe-cap filters on reverse side.

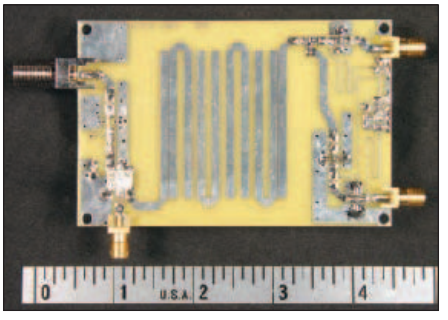

Figure 4 — Transverter board for 902 MHz with four-section printed hairpin filter.

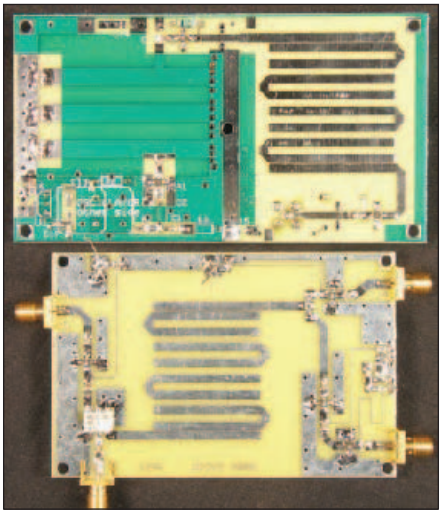

Figure 5 — Transverter board for 1296 MHz with 1152 MHz local oscillator board above it.

The transverter for 902 MHz, in Figure 4, uses a printed hairpin filter and requires no tuning. The local oscillator uses the same PC board shown in Figure 2, but with a 36 MHz oscillator and different value chip capacitors. The LO frequency is 756 MHz, which converts 902 MHz down to 146 MHz. The hairpin filter on the board requires no retuning, as it is designed to cover 720 to 760 MHz.

For 1296 MHz, the common LO scheme requires tuning backwards, which proved unpopular for this band. I went back to a normal low-side LO, at 1152 MHz. This meant a new LO board, with a printed hairpin filter for 1152 MHz, and a different oscillator, at 64 MHz. Other than different size filters, the 1296 MHz boards in Figure 5 are nearly identical to the 902 MHz boards.

Performance

All of the transverters have pretty good performance, suitable for a low-power rover. Output powers are 10 to 30 milliwatts, and receiver noise figures are around 6 dB. This is perfectly adequate for a couple of hundred miles on a clear path. Power consumption is only a couple of watts, ideal for portable operation. Using a single oscillator for multiple bands reduces size and power consumption further — CATV power splitters work fine at 720 MHz.

For higher performance, preamps and power amplifiers may be added. However, adding a good sharp band-pass filter (usually metal) is also recommended — the spurious outputs from these transverters would be excessive at higher power levels.

Summary

These simple microwave transverters make it possible to get on a microwave band for less than $100, and to have fun building it. A bit of homebrewing experience is needed, especially with soldering surface-mount parts, but the parts are cheap enough so that mistakes aren't painful. Several club projects have built these transverters, making the total quantity high enough to reduce the cost of the PC boards. See my Web site for more information, photos, schematics and construction details: **www.w1ghz.org** or **www.qsl.net/w1ghz**. QST

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

Arizona (Tucson) — Oct 17 D F R V
Set up 6 AM; public 7 AM-noon. *Sprs:* Old Pueblo RC and Radio Society of Tucson. Kino Sports Complex, Forgeus Ave and Ajo Way. ARCA meeting. *TI:* 146.8 (156.7 Hz). *Adm:* Free. Tables: $5 per space. Randy Malick, KFØX, c/o Radio Society of Tucson, Box 37882, Tucson, AZ 85755; 520-203-2006; **randy@kf0x.com**; **tucsonhamfest.com**.

Arkansas (Batesville) — Oct 10 D F R S T V
9 AM-2 PM. *Spr:* Batesville ARC. Southside Middle School, 70 Scott Dr. *TI:* 147.27. *Adm:* Free. Tables: Free. David Norris, K5UZ, 640 Josephine Dr, Batesville, AR 72501; 870-793-6431; **k5uz@arrl.org**; **www.batesvillehams.org**.

California (Fresno) — Oct 17 F S
8 AM-2 PM. *Spr:* Fresno ARC. Salvation Army Event Center, 1854 Fulton St. 66th Annual Hamfest. *TI:* 146.94. *Adm:* advance $5, door $8. Tables: $5. Tom Jarvis, KG6KYU, 36268 Manon Ave, Madera, CA 93638; 559-645-1816; **kg6kyu@w6to.com**; **w6to.com**.

CONNECTICUT STATE CONVENTION
October 11, Wallingford
D F R S T V

The Connecticut State Convention (18th Annual Event), sponsored by the Nutmeg Hamfest Alliance, will be held at the MountainRidge Resort, 350A High Hill Rd. Doors are open for indoor vendor setup and tailgating at 6 AM; public 8 AM-2 PM. Features include the largest flea market in Southern New England, indoor exhibitors, unlimited tailgating space, major vendors (**vendors@nutmeghamfest.com**), new and used equipment, forums (new this year "Antenna University"), demonstrations, emcomm equipment and vehicles on display, Annual Meeting, VE sessions (Don Mitchell, KE1AY, **dmitchell1273@sbcglobal.net** or **vetest@nutmeghamfest.com**), plenty of free parking, excellent food at good prices. Talk-in on 147.36. Admission is $7 (under 12 free). Tables are $30 each (8 ft and chair; includes 1 admission); outside spaces are $20 each (bring your own tables and tents, no electricity outside; includes 1 admission). Contact John Bee, N1GNV, 30 Tremont St, Meriden, CT 06450; 203-440-4468; **info@nutmeghamfest.com**; **www.nutmeghamfest.com**.

Florida (Melbourne) — Oct 10-11 D F S T V
Set up Friday 6-9 PM; public Saturday 9 AM-5 PM; Sunday 9 AM-2 PM. *Spr:* Platinum Coast ARS. Melbourne City Auditorium, 625 E Hibiscus Blvd. ARES Badging. *TI:* 146.85. *Adm:* advance $6, door $7. Tables: $20. Kathleen Quinn, KI4RQY, c/o PCARS Melbourne Hamfest, Box 1004, Melbourne, FL 32909-2482; 321-327-2647 (phone and fax); **quinn1225@netzero.com**; **www.pcars.org**.

Florida (Miami) — Oct 3 V
8 AM-5 PM. *Spr:* Dade Radio Club of Miami. Miami Mahi Shrine Temple, 1480 NW North River Dr. Boat dock space available if coming by boat. *TI:* 146.925 (103.5 Hz). *Adm:* advance $5, door $7. Tables: $20. Robert Cruz, KE4MCL, c/o Dade Radio Club of Miami, Box 452253, Miami, FL 33245; 305-513-8255; **hamtoberfest@gmail.com**; **www.hamboree.org**.

Georgia (Dallas)—Sep 19 D F H R T V
8 AM-4 PM. *Spr:* Paulding ARC. Earl Duncan Park (Paulding Meadows), 724 Paulding Meadows Dr (Hwy 61). 19th Annual Hamfest. *TI:* 146.895 (77 Hz). *Adm:* Free. Tables: Free. Tom Burkhart, AJ4LW, 292 Northside Church Rd, Dallas, GA 30132; 678-522-6137; **tburkhar@gmail.com**; **www.pauldingarc.com/events.html#hamfest**.

Georgia (Evans) — Oct 10 S V
9 AM. *Spr:* ARC of Augusta. Evans Middle School, 4781 Hereford Farm Rd. *TI:* 145.49. *Adm:* $5. Tables: $10. Doug Pugh, KE4JSJ, 1806 Birch Dr, N Augusta, SC 29860; 803-279-6725; **doug9945@yahoo.com**; **w4dv.org**.

GEORGIA SECTION CONVENTION
November 7-8, Lawrenceville
D F R S T V

The Georgia Section Convention (Stone Mountain Hamfest and Computer Expo), sponsored by the Alford Memorial RC, will be held at the Gwinnett County Fairgrounds, 2405 Sugarloaf Parkway. Doors are open Saturday 8 AM-4 PM, Sunday 8 AM-2 PM. Features include indoor flea market, huge boneyard, commercial tailgating ($20 per space with electric connections; includes 1 admission), major manufacturers and vendors, forums, youth lounge, contests, VE sessions (both days; registration 8-8:30 AM, testing at 9 AM sharp), on-site camping, refreshments. Talk-in on 146.76 (107.2 Hz), 145.45. Admission is $6 in advance, $8 at the door. Tables are $20 ($25 with electrical hookup; includes 1 admission per table). Contact Randy Bassett, KR4NQ, Box 1282, Stone Mountain, GA 30086-1282; 770-978-9181; **hamfest@totr-radio.org**; **www.totr-radio.org**.

Georgia (Rome) — Oct 17 D R T V
8 AM-2 PM. *Spr:* Northwest Georgia ARC. National Guard Armory, 340 Wilshire Rd NE. Al Brock Memorial Hamfest and Tailgate. *TI:* 146.94 (88.5 Hz). *Adm:* Free. Tables: Bring your own. Grover Keith, KA5QFI, Box 5002, Rome, GA 30162; 706-766-1118 or Ed Wilson, W4EMW, 706-234-7982; **gfkeith@comcast.net**;**www.w4vo.org**.

Iowa (Davenport) — Nov 1 D F H R
8 AM-2 PM. *Spr:* Davenport RAC. Clarion Hotel, 5202 N Brady St. 38th Annual Hamfest. *TI:* 146.88 (192.8 Hz). *Adm:* advance $6, door $7. Tables: $12. John Hoenshell, NØBFJ, 2331 N Linwood Ave, Davenport, IA 52804; 563-326-4985; **n0bfj@arrl.net**; **www.arcsupport.com/drac/hamfest.html**.

Kentucky (Hazard) — Oct 31 F S V
8 AM-1 PM. *Spr:* Kentucky Mountains ARC. National Guard Armory, 782 Dawahare Dr. *TI:* 146.67 (103.5 Hz). *Adm:* $5. Tables: $5. John Farler, K4AVX, 1264 Hall Mountain Rd, Viper, KY 41774; 606-476-9662; **k4avx@arrl.net**; **k4avx.net**.

Maryland (Westminster) — Oct 25
D F R S T V
8 AM-1 PM. *Spr:* Carroll County ARC. Carroll County Agricultural Center, 700 Agriculture Center Dr. 19th Annual Mason-Dixon Hamfest. *TI:* 145.41. *Adm:* $5. Tables: $18. Steve Beckman, N3SB, 2145 Bethel Rd, Finksburg, MD 21048; 410-583-4321; fax 410-583-4149; **n3sb@qis.net**; **www.qis.net/~k3pzn**.

Massachusetts (Bourne) — Nov 7 R V
Set up 7 AM; public 9 AM-noon. *Spr:* Falmouth ARA. Upper Cape Cod Regional Vocational Technical School, 220 Sandwich Rd. Displays. *TI:* 146.655 (88.5 Hz). *Adm:* $5. Tables: advance $9 (by Nov 1), door $10. Ralph Swenson, N1YHS, 99 Fox Run Ln, E Falmouth, MA 02536; 508-548-0422 (phone and fax); **depsher911@comcast.net**; **www.falara.org**.

Massachusetts (Cambridge) — Oct 18
Nick Altenbernd, KA1MQX, 617-253-3776; **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Holland) — Oct 17 F V
8 AM-1 PM. *Spr:* Holland ARC. West Ottawa High School South Campus, 3600 152nd Ave. 7th Annual Lakeshore Super Swap. *TI:* 147.06 (94.8 Hz). *Adm:* $6. Tables: $10. Tom Bosscher, K8TB, 3148 Rosewood St, Hudsonville, MI 49426; 616-662-1080; **k8tb@bosscher.org**; **www.hollandarc.org/?page_id=22**.

Michigan (Kalamazoo) — Oct 18 S V
8 AM-noon. *Sprs:* Kalamazoo ARC and South-

Coming ARRL Conventions

September 18-19
W9DXCC, Elk Grove Village, IL*

September 19
Ohio Section Conference, Reynoldsburg*

September 25-27
ARRL/TAPR Digital Communications, Chicago (Elk Grove Village), IL*

September 26
Mid-Atlantic States VHF, Plymouth Meeting, PA*
SEDCO, Pigeon Forge, TN*
Washington State, Spokane Valley*

October 3
EmComm East, Rochester, NY*

October 9-11
Pacific Northwest VHF, Seaside, OR*

November 14
Alabama State, Montgomery

November 14-15
Indiana State, Fort Wayne

December 5-6
Florida State, Palmetto

*See September *QST* for details.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

west Michigan AR Team. Kalamazoo County Expo Center and Fairgrounds, 2900 Lake St. *Tl:* 147.04 (94.8 Hz). *Adm:* $5. Tables: $12 (8 ft, without electricity). Ruth Bates-Hill, WB8VEV, Box 33, Richland, MI 49083-0033; 269-388-4865; **ruthbateshill@hotmail.com**; **www.KalamazooHamFest.com**.

Michigan (Sterling Heights) — Oct 25 F V
8 AM-1 PM. *Spr:* Utica Shelby Emergency Communication Assn. American Polish Century Club, 33204 Maple Lane Dr. 24th Annual Swap. *Tl:* 147.18 (100 Hz). *Adm:* $5. Tables: $15. Chuck Perushek, N8ZA, **n8za@arrl.net**; **www.usecaarc.com**.

Mississippi (Camp Shelby) — Sep 26
8 AM-4 PM. *Sprs:* ARRL Mississippi Section, Hattiesburg ARC, and MDXA. Camp Shelby Military Museum, US Rte 49. Annual "ARRL Day in the Park," Museum Tour. *Tl:* 145.37. *Adm:* Free. Malcolm Keown, W5XX, 64 Lake Circle Dr, Vicksburg, MS 39180; 601-636-0827; fax 601-634-6876; **w5xx@arrl.org**; **www.arrlmiss.org**.

Missouri (Grandview) — Oct 17 F V
8 AM-1 PM. *Spr:* South-Side ARC. Grandview Middle School, 12650 Manchester Ave. Octoberfest 2009, Emergency Management. *Tl:* 147.12 (151.4 Hz). *Adm:* advance 4 for $5; door 3 for $5 or $4 each. Tables: $15. Donna Quick, KBØYJN, Box 1670, Lee's Summit, MO 64063; 816-537-7464; **kb0yjn@juno.com**; **www.southsidearc.org**.

Missouri (Kirkwood/St. Louis) — Oct 31 F R V
7:30 AM-1 PM. *Spr:* St Louis ARC. Kirkwood Community Center, 111 S Geyer Rd. 18th Annual Halloween Hamfest. *Tl:* 147.15. *Adm:* advance $3 each or 3 for $7; door $5. Tables: $15. Bob Sluder, NØIS, 7511 Local Hillsboro Rd, Cedar Hill, MO 63016; 636-349-6584; **bcsluder@msn.com**; **www.halloweenhamfest.org**.

New Hampshire (Deerfield) — Oct 16-17
Michael Crestohl, W1RC, **w1rc@near-fest.com**; **www.near-fest.com**.

New Jersey (Township of Washington) — Oct 10 D F Q R V
8 AM-3 PM. *Spr:* Bergen ARA. Westwood Jr/Sr High School, 701 Ridgewood Rd. *Tl:* 146.79 (141.3 Hz). *Adm:* $5. Tables: $15. Jim Joyce, K2ZO, 286 Ridgewood Blvd N, Township of Washington, NJ 07676; 201-664-6725; fax 201-265-1366; **k2zo@arrl.net**; **www.bara.org**.

New Mexico (Socorro) — Oct 31 V
8 AM-2 PM. *Sprs:* Socorro ARA and the City of Socorro. NM Firefighters Training Academy, 600 Aspen Rd. ARES/RACES meeting. *Tl:* 146.68 (100 Hz). *Adm:* Free. Tables: $10. Al Braun, AC5BX, 722 California St, Socorro, NM 87801; 575-835-3370; **ac5bx@juno.com**; **www.socorroara.org**.

New York (Hicksville) — Oct 25 D F H R V
Set up 7:30 AM; public 9 AM. *Spr:* Long Island Mobile ARC. Levittown Hall, 201 Levittown Parkway. *Tl:* 146.85 (136.5 Hz). *Adm:* $6. Tables: $20. Richard Cetron, K2KNB, 198 Haypath Rd, Old Bethpage, NY 11804; 516-694-4937; fax 631-574-4851; **k2knb@limarc.org**; **www.limarc.org**.

New York (Queens) — Oct 11 D F H Q R T V
Set up 7:30 AM; public 9 AM-2 PM. *Spr:* Hall of Science ARC. NY Hall of Science Parking Lot (Flushing Meadow Corona Park), 47-01 111th St. Tune-up clinic, "Drop and Shop" available, free admission to Museum from 10-11 AM or $6 after with hamfest ticket). *Tl:* 444.2 (136.5 Hz), 145.27 (136.5 Hz). *Adm:* buyers $5, sellers $10. Stephen Greenbaum, WB2KDG, 85-10 34th Ave, Apt 323, Jackson Heights, NY 11372; 718-898-5599; **wb2kdg@arrl.net**; **www.hosarc.org**.

WESTERN NEW YORK SECTION CONVENTION

October 4, West Seneca
D F H S V
The Western New York Section Convention (Greater Buffalo Hamfest), sponsored by the Lancaster ARC, will be held at the Ismailia Shrine Center, 1600 Southwestern Blvd (Rte 20). Doors are open for setup at 6 AM; public 7:30 AM-2 PM. Features include indoor flea market, vendors, buy and sell electronic equipment, ARRL talks, live demonstrations, VE sessions (registration 8 AM, testing 8:30 AM; John Maxwell, W2JM, 716-741-2317, **maxwell@acsu.buffalo.edu**; walk-ins welcomed), breakfast and lunch. Talk-in on 147.255 (107.2 Hz). Admission is $7 (under 10 free). Tables are $7 (includes 1 admission; Chuck Lawson, KC2BLH, 716-825-7097; **kc2blh@aol.com**). Contact Luke Calianno, N2GDU, 1105 Ransom Rd, Lancaster, NY 14086; 716-481-5747; **luke48@gmail.com**; **gbhamfest.hamgate.net**.

North Carolina (Pfafftown) — Oct 10 F R
8 AM-noon. *Spr:* Forsyth ARC. West Central Community Center, 6130 Yadkinville Rd. *Tl:* 146.64, 145.47 (both 100 Hz). *Adm:* $5. Tables: Bring your own. Ray D'Eau, c/o Forsyth ARC (W4NC), Box 11361, Winston-Salem, NC 27116-1361; 336-245-5740; **hamfest@w4nc.org**; **www.w4nc.com**.

Ohio (Georgetown) — Nov 7 D F R V
8 AM-3 PM. *Spr:* Grant ARC. ABCAP Building, 406 W Plum St. *Tl:* 146.73. *Adm:* $2. Tables: Free. Rodney Crawford, WD8CTX, 2585 SR 138, Sardinia, OH 45171; 937-446-2338 (phone and fax); **wd8ctx@juno.com**; **www.garcohio.net/**.

Ohio (Massillon) — Nov 1 F H R V
Set up 6 AM; public 8 AM-2 PM. *Spr:* Massillon ARC. Massillon Boys and Girls Club Complex, 730 Duncan St SW. 49th Annual Hamfest, auction. *Tl:* 147.18. *Adm:* $5. Tables: $12 (8 ft, limited electricity available). Dan Anastis, N8DZM, 4770 12th St SW, Canton, OH 44710; 330-478-6149; **ddann@sbcglobal.net**; or Terry Russ, N8ATZ, 330-837-3091; **www.marcradio.org**.

Oklahoma (Ardmore) — Oct 23-24 D F S V
Friday 5-8 PM; Saturday 8 AM-1 PM. *Spr:* Texoma Hamarama Assn. Ardmore Convention Center, 2401 N Rockford Rd. *Tl:* 146.97. *Adm:* advance $7, door $8. Tables: $10. Henry Allen, K5BUG, 2802 County Rd 2226, Caddo Mills, TX 75135; 800-588-2841; fax 214-388-2706; **k5bug@arrl.net**; **www.angelfire.com/tx5/TexomaHamarama/**.

Oklahoma (Enid) — Nov 7
enidhamfest@yahoo.com; **www.enidhamfest.com**.

Pennsylvania (Sellersville) — Oct 18 D F H R V
Set up 6 AM; public 7 AM-1 PM. *Spr:* RF Hill ARC. Sellersville Firehouse, 2 N Main St. *Tl:* 145.31 (131.8 Hz). *Adm:* $6 (nonham spouses and children free). Tables: $12 (indoor); $8 (outdoor space; bring your own table), plus admission. Jim Soete, WA3YLQ, c/o RF Hill ARC, Box 336, Perkasie, PA 18944; 215-723-7294; fax 215-257-0724; **wa3ylq@arrl.net**; **www.rfhill.ampr.org**.

Pennsylvania (Washington) — Nov 1 Q V
8 AM-1 PM. *Spr:* Washington Amateur Communications. Washington County Fairgrounds, 2151 N Main St. *Tl:* 145.49. *Adm:* $5. Tables: $20. Bud Plants, N3TIR, 236 Chambers Ridge Rd, W Alexander, PA 15376; 724-484-0207; fax 724-484-0998; **n3tir@arrl.net**; **www.wacomarc.org**.

Quebec (Longueuil) — Oct 24
David Chadufaud, VE2EDF, 450-672-9791; **ve2edf@videotron.ca**; **www.ve2clm.ca/articles.php?1ng=fr&pg=120**.

South Carolina (Sumter) — Oct 24 F T
8 AM-4 PM. *Spr:* Sumter ARA. Jaycee Hut, 314 Pine St. Sumter "Open-Air" Hamfest. *Tl:* 147.015 (156.7 Hz). *Adm:* $5. Tables: $6. Carl Ecabert, AA1MD, 6105 Dubose Siding Rd, Sumter, SC 29153; **aa1md@ftc-i.net**; **www.geocities.com/CapeCanaveral/2695/sara.htm**.

Tennessee (Johnson City) — Oct 17 R S T V
8 AM-2 PM. *Spr:* GrayHamfest Assn. Appalachian Fairgrounds, 101 Lakeview St. *Tl:* 145.29 (103.5 Hz). *Adm:* $6. Tables: $10; tailgating $3. Charlie Stuchell, K4CWA, 222 River Rd, Bluff City, TN 37618; 423-538-3868; **k4cwa@arrl.net**; **GrayHamfesttn.com**.

Texas (Belton) — Oct 3 D F T
7 AM-2 PM. *Spr:* Temple ARC. Bell County Expo Center, 301 W Loop 121. *Tl:* 146.82 (123 Hz). *Adm:* $5. Tables: $10-$25. Mike LeFan, WA5EQQ, 1802 S 13th St, Temple, TX 76504; 254-773-3590; fax 254-231-4128; **expo@tarc.org**; **www.beltonhamexpo.org**.

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests.html**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/FandES/field/hamfests/regform.html** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online, donated ARRL publications and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **November 1** to be listed in the **January** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's Web site for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and *ARRLWeb* banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**. QST

75, 50 AND 25 YEARS AGO

October 1934

■ The cover photo shows Ross Hull working with his directive 5-meter antennas, described in this issue.
■ The editorial relates that 5-meter hams in Boston were in a state of shocked disbelief when Ross Hull's S8 signal (from Hartford) came booming into Boston, thanks to Ross' directive antennas!
■ The lead article by Ross Hull, "Extending the Range of Ultra-High-Frequency Amateur Stations," is enough to excite any 5-meter ham … and to lure other hams to the ultra-highs! The antenna is a four-bay array of two-element antennas made of wire elements and spaced with wooden spreaders.
■ L. W. Hatry discusses "Tailoring Tuned R.F. Transformers for Short-Wave Receivers."
■ H. O. Bixby reports that "Third Corps Area Asks Amateur Help" to relay the heavy message traffic coming from workers in Civilian Conservation Corps camps.
■ Arthur Braaten, W2BSR, discusses the need for "A New Standard of Reporting Signals," and proposes a system of R-S-T reporting.
■ John Kraus, W8JK, reports on "Amateur Radio in the Soviet Union," and shows a photo of U3EB's station in Leningrad.
■ James Millen, W1HRX, describes "A Pentode Output Transmitter with Six-Band Exciter," which features 140 watts of C.W. and 30 watts of suppressor-modulated 'phone.

October 1959

■ The cover photo shows W3RQZ taking off for some "balloonautical mobile" work.
■ The editorial looks at some of the many ways the League represents you.
■ Ted Crosby, W6TC, presents "The HBR-16 Communications Receiver," a dandy little receiver with excellent performance.
■ O. E. Gardner, W9RWZ, and J. D. Good, W9YRV, discuss the use of "The 6DQ5 as a Linear Amplifier."
■ Ed Tilton, W1HDQ, presents tips for V.H.F. newcomers, in "Firing Up on 6 and 2."
■ Meanwhile, at the other end of the ham spectrum, D. A. King, K8EEY, asks (and answers) the question, "160 for Mobile?" with a little rig that uses three 6AQ5 tubes.
■ Claude Maer, WØIC, in "The Perseids Powerhouse," describes his kilowatt rig that covers 50 and 144 Mc. without switching or changing coils.
■ In "Riding the Rails," Michael Treister, K8GJM, reports on how he cut through red tape to go mobile on a train between Cleveland and New York City.
■ In "Balloon Mobile," Robert Thomas, W3RQZ, tells about taking to the air in a helium balloon to operate ham radio.
■ Katashi Nose, KH6IJ, discusses "Operating in the ARRL DX Test" from the DX viewpoint.

October 1984

■ The cover photo shows the 200-year-old tower that the Jersey ARS Group, GJ3DVC, operated from during the ARRL DX Test.
■ The editorial proclaims, "Phone Expansion — A Reality at Last!"
■ Barry King, KA7SPU, describes "A Complete Morse-Code System for the VIC 20 Computer" that will transmit code from the keyboard and copy the incoming signal.
■ Doug DeMaw, W1FB, discusses "TR Circuits for Homemade Rigs," and gives us a simple circuit from QSK or semi-break-in.
■ In another article, DeMaw joins Lee Aurick, W1SE, in examining "The Full-Wave Delta Loop at Low Height."
■ DeMaw's keyboard must be smoking … he also wrote "How Receivers Work," Part 10 of his informative series on getting on the air.
■ Peter Dodd, G3LDO, provides information on "Wire Beam Antennas and the Evolution of the 'Double-D'," a compact beam.
■ "New Voices from Old Tangier," by Wayne Houser, KJ6E/CN8CU, reports on the ham shack of the American School of Tangier.
■ In "Product Review," Larry Wolfgang, WA3VIL, takes a look at the spiffy new Heathkit HF transceiver — the HW-5400.

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

JULY 2009

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program are at this Web page: **www.arrl.org/FandES/field/pshr/.**

716
AC8AL
605
KT2D
473
KØIBS
465
WB7WOW
406
KI4KWR
405
AC8AR
383
NC4VA
335
N2LTC
321
N4HUB
320
KK1X
N1UMJ
300
KD1LE
298
W4CAC
295
W2MTA
285
KA2ZNZ
283
WB8RCR
270
KB2RTZ
267
K8RDN
254
KI4GEM
250
AK2Z
240
KI4GWC
238
K7OAH
230
KB8GT
210
N7CM
201
KB2BAA
199
KB2ETO
190
K7EAJ
189
WA2BSS
188
KK7DEB
186
W7ELI

182
K8AMR
180
KK3F
175
K2HJ
173
WB9FHP
170
WD9FLJ
W5DY
KA8ZGY
169
KA5EXI
165
K7BFL
161
KØLQB
KC7ZZ
160
KGØGG
KE5HYW
156
WD8USA
155
W2DWR
150
WB6UZX
145
K7MQF
AA3SB
144
K2ABX
140
W1PLW
136
W9AL
135
W1SGC
W3YVQ
W7JSW
134
N2JBA
131
K7BC
130
WB9JSR
WB2FTX
K6JT
W4ZJY
K9EOH
W4FAL
126
KB2EV
125
W7EKB
NN7H
KK5NU
KE4PAP
W4DNA
120
K9LGU

KA4FZI
W8UL
N2GJ
N3RB
WØLAW
KW1U
W1GMF
N1LKJ
N7IE
K4IWW
KI4ZJI
119
WB2KNS
116
K4DND
115
W7TVA
112
W6SX
110
WB4GHU
N7EIE
W7QM
W7GB
W7GHT
N7BEC
N5NVP
W5PY
K5KV
KK5GY
WM2C
K4DLF
K1HEJ
KB1NMO
N8IO
N1JX
K2UL
N1IQI
K1YCQ
N7XG
N7YSS
K4GK
WA9WNE
KF7GC
W6DOB
W2EAG
109
W2KFV
107
KI4JOO
105
KE4CB
W4TTO
104
N2DW
103
K2RRM
101
WB8OIF
100
N2VGA
KB2KLH
K2TV
WØCLS
NØMEA

N9MN
NR2F
K4SCL
NX1Q
N8OD
N2GS
W5ESE
N5OUJ
WØGCB
N3SW
W3TWV
KM1N
K4BG
WB4FDT
K2AN
NA9L
KI4YV
96
W2CC
K2GW
95
WG8Z
94
K2YYD
92
K5MC
91
N4ABM
90
N2RDB
K1JPG
KI4PRX
NU8K
N9VC
NX9K
N2VC
KA1RMV
NM1K
KA1GWE
N8DD
WB8SIQ
WD8Q
KI4JQB
K4MSG
W3GQJ
WA2CUW
WB4BIK
N3ZOC
K3IN
KB3LNM
KA8WNO
N8NMA
89
KC5OZT
88
K5SFM
W2DSX
W8IM
KI6RUW
AD4BL
KT5SR
KA3NZR
86
KB8NDS
85
KA2EJD

NY3H
KB9KEG
84
K6RAU
W5GKH
W7VSE
83
KB3LFG
W9ILF
82
K2BRG
W9WXN
KB1KRS
81
W3BC
NS7K
80
K8KV
WB8WKQ
W2LIE
KE7DVV
KE5PWL
N2YJZ
KE5YTA
KB3MXM
79
KS3Z
78
KD8CYK
N2VQA
W4QAT
77
WDØGUF
76
KC2SYM
NA7G
75
N2RQ
KBØDTI
74
K2KYQ
73
KE5DKV
KM5YQ
KB3KKY
72
WA1JVV
KJ7NO
70
WØADZ
NØDUW
NØDUX
NUØF
KAØFUI
NIØI
KBØJKO
NØMHJ
KØPTK
KØOR
KØRXC
NØUKO
WAØVKC
KDØZUP
KC4PZA

The following stations qualified for PSHR in previous months, but were not recognized in this column: (June) KT2D 715. (May) KT2D 775, K7OAH 206, W6SX 113, K6RAU 100. (Apr) KT2D 515. (Mar) KT2D 720.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, EMA, EPA, EWA, GA, ID, IN, KS, LA, MDC, MI, MN, NC, NFL, NH, NLI, NNJ, NTX, OH, OR, ORG, SD, SNJ, SJV, STX, TN, UT, VA, WCF, WMA, WNY, WI, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, EWA, GA, IN, KS, LA, MDC, ME, MI, MO, MT, NC, ND, NLI, NM, NTX, OK, SFL, SNJ, STX, TN, VA, WTX, WV, WWA.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

W4ZJY 1591, KA9EKG 1410, KK3F 1398, WB5NKD 1044, K7BDU 969, WB5NKC 868, WB9JSR 606.

The following station qualified for BPL by achieving 100 or more points by originations plus deliveries: NM1K 133.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

KC1BK **DeWitt**, Earl, Fairfield, CT
♦K1HF **Fortin**, Henry R., Greenville, SC
W1HNF **Mazuronis**, Edward G., Kensington, CT
W1JUW **Pike**, Frank L., Durham, NH
K1KEE **Laflamme**, Conrad J., North Smithfield, RI
KB1OVK **Hill**, Michael E., Hinsdale, NH
N2AFW **Salva**, John T., Southport, NY
KB2AK **Sixt**, Gary, Machias, NY
W2BLG **Green**, Ralph E. Jr, Hilton Head, SC
KB2FME **Uleskey**, John R., West Seneca, NY
W2GBC **Conner**, Fed Judge William C., Dobbs Ferry, NY
KB2GSD **Cronkite**, Walter, New York, NY
KB2HVE **Bloink**, Hans R., Watchung, NJ
WB2JSE **Kalicki**, Matthew A., Stafford, NY
WA2LIT **Matthews**, Charles T., Cold Spring Harbor, NY
WB2MWW **Gersten**, Edward J., Liverpool, NY
WB2NKO **Boehm**, George J., Coram, NY
WB2RIL **Golder**, Arthur W., Crossville, TN
♦K2UZF **Mudge**, Ronald G., Marathon, NY
♦W3BR **Adkins**, Asa W. Jr, Boerne, TX
N3FOS **Hitchens**, Pam J., Williamsport, PA
NE3K **Nielsen**, Charles A. Sr, Cookeville, TN
WA3LKF **Clasen**, Stanley M., Washington, DC
K3OOE **Yaun**, Julian S., Warminster, PA
N3OY **Goldman**, Arthur E., Columbia, MD
K3VC **Chapin**, Vernon S., Lutherville, MD
W4DTI **Hardeman**, Guy N., Chattanooga, TN
W4DUP **Ardern**, George S., Cookeville, TN
K4DVK **Lawson**, Edwin N., Signal Mtn, TN
N4GAP **Durham**, Frank F., Soddy Daisy, TN
KB4GG **Buff**, Chris, Saint Petersburg, FL
W4GKE **Ayres**, Terrell C., Warner Robins, GA
W4HEQ **Norwood**, Donald E., West Jefferson, NC
♦W4HR **Hudson**, Robert J., Marietta, GA
W4JKY **Martin**, William C., Paintsville, KY
KD4LNP **Sutherland**, Janet, DeLand, FL
KI4LW **Otto**, Arnold C., Shelbyville, TN
KG4MRH **Crabtree**, Richard A., St Petersburg, FL
KE4OWZ **Robertson**, Mary H., Lillian, AL
KG4PEA **Strain**, Willard E., Dalton, GA
K4PHK **Richards**, Festus R., Bessemer, AL
WD4PHQ **Burousas**, Jimmie Jr, Concord, GA
W4PZV **Luhrman**, Henry L., West Palm Beach, FL
♦KS4Q **Zingleman**, Ernest J., Cumming, GA
N4SEJ **Cromer**, Malcolm, Cowpens, SC
N4SEK **Cromer**, Juanita, Cowpens, SC
KA4SUG **Marshall**, Willard D., Berea, KY
W4SUG **Jones**, Richard "Dick" A., Neptune Beach, FL
K4VIK **Kilgore**, Clint C. Jr, Whitwell, TN
KE4VU **Boggess**, Marion M., Largo, FL
W4ZEC **Walborn**, George S., Mountain Home, ID
KG4ZVD **Parrish**, Audray J., Mount Washington, KY
W5AJS **Ports**, Chester "Bud" M., Shreveport, LA
KF5BAF **O'Leary**, Vincent E., Houston, TX
W5CPO **Moore**, Ralph A., Meridian, MS
K5KDQ **Hall**, Tony F., Shreveport, LA
♦WB5LCM **Simms**, Phil L., Gage, OK
KD5LWJ **Jacobson**, Larry W., Hammond, LA
WB5SDI **Burns**, James E., Tishomingo, MS
K5UKJ **Needles**, John R., Bethany, LA
K5WAE **Rodgers**, Pollard "Bill," El Paso, TX
W6BTM **Redlin**, Eugene, N Las Vegas, NV
N6ECE **Lockhart**, Earl C., Los Angeles, CA
WA6HBS **Brackett**, Lynn H. Jr, Cerritos, CA
KM6K **McDuffie**, Thomas F., Carlsbad, CA
KC6KZY **Robinson**, Andrew, Palm Desert, CA
W6LUX **Johnson**, Arthur L., Roswell, NM
W6NTK **Storey**, Grant E., Bishop, CA
W6TCE **Kelley**, John R., Pasadena, CA
KE7AWA **Ruckman**, Margaret A., Silver Springs, NV
W7BKZ **Barton**, Dennis L., Athol, ID
♦K7CC **Paine**, Hobart J., Tucson, AZ
♦WA7EPU **Figgins**, Walter Dean, Las Cruces, NM
KC7NO **Reich**, Jack E., Port Townsend, WA
KT7S **LeClair**, Cleve, Eugene, OR
W8BT **Taylor**, Robert M., Toledo, OH
♦K8CCV **Shelar**, Richard C., Leetonia, OH
KG8CF **Bickford**, Owen, Muskegon, MI
W8GVS **Hagen**, Isaac N., Northport, MI
♦N8IR **Koperski**, Ronald F., Maumee, OH
W8OQY **Barrett**, Harry M., Whitehall, MI
W8OXH **Haddad**, Fred L. Jr, Toledo, OH
N8SDQ **Kuczewski**, William V., Warren, MI
W9AQA **Courtney**, Albert L., South Bend, IN
♦KB9II **Matz**, John E., Hanover Park, IL
K9JRB **Fry**, Richard N., Richmond, IN
KA9KWE **Thompson**, Brian J., Flossmoor, IL
W9QVN **Parker**, Leslie E., Hot Springs, AR
K9TRG **Housholder**, Arthur E., Elk Grove Village, IL
N9VXQ **Giles**, Jimmie L. Jr, Lebanon, IN
WBØAUP **Rolfzen**, B. J., Hibbing, MN
AAØEV **Wood**, Jay C., Alexandria, MN
WØIXA **Zimmerman**, David L., Pomona, KS
WØIXF **Berg**, Milton "Milky" S., North Platte, NE
KAØJBL **Salvay**, Seymour N. "Nate," Mission Hills, KS
NØLRF **Stump**, Paul W., Berryton, KS
KBØOCW **Cary**, Howard D., Loveland, CO
WØPOK **Parla**, Tony, Raytown, MO
KØTBU **Goddard**, Frances Eileen, Dodge City, KS
WBØTDW **Zadra**, Michael J. Sr, Iron, MN
KCØTJ **Clay**, Richard R., Richfield, MN
KCØWPK **Wallace**, Charles E., Hutchinson, KS
KØYEH **Hawk**, Frederick R. "Bob," Iowa City, IA

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Gail Iannone ♦ Silent Keys Administrator ♦ sk@arrl.org

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 1.8025, 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 also transmitted monthly. See "This Month in Contesting" in this issue for further details on the Qualifying Runs. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. The initial certificate is available for a $10 fee. Subsequent endorsement stickers are available for a $7.50 fee.

♦ **Digital transmissions:** Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent at 45.45-baud Baudot and PSK31. MFSK16 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 2009, Headquarters and W1AW are closed on New Year's Day (January 1), Presidents' Day (February 16), Good Friday (April 10), Memorial Day (May 25), Independence Day (July 3), Labor Day (September 7), Thanksgiving and the following day (November 26 and 27) and Christmas Day (December 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				

HAMSPEAK

The following are brief descriptions of Amateur Radio related terms found in this month's issue of *QST*. More information on most can be found in *The ARRL Handbook*, or other specialized ARRL publications.[1] See also **www.arrl.org/qst/glossary.html**.

The Doctor is IN

Antenna tuner — A device that sits between an antenna and a transmission line, or a transmission line and a radio, and transforms the impedance to match the radio or line.

Elevation pattern — Graphical plot of the radiation intensity of an antenna at different elevation angles. For an omnidirectional antenna, the elevation pattern is the same at every azimuth angle. Other antennas will have elevation patterns that are different at each azimuth angle, so usually the plot at the most significant azimuth is shown.

Elevation patterns with large signals near the horizon are generally preferred for line of site operations, such as in VHF mobile communication. Low elevation angles also provide for the longest distance communication via ionospheric propagation.

Radio direction finders — A radio receiver coupled to a movable directional antenna configured so that the bearing from a transmitter to the receiver can be measured. Often abbreviated RDF.

Spectrum analyzer — Visual display system that typically shows frequency on the horizontal axis and received signal amplitude on the vertical axis. A spectrum analyzer can be used to determine frequencies with activity or frequencies that are clear, depending on interests. Level of band activity and even propagation can be inferred. Originally deployed as early form of electronic countermeasure equipment during WWII and also known as a panoramic receiver or panadapter.

SWR and power meter — Measurement instrument that samples incident (forward) and reflected power on a transmission line to measure standing wave ratio (SWR).

Vertical monopole — Single vertical antenna element, typically a quarter or more wavelengths long. Often used as a transmit and receive antenna, singly or in combination with other similar antennas.

[1]*The ARRL Handbook for Radio Communications,* 2009 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0261 (Hardcover 0292). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Hands-On Radio

Q section — Popular name for a one quarter wave section of transmission line used to transform impedances.

Reflection coefficient — The fraction of a signal that is reflected from a boundary between transmission lines with different impedances.

SWR bandwidth — The difference between higher and lower frequencies at which an antenna system has a mismatch corresponding to an arbitrary standing wave ratio — typically 2:1. For many transmitters, this corresponds to the range of frequencies over which the transmitter can efficiently drive power into the antenna without the need for additional adjustment.

Synchronous transformer — General term reflecting the class of transmission line systems used to transform impedances, of which the quarter wave line section is a special case.

The KL7CE No Holes Mobile Installation

Airmail — Software that allows the relaying of Internet e-mail via Amateur Radio.

ARES® — The Amateur Radio Emergency Service (ARES) consists of licensed amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service when disaster strikes. See **www.arrl.org/FandES/field/pscm/sec1-ch1.html**.

ARRL Field Day — An ARRL operating event in June of each year in which hams typically operate for 24 hours from temporary locations using emergency power and portable equipment to simulate emergency conditions and have fun. See **www.arrl.org/contests/rules/**.

AX.25 packet — Amateur packet-radio link-layer protocol. Copies of protocol specification are available from ARRL HQ.

EmComm — Emergency communication. Umbrella term encompassing all portions of communications in response to emergencies, especially those provided by Amateur Radio.

Sound card — Generic name for an audio to computer processing interface device. Originally available as an internal plug-in accessory card for a PC, the functionality is now generally available in the PC itself. Advanced models are often configured as an external device from the connected PC. See a *QST* Product Review of samples of various configurations at **www.arrl.org/members-only/prodrev/pdf/pr0705.pdf**.

USB — Universal serial bus. Connection arrangement intended to allow computer peripherals to be connected to a PC. Originally supplied as a more compact replacement for RS-232 type serial connections on laptop PCs, it is commonly found on all recent PCs. See **www.usb.org**.

The Quadrifilar Helix as a 2 Meter Base Station Antenna

Circular polarization — Electromagnetic propagation mode in which the polarization, rather than being vertical or horizontal as in *linear* polarization, rotates as the wave moves from the source. If the polarization rotates clockwise as it leaves the source, as seen by the source, it is called right hand circular polarization. A circularly polarized antenna receives signals equally well from transmitters with horizontal, vertical or any polarization in between. It is thus well suited to receiving signals from a tumbling satellite with linear polarized antennas.

Low polar orbit — Satellites that have orbits close, typically 200 to 1200 miles, to the surface of the Earth and pass near both poles. They pass relatively quickly over a particular spot providing strong signals for perhaps 15 minutes at a time. This is in contrast to the geosynchronous orbit satellites, now used for TV feed, that have an orbit that rotates at the same rate as the Earth, and thus seem stationary above a spot on the surface. Such satellites are at an altitude of around 21,450 miles and thus require more power for communication than LEOs. Interestingly, geosynchronous orbits were predicted in 1945, long before space vehicles were available, by British futurist Sir Arthur C. Clarke, then a radar technician in the Royal Air Force, and later an author of a book that became the movie *2001, A Space Odyssey*.

Omnidirectional — An antenna, microphone or light source that radiates equally in all directions. In contrast to a directional source, such as a flashlight, that focuses its energy in a particular direction.

Simplex station — Simplex originally referred to communication in one direction only, as in a public address system. In the world of amateur FM, it refers instead to two way communication that takes place directly between stations on a single frequency rather than through a repeater station using two frequencies.

Spherical radiation pattern — Description of the radiation from an antenna that radiates well in all directions. If it were a point source in the middle of a sphere, it could be received from any portion of the sphere. If all such portions are at equal amplitude, it is called an isotropic radiator.

Simple Mobile Transceiver Protection

NPN transistor — An electronic device composed of a sandwich of semiconductor material in three layers, two type N, one type P. The type N material can release electrons, while the P type accepts them, if the junctions are appropriately biased. Such a device is called a bipolar junction transistor, in contrast to a field effect transistor. Similar transistors are made the opposite way, as PNP transistors.

Relay — Electromechanical device in which a voltage to a coil produces a magnetic field that pulls electrical contacts together or apart. It serves as a remote control switch.

TO-220 case — Transistor housing characterized by a flat surface that is designed to carry heat away from the transistor. It is normally bolted to the chassis or another heat sink in order to efficiently remove the generated heat.

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- 3 x AA Ni-Cd or alkaline cells
- SMA connector
- Rain resistant IPX4 standard
- CTCSS and DTSC decode is built in
- Built-in ferrite rod antenna [AM] reception

Detailed illuminated map shows time, time zone, sun position and day of the week at a glance for any place in the world.Continuously moving – areas of day and night change as you watch.

- Mounts easily on wall. Size: 34 1/2" x 22 1/2"

US TOWER

Shown with Optional Rotor Base

MA-40

40' Tubular Tower

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MA-550

55' Tubular Tower

Handles 10 sq.ft. at 50mph
Pleases neighbors with tubular streamlined look

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55' Freestanding Crank-Up
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No guying required
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Can add raising and motor drive acces.

Towers Rated to EIA Specifications
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- Lowest possible take-off angle reduces domestic QRM signals

DXE-VRW-1

High Strength Pivoting Fixture
- Self supporting—will withstand steady-state winds in excess of 50 mph without guying (guying required under extreme wind speed conditions)
- Extremely high strength heavy wall tubing made to DX Engineering specs
- Massive fiberglass channel insulator

We also offer an affordable manual winch for easy one-person raising and lowering of the antenna. You can move the winch between similar antennas in a multi-antenna installation.

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The perfect solution—use singly or in a phased array for full, no-compromise 80 meter performance. Achieve the strongest possible presence at your power level and be competitive!

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43 FEET
90 MPH
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80/40 DUAL BAND
55 FEET—NO GUYS
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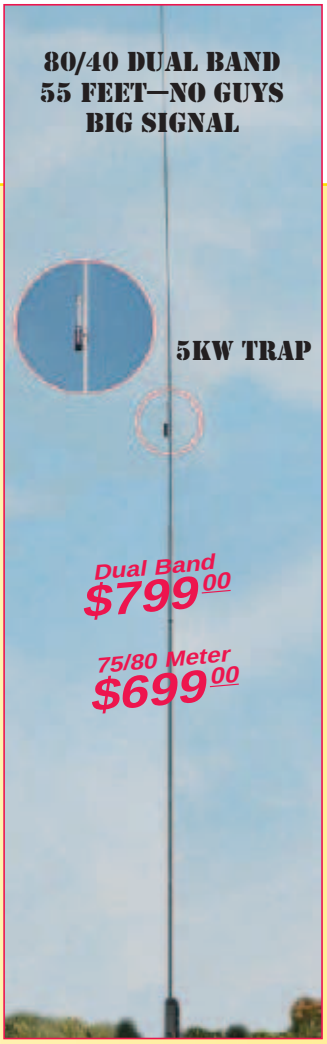

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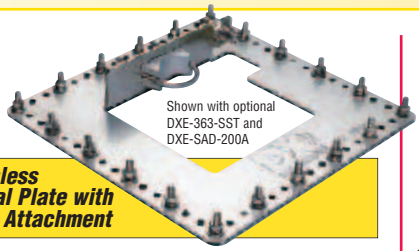
Hustler BTV Direct Coax Attachment All Stainless **$22.95**



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- High strength Type 6063-T832 drawn aluminum tubing
- Sections with 0.058 and 0.120 inch wall thickness are perfect for telescoping antenna elements
- Most sizes are pre-slit on one end for element clamps
- Available in 3 and 6 foot lengths

Aluminum Tubing, 0.058" Wall, 3 Foot Length

Part Number	Diameter/End Type	Price	Cost/Foot
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DXE-AT1241	0.500", one end slit	$3.30	$1.10
DXE-AT1242	0.625", one end slit	$3.60	$1.20
DXE-AT1243	0.750", one end slit	$3.90	$1.30
DXE-AT1244	0.875", one end slit	$4.20	$1.40
DXE-AT1245	1.000", one end slit	$4.50	$1.50
DXE-AT1246	1.125", one end slit	$4.95	$1.65
DXE-AT1247	1.250", one end slit	$5.55	$1.85
DXE-AT1248	1.375", one end slit	$6.15	$2.05
DXE-AT1249	1.500", one end slit	$6.75	$2.25
DXE-AT1250	1.625", one end slit	$7.65	$2.55
DXE-AT1251	1.750", one end slit	$8.40	$2.80
DXE-AT1252	1.875", one end slit	$9.15	$3.05
DXE-AT1253	2.000", one end slit	$9.90	$3.30
DXE-AT1254	2.125", one end slit	$11.40	$3.80

Aluminum Tubing, 0.058" Wall, 6 Foot Length

Part Number	Diameter/End Type	Price	Cost/Foot
DXE-AT1189	0.375", no slit	$5.40	$0.90
DXE-AT1205	0.500", one end slit	$6.60	$1.10
DXE-AT1206	0.625", one end slit	$7.20	$1.20
DXE-AT1207	0.750", one end slit	$7.80	$1.30
DXE-AT1208	0.875", one end slit	$8.40	$1.40
DXE-AT1209	1.000", one end slit	$9.00	$1.50
DXE-AT1210	1.125", one end slit	$9.90	$1.65
DXE-AT1211	1.250", one end slit	$11.10	$1.85
DXE-AT1212	1.375", one end slit	$12.30	$2.05
DXE-AT1213	1.500", one end slit	$13.50	$2.25
DXE-AT1214	1.625", one end slit	$15.30	$2.55
DXE-AT1215	1.750", one end slit	$16.80	$2.80
DXE-AT1216	1.875", one end slit	$18.30	$3.05
DXE-AT1217	2.000", one end slit	$19.80	$3.30
DXE-AT1218	2.125", one end slit	$22.80	$3.80

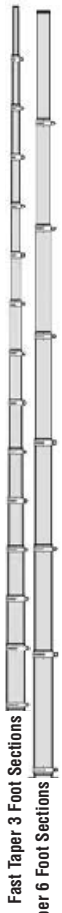
Aluminum Tubing, 2.000" Diameter, 0.125" Heavy Wall

Part Number	Length/End Type	Price	Cost/Foot
DXE-AT1255	3', no slit	$14.85	$4.95
DXE-AT1204	6', no slit	$29.70	$4.95

Aluminum Tubing, 0.120" Wall, 6 Foot Length

Part Number	Diameter/End Type	Price
DXE-AT1311	1.5", no slit	$23.85
DXE-AT1312	1.75", no slit	$28.20
DXE-AT1313	2.0", no slit	$33.00
DXE-AT1314	2.25", no slit	$37.45
DXE-AT1315	2.5", no slit	$42.50
DXE-AT1316	2.75", no slit	$46.95
DXE-AT1317	3.0", no slit	$51.40

Visit DXEngineering.com for stainless steel Element Clamps that fit exact tubing sizes!



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- 65 ft. slow taper from HD 2" O.D. base to 7/8" O.D. top
- Build your own vertical antennas or arrays
- Use with DXE Insulated Base Assemblies

DXE-ATK65 ..... $194.50

Insulated Vertical Base Assemblies for 2" O.D. Antenna Masts

Standard Base

- Tilt Base optional
- Two DXE-CAVS-1P mounting clamps required to attach base to mounting post

DXE-VE-BASE ..... Only $99.50

DXE-CAVS-1P V-Saddle Clamp $9.95
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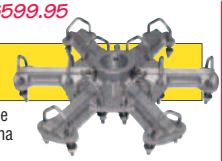
COMPLETE 5 BAND KIT—$599.95

Hexx© 5-Band HF Beam Antenna Kits



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- Good results at 20 to 30 feet above ground

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DXE-HEXX-5CFP	5-Band Coax Feeder Package	$194.95
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Add a dedicated receive antenna to HF transceivers which lack a separate RX antenna input port! The DX Engineering RTR-1 Receive Antenna Interface is a unique, multi-purpose switch unit which automatically or manually switches the RF output antenna connector on any HF transceiver between reception using a separate receiving antenna system and transmitting with a standard transmitting antenna. Enjoy the improved reception that a low noise receiving antenna system offers. Connection to a Beverage, receive four-square, active receive antenna, other receiving antennas and accessories is now possible.

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- Ideal for vehicle noise reduction with mobile systems, ground radial plate or balun to antenna
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The SYS-3 is designed for monoband 3-stack Yagis. Based on K3LR's design, it allows you to select any one antenna, all antennas, or any combination of two antennas.

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HEI-HM-4	Handi-Mic Hand Mic, HC4	**$79.00**
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HEI-HM-IC	Handi-Mic/Electret Element ICOM	**$85.00**
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HEI-SM-2B	Shock Mount, PR40	**$95.00**
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NEW! Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. ***Suggested Price $159.99***

NEW! Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Powered by four AA internal Alkaline batteries (not included), no additional cables required. A coax jumper cable is also induced for fast hook up. ***Suggested Price $129.99***

Z-11Pro

The Z-11Pro, 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 an optional LDG balun, it will also match longwires or antennas fed with ladder-line. All cables included. ***Suggested Price $179***

AT-100Pro

Covers all frequencies from 1.8 – 54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch, allowing you to switch instantly between two antennas. The AT-100Pro requires just 1 watt for operation, but will handle up to 125 watts. All cables included. ***Suggested Price $219***

radio not included

FTL Meter 2.5" face with calibrated scales for signal strength, discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit, all selectable from the radio's menu. ***Still Only $49***

NEW FTL Meter For Yaesu FT-857(D) and FT-897(D). 4.5" face with calibrated scales for signal strength, discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit, all selectable from the radio's menu. ***Suggested Price $79.99***

NEW! M-7700 For IC-7700. It will display S-meter on receive, or power out, SWR, ALC level or supply voltages, all selectable from the radio's menu. What's more, the M-7700 and the virtual meter on your radio can work together. ***Suggested Price $79.99***

NEW! IT-100

Matched in size to the IC-7000 and IC-706, the IT-100 sports a front panel push-button for either manual or automatic tunes, and status LEDs so you'll know what's going on inside. You can control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. It's the perfect complement to your Icom radio that is AH3 or AH-4 compatible. ***Suggested Price $179.99***

NEW! KT-100

LDG's first dedicated autotuner for Kenwood Amateur transceivers. Easy to use - just right for an AT-300 compatible Kenwood transceiver. Has 2,000 memories for instant recall. If you have an AT-300 compatible Kenwood radio, you can simply plug the KT-100 into your transceiver with the provided cable; the interface powers the tuner, and the Tune button on the radio begins a tuning cycle. The supplied interface cable makes the KT-100 a dedicated tuner for most modern Kenwood transceivers. ***Suggested Price $199.99***

NEW! YT-100

An autotuner for several popular Yaesu Radios. An included cable interfaces with your FT-857, FT-897 and FT-100 (and all D models) making it an integrated tuner, powered by the interface. Just press the tune button on the tuner, and everything else happens automatically: mode and power are set, a tune cycle runs, and the radio is returned to its original settings. It's the perfect complement to your Yaesu radio.
Suggested Price $199.99

AT-200Pro

The AT-200 features LDG's new "3-D memory system" allowing up to eight antenna settings to be stored for each frequency. Handles up to 250 watts SSB or CW on 1.8 – 30 MHz, and 100 watts on 54 MHz (including 6 meters). Rugged and easy-to-read LED bar graphs show power and SWR, and a function key on the front panel allows you to access data such as mode and status. All cables included. ***Suggested Price $249***

See *AT-1000Pro Review in Nov. '08 CQ*

AT-1000Pro

The AT-1000Pro has an Automode that automatically starts a tuning cycle when the SWR exceeds a limit you set. Operates at any power level between 5 and 1,000 watts peak. RF Relay protection software prevents tuning at greater than 125 watts. Tunes from 1.8 to 54.0 MHz (inc. 6 meters), with tuning time usually under 4 seconds, transmitting near a frequency with stored tuning parameters, under 0.2 seconds. 2000 memories. 2 Antenna connections. All cables included. ***Suggested Price $599***

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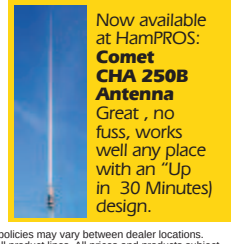

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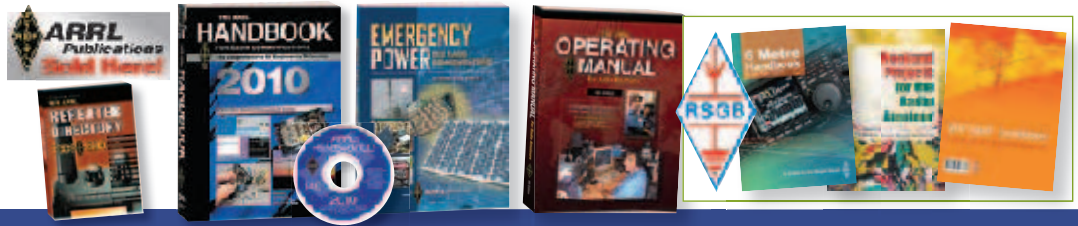

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400 watts, dual analog meter sets, LCD display, memory card installed, main and sub receiver VRF, full dual rx, external power supply with twin speaker enclosure.

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200 watts, large TFT, built-in memory board, main & sub receiver VRF, full dual rx, internal power supply.

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Provides a full 100 Watts of power output (AM: 25 W) on the 160-6 Meter Amateur bands.

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Package Includes: Ni-Cad Battery and Wall Charger

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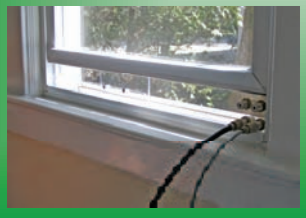

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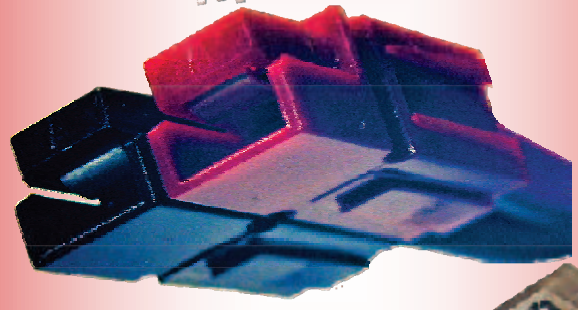

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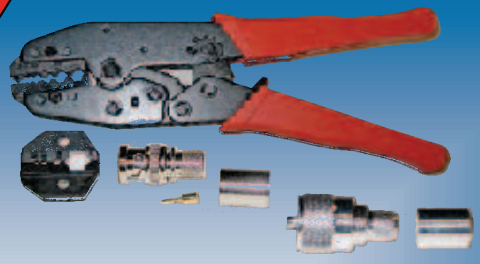

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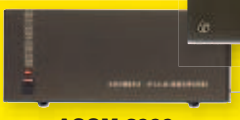

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• Power: 5/2.5/0.5/0.1W • Improved User Interface
• Optional HM-189GPS Speaker Mic adds GPS capabilities

IC-92AD
2M/440 D-Star & FM HT

• TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
• Power: 5/2.5/0.5/0.1W
• Optional HM-175GPS Speaker Mic adds GPS capabilities

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• TX: 144-148, 430-450 • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blkd) • Power: 50/15/5W
• Memories: 1052 • D-Star Digital Ready
• Improved User Interface

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• SSB, CW, RTTY and AM (40W)

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• TX: HF/6M/2M • RX: 0.03-60, 108-174 MHz
• Power: 5-100W • Memories: 102
• 32-bit floating DSP & 24-bit AD/DA converter
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HF/6M Base

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• Memories: 101 • 5 inch color screen • 32-bit floating DSP
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• Improved 3rd order intercept point • PS-125 included!

IC-7800
Multimode HF/6M Base

• TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
• Memories: 101 • 7" color screen • Two receivers
• Four 32-bit floating DSPs • Three roofing filters
• External VGA connector • Automatic antenna tuner

PW-1
HF/6M 1KW Linear Amplifier

• TX: 160-15M/6M • Power: 1000W (180-264 VAC), 500W (90-132 VAC) • Automatic band change & antenna tuner • Two input & Four output connectors
• Easily connects to any current Icom HF transceiver

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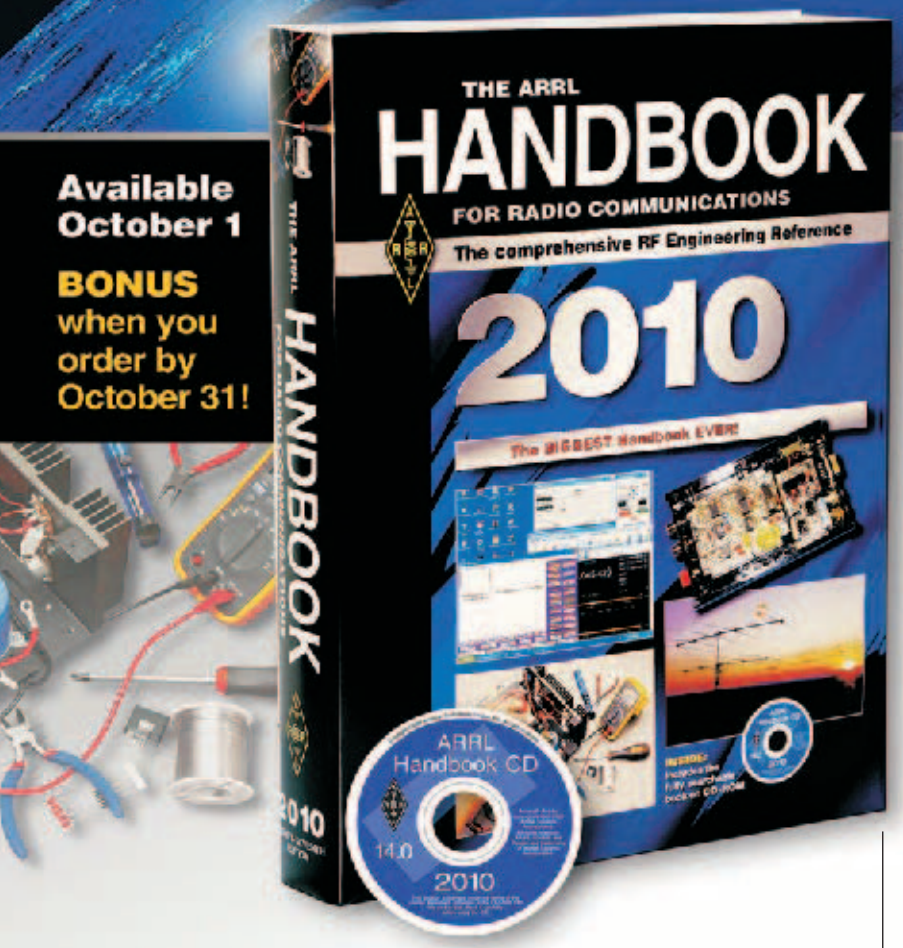

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TM-271A 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 60/25W • Memories: 200

TM-V71A Dualband FM Mobile

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Cross-band repeat • EchoLink® ready

TM-D710A

Dualband FM Mobile w/TNC

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Built-in TNC for APRS (needs GPS)
- Cross-band repeat • AvMap G5 & EchoLink® ready

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- Bright non-glare 5 inch color touchscreen
- Preloaded Tele Atlas street maps of N. America
- AV input; enjoy films, video games & pictures
- Import extra POI's with no extra costs
- Kenwood ready APRS cable included

TH-K2AT

TH-F6A

TH-K2AT 2M FM HT

- TX: 144-148 • RX: 136-174
- Power: 5/1.5/0.5W • Memories: 100

TH-F6A Triband FM HT

- TX: 144-148, 222-225, 438-450 MHz
- RX: 0.1-1300 MHz (cell blkd) • Power: 5/0.5/0.05W
- Memories: 435 • Dual band RX

TS-480HX

200W HF/6M Mobile/Base

- TX: HF/6M • RX: 0.5-60 MHz
- Power: 10-200W (with two optional 22A PS's)
- Memories: 99 • IF/stage DSP on main band, AF/stage DSP on sub-band

TS-480SAT

100W version with built-in auto antenna tuner.

TS-2000 100W HF/VHF/UHF Base

- TX: HF/6M/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz)
- Memories: 99 • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-B2000 Same as the TS-2000 with high-tech "silver box" look & no front panel controls. Includes PC control software.

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

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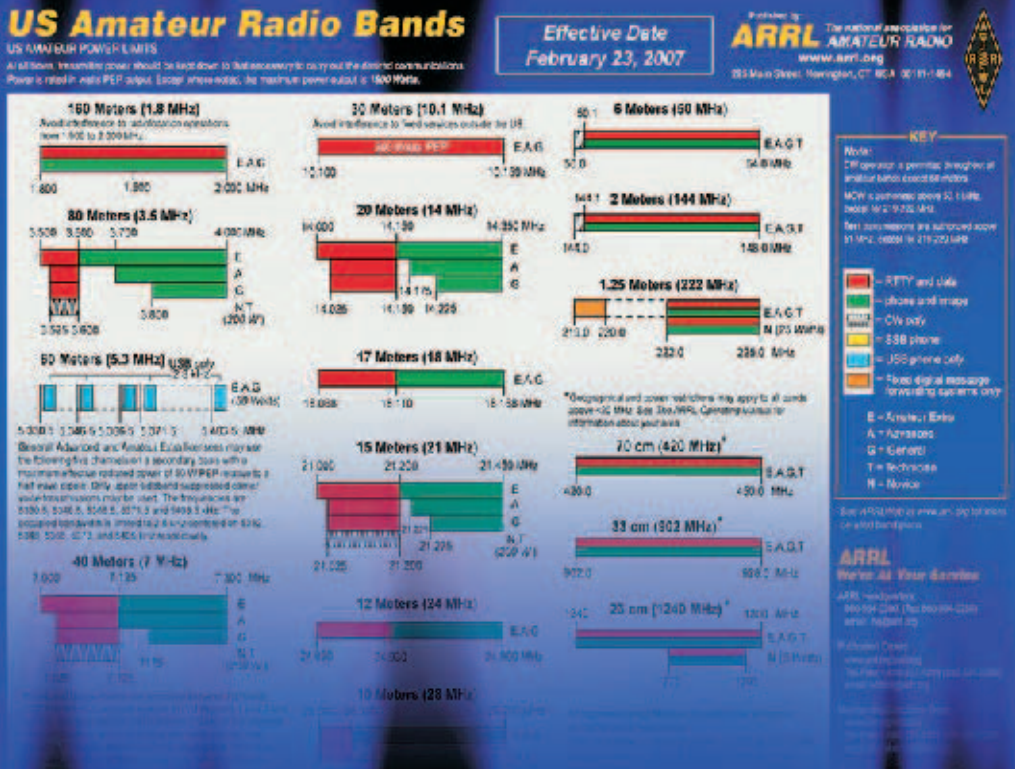

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Mary M. Hobart, K1MMH
Chief Development Officer
ARRL
225 Main Street
Newington CT 06111-1494
Telephone: **860-594-0397**
Email: **mhobart@arrl.org**

FT-250R 2M FM HT

- TX: 144-148 • RX: 140-174
- Power: 5/2/0.5W • Memories: 209
- Increased AF output & added "Memory Only" mode

FT-270R 2M FM HT

- TX: 144-148 • RX: 136-174
- Power: 5/2/0.5W • Memories: 200
- Extra large LCD display & speaker
- Increased AF output & added "Memory Only" mode

FT-1900R 2M FM Mobile

- TX: 144-148 • RX: 136-174
- Power: 55/25/10/5W • Memories: 221
- Added "Memory Only" mode

FT-2900R 2M FM Mobile

- TX: 144-148 • RX: 137-174
- Power: 75/25/10/5W • Memories: 221
- Added "Memory Only" mode and EPCS operation

FT-7900R 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz
- RX: 108-520, 700-999 MHz (cell blocked)
- Power: 50/20/10/5W (2M), 45/20/10/5W (440 MHz)
- Memories: 1055 • YSK-7800 included!
- Added "Memory Only" mode

FT-897D 100W HF/VHF/UHF Portable

- TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200

FT-450 100W HF/6M Portable/Base

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 500 • IF DSP Technology
- Selectable AGC, IF width & shift, contour, digital noise reduction, manual notch filter and clarifier
- Optional Auto Antenna Tuner (ATU-450)

FT-450AT

- The FT-450 except ATU-450 Antenna Tuner is installed

FT-950 100W HF/6M Base

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 100 • Auto Antenna Tuner
- 32-bit Floating Point DSP • Requires 12VDC PS
- Built-in high stability TCXO • Optional DMU-2000 Data Management Unit displays various operational conditions
- Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000 100W HF/6M Base

- TX: HF/6M • RX: 0.03-60 MHz • Power: 10-100W
- Memories: 99 • Auto Antenna Tuner • 32-bit Floating Point DSP • Dual In-Band Receive • Internal Power Supply

FT-2000D 200W HF/6M Base

- FT-2000 except RF output is 200W and supplied power supply is external

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FT2000/D

The FT-2000 (100 watts) and FT-2000D (200 watts) are the 2nd Generation in the proud lineage of the FTdx9000 Series! Featuring extensive DSP filtering, factory installed antenna tuner and power supply and a host of outstanding ergonomic and performance features, the FT-2000 series radios are destined to be the centerpiece of your HF/50 MHz station!

DMU2000 Data Management Unit ..... **Call**
FH2 Remote Keypad **84.95**
SP2000 External Speaker **175.95**
UTUNINGKIT A, B, or C model **479.95**
YF122C 500 hz CW filter **159.95**
YF122CN 300 hz CW filter **164.95**

FT950

The FT-950 has been developed to fit the needs of both the casual and serious DX enthusiasts as well as new licensees desiring a top notch first radio to discover the magic of the HF and 50MHz bands. This superb radio features DSP filtering, 100 Watts of power output, factory installed antenna tuner and many of the outstanding ergonomic and performance features first introduced in our FTdx-9000 and FT-2000 flagship radios.

DMU2000 Data Management Unit ..... **Call**
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MD100A8X Desk top mic **129.95**
MD200A8X Desk top mic **379.95**
SP2000 External Speaker **175.95**
UTUNINGKIT A, B, or C model **479.95**

FT450/AT

The FT-450(AT) is an amazing compact radio that bundles the most desirable IF DSP features of the FT-2000 and FT-950 into a convenient sized lightweight package. Suitable for home, portable, or mobile use, the economical FT-450(AT) is a rugged 100 watt HF/50MHz radio unequalled in its price class. Available with or without factory installed antenna tuner.

ATAS120 Auto tuning antenna **299.95**
ATU450 Auto antenna tuner **149.95**
FC40 Auto antenna tuner **249.95**
MD100A8X Desk top mic **129.95**
MMB90 Mobile mount **33.95**

FT897D

The FT-897D is a rugged, innovative, multiband, multimode portable transceiver for the amateur radio MF/HF/VHF/UHF bands. Providing coverage of the 160-10 meter bands plus the 6 m, 2 m, and 70 cm bands and it's capable of 20-Watt portable operation using internal batteries, or up to 100 Watts when using an external 13.8-volt DC power source.

ADMS4B Programming software/cable **51.95**
ATAS120 Auto tuning antenna **299.95**
CT39 Packet Cable **9.95**
CT62 Computer Interface Cable **32.95**
FC30 Bolt on auto antenna tuner **189.95**
FNB78 NiMH Internal Battery **115.95**
FP30 Internal Power Supply **209.95**
MD100A8X Desk top mic **129.95**
MH59A8J Remote Control Mic **64.95**
YF122S 2.3 kHz SSB Filter **164.95**

FT857D

The FT-857D, the world's smallest HF/VHF/UHF mobile transceiver, provides base station-type performance from an ultra-compact package that's ideal for mobile or external battery portable work. Wide frequency coverage, outstanding receiver performance, and the convenience of optional remote-head operation make the FT-857D the expert's choice for high-performance mobile operation!

ADMS4B Programming software/cable **51.95**
ATAS120 Auto tuning antenna **299.95**
CT39 Packet Cable **9.95**
CT62 Computer Interface Cable **32.95**
FC30 Auto antenna tuner **189.95**
JTPS28 Jetstream Power Supply **84.95**
MH59A8J Remote Control Mic **64.95**
YF122S 2.3 kHz SSB Filter **164.95**
YSK857 Separation Kit **39.95**

FT817ND

The world's first self-contained, battery-powered, Multi-mode Portable Transceiver covering the HF, VHF, and UHF bands! Providing up to five watts of power output, designed for operation on the 160-10m HF bands, plus the 6m, 2m, and 70 cm bands.

CSC83 Soft Case **23.95**
CT39 Packet Cable **9.95**
CT62 Computer Interface Cable **32.95**
EDC5B Lighter Cable **23.95**
FNB72 Ni-Cd Battery Pack **59.95**
MH36E8J DTMF Mic **56.95**
YF122S 2.3 kHz SSB Filter **164.95**

FT2900R

Massive heatsink guarantees 75 watts of solid RF power, Loud 3 watts of audio output, 200 memory channels, CTCSS and DCS encode/decode built in.

JTPS14M Jetstream Power Supply **49.95**
MLS100 External Speaker **46.95**
MX2 Hustler 2m Mag Mount **32.95**

FT1900

The ruggedly built yet compact new FT1900R 2m transceiver brings you Yaesu's legendary mechanical toughness along with outstanding receiver performance and 55 watts with crisp, clean audio that will get your mes-

JTPS14M Jetstream Power Supply **49.95**
MLS100 External Speaker **46.95**
MX2 Hustler 2m Mag Mount **32.95**

FT250R

Compact yet incredibly rugged, the FT250R 2-meter handheld is derived to perform under the most difficult operating conditions. It is packed with the leading-edge features you've come to expect from a Yaesu product. The FT250R's die-cast aluminum case houses a large, high-output speaker and the illuminated keypad provides easy viewing during night time operation

SMAUHF SMA-UHF Adapter **3.50**
SMABNC SMA-BNC Adapter **3.50**
ADMS1F Software and cable **38.95**
EDC5B Cigarette Lighter Cable **23.95**
FBA25A AA Battery case **21.95**
MH34B4B Speaker Mic **33.95**
VC25 Vox Headset **62.95**

FT270R

The FT270R is a compact, high performance submersible FM hand held providing up to 5 watts of RF power, along with loud audio output (800 mW) for the 2m or 70cm amateur bands. Submersible up to 3ft for 30 minutes. Long operating times thanks to the supplied 1400 mAh Ni-MH battery pack.

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50 Watt 220 MHz Mobile

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JT220M

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NC85B Wall Charger for CD40	16.95

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ADMS1J Software/Cable	39.95
EDC5B DC Cable w/Noise Filter	23.95
EDC6 DC Cable	7.95
FBA25A AA Battery Case	21.95
FNB83 7.2V 1400mAh Ni-MH	39.95
MH34B4B Speaker Mic	33.95
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VX3R

The new ultra-compact VX-3R 2m/70cm FM HT Transceiver is loaded with convenience features. In addition to top quality performance on the 2m and 70cm, you will also be able to enjoy stereo FM and AM broadcast band.

ADMSVX3 Software/Cable	39.95
CSC92 Soft Case	14.95
EDC21 DC Cable w/Noise Filter	36.95
FBA37 AA Battery Case	17.95
FNB82LI 7.2V 1400mAh Ni-MH	34.95
MH34B4B Speaker Mic	33.95

FT8800R

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ADMS2I Software and cable	39.95
JTPS14M Jetstream Power Supply	49.95
MLS100 External Speaker	46.95
MMB60 Quick Release Mobile Bracket	29.95
YSK8900 Separation Kit	49.95

FT7900R

Yaesu's economically priced One-Touch Operation FT-7900R Dual band FM mobile. Back-lit push button controls ensure extraordinarily easy and safe operation while driving at night. The exceptionally wide receiver coverage provides all sorts of additional uses!

ADMS2K Programming software and cable	39.95
MEK2 Microphone Extension Kit	42.95
JTPS14M Jetstream Power Supply	49.95
MLS100 External Speaker	46.95
MMB60 Quick Release Mobile Bracket	29.95
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Optional Accessories

- EBP-71 Li-ion 7.4 v 1200 mAh battery pack,
- EDC -164 Li-ion charger.
- EME-12A Speaker Headset with VOX
- EME-13A Earphone Headset with VOX
- EMS-59, EMS-47 Speaker/Microphone
- EME-15A Tie Pin Microphone with VOX
- EME-21A Heavy Duty Earphone Microphone
- EME-23A Earphone Microphone
- EME-6 Earphone
- ESC-49 Soft Case
- ERW-4C/serial Computer interface cable
- ERW-7/USB Computer interface cable.

Standard Features

- TX 144-147.995 MHz RX 136-173.995 MHz
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- Direct frequency input through illuminated keypad
- 200 Memories plus 1 CALL channel
- VFO, Memory and Scan modes
- Ultra flexible SMA antenna
- Two prong mic jack
- Wire-cloning capability
- 3 Levels of output power 5 watts, 2 watts, 0.5 watts
- Clean, crisp and loud 500mW audio

Standard Accessories

- EBP-72 Ni-MH 7.2 v 700 mAh battery
- EDC-165 Trickle charger
- EA-141 Flexible whip antenna

Dimensions: 2.28"(w) x 4.23"(h) x 1.43"(d) and weighs just 8.7 oz. with standard battery and antenna attached

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- **ANC-4 Antenna Noise Canceller**
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Sound card interface, USB, Pactor, RTTY, Packet & more!

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  Adapter Cable with 1 USB to 2 RS-232 DB9
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A programme for everyone!

Islands have always excited the imagination. They evoke a sense of mystique and romance to those of us who live in crowded cities and commute on busy roads. For the radio amateur, contacting islands encourages the imagination to run riot with visions of a remote station set up, perhaps, on a tropical beach among palm trees or, for the daring, a rocky Antarctic island in a blizzard at - 40°C. This, surely, is what amateur radio is all about!

The **Islands on the Air** (IOTA) programme began over 45 years ago when a British short wave listener, Geoff Watts, set up a highly rewarding and fun awards programme.

If you want to get into the IOTA programme it is really easy to get started!

The IOTA programme is based on the simple idea of collecting QSL cards or QSOs you make from and to the 1000s of islands around the globe. The idea is that you start to collect the cards and when you reach certain numbers you can apply for an IOTA award. There are many different award levels but the IOTA 100 Islands certificate is the start for many. If you prefer you can collect rare islands or even from geographical areas.

IOTA AWARDS receive certificates and trophies to mark your success

You don't even need an amateur radio licence to participate in IOTA, as shortwave listeners can also participate. So you can get started straightaway! If you want to start finding these QSOs try tuning to 14.260MHz (20m) which is the main IOTA meeting frequency. There are a number of other meeting frequencies which are in the table below.

There is far more to this fascinating programme than can be written here so if you would like extra information on IOTA please visit

www.rsgbiota.org

What are you waiting for?
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QSL CARDS send and collect QSL cards from the contacts you hear

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28.460MHz	(10m)
24.950MHz	(12m)
21.260MHz	(15m)
18.128MHz	(17m)
7.055MHz	(40m)

This article was brought to you by the Radio Society of Great Britain 3 Abbey Court, Priory Business Park Bedford, MK44 3WH, UK Tel: +44 (0)1234 832 700

NEW IOTA Directory

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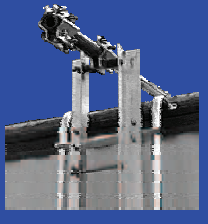
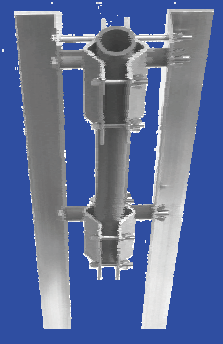


QUICK TILT LADDER MOUNT



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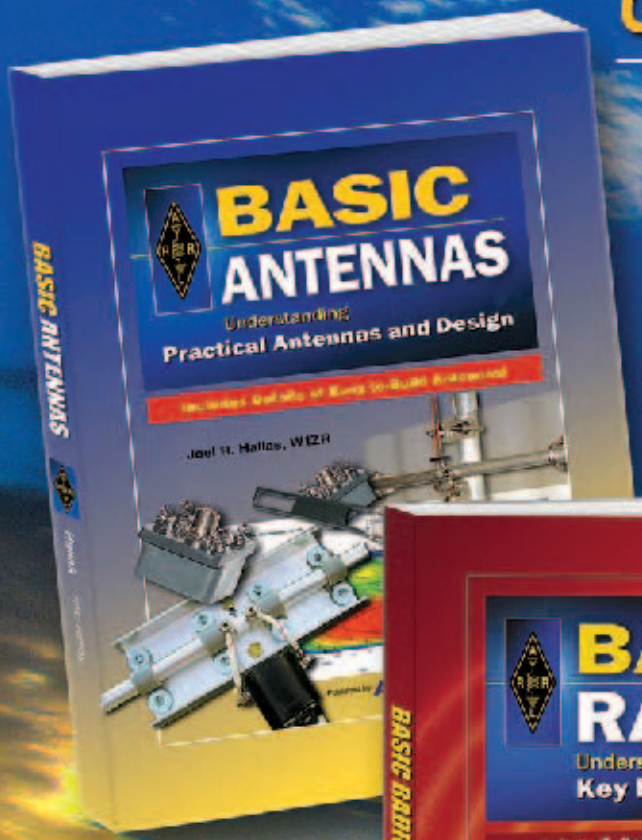

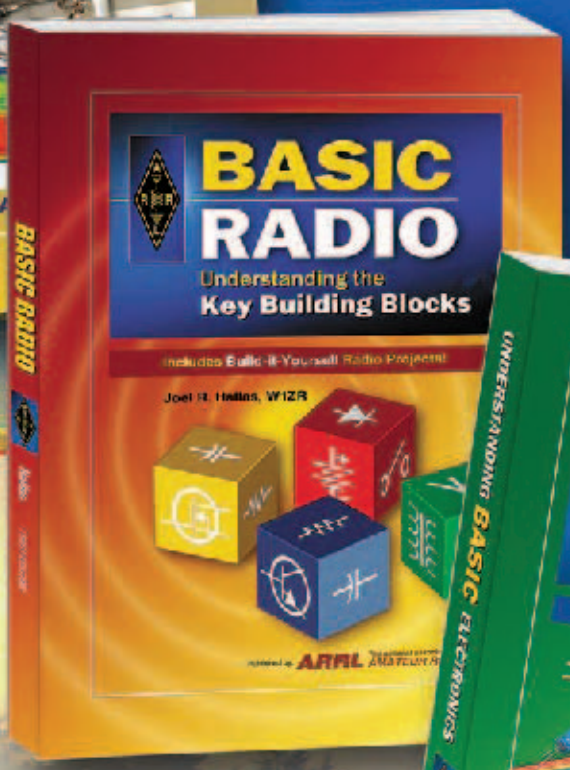

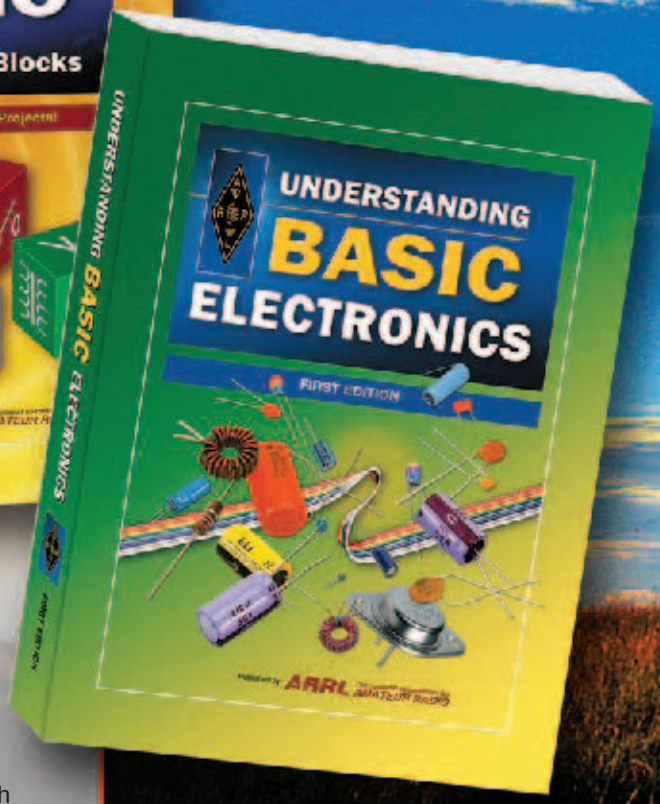

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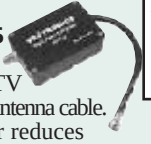

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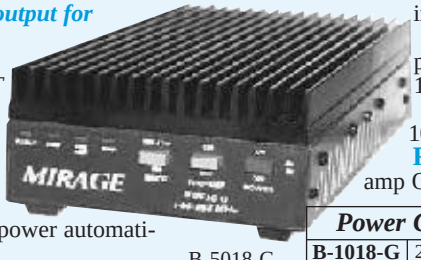

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B-2518-G	5	7	40	60	80	100	125	160	160	160
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Watts In	.25	.5	3	5	8	10	15	25	35	50

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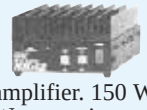

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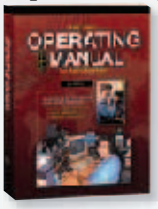

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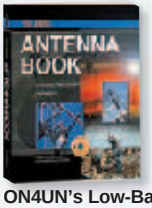

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Continued on page 144

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Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

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And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

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160M, 265 ft.

MFJ-1779B
$49.95
80-40M, 135 ft.

MFJ-1779C
$29.95
20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
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True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*(R) coax and *Teflon*(R) coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

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$29.95

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz. **MFJ-919, $59.95.** 4:1 current balun,1.5 kW. **MFJ-913, $29.95.** 4:1 balun, 300 Watts.

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MFJ-1704 heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D inches.

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MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.

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MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

33 ft. Telescoping fiberglass Mast

3.8 feet collapsed, 3.3 lbs.

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$89.95

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

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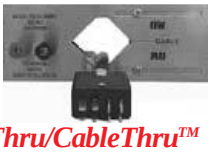

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Bring cables thru eave of your house

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shown with standard full-size vent (not included) it replaces. For *6 Cables*
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New!

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Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

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For 2 Cables
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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 . . .

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

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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!*

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You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

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A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz

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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.

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

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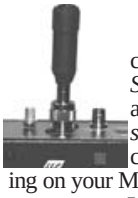
Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.
Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors.



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Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer*™.

MFJ-99C, $40.90.
SWR** Analyzer Power Pack*. 10 Pack MFJ *SuperCell*™ Ni-MH batteries, and power supply for SWR analyzers. ***Save $5!

MFJ-98, $60.85.
MFJ-269** Accessory Pack*. MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coils, power supply for MFJ-269. ***Save $5!

MFJ-98B, $88.90.
MFJ-269** Deluxe Accessory Pack*. Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. ***Save $7!

MFJ-269*PRO*™ Analyzer

MFJ-269*PRO* $419.95 ***NEW!***

Like MFJ-269, but has extended coverage in UHF range ***(430 to 520 MHz)*** and ruggedized cabinet that protects LCD display, knobs, meters and connectors from damage.

MFJ-259B HF/VHF Antenna *SWRAnalyzer*™

MFJ-259B $289.95

The world's most popular antenna analyzer gives you a complete picture of your antenna performance 1.8 to 170 MHz.

It's Super easy-to-use -- makes tuning your antenna quick and easy.

Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet. Read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Free MFJ Catalog

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

MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-993B 300 Watt *IntelliTuner*™

The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B $259.95

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B $359.95

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

1500 Watt *Legal Limit*

for Ameritron AL-1500/1200/82 amps

Roam the entire HF spectrum 1.8-30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

MFJ-998 $699.95

300 Watt...*Extra* Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B $219.95

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 $219.95

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 $199.95

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 $179.95

G5RV Antenna

MFJ-1778 $44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

MFJ-926 $399.95

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

MFJ-927 $259.95

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

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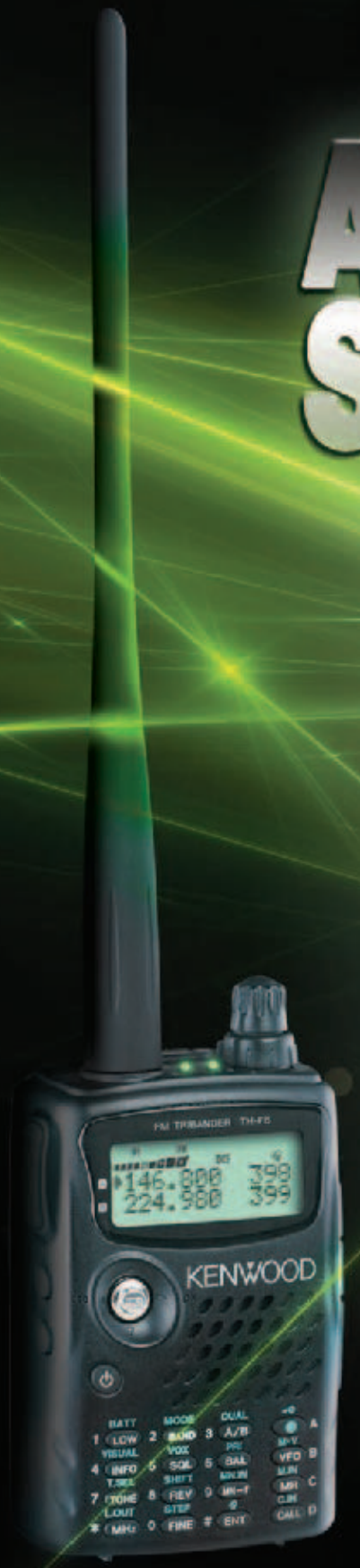
KENWOOD
Listen to the Future

AIRWAVE SUPERIORITY

Never before has a compact HT offered as many features, and such high powered performance as the TH-F6A. Arm yourself with one today and gain your own airwave superiority.

- Triband 144/220/440 MHz all at 5W
- Receives 2 frequencies simultaneously even on the same band
- 0.1~1300MHz high-frequency range RX (B band)[1]
- FM/FM-W/FM-N/AM plus SSB/CW receive
- Bar antenna for receiving AM broadcasts
- Special weather channel RX mode
- 435 memory channels, multiple scan functions
- 7.4V 2000mAh lithium-ion battery (std.) for high output[2] and extended operation
- 16-key pad plus multi-scroll key for easy operation
- Built-in charging circuitry for battery recharge while the unit operates from a DC supply
- Tough construction: meets MIL-STD 810 C/D/E standards for resistance to vibration, shock, humidity and light rain
- Large frequency display for single-band use
- Automatic simplex checker
- Wireless remote control function
- Battery indicator • Internal VOX • MCP software

[1]Note that certain frequencies are unavailable. [2]5W output



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ADS#06309

MFJ TUNERS

Ham Radio's *Most Popular* 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*(R) insulating washers and proper L/C ratio gives you *arc-free* no worries operation

MFJ-949E $179.95

up to 300 Watts PEP transceiver input power.

The MFJ-949E inductor switch was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full *size* 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, *peak* or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune™* lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

Full *size* built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^{5}/_{8}$x$3^{1}/_{2}$x7 inches. Superior cabinet construction and more!

MFJ-948, $159.95. Econo version MFJ-949E. Has all features except for dummy load.

***No Matter What™* Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D ***Legal Limit*** Tuner

MFJ-989D $389.95

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. Easily handles *full* 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. *New* 500 pF air variable capacitors. *New* improved *AirCore™* Roller Inductor. *New* high voltage current balun. *New* crank knob. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D".

MFJ-986 Two knob ***Differential-T™***

MFJ-986 $349.95

Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D ***compact*** kW Tuner

MFJ-962D $299.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore™* roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W ***Roller Inductor*** Tuner

MFJ-969 $219.95

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-941E ***super value*** Tuner

MFJ-941E $139.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M ***mobile*** Tuner

MFJ-945E $129.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 ***portable/QRP*** Tuner

MFJ-971 $119.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B ***smallest*** Versa Tuner

MFJ-901B $99.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 ***Tiny Travel*** Tuner

MFJ-902 $99.95

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 ***random wire*** Tuner

MFJ-16010 $69.95

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 ***6 Meter*** Tuners

MFJ-906 $99.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 ***VHF/UHF*** Tuners

MFJ-921/924 $89.95

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 ***artificial*** RF Ground

MFJ-931 $109.95

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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MFJ tiny Travel Tuner

Tiny 4½x2¼x3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything!

MFJ brings you the *world's smallest* full power 150 Watt 80-10 Meter Antenna Tuner. Extra wide matching range lets you tune nearly any antenna.

It's no toy, its got guts! Built with real *air* variable capacitors (600 Volt, 322 pF) and *three* stacked powder iron toroids to handle real power -- not just QRP. Bypass switch lets you bypass tuner when you don't need it.

You can use nearly any transceiver at full power with nearly any coax fed or random wire antenna for portable, home or mobile operation.

It's perfect for compact rigs like Icom IC-706MKIIG, Yaesu FT-100D, Kenwood TS-50, QRP rigs and others with a built-in SWR meter.

Operate anywhere, anytime with a quick easy set-up! Tune out SWR on your mobile whip from inside your car. Operate in your apartment with a wall-to-wall antenna or from a motel room with a wire dropped from a window or from a mountain top with a wire over a tree limb. Great for DXpeditions or field day. Be prepared for emergencies.

MFJ-902 is so small and handy, you'll rely on it wherever you go! It's easy to pack away in your briefcase, suitcase, backpack, glove compartment or desk drawer. It's tiny enough to slide in your back hip pocket! 4½Wx2¼Hx3D inches.

MFJ-902
$99.95

Tiny Travel Tuner with 4:1 Balun

MFJ-902H
$119.95

MFJ-902H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun* for balanced lines and 5-way binding posts for balanced lines and random wire. 5¾Wx2¼Hx 2¾D in.

Tiny Travel Tuner with Cross-Needle SWR/Wattmeter

MFJ-904
$129.95

MFJ-904, same as MFJ-902 *Tiny Travel Tuner* but has *Cross-Needle SWR/Wattmeter*. Read SWR, forward and re-flected power all at a glance in 300/60 and 30/6 Watt ranges. 7¼Hx2¼Hx2¾D inches.

ALL-in-one *Tiny Travel Tuner* with 4:1 Balun *and* SWR/Wattmeter

MFJ-904H
$149.95

ALL-in-one! MFJ-904H, same as MFJ-902 *Tiny Travel Tuner* but has *4:1 balun for balanced lines* and Cross-Needle SWR Wattmeter. Read SWR, forward and reflected power all at a glance in 300/60 and 30/6 Watt ranges. Has 5-way binding posts for balanced lines and random wire. 7¼Hx2¼Hx2¾D inches.

Long 10/12 foot Telescoping Whips

MFJ-1954
$29.95
10 Feet

MFJ-1956
$34.95
12 Feet

10 foot extended, 19 inches collapsed, MFJ-1954, $22.95. 12 foot extended, 22.5 inches collapsed. MFJ-1956, $29.95. Standard 3/8 inch by 24 threaded stud for use with all standard mounts. Durable 1/2 inch diameter plated brass. Telescopes for full 1/4 wave operation 2 to 12/15 Meters. Cover 17, 20, 30, 40, 60, 80, 160 Meters with loading coil. Use two for multi-band dipoles. Replace screwdriver antenna whip for highly efficient *fixed* mobile operation.

MFJ RF Isolator

MFJ-915 *RF Isolator*

MFJ-915
$29.95

prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. *Don't operate without one!* 5x1½ inches. For 1.8 to 30 MHz.

Portable Collapsible Antenna Tri-Pod

MFJ-1918
$49.95

Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.

40-10M G5RV Junior
MFJ-1778M, $39.95.
Half-size 52 foot *G5RV Jr* 40-10 Meters, 1500 Watts.

1500 Watt Lightning Surge Protector

MFJ-272
$39.95

Protect your expensive transceiver from static electricity and lightning induced surges with an ultra-fast gas discharge tube. Plug between rig and antenna, attach ground. DC to 1000 MHz. SO-239s.

All-Band G5RV Antenna

MFJ-1778
$44.95

Cover all bands, 160-10M with tuner. 102 ft. long, 1.5kW. Custom fiberglass insulator stress relieves 450 Ohm ladder line. Use horizontally, as inverted vee or sloper. Marconi on 160M.

Glazed Ceramic Antenna Insulator

MFJ-16C06
6-Pack
$4.56
(79 cents each)

Authentic *glazed ceramic* antenna insulator. Extra-strong -- will not break with long antennas and will not arc over or melt even under full legal power. Molded ridges give extra-long high voltage path to prevent high-voltage breakdown. Smooth wire holes prevent wire damage. Use as center or end insulator for dipoles, doublets, G5RVs, guy wires and others.

Current Balun/Center Insulator

MFJ-918
$24.95

True *1:1 Current Balun/Center Insulator* forces equal currents into dipole halves to reduce coax feedline radiation and field pattern distortion. Reduces TVI, RFI and RF hot spots in your shack. 50 ferrite beads on *Teflon*(R)coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

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MFJ . . . the world leader in ham radio accessories!

MFJ *Switching* Power Supplies

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these highly reliable 15, 22, 30, 40 or 75 Amp MFJ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's *MightyLites*™ are so light and small you can carry them with one hand! Take them with you anywhere.

No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either! These super clean *MightyLites*™ meet all FCC Class B regulations.

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

You won't burn up our power supplies!

MFJ Power supplies are *fully protected* with Over Voltage, Over-temperature and Over Current protection circuits.

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

A whisper quiet internal fan efficiently cools your power supply for long life.

22 Amp Continuous

Ham Radio's smallest and lightest 22 Amp continuous power supply is also its best selling!

MFJ-4125 $109.95

22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. 5¾Wx3Hx5¾D".

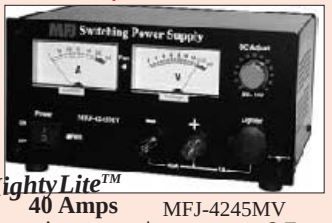
MFJ-4125P, $124.95. Adds 2-pairs *Anderson PowerPoles*™.

22 Amp Continuous

22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. 5¼Wx 4½Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4225MV $149.95

40 Amp Continuous

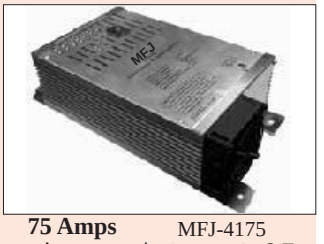


***MightyLite*™**

40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. 7½Wx 4¾Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4245MV $199.95

75 Amp Continuous



75 Amps continuous. Adjustable 13.8-14.2 VDC output. Reverse polarity, over-current/temperature, brown-out input protection, 7.8 lbs. 6½Wx3½Hx10D in. 108-132 VAC. Great for Ameritron's ALS-500M mobile amplifier!

MFJ-4175 $359.95

High Current Multiple DC Power Outlets

Power multiple Transceivers/accessories from a single DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

Versatile 5-Way Binding Posts

MFJ-1118, $84.95. Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. 12½x2¾x2½ in.

MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

All PowerPoles™

MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. Extra contacts, fuses. 12Wx1¼Hx2¾D".

MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®*, *extra* fuses -- *no extra cost*. 9Wx1¼Hx2¾ inches.

PowerPoles™ AND 5-Way Binding Posts

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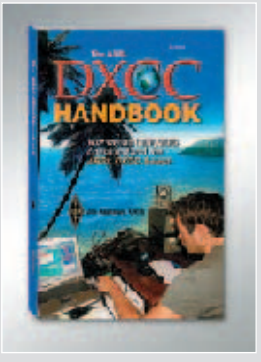

Many radio amateurs enjoy the lure of DXing—seeing how far away we can communicate with other Amateur Radio operators. It's a way of determining how well our stations—and we, the operators— perform. DXing is a full-time goal for some hams and a just-for-fun challenge for others. We hope this book will inspire you to try DXing, and that you'll use it as a guide to beginning your own DX journey.

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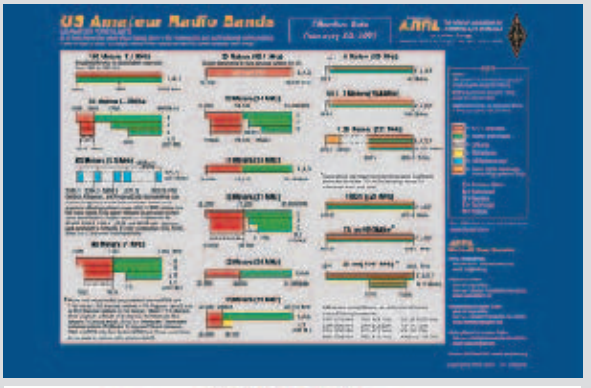

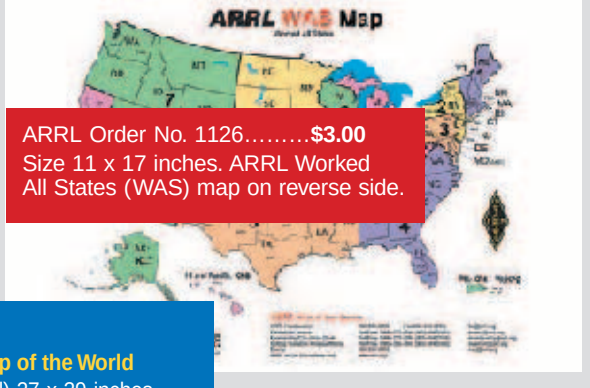

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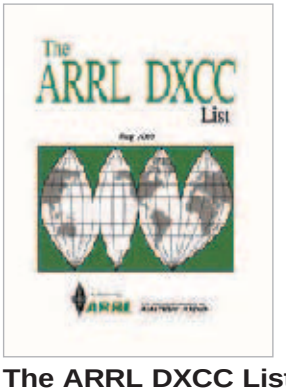

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As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

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.

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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.

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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.

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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.

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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.

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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.

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MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null ***wipes out*** noise and interference

MFJ-1026
$199.95

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.

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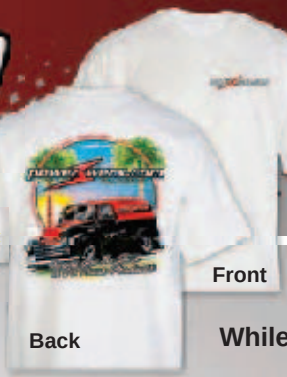

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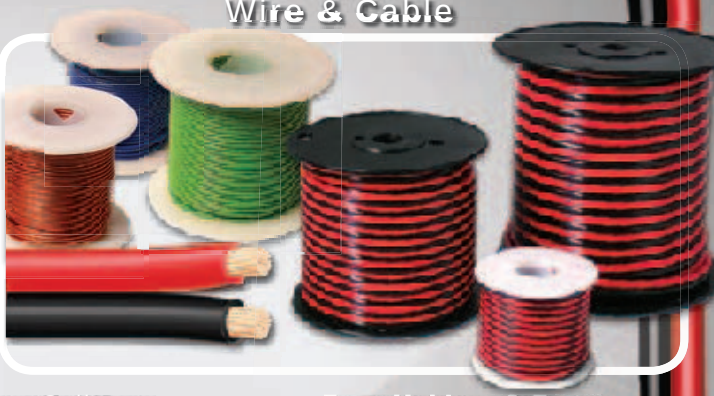

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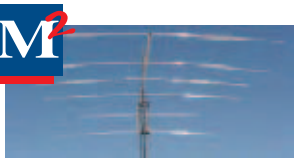

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HF/50 MHz Transceiver

FT DX 9000 Series

The radio... FT DX 9000

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HF/50 MHz Transceiver
FT DX 9000MP 400 W Version

HF/50 MHz Transceiver
FT DX 9000D 200 W Version

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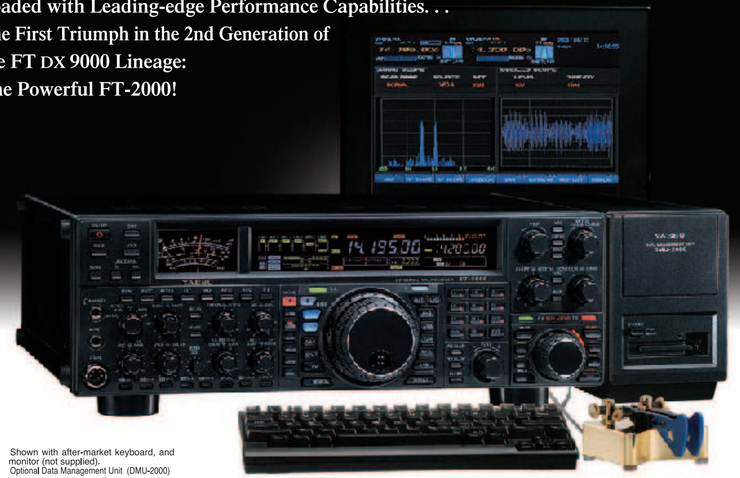

Shown with after-market keyboard, and monitor (not supplied).
Optional Data Management Unit (DMU-2000)

HF/50 MHz Transceiver
FT-2000D
200 W Version (External Power Supply)

HF/50 MHz Transceiver
FT-2000
100 W Version (Internal Power Supply)

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HF/50 MHz 100 W Transceiver

FT-950

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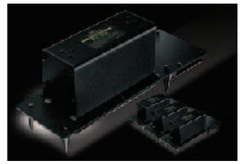
FT-950

Optional, YAESU Exclusive, Fully-Automatic μ-Tuning Preselector System!

(For FT-2000 series and FT-950)

Fully automatic, Ultra-sharp, External μ-Tuning Preselector (optional) features a 1.1" (28 mm) Coil for High Q

On the lower Amateur bands, strong signal voltages impinge on a receiver and create noise and intermod that can cover up the weak signals you're trying to pull through. YAESU engineers developed the μ (Mu) Tuning system for the FT DX 9000/FT-2000, and it is now available as an option for the FT-950. Three modules are available (MTU-160, MTU-80/40, MTU-30/20); these may be connected externally with no internal modification required! When μ-Tuning is engaged, the VRF system is bypassed, but the fixed Bandpass Filters are still in the received signal path.



Optional External Data Management Unit (DMU-2000) Provides Many Display Capabilities

(For FT-2000 series and FT-950)

Enjoy the ultimate in operating ease by adding the DMU-2000! Enjoy the same displays available with the FT DX 9000 and FT-2000: Band Scope, Audio Scope, X-Y Oscilloscope, World Clock, Rotator Control, Extensive Transceiver Status Displays, and Station Logging Capability. These extensive functions are displayed on your user-supplied computer monitor.

DMU-2000
Data Management Unit (option)

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The radio... FT DX 9000

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HF/50 MHz Transceiver
FT DX 9000MP
Two Pairs of Meters, plus LCD Window; Data Management Unit and Flash Memory Slot Built In. Main/Sub Receiver VRF, plus Full Dual Receive Capability, External 50 V/24 A Switching Regulator Power Supply and Speaker with Audio Filters

Display color (Umber or Light Blue) may be selected at the time of purchase. Modification from 400 to 200 W not possible.

HF/50 MHz Transceiver
FT DX 9000D 200 W Version
Large TFT, Data Management Unit and Flash Memory Slot Built In, Main/Sub Receiver VRF, plus Full Dual Receive Capability, Three µ-Tuning Modules for 160 - 20 M, 50 V/12 A Internal Switching Regulator Power Supply

HF/50 MHz Transceiver
FT DX 9000 Contest
Custom-Configurable Version
Two Pairs of Meters, plus LCD Window, VRF Input Preselector Filter, Three Key Jacks, and Dual Headphone Jacks, 50 V/12 A Internal Switching Regulator Power Supply

Display color (Umber or Light Blue) may be selected at the time of purchase. Modification from 200- to 400-Watt version not available.

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Optional Data Management Unit (DMU-2000)

HF/50 MHz Transceiver
FT-2000D
200 W Version (External Power Supply)

HF/50 MHz Transceiver
FT-2000
100 W Version (Internal Power Supply)

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