Official Journal of
ARRL
The national association
for AMATEUR RADIO

QST

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AMATEUR RADIO

March 2004

QST reviews

Ten-Tec Titan III
HF Linear Amplifier

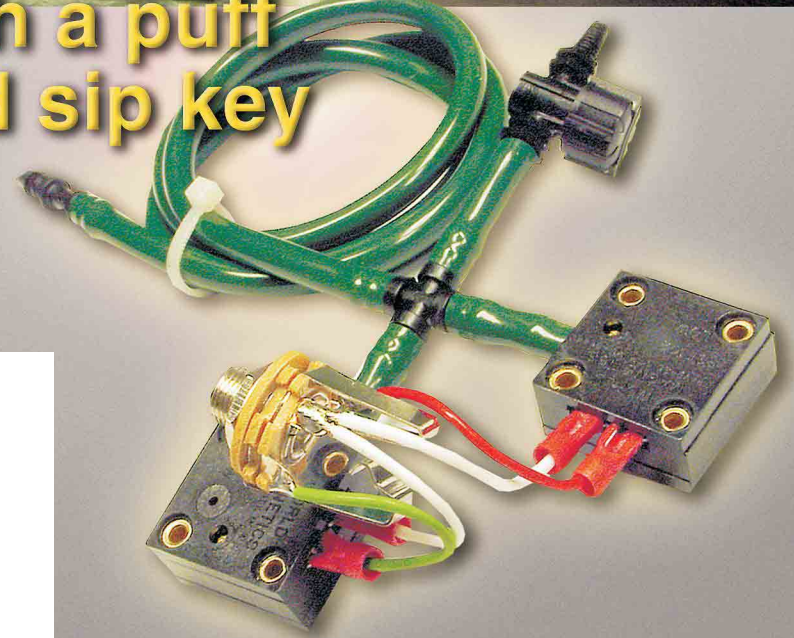
Kenwood TM-271A
2-Meter FM Transceiver

The classic multiband dipole

Replace your old meter face

Indoor antennas: Do they work?

Send code with a puff and sip key



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HAM-IV, $559.95. *The heavy duty Ham-IV is the most popular rotator in the world!* It is designed for medium size antenna arrays up to 15 square feet wind load area when mounted in-tower, or 7.5 square feet when mast mounted with an optional lower mast bracket. New alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. New low temperature grease permits normal operation down to -30 degrees Fahrenheit. New wire-wound potentiometer gives reliable and precision directional indication, new ferrite beads reduce RF susceptibility, new Cinch plug connector plus 8-pin plug at control box (no screwdriver needed). Dual 98 ball bearing race for load bearing strength. Strong electric locking steel wedge brake prevents wind induced antenna movement. Easy-to-use Control Box has illuminated directional meter with North or South center of rotation scale, separate snap-action brake and rotation switches. Uses low voltage control for safe operation. Accepts masts up to $2^{1}/_{16}$ inches diameter. Rotator size is $13^{1}/_{2}$Hx8D inches.

T-2X, $649.95. *Extra heavy duty Tailtwister antenna rotator!* For large antennas up to 20 square feet wind load when mounted in-tower, or 10 square feet when mast mounted with optional support bracket. Triple 138 ball bearing race, strong electric locking steel wedge brake. Control Box has an illuminated directional indicator with North or South center of rotation scale, separate snap-action brake and rotation control switches. Accepts masts up to $2^{1}/_{16}$ inches diameter. Rotator size is $14^{1}/_{16}$Hx$9^{1}/_{16}$D in.

CD-45II, $389.95. *Medium duty antenna rotator.* Handles antenna arrays up to 8.5 square feet windload area when mounted in-tower, or 5 square feet when mast mounted with supplied lower support. Dual 48 ball bearing race, disc brake system. Control Box has an illuminated directional indicator with North or South center of rotation scale, separate snap-action brake and rotation control switches with disc brake release. Accepts mast sizes up to $2^{1}/_{8}$ diameter. Includes light duty lower mast support, Rotator size is $17^{3}/_{8}$Hx8 D inches.

AR-40, $289.95. *Lightweight antenna rotator.* Handles smaller ham antennas and large TV/FM antennas up to 3.0 square feet windload area when mounted in-tower, or 1.5 square feet when mast mounted using the supplied lower support bracket. Dual 12 ball bearing race, disc brake system. Silent, automatic control box -- just dial and touch for desired direction. Accepts mast sizes up to $2^{1}/_{8}$ diameter. Includes light duty mast support. Rotator size is $17^{3}/_{8}$Hx8D inches.

Call your dealer for your best price!

Rotator Specifications	T2X	HAM-IV	CD-45II	AR-40
Wind Load capacity (inside tower)	20 sq. ft.	15 sq. ft.	8.5 sq. ft.	3.0 sq. ft.
Wind Load (with mast adapter)	10 sq. ft.	7.5 sq. ft.	5.0 sq. ft.	1.5 sq. ft.
Turning Power (in pounds)	1000	800	600	350
Brake Power (in pounds)	9000	5000	800	450
Brake Construction	Electric wedge	Electric wedge	Disc brake	Disc brake
Bearing Assembly/How many	Tripl race/138	Dual Race/96	Dual race/48	Dual race/12
Mounting Hardware	Clamp plate	Clamp plate	Clamp plate	Clamp plate
Control Cable Conductors	8	8	8	5
Shipping Weight (pounds)	28	24	22	14
Effective Moment (in tower)	3400 ft/lbs.	2800 ft/lbs.	1200 ft/lbs.	300 ft/lbs.

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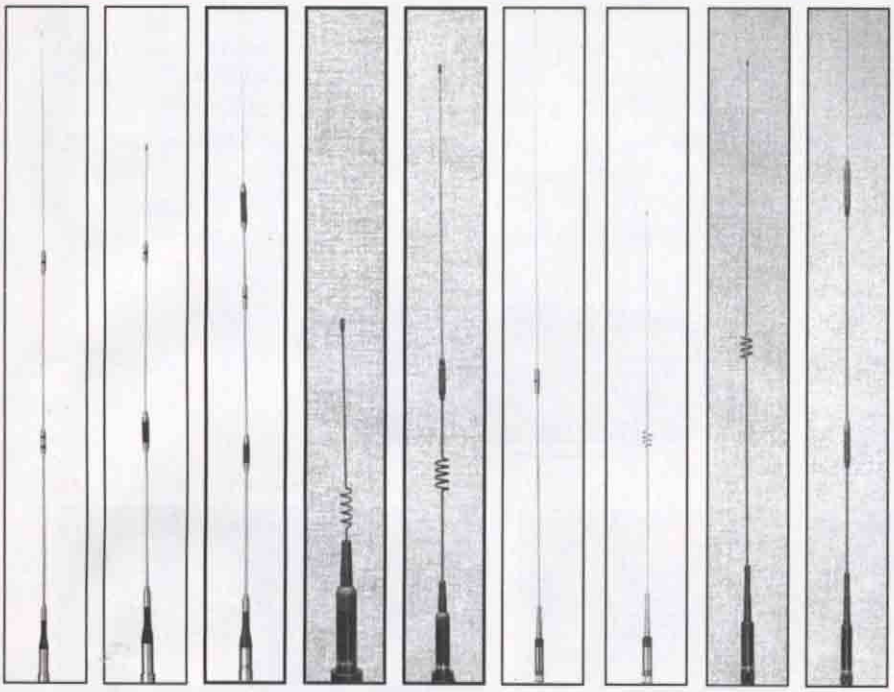


SG2000HD · SG7500A SG7500NMO · SG7900A · NR72BNMO · NR73BNMO · NR2C · NR770HA NR770HB · NR770HNMO NR770HBNMO · CR627B CR627BNMO

HV7A Mobile Antenna System

For New HF/VHF transceivers (Such as: IC706 series and FT100) NEW!

Optional Loading Coils

HVC7	40m
HVC14	20m
HVC18	17m
HVC21	15m

Recommended Antenna Mounts: K400C or K600M

MX62M Duplexer

Specifications:
HF/6m & 2m/70cm bands
1.6-56 MHz LPF
76–470 MHz HPF
(76–120 receive only)

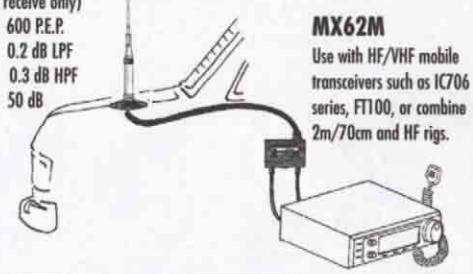
Watts:	600 P.E.P.
Loss:	0.2 dB LPF
	0.3 dB HPF
Isol.:	50 dB

The NEW HV7A has 5 band capability: 70cm, 2m, 6m, and 2 HF bands through use of loading coils. Foldover feature allows for easy access into low overhead buildings. Ideal for users of IC706 series and FT100 radios.

Bands Supplied:	10m/6m/2m/70cm
Opt. Loading Coils:	40m/20m/17m/15m
Power, P.E.P.:	HF 120w/VHF 200w
Mount Connection:	UHF
Length:	54"
SWR:	1.5:1 nominal

MX62M

Use with HF/VHF mobile transceivers such as IC706 series, FT100, or combine 2m/70cm and HF rigs.



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- NMO and UHF (PO) base styles
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- No grounding required unless noted
- Fold-over feature on most models

FOLD-OVER

Patented One-Touch Fold-over Feature
(Not available on NR72BNMO, NR73BNMO, & NR770SA.)

MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
NR72BNMO*6	2m/70cm	100	NMO	13.8	1/4λ, 1/2λ
NR73BNMO	2m/70cm	100	NMO	33.5	1/2λ, 1-5/8λ
NR770HA7	2m/70cm	200	UHF	40.2	1/2λ, 2-5/8λ
NR770HNMO8	2m/70cm	200	NMO	38.2	1/2λ, 2-5/8λ
NR770RA	2m/70cm	200	UHF	38.6	1/2λ, 2-5/8λ
SG7000A*6	2m/70cm	100	UHF	18.5	1/4λ, 6/8λ
SG7500A	2m/70cm	150	UHF	40.6	1/2λ, 2-5/8λ
SG7500NMO	2m/70cm	150	NMO	41.0	1/2λ, 2-5/8λ
SG7900A*	2m/70cm	150	UHF	62.2	7/8λ, 3-5/8λ

* Not recommended for Magnet Mount
6 Grounding required.
7 NR770HB same specifications but in black finish.
8 NR770HBNMO same specifications but in black finish.
9 52-54MHz only

MODEL	BAND (MHz)	WATTS	CONN.	HT. IN.	ELEMENT PHASING
NR2C	2m	150	UHF	55.5	1/2λ+1/4λ
SG2000HD*	2m	250	UHF	62.6	1/2λ+3/8λ
SG6000NMO*6,9	6m	150	NMO	39	1/4λ
CR224A*6	2m/1-1/4m	150	UHF	68.5	7/8λ, 2-5/8λ
CR320A*6	2m/1-1/4m 70cm	200 100/200	UHF	37.4	1/4λ, 1/2λ 2-5/8λ
CR627B*6,9	6m/2m/	120	UHF	60	1/4λ, 1/2+1/4λ/
CR627BNMO*6,9	70cm	120	NMO	60	2-5/8λ

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March 2004 ♦ Volume 88 Number 3

CONTENTS

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See page 15 for detailed contact information.

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Technical

28 Adventures with Indoor Antennas — *Kim Stenson, W4KVS*
Have attic space but no room for outdoor antennas? The author has some advice for you.

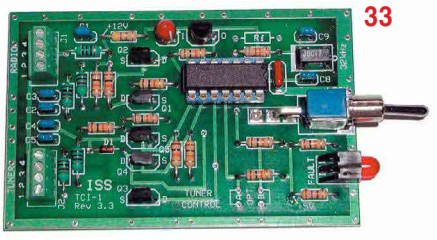
31 Build a Puff-and-Sip Keyer — *Gary Gordon, K6KV*
This inventive take on sending Morse code is a device that's easy to build and fun to use.

33 ICOM and SGC—A Perfect Match — *Bob Lewis, AA4PB*
An interface circuit that brings a popular ICOM transceiver and an SGC tuner into blissful union.

38 An Integrated AO-40 Antenna System — *Dick Jansson, WD4FAB*
Take the Teksharp 1.2 meter dish, add an AIDC-3731AA downconverter, and you'll be working AMSAT-OSCAR 40 in no time!

70 Product Review — *Joel R. Hallas, W1ZR*
Ten-Tec Titan III HF linear amplifier; Kenwood TM-271A 2-meter FM transceiver

70



33

News and Features

9 "It Seems to Us. . ." Restructuring II

12 ARRL in Action — *Dave Hassler, K7CCC*
RFI a daily matter for HQ staffer W1MG; Alabama section technology Web page documents balloon chase; technical specialist's work aids in house buying decision; more.

42 ARRL Board Seeks Major FCC License Restructuring — *Dave Patton, NN1N, and Rick Lindquist, N1RL*
At its Annual Meeting January 16-17, the ARRL Board dealt with a number of pressing domestic and international issues.

46 Three Flags Mobiling, from ALCAN to the Yucatán—*Part 2* — *David A. Rosenthal, N6TST*
Wrapping up his mobile odyssey, the author does his best Indiana Jones impression as he heads to the Yucatán to explore Mayan temples and mine the ham bands from his small rental car.

49 The Amateur Storm Chaser — *Seth Price, N3MRA*
College student N3MRA uses ham ingenuity to find severe weather before it finds populated areas.

52 Once Upon a California Hilltop — *Bill Pasternak, WA6ITF*
Art Gentry, W6MEP, was a repeater pioneer whose story is still compelling 50 years later.

75 Happenings — *Rick Lindquist, N1RL*
Organizations' comments augment alarm over BPL; ham antennas not a hazard to migratory birds, ARRL says; FCC begins "interference temperature" proceeding; more.

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QST Workbench

56 The Doctor is IN
Transfer metrology; horizontal Hula Hoop; Collins receiver diode load; more.

58 Short Takes — *Joel R. Hallas, W1ZR*
The A&A Engineering 5 A Smart Battery Charger

59 Rescaling and Customizing Meter Faces — *Ronald Lumachi, W2CQM*
Need a spiffy panel meter to complete your homebrew project? Save money by using readily available military surplus meters.

62 Hands-on Radio — *H. Ward Silver, NØAX*
Experiment #14—Optocouplers

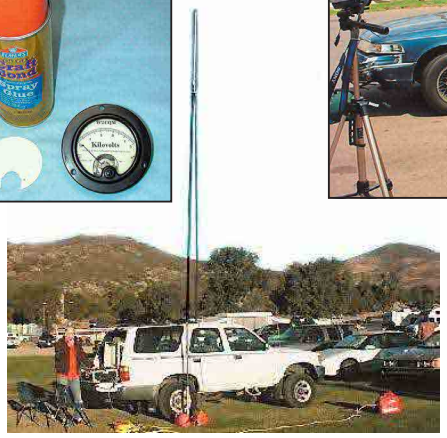
64 Help Desk
Schematic symbols

65 The Classic Multiband Dipole Antenna — *Steve Ford, WB8IMY*
It's easy to build and install, so why don't more hams use this wire antenna, fed with low-loss ladder line?

66 Short Takes — *Clarke Greene, K1JX*
Par Electronics SM-50 6-Meter Stressed Moxon Antenna

67 Hints & Kinks — *Robert Schetgen, KU7G*
Use antenna analyzers for better feedline-loss measurements; keeping water out of Hy-Gain TH-7 traps; more.

49



80

66

Operating

104 2003 September VHF QSO Party Results — *Jeff Klein, K1TEO*

107 2003 ARRL 10 GHz and Up Contest — *David Sumner, K1ZZ*

Departments

Amateur Radio World	93	New Books	69
Amateur Satellites	95	New Products	55, 69, 101
At the Foundation	96	Old Radio	86
Coming Conventions	97	Op-Ed	94
Contest Corral	100	Public Service	80
Correspondence	24	Silent Keys	102
Digital Dimension	92	Special Events	101
Feedback	30	Strays	63, 99, 102, 106
Ham Ads	138	Up Front in *QST*	20
Hamfest Calendar	97	W1AW Schedule	103
How's DX?	88	We're at Your Service	15
Index of Advertisers	158	The World Above 50 MHz	83
Microwavelengths	90	75, 50 and 25 Years Ago	103

Our Cover
Tailor-made for the ham with a disability, this unique keyer can be great fun for all hams. Photo courtesy Gary Gordon, K6KV.

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

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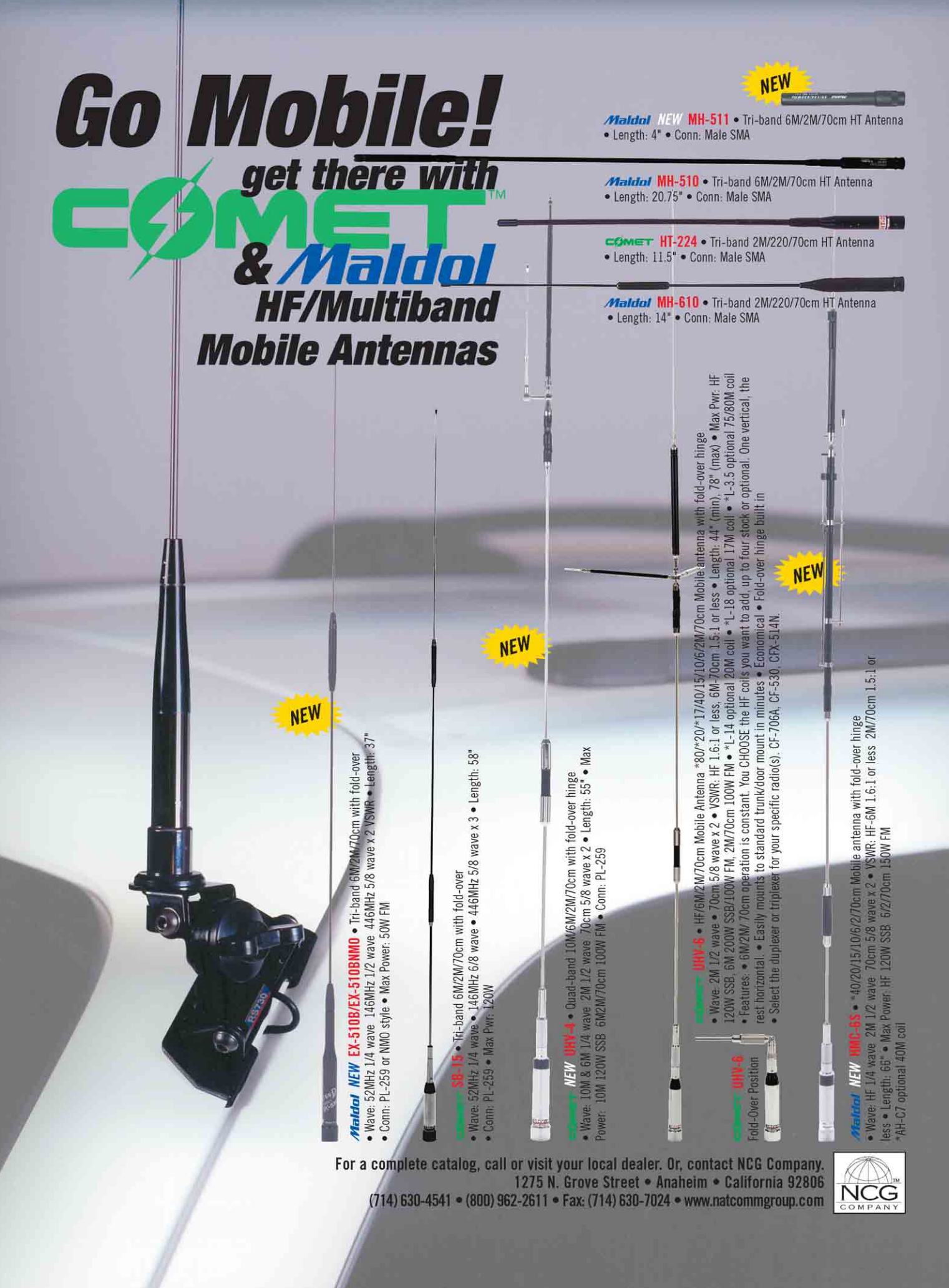

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Maldol NEW MH-511 • Tri-band 6M/2M/70cm HT Antenna
• Length: 4" • Conn: Male SMA

Maldol MH-510 • Tri-band 6M/2M/70cm HT Antenna
• Length: 20.75" • Conn: Male SMA

COMET HT-224 • Tri-band 2M/220/70cm HT Antenna
• Length: 11.5" • Conn: Male SMA

Maldol MH-610 • Tri-band 2M/220/70cm HT Antenna
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Maldol NEW EX-510B/EX-510BNMO • Tri-band 6M/2M/70cm with fold-over
• Wave: 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/70cm with fold-over
• Wave: 52MHz 1/4 wave • 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58"
• Conn: PL-259 • Max Pwr: 120W

NEW

COMET NEW UHV-4 • Quad-band 10M/6M/2M/70cm with fold-over hinge
• Wave: 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

COMET UHV-6 • HF/6M/2M/70cm Mobile Antenna *80/*20/*17/40/15/10/6/2M/70cm Mobile antenna with fold-over hinge
• Wave: 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 75/80M coil
• Features: • 6M/2M/ 70cm operation is constant. You CHOOSE the HF coil/s 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
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*AH-C7 optional 40M coil

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See Our Product Review in February 2004 QST

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The ARD9800 is a breakthrough in communications technology. By simply connecting the ARD9800 to a pair of transceivers, clear, reliable digital communications are a reality.

- **Digital voice communications using existing analog 2way radios.**
The ARD9800 uses the same audio frequencies (300 Hz ~ 2500 Hz) as microphone audio to modulate the voice signal. This allows you to use an analog radio as a digital voice radio.

- **Works on Single Side Band (SSB) mode.**
The Automatic frequency clarifier function adjusts frequency drift automatically in the SSB mode. (Approximately up to +/- 125 Hz). Utilizes the OFDM (Multi Carrier Modulation) circuit that is effective against Multi-path or Selective Fading, a powerful tool against adverse band conditions.

- **Automatic digital receive**
Automatic voice signal detector recognizes the received signal as analog or digital, automatically switching to the appropriate mode.

- **Digital Slow Scan TV***
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- **Built-in high grade Vocoder (AMBE)**
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- **Built-in FEC error correction**
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- **Utilizes a uniquely designed high performance DSP engine**

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"IT SEEMS TO US..."

Restructuring II

At its mid-January meeting the ARRL Board of Directors agreed on a proposal for additional restructuring of amateur licensing in the United States. This resumes a process that was begun by the FCC in 1998 but only partly completed by the Commission's decision, effective on April 15, 2000, to offer only three classes of amateur license and to reduce the maximum Morse code examination requirement to 5 words per minute.

Long before the FCC opened its 1998 proceeding, known as WT Docket 98-143, it was clear that the Novice license was no longer functioning as the normal entry point into Amateur Radio. That role had been supplanted in 1991, when Morse code was removed from the qualifications for a Technician license. Under the international Radio Regulations, a license for operation below 30 MHz could only be granted to an applicant who had demonstrated Morse code ability. As a result, new Technicians are restricted to VHF and higher bands. The Technician license offers full privileges above 50 MHz, so the written examination must cover a broad range of material—much of which is irrelevant to a beginner.

Typically, new Technicians obtain an FM transceiver for two meters (and perhaps one or two other bands) and listen to their local repeaters until they build up enough courage to hit the push-to-talk switch. Depending on the local situation, this may—or may not—be very rewarding. Hundreds of local clubs and informal groups throughout the country do a great job of welcoming newcomers, helping them discover how to enjoy Amateur Radio and improve their skills. New hams often are eager to volunteer for public service opportunities, which can lead to involvement in other local activities. Of course, if they're fortunate enough to have friends or family members who are hams the process is a whole lot less intimidating.

But the story doesn't always have a happy ending. At least one-fourth of new Technicians *never* get on the air. Of those who do, many don't feel welcome or don't find anything to hold their interest and quickly join the inactive ranks without considering upgrading. Putting more emphasis on mentoring can help, and the ARRL Board is setting out to do that. But new amateurs also should have more opportunities to connect to the wider world of Amateur Radio outside their local area, as many of us did as Novices.

The Board's answer is a new entry-level amateur license with enough privileges to be interesting, without requiring a more difficult exam or reducing the motivation to upgrade. As a result of WRC-03, amateur licenses without a Morse requirement now can include HF privileges. At the same time, it is counterproductive at the entry level to include privileges that are inappropriate or unattractive; this needlessly expands the exam syllabus, shifting the focus away from things a newcomer should know. When you're just getting started in Amateur Radio you don't need to run 1500 watts, be able to operate in the microwave bands or control satellites—all things that Technicians can do.

At the other end of the licensing continuum, the requirements for the present Amateur Extra license seem to be serving their purpose and the Board found no compelling reason to change them. This may disappoint those who regard the Morse code as obsolete. However, it reflects a rather widely held belief that in view of CW's continuing popularity, the most accomplished radio amateurs should possess at least basic Morse capability in their portfolio of operating skills.

If there are to be three classes of amateur license, one at the entry level and one at the Amateur Extra level, it logically follows that the existing classes of license must be mapped into the new structure. The FCC chose not to do that in Docket 98-143, leaving "legacy" license classes in place indefinitely—presumably, until the last license-holder passes away 70 or 80 years from now. This unnecessarily complicates the FCC regulations and serves no useful purpose for the future.

The Board proposes converting existing Novices—the smallest and least active group of amateurs—into the new entry-level license, which is being called "Novice" until someone comes up with a better name that can fit into the FCC's computer program. This is a change from the ARRL's position on Docket 98-143, when the Board proposed merging the Novice license into General.

When it was available, the Advanced license had a 13-WPM Morse requirement and a written exam on par with the Extra; since the privileges one gains on going from Advanced to Extra are mostly in the CW bands, it makes little sense to withhold them from Advanced licensees when the Morse exam for the Extra is now 5 WPM. So the Board concluded, as it did five years ago, that the Advanced should be merged into Extra.

The middle step is the General license, into which the present Technician and Tech Plus licenses would be merged. The short-term impact is that no one loses any privileges, while Technician and Tech Plus licensees would gain new privileges. In the longer term, Amateur Radio will gain a straightforward three-step licensing structure with a close match between requirements and desired privileges while retaining incentives to improve one's skills. More details, including how the Board's proposals mesh with the earlier ARRL petition to make better use of the existing Novice bands, RM-10413, are in the article on pages 42-45.

Any licensing proposal is bound to be controversial. Plenty of controversy was stirred up by more than a dozen petitions filed with the FCC by groups and individuals after WRC-03. Responding to membership input requested after last July's Board meeting, the ARRL Board correctly saw the issue of licensing requirements as involving more than just the Morse code. Using where the FCC left off in Docket 98-143 as the starting point for a more holistic approach, the Board has developed a solid base for a healthy Amateur Radio Service for the next decade and beyond.

—David Sumner, K1ZZ

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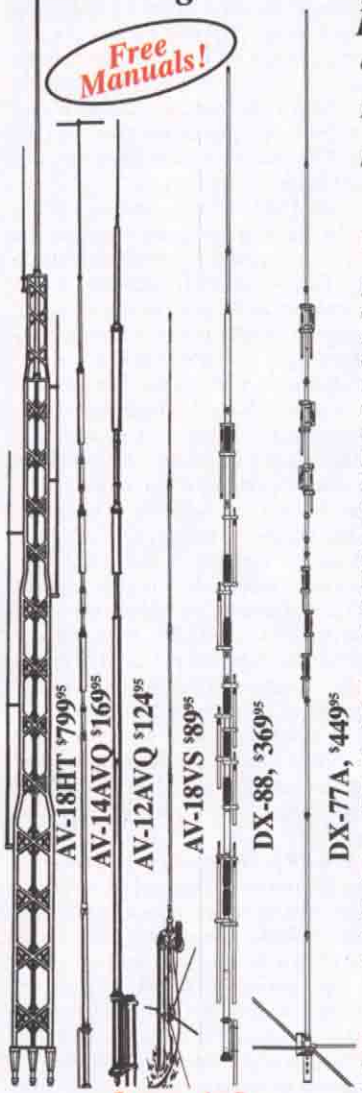

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AV-14AVQ, $169.95. (10,15,20,40 Meters). 18 ft., 9 lbs. The Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance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

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

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

DX-88, $369.95. (10, 12, 15,17,20,30,40,80 Meters, 160 Meters optional). 25 ft., 18 lbs. All bands are *easily* tuned with the DX-88's *exclusive* adjustable capacitors. 80 and 40 Meters can even be tuned from the ground without having to lower the antenna. Super heavy-duty construction. DX-88 OPTIONS: 160 Meter add-on kit, KIT-160-88, $189.95. Ground Radial System, GRK-88, $99.95. Roof Radial System, RRK-88, $99.95.

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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	$134.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$89.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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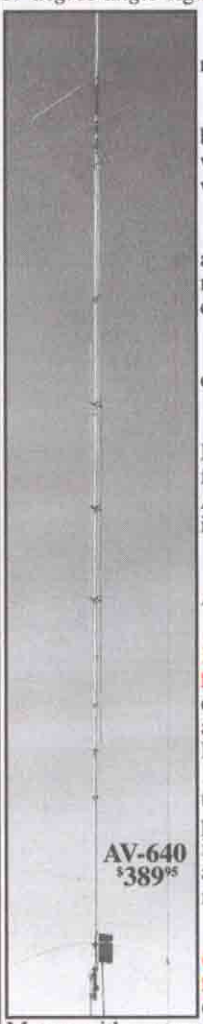

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Daring dual bands

DR-620T VHF/UHF

Mobile/Base FM Transceiver with Wide Band Receive

Dare to be different with this "new breed" mobile. VHF and UHF operations are a snap but there's a lot more. Listen to wide band broadcast FM signals, AM Airband, monitor weather and other public safety frequencies and keep track of it all with the large alphanumeric display that lets you change display colors! You can add the optional internal TNC for packet or APRS® operations or be among the first to enjoy digital voice communications with the optional digital module. Removable remote-mount head also allows you to invert the transceiver for the best speaker placement, illuminated mic, internal duplexer, CTCSS encode+decode, DCS and more!

DR-605TQ VHF+UHF

Dual Band Mobile FM Transceiver

Who said dual-banders had to be expensive? Dual band, dual watch and crossband repeat at a price that's amazingly low. CTCSS encode+decode, 50 memories per band, internal duplexer, large controls. Massive heatsink for quiet, fan-free operation. Reviewers loved this radio; you will too!

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DR-135T MkII VHF

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This rugged 2 meter mobile is ready for the "real world" of heavy use in demanding conditions. Whether you're chasing storms or chatting through the commute, you'll appreciate the large alphanumeric display, the big illuminated mic and the well designed functions that are easy to use. 100 memories, AM Airband receive, high stability TCXO, ignition key on/off feature, theft alarm, direct frequency input & optional internal TNC or optional internal digital voice module and more!

DR-235T 222 MHz

FM Mobile/Base Transceiver

If you're not yet on 222 MHz, you're not using all your privileges. From voice contacts to remote control of repeaters and more, now you can get on 222 MHz at a reasonable price. Enjoy 100 memories, alphanumeric channel labels, ignition key on/off operation, large illuminated mic, autodial memories, CTCSS encode+decode, DCS, wide/narrow FM operation, optional internal TNC and a host of features.

DR-435T MkII UHF

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There are many reasons you might want a monoband 440 MHz transceiver and the DR-435 is ready for whatever job you have in mind. From working repeaters, UHF satellites, remote command and control, data or simplex voice, and more; you'll find the 100 memories, large alphanumeric display, mic with illuminated keys all well designed to suit your purposes. Packed with features like CTCSS encode+decode, DCS, tone bursts, theft alarm, alphanumeric display, autodial memories, high stability TCXO and more.

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ARRL in ACTION

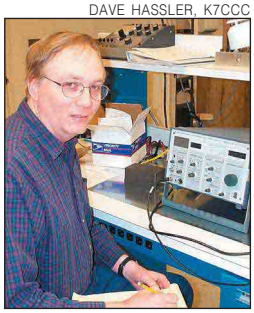
***YOUR* membership at work**

By Dave Hassler, K7CCC, dhassler@arrl.org

RFI is a Daily Matter for ARRL Laboratory Engineer

RFI. It seems every ham has to deal with it sooner or later. ARRL RFI/EMC Engineer Mike Gruber, W1MG, deals with it every day, as he handles an average of 120 member inquiries on RF interference problems each month. "We have a cooperative agreement with the FCC to help members in cases of power line noise and other interference to the Amateur Service," Gruber said. "My job is to resolve as many cases as possible before it becomes an FCC matter."

DAVE HASSLER, K7CCC



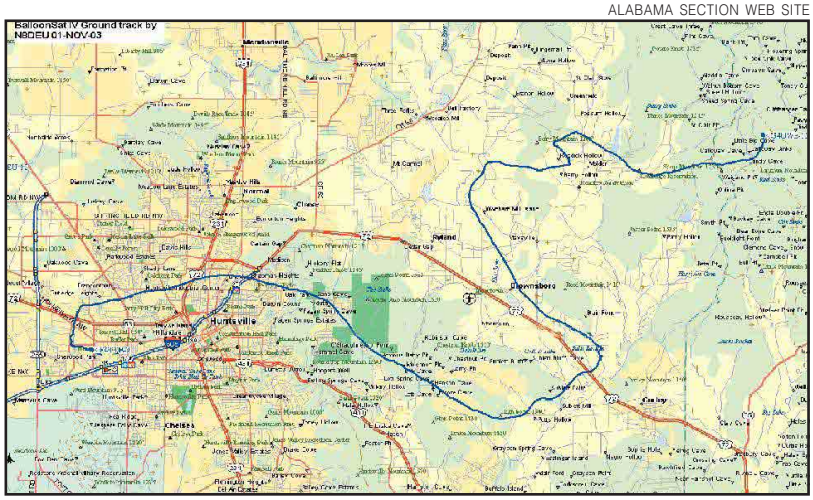
ARRL RFI/EMC Engineer Mike Gruber, W1MG, conducts RF emissions testing on all kinds of Part 15 consumer devices. Here he tests a suspect transformer that's used in walkway and patio lighting systems. Each month Gruber also handles over 100 member inquiries about harmful interference from power lines and other unintentional radiators.

Gruber aids members by either advising the member on the best way to approach the problem so the ham can resolve the problem on her or his own, or by directly contacting the operator of the offending power line or Part 15 device himself. One of the first places a ham should go if an RFI problem is suspected is the ARRL Technical Information Service's Power Line Noise FAQ, located at **www.arrl.org/tis/info/powerline-FAQ.html**. Gruber recently updated the comprehensive FAQ, which features a tutorial, power company responsibilities, the amateur's role, and how the ARRL can help.

Alabama Section Technology Page Documents Balloon Chase, More

Implementing technology has always been an important element of Amateur Radio. In recognition of that fact, ARRL Alabama Section Manager Greg Sarratt, W4OZK, has put up a page on the Alabama Section Web site that highlights some of the ways hams in the state are using Amateur Radio technology for public service work, experimentation and fun. Currently, two interesting APRS-equipped balloon chases are documented, and there are also links to see where the weather stations of Northern Alabama are located and a link to look up currently active APRS stations. Sarratt said the page is still under construction and that he's looking for more submissions and ideas.

ALABAMA SECTION WEB SITE



The path of the APRS/GPS-equipped balloon was plotted in blue to illustrate the journey it and the balloon chasers took across Huntsville and through the northern Alabama countryside.

Hare, Miller Speak at HRU

ARRL Lab Manager Ed Hare, W1RFI, spoke on interference issues at Ham Radio University January 18 as part of the ARRL New York City/Long Island Section Convention. Also present was ARRL Emergency Communications Grants Manager Dan Miller, K3UFG, who described the range of on-line ARRL Certification and Continuing Education courses now available. The event carried the theme "Spreading Ham Radio Knowledge and Know-How."

DXCC Staff Bust QSL Card Pileup

It happens every year: a lot of hams wait until late September to send in DXCC applications, causing a mountain of cards to pile up. "The reason for this September rush is that we have a September 30 deadline so that hams can get the highest DXCC totals possible listed in the *DXCC Yearbook*," said DXCC Supervisor Bill Moore, NC1L. "People bury us in applications at the last minute so they'll be able to get up-to-date and be listed in the new book."

For 2003, the DXCC Branch took in 5634 applications comprised of 623,725 QSL cards; Moore said his staff registered 1450 applications in September, totaling 142,847 cards. "On the final day, September 30 alone, we logged in 589 applications with 62,247 cards."

There's only one way to whittle that pile down—settle in, get determined and work 'em all. "The staff really attacked the backlog with a vengeance and got through it," Moore said, noting some staffers deferred vacation and personal time in November to aid the effort. "I projected a mid-January completion and they got it done right after Christmas."

Technical Specialist's Work Aids in House Buying Decision

When Wisconsin Section Technical Coordinator Richard Regent, K9GDF, heard loud, whining interference on his car radio at 1710 kHz from somewhere in a neighborhood where he was looking to buy a house, he knew there would be problems higher up, as well. "We wanted to buy a home in the area...wouldn't you listen to the radio, too?" Regent asked rhetorically. That's when he called Technical Specialist Richard Polivka, N6NKO, for assistance to find the noise source. Polivka did a little direction finding and RF sniffing and found the source of the problem, which he documented and reported to the We Energies utility. Soon, a bad lightning arrestor was found, parts replaced and the interfering noise vanished from the scene. Polivka later met with the We Energies RFI Group Leader and compared notes. "Members of the We Energies RFI Detection Team are now aware of ARRL members' capabilities, the Technical Specialist program and have asked for [our] continued help and cooperation," Regent said.

SM Makes the Rounds in North Texas

Before slipping into holiday mode late last year, North Texas Section Manager Roy Rabey, AD5KZ, did some hard traveling in his section, visiting six Amateur Radio clubs and speaking one-on-one to hams from the ARRL information table November 8, 2003 at the NCTECH Hamfest, put on by the Tri-County ARC of Azle, Texas. "We also had a section forum at the hamfest, with a focus on emergency communications issues. It was very well attended, I thought," Rabey said.

In a three-week span he also visited the Hurst ARC, the Arlington RC, the Parker County ARC, the Red River Valley ARC, the Northeast Tarrant ARC and the Fannin County ARC—all ARRL affiliated clubs. Topics of discussion ranged from BPL to public relations to Morse code testing to club promotion.

Sussing it Out

DOUG KILGORE, KD5OUG

North Texas Section Technical Coordinator Chris Hudgins, N5IUF, assisted the Richardson Wireless Klub in January by diagnosing a problem with their club repeater. Hudgins determined that receive sensitivity was being degraded by close proximity wideband noise. He then made plans for a DFing session to try to track down the noise source.

Getting the Top View

Southwestern Division Vice Director Tuck Miller, NZ6T (left), went up, up and away recently over the skies of San Diego with Blair Stephens, KD6IFG, a helicopter pilot with the air support unit of the San Diego Police Department. "Blair took me up as a ride-along and showed me the different hills, canyons and topography of the area," Miller said. "We also saw some of the burned out areas from our October firestorm down here." There's a roundup of ham radio's contribution to the firefighting effort in the Public Service column in this issue, beginning on page 80.

COURTESY TUCK MILLER, NZ6T

Donahue, Swiderski Boost ARRL at TechFest

ARRL Southeastern Division Vice Director Sandy Donahue, W4RU, participated in the Gwinnett Amateur Radio Society's "TechFest" January 24, spreading the word about the benefits and fellowship of ARRL membership. "This is like a hamfest without the commercial exhibits and flea market," Donahue said. "Tables were set up in a big room at the First United Methodist Church in Lawrenceville, Georgia, where various aspects of Amateur Radio were demonstrated." He said there were demonstrations of HF, VHF and UHF operating; voice-over-Internet systems, slow scan and fast scan amateur television, and much more. "You name it and we try to demonstrate it," he stated. The ARRL had an information table there, also, where Georgia Section Manager Susan Swiderski, AF4FO, joined Donahue.

League Warehouse Staff Meet Demands

The holidays are a busy time for most everyone, including the staff at the ARRL Warehouse. "After the hustle and bustle of the holiday season in which the warehouse crew shipped close to 6000 packages in the month of December alone, Warehouse Supervisor Steve Capodicasa was able to determine that the warehouse staff had shipped 60,083 total packages to individual hams and retailers for the year of 2003," said ARRL Sales and Marketing Manager Dennis Motschenbacher, K7BV.

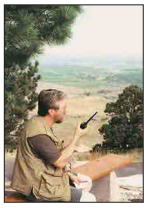
"Also, more than 60,000 supplemental issues of *QST* were shipped from the warehouse in 2003. (The *QST* main run is shipped from the printing plant in Glasgow, Kentucky.) That amounts to countless tons of Amateur Radio publications leaving the dock."

DAVE HASSLER, K7CCC

ARRL Warehouse Manager Steve Capodicasa maneuvers a forklift through the fully stocked aisles of the League Warehouse, located about half a mile from ARRL Headquarters. He and his staff processed and shipped over 200 packages a day during the month of December 2003.

Guide to ARRL Member Services

ARRL, 225 Main Street, Newington, CT 06111-1494



www.arrl.org/services.html/ **860-594-0200**

Technical and Regulatory Information Services

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

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

ARRLWeb www.arrl.org

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

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

ARRL News

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

QSL Service

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

Educational Materials

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

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Insurance

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

DXCC/VUCC

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

Volunteer Examiner Coordinator (VEC)

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

Trust in Advertising

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

ARRL Foundation

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

Write for *QST*

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

Interested in Becoming a Ham?

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

We're at *your* Service

ARRL Headquarters is open from 8 AM to 5 PM Eastern Time, Monday through Friday, except holidays. Call **toll free** to join the ARRL or order ARRL products: **1-888-277-5289** (US), Monday-Friday only, 8 AM to 8 PM Eastern Time. From outside the US, call 860-594-0355. The fax number is 860-594-0303 (24 hours a day, 7 days a week).

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

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

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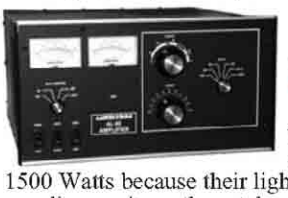

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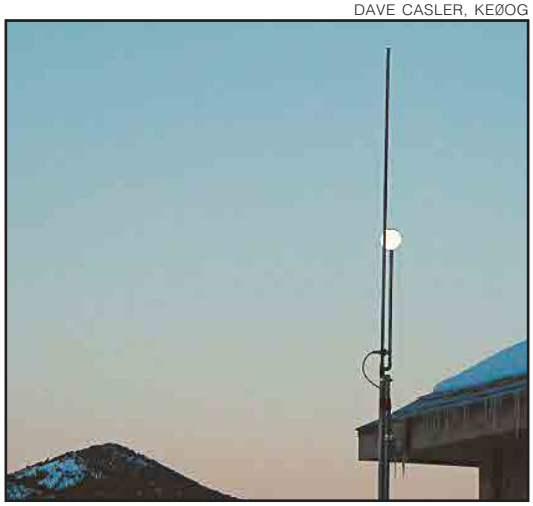
DAVE CASLER, KEØOG



Balancing act: **Dave Casler, KEØOG, of Ridgway, Colorado, says he woke one morning in early January to find his J-pole antenna had snagged the moon! He reports that he wiggled the antenna until the moon slid down just enough to be resting on the lower element.**

Governor on the Air

GOTA, the acronym for ARRL's Get On The Air Program, will soon take on a new meaning, as Maine Governor John E. Baldacci is preparing for his Amateur Radio license. Gov Baldacci, who just completed his first year in office, had visited with a number of Maine ham clubs as a congressman from the state's second (northern) district, and often expressed his admiration for the hobby and the public service it performs. Eventually, word got back to Bill Crowley, K1NIT, president of the Augusta Amateur Radio Association in the state's capital city, who made "GOTA" an official club project.

BILL CROWLEY, K1NIT

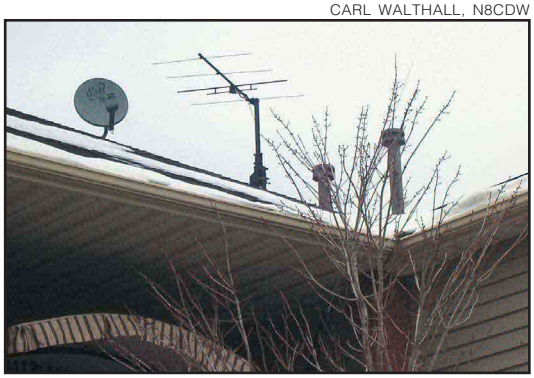
Maine hams start the process of getting Gov John E. Baldacci licensed as an Amateur Radio operator. From the left, Section Manager Bill Woodhead, N1KAT; Rod Scribner, KA1RFD, who is tutoring the governor; Gov Baldacci, and Augusta ARA President Bill Crowley, K1NIT.

Rod Scribner, KA1RFD, is serving as the governor's personal tutor. Gov Baldacci said he hopes to progress through the license steps so he can talk worldwide with other hams. Scribner, a former state treasurer and comptroller, is AARA's education guru and conducts ham radio classes in local youth and adult education groups. He is also active in Amateur Radio operations at the Children's Discovery Museum in Augusta and with the Maine Emergency Management Agency. Scribner said he expects to have the governor on the air by late spring or early summer.—*Bill Crowley, K1NIT*

Harmonious apartment station

Carl Walthall, N8CDW, of Rockford, Illinois, wrote to share his success story of operating in harmony with his neighbors from an apartment. He writes: I am enjoying hamming out of my apartment on 75, 20, 17, 15 and 10 meters, as well as 2 meters and 70 centimeters. Because apartment building owners do not have to comply with PRB-1, I had to work with them very closely in order to set up and operate my station. That included showing them the first antenna I was planning to install on my balcony and then getting their approval after it was installed. I also ran limited power for a year and routinely checked with my neighbors for any potential interference. After researching the subject on the ARRL Web site and the Antenna Newsgroup, I did some major filtering and grounding on all my equipment.

CARL WALTHALL, N8CDW



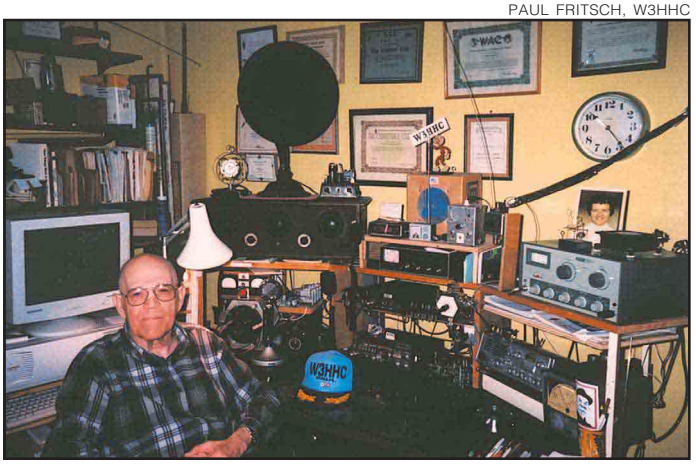
N8CDW's 4 element beam with rotator mounted on the roof of his apartment building.

CARL WALTHALL, N8CDW

The dish is a two way satellite Internet, and the antenna is an 80-10 meter High Sierra HS-1800/Pro.

After the first year in my apartment, without receiving any complaints, I decided to upgrade my HF antenna, and installed a High Sierra HS-1800/Pro along with an automatic screwdriver antenna tuner. Later, I installed a 2 meter, four element beam on the roof of the apartment building. I've found that by working with your apartment management and neighbors, and scheduling your transmissions off peak time, with the minimum amount of power, you can operate your ham station successfully from an apartment building.—*tnx Bradley Smith, WW9WWW*

PAUL FRITSCH, W3HHC



Creative indoor antenna: **A ham for 65 years, Paul Fritsch, W3HHC, of Allentown, Pennsylvania, uses what he describes as a "very oddball antenna." He writes: "The dark strip on the right of the photo goes up the wall to the ceiling, left and left again. It is a 16 foot piece of conducting wrapper from a steak sandwich. I also use the air conditioning metal ductwork as an antenna and have worked DX with both. Removal of all outside antennas was made necessary when I had the house sided." There's more on indoor antennas in the article that begins on page 28.**

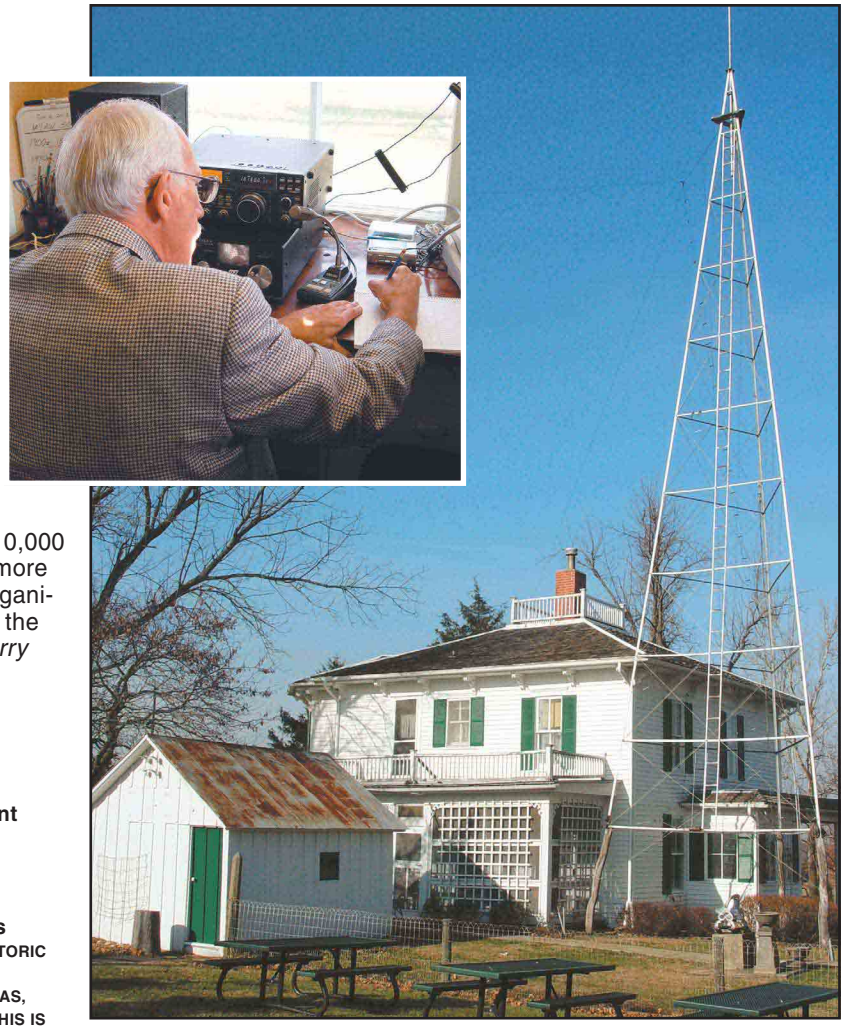
141CF/SCS

All in a day's work...: **During a recent military training exercise, technicians practice radio maintenance while wearing individual protective equipment. Note *The ARRL Handbook* at their side. The radio technicians are from the 141st Communications Flight, Washington Air National Guard, Fairchild Air Force Base, Washington.—*Lt Col Michael L. Maxson, N1NG, Commander, 141CF***

Ensor farm-museum station reactivated after 62 years

On December 6, 62 years to the day since the last QSO was made from the Ensor farmhouse near Olathe, Kansas, members of the Marshall H. Ensor Memorial Organization ARC and others reactivated W9BSP and contacted W1AW on 20, 17 and 15 meters. The W9BSP call sign now is held by the club as a tribute to Ensor, who died in 1970. The farmhouse, which is a National Historic Site and has a place on the Register of Historic Kansas Places, had been the lifelong home of Ensor, later WØBSP, and his sister, Loretta, W9UA (later WØUA), who died in 1991. After Loretta Ensor's death, the farm became The Ensor Farmsite & Museum. Between 1929 and 1941, the year Amateur Radio was shut down for the duration of World War II, the Ensors helped an estimated 10,000 people become Amateur Radio operators. For more information on the Marshall Ensor Memorial Organization and activities at the Ensor Museum, see the club Web site at **www.W9BSP-W9UA.org**.—*Larry Woodworth, WØHXS*

PHOTOS BY MICHAEL DOWN, KD5QLN



***Inset*—Ensor Memorial ARC President Larry Woodworth, WØHXS, fires up the rig at W9BSP as contact is made with W1AW. He described the event this way: "People jostled for position in the small kitchen adjacent to the radio room. Cameras and recorders were made ready. Excited conversation became the background QRM. The 24-hour clock closed in on 1900Z. Heard then on 18.160 MHz was** TESTING 1-2-3-4, W9BSP TESTING IN PREPARATION FOR AN HISTORIC CONTACT WITH ANOTHER HISTORIC STATION...CALLING W1AW STATION, CALLING W1AW. W1AW, THIS IS W9BSP, OLATHE, KANSAS, CALLING AND OVER. **And then the reply:** W9BSP, W9BSP, THIS IS WHISKY 1 ALFA WHISKY, W1AW IN NEWINGTON CONNECTICUT. **With that exchange, we all feel that history was once again made. Personally, I felt the warmth as if an unseen and unspoken entity had passed close by at that moment."**

Nearly two years of planning culminated in the December 6, 2003 reactivation of W9BSP. The preparation for the occasion included restoration of the 90-foot three-legged tower at the Ensor Farmsite & Museum.

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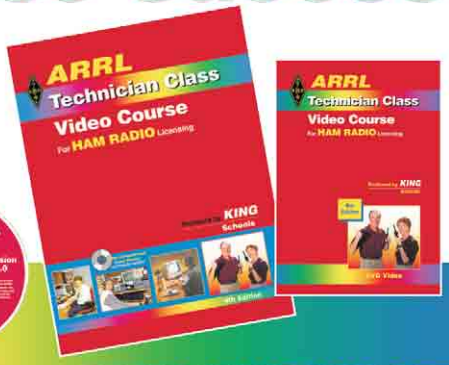

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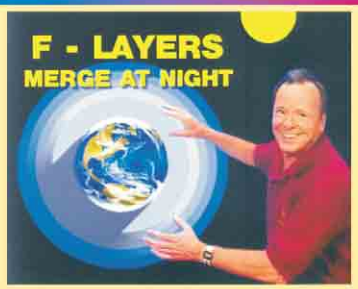

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RESTRUCTURING REDUX

♦ Hey, I like it! Well thought out. Something new and exciting and something that should get us some much needed "new blood." Best of all, there's even a bit saved for the diehard "CW Forever" gang.—*Jess Lewis, KR4OJ, ARRL Life Member, Manchester, Tennessee*

♦ I have read over the proposed reorganization of the license structure, and enthusiastically endorse all aspects of the plan. I must assume the FCC has been waiting to see what the amateur community wanted. Now they know, and if they will quickly come through with their Order, the plan can be put into operation. We have waited long enough!—*Wil Short, AB7FI, Boise, Idaho*

♦ I worked hard for my General class license and passed CW at 13 WPM. Now I read your latest proposals and I am somewhat dismayed. I do not mind the new Novice privileges—my main objection is putting Tech and Tech Plus into the General class. You can certainly count on me not renewing my ARRL membership and not purchasing any ARRL products in the future. I do hope the FCC denies all your latest proposals.—*Don Martin, N6RPI, Long Beach, California*

♦ I just finished reading your restructuring announcement and elimination of the code for two of the three HF licenses and I applaud you for making the necessary changes to help our hobby grow and flourish! Although I personally enjoy CW, I see the dropping of this requirement to be consistent with other radio services that have also dropped CW as a mode of operation—and I'm very enthusiastic that we will have an influx of new talent that otherwise might not have participated in this great hobby.

I'm a DXer and enthusiastic contester, and have enjoyed hearing the many European stations that have recently been "upgraded" or grandfathered into having HF privileges, and I'm happy to report they're among the most well behaved, friendly operators I've heard. I'm also hoping that this will create an opportunity for children to have easier access to the hobby—so that those of us who are aging old timers (that's most of us) will have young operators enter our ranks; it's the only way to keep the hobby alive and growing!

Congratulations on making the necessary changes. I appreciate your leadership and look forward to hearing many new operators in the upcoming years.—*Jim Nitzberg, WX3B, Manchester, Maryland*

DYSLEXIA

♦ I was interested in the letter from Shel Epstein, K9APE [Feb 2004, p 24]. I agree that provisions should be made for accommodating candidates with disabilities. Indeed, I have had the pleasure and privilege a number of years ago of being on a VE team that tested a blind teenager for the written portion of both his Advanced and Extra class licenses (I read the questions aloud to him, and he then gave the answers). We VEs were worried about the circuit diagram questions, but this proved unnecessary; he passed both exams before we got to them.

I do not mean to demean Shel's concern about dyslexic candidates, and I would support any means he might suggest to alleviate these problems. The only thing I would question is the capability of VEs unknowledgeable about dyslexia to make a valid judgment about alleviating the problem.—*Dave Sher, W9LYA, Skokie, Illinois*

HOORAH!

♦ Hoorah for the Doctor in the December 2003 issue [p 51]. I have been looking in vain for years in Amateur Radio publications for an explanation of iambic keying. I also enjoyed the article on "Tex" Burdick [Dec 2003, pp 48-49]. It is wonderful that he is still going strong.

The last two issues of *QST* have been outstanding! Being an old fashioned "geezer," I love historic equipment. To me, any decent ham transmitter is rack mounted! —*Ruddy Ellis, W4LNG, Atlanta, Georgia*

CARPE DIEM

♦ When President George W. Bush made his recent proposal to return to the moon and eventually put a human on Mars, I thought members of the Amateur Radio community would've been among the first to be openly supportive of this endeavor. After all, aside from the military, only licensed Amateur Radio operators are permitted to make contact with the space shuttle and the International Space Station. This ambitious plan, if nothing else, is a chance for Amateur Radio to shine.

If you think SAREX and ARISS are impressive, imagine a QSO with someone in a newly established lunar facility.

If downloading ATV pics from orbiting satellites is exciting, imagine ATV from the lunar surface...like a photograph of the plaque left by the Apollo astronauts or downloading image transmissions from a lunar-based telescope (much like Hubble) probing the void of space and being more readily accessible by lunar crews.

If you enjoy WeatherFax images, imagine students studying real-time images of Earth's weather patterns or a volcanic eruption as seen from the lunar surface.

Theoretically, AMSAT could even construct a small lunar rover (much like the current Mars model) to be manually deployed in much the same way one would put down a remote controlled car. No difficult landings for the little bot...just an astronaut unpacking it, turning it on and putting it on the lunar surface during a surface EVA. After that, it would be up to the crew assigned by AMSAT as to where on the lunar surface it would explore.

With some Amateur Radio operators already experienced in moonbounce, regular scheduled school contacts with lunar crews could become a reality. Transmissions could include live ATV transmissions from the lunar surface.

In the late 20th century, President John F. Kennedy pushed for America to put a man on the Moon.

Thirty-five years later, the resulting benefits from NASA's earlier space endeavors are evident in everything from computers to Velcro.

What President Bush has done is asked us to focus on continuing Kennedy's dream and take the next logical step. Not just to visit and "play" but to stay.

Amateur Radio can be there from the start to help contribute in the pioneering efforts of space exploration and lay the groundwork for interplanetary communications on a non-military level accessible by the citizens.

Lastly, if you like DX, there's a trophy sitting in one of the cases at the ARRL HQ for the first Earth/Mars contact. How nice would it be to have your name and call sign immortalized next to it?

Even if we only see the very beginning, it is something worth aiming for...especially if it gives Amateur Radio a boost to go for, at least, another century.—*Scott Verity, KC2FBV, Massapequa Park, New York*

LOGBOOK OF THE WORLD

♦ I have been an ARRL member for about 20 years. I used eQSL, and still do, and was very skeptical about LoTW. I have to say that what I sense you guys are doing there is right on target.

The site is clean—technical but not overly so. I like the way it is laid out—very professional. The FAQ section you put together is one of the best levels of details I have seen. I run a support Contact Center for a major Fortune 500 company so I know from what I speak.

Once you get the word out, you can make things very interesting for hams around the world and give them another "jolt" for staying active. The site can be a driving force for the hobby if done right—very cool.

I really did not mind going through all the gyrations to ensure data integrity. I know some out there will have an issue with it. The more you can streamline that aspect of the system, and make the process seem "painless" the more it will catch on.

Hope you get some good reviews in the literature...Keep up the great work! —*John DeBlase, W2SWL, Hamilton Square, New Jersey*

CRYSTALS

♦ The article on quartz crystals ["...And We Had Crystals," Jan 2004, pp 43-45] reminded me of an incident from my Novice days. In 1952 when I was first licensed as a Novice, I bought a 3746 kc crystal from the Knight Company in Sandwich, Illinois for my first rig, an Eldico TR-75. I think the crystal cost around $3.

I still have the crystal. In 1988 I was working for a major Dallas defense contractor and traveled to Sandwich to give a presentation to the management team of CTS Knights, Inc, the successor to the old Knight Company. At the end of my presentation and the questions that followed, I tossed the old FT-243 crystal out onto the conference room table. This brought a lot of "Wows" and "Goll-lees" from the folks around the table—none of them had ever seen an FT-243 before. This one still had the JK Knight logo, and Sandwich, IL on the front. Somebody went back to the shop and brought an elderly technician into the room. He picked up the crystal and said "Yeah, I made this one."

I explained how we hams would grind down the quartz to raise the frequency. One of the younger guys said "Didn't that ruin the metallization?" He was referring to the modern technique of applying a layer of metal to the quartz, which allowed a wire to be soldered to it. I explained that there was no metallization, just springs to hold the assembly together and make contact with the quartz. He had to take the crystal apart to see this.—*Tom Webb, W4YOK, Plano, Texas*

OBSOLETE STUDY GUIDES

♦ The article in "Exam Info" [Jan 2004, p 81] noting that effective July 1, 2004, the revised Element 3 question pool takes effect, prompts me to write.

I have been a VE for the past three years, helping administer examinations in the Wilmington, Delaware, area for two VECs. I am observing that all too often examinees are failing tests because they have been studying obsolete test study guides. With tests being redesigned every three years, this confusion will only increase as more and more obsolete study guides float around. We have unintentionally set up a trap for potential new hams. Even though study guides may note the time frame the test material is valid, the warning appears to be ignored. Also, we need to make sure that Amateur Radio clubs do not donate study guides to local libraries; there is no practical way these books will be removed from shelves when obsolete.

Although I believe tests should be revised periodically to mirror the changing state of the art, we should not revise on a three year cycle—it is too rapid and allows many test study guide versions to remain in circulation. I do not remember students who have failed exams coming back to be retested over the following test sessions; perhaps they do not want to invest more of their time or money.

The last thing we need is to discourage new hams!—*Allan F. Falcoff, K3YZ, Chadds Ford, Pennsylvania*

ARRL VEC Manager Bart Jahnke, W9JJ, replies: The question pools (as revised by the National Conference of Volunteer Examiner Coordinators—Question Pool Committee) are presently updated on a four-year cycle (as reported in January 2004 *QST* "Exam Info"). The next pool up for review is the Extra—for implementation in 2006 (there is no update scheduled for release or implementation in 2005). Other than during FCC license structural changes, about two-thirds of each released pool's questions are generally verbatim from the previous pool, and most syllabus material remains the same, update to update. QST

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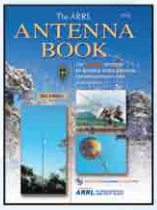

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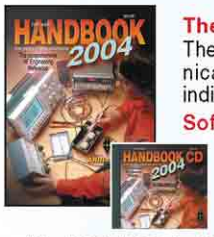

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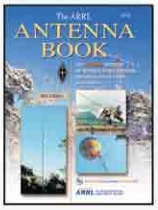

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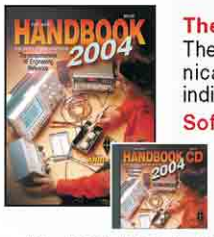

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By Kim Stenson, W4KVS

Adventures with Indoor Antennas

W4KVS has a modest, inconspicuous and effective aerial arsenal—in the attic.

A few days after receiving my ham license I purchased an ICOM IC-551D 6 meter transceiver (circa 1987), power supply, tuner and 6 meter dipole. Living in an antenna-restricted area I was forced to use an indoor antenna. I temporarily installed the dipole on the second floor of my two-story brick home and conducted an RF exposure safety check. I soon located a local net, the Sandlapper 6 meter Net. Not being sure my temporary indoor dipole would work, I made a call. To my surprise, K4IRT came back to me and I checked into the net. Over the next few weeks, I was also able to check into nets in both Georgia and North Carolina. Received signal reports were not good, but I was able to make contact.

Improving the Indoor Antenna

In search of better performance, I moved the dipole from the second floor to a more permanent setup in the attic. Mounting the antenna there served three purposes: First, it would add at least 10 feet to the antenna height, putting it about 25 feet up. Second, it would reduce RF exposure. Third, my signal would only have to go through plywood and shingles. The available attic space was 15×25 feet but it had some drawbacks. Most of the attic was not decked, making movement difficult. Additionally, a large HVAC unit was located on what decking there was.

Working space was one thing, but I had no idea how the HVAC unit might affect operations. Despite the heating unit and the wood and shingles, signals improved significantly. Nevertheless, the search for a better system continued. After a little research, I determined a loop antenna might be a possible solution. I purchased and installed an M² Products 6 meter HO loop in the attic, approximately 30 feet above ground level. A view of the loop can be seen in Figure 1.

Local contacts immediately improved and shortly thereafter I experienced my first 6 meter opening and worked WA2SPL/1 in Vermont. Over the next several weeks I worked numerous stations including K7MI in Oregon and HC1BI in Ecuador. During these openings I was able to compare the dipole and the loop in the receive mode. There was a noticeable 2 or 3 S-unit improvement using the loop (the M² Products HO 6 meter loop gain is advertised at 4.2 dBd at 11 feet above ground). Despite the improvement with the loop, I looked into the possibility of a beam in the attic—settling on a Cushcraft 3 element beam with a 6 foot turning radius.

Using a piece of metal pipe and a flange, I built a base for the antenna and installed it on one of the crossbeams. With a TV rotator and short mast, the beam itself was a little less than 25 feet above ground. Assembling all the antenna parts in the attic was a bit awkward, but successful. The rotator installed on a ceiling joist is shown in Figure 2 and a view of the beam can be seen in Figure 3.

Signals also improved with the use of the beam, but not as much as the loop over the dipole. With both antennas it was necessary to use a 6 meter tuner to obtain an acceptable SWR (probably not necessary outside, but a necessity in the attic).

Although I prefer the loop because of its omnidirectional capabilities, the beam is often handy in pulling out the weaker signals. Another advantage of the loop is

Figure 1—The 6 meter loop mounted near the top of the roof.

Figure 2—The rotator is mounted to a pipe support secured to a floor member. Ceiling insulation covers the support.

Figure 3—The 3 element, 6 meter beam with crossed dipoles above.

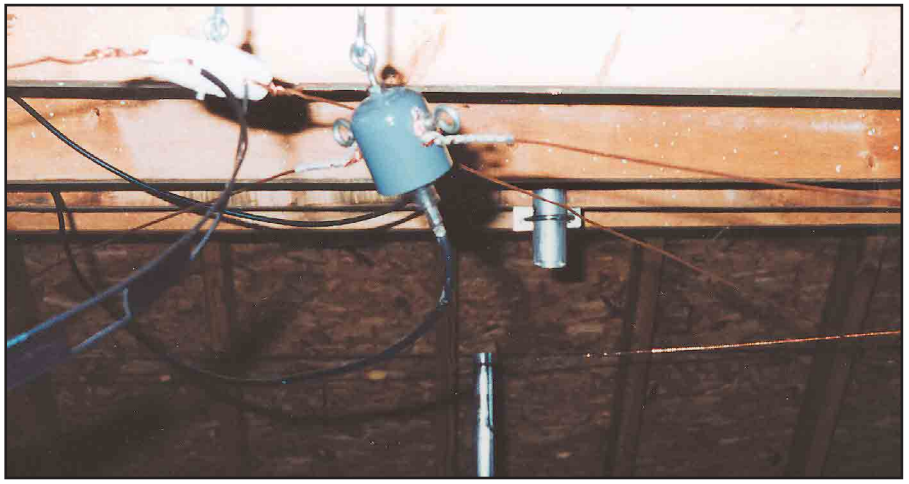


Figure 4—The 10 meter dipole center feed. Part of the second, orthogonal dipole can be seen above it.

that it is stationary and tuner adjustments are usually not required. The beam moves and with it goes the SWR, which requires tuner adjustment when changing directions. Both proved to be acceptable indoor antennas. In less than a year on the air, I was able to work 10 countries, 40 states and over 100 grids on 6 meters.

On to HF

Exploration of the HF bands using an ICOM IC-718 was my next goal. A 10 meter beam seemed impractical so I settled on a dipole, whose center feed is

The RF Proximity Question

Any time one operates with indoor antennas, consideration should always be given to the dangers of RF radiation. An attic antenna could pose a radiation hazard if the operator or, for that matter, anyone, is subject to RF radiation levels that are unsafe. How do we determine a safe radiation level? There are certainly standards, but these require sophisticated RF measurement instruments to get quantitative results. Fortunately, sophisticated measurement techniques aren't necessary if we keep the power levels *reasonable*. Much of the hard work has been done for us by means of accurate modeling software and representative antennas have already been modeled. (See *RF Exposure and You* by Ed Hare, W1RFI.[1]) A reasonable power level and one that will ensure compliance with accepted standards for an attic antenna system such as this is frequency and antenna gain dependent.

Consider a 10 meter half-wave dipole at a height of 20 feet (typical for an attic antenna in a 2-story home). Compliance is achieved if we limit our power to 50 W output and we are at least 3 feet away from the antenna. If we run 100 W output, we must maintain at least a 4 foot distance. These are so-called *controlled* limits and apply to the operator. If we consider *uncontrolled* limits (the general population), we must be 9 feet from the antenna for compliance at 100 W or 6.5 feet away for compliance at 50 W. Common sense tells us that we are indeed better off at low power levels. If we consider a 17 meter dipole at the same height, we must be 1.5 feet away at 50 W (controlled exposure) or 3.5 feet away (uncontrolled). For the same 17 meter dipole at the same height (20 feet) at 100 W, we must be 2.5 feet away (controlled) and 5 feet away (uncontrolled).

The 6 meter, 3 element beam is another story. For an attic antenna, if we are running 50 W, we must be at least 6 feet away (controlled) or 12 feet away (uncontrolled). If we lower our power to 10 W, we can be 4 feet away (controlled) or 6 feet away (uncontrolled). Clearly, it would be prudent to avoid antennas with meaningful gains in attic installations.

In all of these situations, common sense should prevail. Avoid high power levels and keep your distance. Also, remember the RFI (radio frequency interference) potentials as well. A by-product of the lower power levels will be lower tendencies for interference with common household appliances that are much closer to the antenna in an attic installation. Attic antennas certainly require compromises. Have fun, but keep the safety issues in mind.—*Stu Cohen, N1SC, Technical Editor, QST*

[1]Available from your local dealer or the ARRL Bookstore. ARRL order no. 6621.

Figure 5—The 10 meter dipole is lengthened for other bands with a simple extension on both ends. An alligator clip secures the extended element.

shown in Figure 4. VHF operation with a dipole was a bit spotty, at best. I wasn't overly optimistic. The result, however, was pleasing, as the band was full of signals and I jumped right in.

My first HF contact was in Barbados, 8P9JW, who gave me a 59 report. Not bad, but the Caribbean is pretty close. I heard a QRP station in Colorado calling CQ. I adjusted my output to 5 W and answered. To my surprise KF7MD came back with a 56 report. Not as good as my report from Barbados but not bad for two way QRP. By this time it was late in the afternoon and 10 meters started to close. I couldn't wait until the next morning to see how I might do with signals coming in from Europe.

Early in the morning the band started to open up again with many signals. I heard Ted, LZ1WR, calling CQ. I called; he answered with a 59 report. The attic dipole was going to work!

After a couple of months working on 10 meters, I wanted to explore other bands. I extended my dipole to 12 meters by adding a foot (or so) of wire to each end of the dipole with an alligator clip. One end of this can be seen in Figure 5. The result was a sort of inverted U-dipole. I experienced similar results with this setup and found I could easily work many stations. I even worked my first Japanese station on 12 meters. One drawback to this setup was that changing bands required a trip to the attic.

I decided to further modify my dipole and add extensions (again using alligator clips) to create a 20 meter zigzag dipole. Results of this setup were also acceptable and I could easily work everything between 10 and 20 meters using a tuner. On occasion, I was even able to bust pileups with the dipole, including a memorable QSO with a station in Tanzania on 17 meters. I later installed another dipole at right angles to the original dipole with some interesting results. Signals on 10 through 17 meters were about the same, but the difference on 20 meters was amazing. Signals barely registering 1 unit on the S meter with the first dipole now boomed in at S9 with the second dipole. With my indoor dipole, loop and beam I was able to work stations in over 240 countries in less than a year of operation.

Maximize Success

Here are a few tips for a successful indoor antenna. Any antenna should be mounted as high as possible. A low dipole in the clear is not going to be particularly effective and will be less effective if under a roof at the same height. Place the antenna as far away as possible from any wiring or other metallic objects.

Expect at least some RF interference from appliances in the home and also expect to create some yourself. Plan on doing some work to mitigate that interference.

Indoor antennas can and do work well.[1] Are they comparable to outside antennas? Maybe not, but indoor antennas can provide many good contacts and a fair amount of DX.

Photos by the author.

Kim Stenson, W4KVS, was first licensed in 2000 and has worked 257 countries (250 confirmed) with indoor antennas. He earned a BA from Washington and Lee University and an MA from Norwich University. Kim is a retired US Army Infantry Officer and saw combat service during the (first) Gulf War. Currently, Kim is manager of National Hazard Plans, South Carolina Emergency Management Division. He may be contacted at **w4kvs@arrl.net**.

[1]*Stealth Amateur Radio* by Kirk A. Kleinschmidt, NTØZ , has additional information on invisible and indoor antennas. It is available from your local dealer or the ARRL Bookstore. ARRL order no. 7571. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**. QST

FEEDBACK

◊ *Clarification:* After reading "A Mobile Antenna Base with Internal Capacitive Matching" and "The Doctor is IN" [Feb 2004, pp 43-46 and 65], Alan Applegate, KØBG, reminds us that there's another virtue to inductive, not capacitive, antenna matching. With an inductor shunted to ground, the mobile antenna is dc grounded. DC grounding can reduce static build-up and "grounds" the antenna should it contact any low-hanging power lines.

By Gary Gordon, K6KV

Build a Puff-and-Sip Key

Do you know a ham with a disability? Want to try hands-free CW? You'll have fun building and using this easy and inexpensive one-evening project.

Puff-and-sip keys have an interesting history, having been invented to provide a means of communication for people with severe disabilities. With these keys, they can send Morse code by using only their mouth. Most of these users aren't even hams! Every day, thousands rely on puff-and-sip keys and software programs like *EZ Keys*[1] to do serious office work, send e-mail and surf the Web.

Besides their social value, puff-and-sip keys are fun to master. I first saw one at a *Handi-Ham*[2] radio camp and I was soon sending at two-thirds my usual speed. Experienced users routinely reach 25 wpm or more. For most of us, puff-and-sip keys will never quite match the speed and convenience of paddles, but we might easily imagine special uses for these unusual keys. They can leave both your hands free and don't cause RSI (repetitive strain injury).

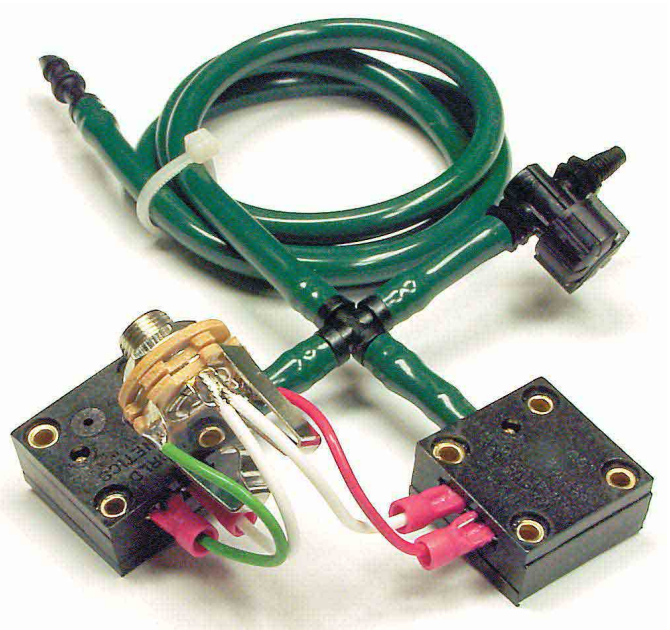


Figure 2—The two pressure switches are interconnected using drip-irrigation tubing and fittings.

[1]Notes appear on page 32.

Figure 1—K6KV pumps out a CQ using the puff-and-sip key.

Puff-and-sip keys can plug into your keyer or rig the same way that conventional paddles do. They're operated by gently blowing or sucking on a plastic tube that feels much like using a straw (that is, if you include blowing bubbles!). It's fastest to use only one's mouth and not one's lungs, since very little air is needed. Blow and you get dashes; sip and you get dots, perhaps mimicking the motions of one's mouth when saying "dah" and "dit." Figure 1 shows the author using the key. Try closing your mouth and pretending you're using a puff-and-sip key, and you'll almost hear the code!

Construction

Much of the simplicity of the key is due to the use of commercial pressure switches. These contain tiny diaphragms that deflect under pressure, opening or closing pairs of gold contacts. Depend-

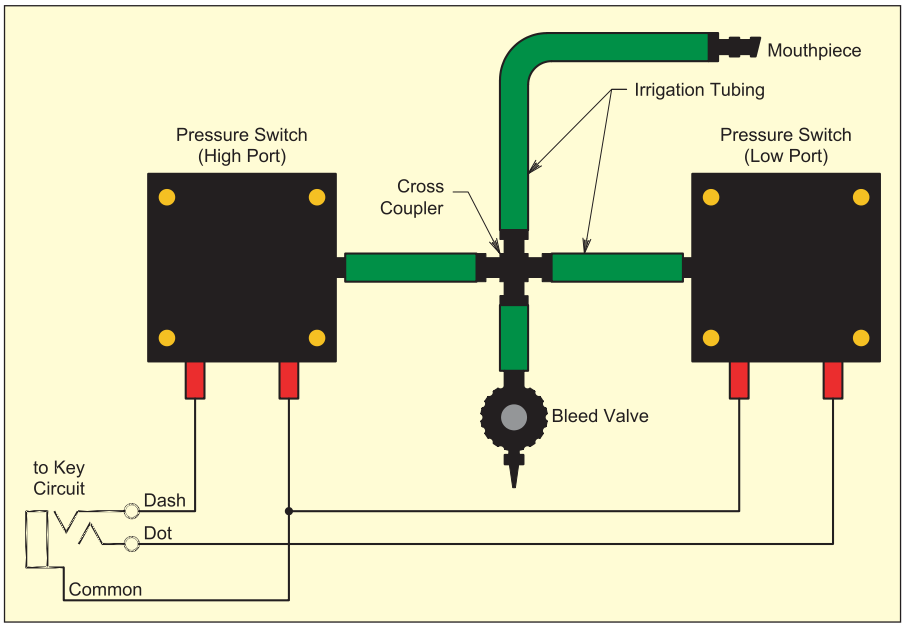


Figure 3—The schematic for the puff-and-sip key. Relating this to Figure 2 should enable easy construction.

ing on which side of the diaphragm is fitted with the contacts, they sense either pressure or vacuum. For this project, one switch of each configuration is used.

The recommended switches are adjustable over a pressure range between 0.5 and 2.0 inches of water. *Inches of water,* or *inches* for short, is a measure of the height of a water column that a particular vacuum will lift, working against gravity. For comparison, a moment's thought will confirm that sucking a soda straw requires "5 or 10 inches" of vacuum.

The project is further simplified by using drip irrigation tubing and its associated fittings, whose size exactly matches the stems on the recommended pressure switches. These parts should be readily available at most garden stores. You'll want to buy tubing, a cross coupler, some straight-through couplers for the mouthpiece and a valve. All of these parts are packaged many to a bag, so for a cost of around $15, you'll have lots of spares. The total parts cost for one key should run around to $50 and for two, to around $70. The completed key is shown in Figure 2 and a pictorial/schematic is shown in Figure 3.

Adjustments

The pressure switches should arrive set at 1.0 inch of water, a good starting point. For first tests, the air bleed valve should be set to block all airflow completely.

Where paddles have adjustments for spring tensions, the corresponding adjustments on this key are for air pressure and vacuum. Turning the adjustment screws clockwise on either switch will increase its sensitivity.

This key also includes an air bleed, something I haven't seen before. For whatever reason, a small air leak definitely improves the feel and accuracy, perhaps because it mimics the feel of a straw where some flow accompanies the vacuum. The bleed valve is quite sensitive, and needs to be cracked only enough to produce a faint "hiss" when blowing into the switch. The goal is to improve the feel of the key, but not bleed enough air as to require using one's lungs.

Once you've tried your new key, you may want to put it in some sort of box. This might be a reason to substitute surgical rubber tubing for the short interconnects, to allow the switch's components to fold over and become more compact. Commercial puff-and-sip switches also come with a fancy over-the-ear tube support, and you may eventually want to adapt yours to the microphone boom of a headset.

Conclusion

If the Handi-Ham camps are any indication, everyone in your club will want to try your new key. In the interest of sanitation, the key uses irrigation tubing splices as interchangeable mouthpieces.

Should you ever have the opportunity to see a person with a disability working one of these keys, you may be surprised to see that they use a 1:1 dot-dash ratio, not the 1:3 ratio used by hams. This is possible because their computer system doesn't need to encode information for a two-state channel, such as CW.

Interestingly, Morse code use is increasing among people with disabilities using computers because it can be very fast. Chances are that you might know someone who might benefit from this empowering technology. For the rest of us, however, puff-and-sip keys are easy to build, fun to master, and something to challenge other hams with at your next club meeting. It takes skill and composure to look cool using this key!

Sources for Parts

Pressure Switch

World Magnetics #7481-711 (0.5-2.0 inch H_2O, $^1/_8$ inch barb *high port*; vent-hole low port. Specify an initial pressure setting of 1.0 inch H_2O).

Vacuum Switch

World Magnetics #7861-711 (0.5-2.0 inch H_2O, vent-hole high port; $^1/_8$ inch barb *low port*. Specify same initial pressure setting of 1.0 inch H_2O).[3]

Irrigation Tubing and Fittings

RainDrip or equivalent. Available from garden or home supply stores.

Notes

[1]*EZ Keys* is available from Words+ Inc, 1220 W Ave J, Lancaster, CA 93534; tel 800-869-8521; **www.words-plus.com**.

[2]Courage Handi-Ham System, 3915 Golden Valley Road, Golden Valley, MN 55422; tel 866-426-3442; **www.handiham.org**.

[3]The pressure switches are available for $13.79 each directly from World Magnetics; tel 231-946-3800; **www.worldmagnetics.com**; minimum order $50. By special arrangement with Larry Hedeman of World Magnetics, this minimum may be waived for a fee of $10.

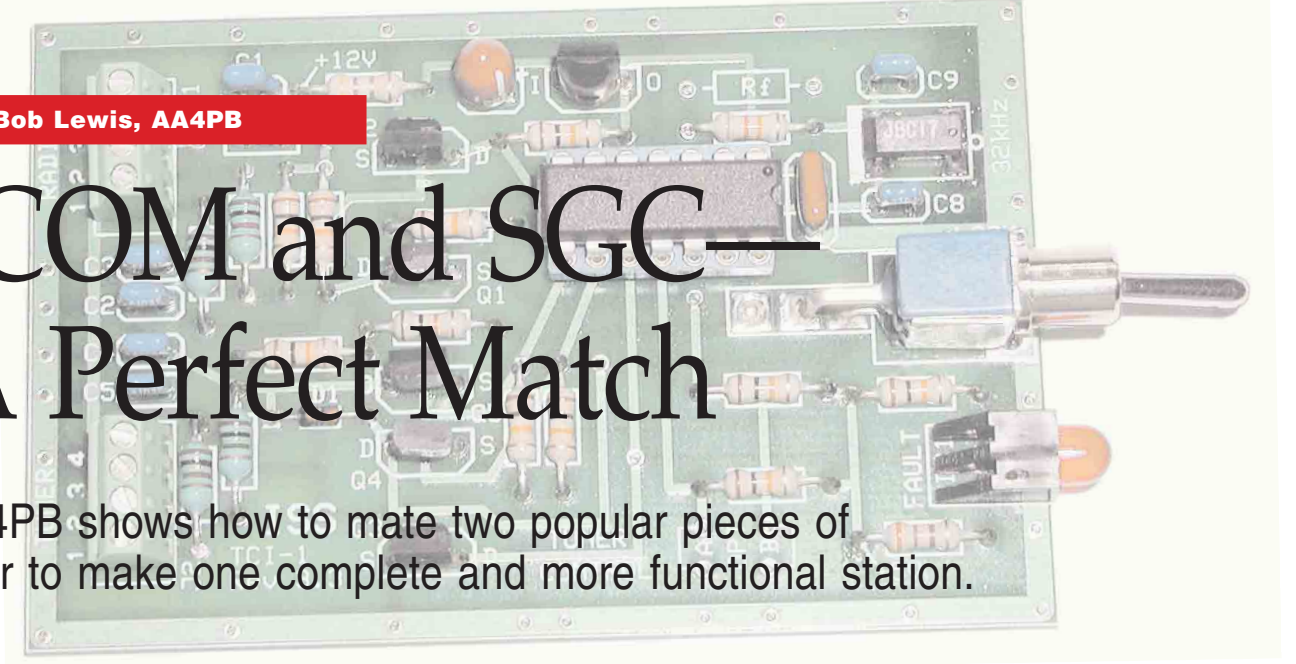
Photos by the author.

First licensed in 1955, while in high school, Gary Gordon, K6KV, used to build his own exciters and power amplifiers. Now a Scientist-Fellow at Agilent Technologies Laboratories, Gary co-invented the optical mouse, designs instrumentation for molecular biology and volunteer instructs at the Handi-Ham Radio Camps. You can reach him at 21112 Bank Mill Rd, Saratoga, CA 95070; **gary_gordon@agilent.com**.

By Bob Lewis, AA4PB

ICOM and SGC—A Perfect Match

AA4PB shows how to mate two popular pieces of gear to make one complete and more functional station.



Having recently purchased an ICOM IC-706MKIIG for the mobile station, I decided to look into a better HF antenna for my pickup. I'd been through the Ham Stick and Hustler antennas, both of which worked fine but were rather inconvenient for changing bands or even moving around within a band. The various screwdriver type antennas are good performers but they are large and fairly difficult to mount on a pickup. In addition, tuning is slow and antenna removal for entering a garage or a drive-through was not very convenient.

The Problem

What I decided to try was a whip antenna with an automatic tuner located at the base. The ICOM AH-4 looked good because it could be controlled from the IC-706MKIIG front panel. The problem is that it is not designed to tune 75 meters with an 8 foot whip. The SGC SG-237, on the other hand, will tune 75 meters but it doesn't fully integrate with the '706. Yes, I know an 8 foot antenna on 75 meters isn't going to be very efficient, but it is better than nothing. For me, it represents an acceptable trade in exchange for the convenience. The SG-237 also retains all of the various frequency settings in non-volatile memory while the AH-4 loses all this information as soon as power is removed. Having these tuning solutions available means that the tuner may be able to find a match in well under a second if you have tuned on that frequency before. When this is combined with an interface that terminates the tune signal as soon as a match is found, you may only need to transmit a short "blip" of RF in order to get tuned up on frequency.

A Partial Solution

There are circuits available (one as simple as a single capacitor and resistor) that can cause the '706 to enter a tune mode and put out a 10 W carrier when its TUNE button is pressed. While this setup will certainly permit the SGC to tune, it lacks some very nice features of the AH-4. Using this method, the SGC will not notify the '706 that a match has been made, so the radio will continue to transmit the 10 W carrier until it has either timed out or the operator has pressed the TUNE button again to cancel it. Without this notification, the TUNE light on the radio could not properly display the status of the tuner (the light will normally be on if a match was found and off if the tuner was unable to find a match). The '706 could not reliably place the tuner in bypass (whip connected directly to the radio) in response to changing bands or a momentary press of the TUNE button. It has also been reported by a number of users that this circuit can occasionally cause the '706 to go into tune on its own when changing bands because the bypass pulse is misinterpreted as a TUNE command.

The Complete Solution

My solution was to build a small interface circuit that would connect between the '706 and the SG-237 tuner to provide the proper control signals for each. The schematic for this circuit is shown in Figure 1. I used a 14-pin PIC processor to provide all the timing and control functions. A 32 kHz tuning fork crystal divides down nicely to provide a 1 ms resolution for the PIC on-board timer. Timing is not critical but it needs to be reasonably stable because it is the pulse width that differentiates the various commands into and out of the radio's tuner interface.

One area of concern in this design was the potential for the PIC processor to generate RFI that would get into the '706 receiver. This is handled by ensuring that the processor is in sleep mode (with no oscillator running) except during the tuning process. RFI filters are placed on all of the inputs and outputs to help ensure that RF from the transmitter does not make its way into the processor circuitry.

The Tune Lock Feature

SGC tuners have a feature called *Tune Lock* that is generally implemented via their *SmartLock* accessory. Once the tuner has found a tuning solution, it can be locked so that it does not attempt a re-tune if the SWR changes momentarily as the whip moves around during vehicle motion. Ordinarily, one would have to manually flip the switch to unlock the tuner before it could respond to a band or frequency change. In this design, the PIC processor automatically overrides the *Tune Lock* switch setting when commanded to tune by the radio and then re-enables the setting when finished. If you prefer to have the tuner locked during normal operation, you can simply leave the switch in the LOCK position. When you press the TUNE button on the radio the tuner will unlock, retune the antenna and then lock the new settings.

I found a feature in the SG-237 that has not been documented in the SGC manual. If the *Tune Lock* switch is in the locked position when power is first applied or the tuner is reset, then the tune from memory feature is disabled until the power has been removed and reapplied. If the switch is in the normal position while power is applied, then the tune from memory feature works as expected. I worked around this problem by changing the PIC firmware to disable the tune lock until 100ms after power has been applied. This gives the tuner time to wake up and initialize before the lock function is asserted and permits you to

leave the *Tune Lock* switch in the locked position at all times, even during power-up if desired.

Avoiding Multiple Resets

Rapidly switching the '706 through memory positions containing frequencies on different bands will cause the radio to output a series of tuner *reset/bypass* commands. This would occasionally cause the tuner to become confused and lock out the tune from memory feature. This is avoided by having the PIC firmware check the condition of the tuner before processing a reset command from the radio. The *reset/bypass* command is only sent to the tuner if it is in a tuned condition. Once the tuner has been placed in *bypass*, additional *reset* commands from the radio are ignored until the tuner has once again been tuned.

Planning for the Future

There are two jumpers (*Option A* and *Option B*) on the PC board that connect to two inputs on the PIC processor. These do nothing with the current version of PIC firmware. In the future these could be used to enable different features or possibly to select a different radio model if ICOM should decide to make some minor changes to the tuner interface.

How It All Works

Figure 1 shows the schematic of the interface. L1 through L5 and C1 through C5 form RFI filters for each lead entering or exiting the interface to ensure that internal circuits are not affected by RF from the transmitter.

When the '706 is first turned on it applies +12 V dc to pin 3 of the tuner interface connector. The radio then checks to see if +12 V dc is present at the STRT line (pin 2). If so, it assumes that a tuner is connected and activates that portion of the radio firmware that controls the tuner. If not, it assumes that a tuner is not connected and disables that portion of the firmware. Resistor R1 (10k) in the interface pulls the STRT line to +12 V dc in order to notify the radio that a tuner is connected.

The +12 V dc from the radio is used to power the tuner as well as being applied to the input of U1, which in turn supplies a regulated +5 V dc for the PIC processor. Resistor R3 and capacitor C6 provide an RC filter to keep any noise and spikes that may be on the vehicle power from reaching the regulator.

It is the STRT line (pin 2) that the radio uses to signal the tuner. The problem of course is that the SGC tuner doesn't understand the ICOM commands. The PIC processor translates those commands into something the SGC tuner does understand. A short low-level pulse (about 60 ms) on the STRT line means that the tuner should

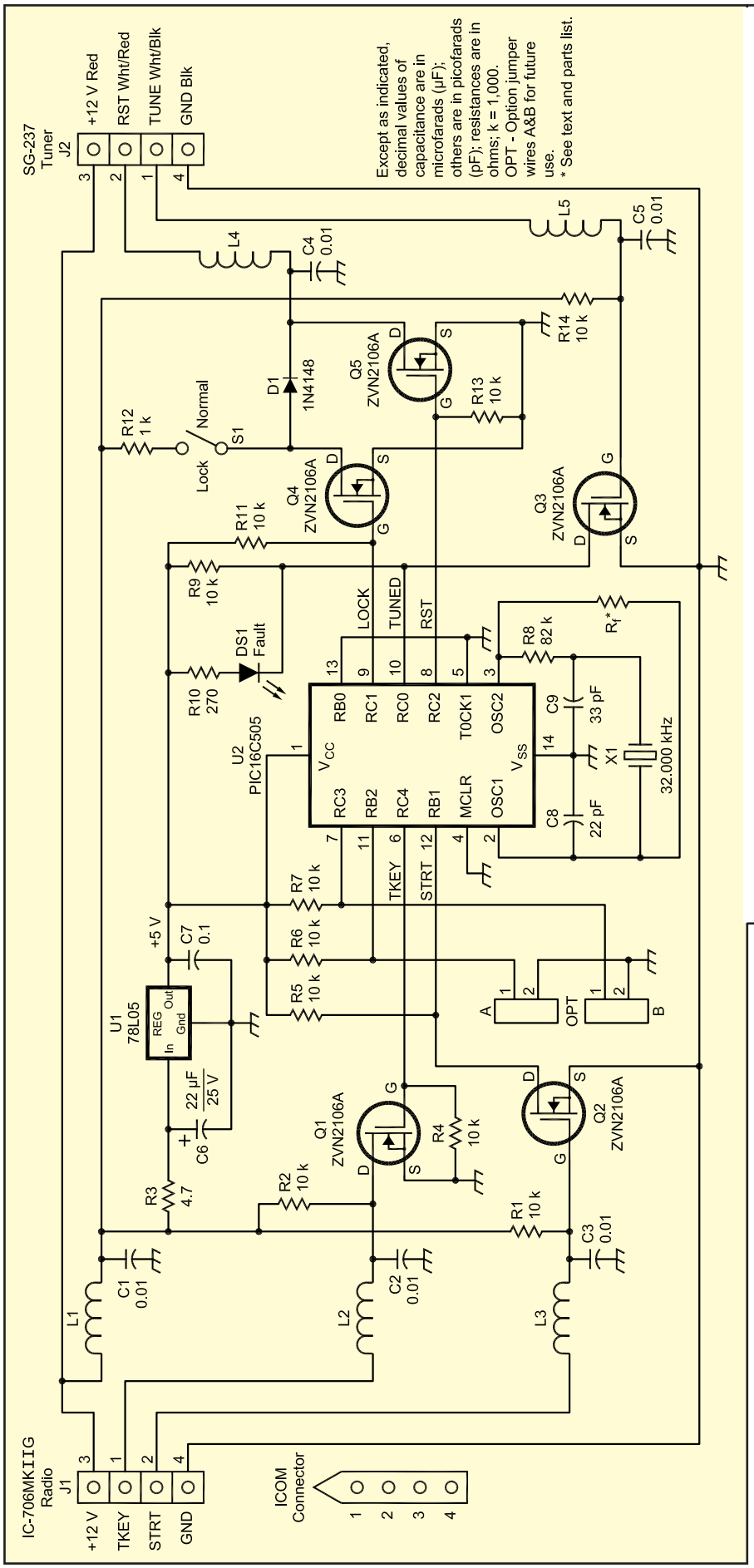


Figure 1—Schematic of the PIC controlled SGC-ICOM interface. Parts are obtainable from DigiKey (701 Brooks Ave South, Thief River Falls, MN 56701; tel 800-344-4539; www.digikey.com) or Mouser Electronics (1000 N Main St, Mansfield, TX 76063; tel 800-346-6873; www.mouser.com).

C1-C5—0.01 µF, 50 V monolithic capacitor, DigiKey P4922-ND.
C6—22 µF, 25 V, tantalum capacitor, DigiKey, P2051-ND.
C7—0.1 µF, 50 V metal film capacitor, DigiKey, P4525-ND.
C8—22 pF, 100 V, 5% COG ceramic capacitor, DigiKey P4841-ND.
C9—33 pF, 100 V, 5% COG ceramic capacitor, DigiKey P4843-ND.
D1—1N4148 diode, DigiKey 1N4148FS-ND.
DS1—Red LED, right angle, PC mount, T-1.75, DigiKey L20011-ND.
J1, J2— Terminal block, Phoenix MPT-0.5/ 4-2.54, DigiKey 277-1275-ND.
L1-L5—100 µH, 125 mA inductor, J. W. Miller, DigiKey M7837-ND.
Q1-Q5—ZVN2106A or 2N7000, N-channel FET, TO92, DigiKey ZVN2106A-ND.
R1, R2, R4, R5, R6, R7, R9, R11, R13, R14—10 kΩ, ¼ W, 5% resistor, DigiKey 10KQBK-ND.
R3—4.7 Ω, 1/4 W, 5% resistor, DigiKey 4.7QBK-ND.
R8—82 kΩ, 1/4 W, 5% resistor, DigiKey 82KQBK-ND.
R10—270 Ω, 1/4 W, 5% resistor, DigiKey 270QBK-ND.
R12—1 kΩ, 1/4 W, 5% resistor, DigiKey 1.0KQBK-ND.
R_f—Typically 1 MΩ, 1/4 W, if needed for slow starting oscillator (see note).
S1—SPST, 2 pin right angle PC switch, Mountain Switch, Mouser or DigiKey 1055-TA1220 CKN1059-ND, SPDT RT Angle PC switch, C&K.
U1—78L05 regulator IC, 5 V dc, TO92, DigiKey NJM78L05A-ND.
U2—PIC16C505 µcontroller IC, UV erasable, DigiKey PIC16C505/JW-ND or PIC16C505 µcontroller IC, one-time programmable, DigiKey PIC16C505-04i/P-ND.
U2 socket—14 pin IC socket for U2, DigiKey A401-ND.
X1—Quartz crystal, 32.000 kHz, SMD, Citizen DS1 (see note) DigiKey 300-2007-1-ND.
ICOM connector—Molex 03-09-1041P connector, DigiKey WM1308-ND and Molex 02-09-2103 pins, DigiKey WM1100-ND.
Enclosure—Hammond 1455C801BK, Mouser 546-1455C801BK or DigiKey 1455C801BK-ND.
Rear panel grommets—Keystone, 5/16 inch mounting hole, Mouser 167-211.
Cable—8 inches, 4 cond, 22 gauge, stranded, 0.19 inch OD, Alpha 1174C, Mouser 602-1174C-100.

Notes

DigiKey XC488CT-ND 32.768 kHz crystal may be substituted with insignificant timing differences.

R_f is typically not needed unless there is a problem with slow startup of the oscillator after sleep mode.

The author has a limited number of PC boards and programmed PIC processor chips available for this project. The PC boards are double sided, plated through holes, solder masked and silk screened. The cost per set is $14 plus $1.50 shipping for delivery in the US and Canada. The shipping cost is $5 elsewhere. Orders can be accepted by mail or via PayPal at rlewis@midatlanticbb.com.

reset and enter the bypass mode, connecting the whip antenna directly to the radio. Bypass usually provides a better receive signal strength than going through a tuner set to the wrong frequency. It is therefore a good mode to be in until you are able to transmit the tune signal without causing interference to other stations. A long low-level pulse (about 500 ms) on the STRT line is the signal to begin tuning the antenna. The PIC processor monitors the STRT line while it is asleep and wakes up in response to any change.

As soon as the PIC processor detects a signal on the STRT line it immediately unlocks and resets the tuner into bypass mode. We want to enter bypass before tuning in order to force the tuner to find a new solution, even if it were already close. If the STRT line is released in a short time then tuning is not being requested and the PIC processor goes back to sleep, leaving the tuner in bypass. If the STRT line remains low for 500 ms then a tune is being requested. The PIC processor then pulls the radio's TKEY line low via Q1 in order to force the radio to emit a 10 W carrier for tuning. During this time the radio emits a tone from its speaker to notify the operator of the tuning operation.

Upon receiving the RF carrier, the first thing the SG-237 tuner does is to measure the frequency. It then checks to see if the frequency is listed in one of its memory bins. If so, it can simply reselect the appropriate L and C values from a look up table rather than going through the whole tuning process. Under these circumstances the antenna can be tuned in as little as 10 ms, according to the SGC manual. I find the total "on the air" time to be about 500 ms in most cases. This includes the tuning time plus delays in the radio and PIC interface. If the settings for this frequency are not available from a memory bin or the resulting SWR is greater than 2:1 then the tuner goes through its tuning algorithm in order to find a good match and then records those settings in a memory bin for future use. I find this generally takes between 2 and 5 seconds of total "on the air" time. Upon finding an appropriate match, the tuner pulls its TUNED line low signaling the PIC processor to unkey the TKEY line and terminate the carrier. This action results in a short transmit time in order to tune the antenna and minimizes interference.

If the tuner fails to find a match after trying all possible combinations of L and C, then it signals the PIC processor by pulsing the TUNED line. This was intended by SGC to flash the LED on their *SmartLock* device. The PIC processor also has a 30 second fail-safe timer to prevent the radio from remaining keyed if the tuner should fail. In either case a match is not found, so the PIC processor sends a 200 ms pulse to the radio's TKEY line to signal the radio to turn off its TUNE light. The operator then knows the antenna is not functioning properly.

DS1, the FAULT LED on the interface provides an additional indication of the tuner condition by lighting any time that the tuner is not properly tuned (meaning its TUNED line is high). This is inverted from SGC's normal method of providing a green light indicating that the tuner is properly tuned. My thinking is that the FAULT LED will not be on during normal operation so there is one less light source in the vehicle at night and the red light is more alerting to the operator in the event of a tuning problem.

Now lets take a closer look at how the lock and reset functions work. The RST line on the SGC tuner is three-state. Momentarily pulling it to ground puts the tuner in bypass. Pulling it high (toward +12 V dc) puts the tuner in lock. Letting it float puts the tuner in normal operation. If S1 is in the locked (closed) position then R12, through D1, pulls the RST line high (locked). If S1 is in the open position then R12 is not connected and the RST line floats (normal operation). If the PIC processor wants to unlock the tuner then it pulls the gate of Q4 high. Q4 in turn grounds the junction of R12 and D1 so that D1 is reversed biased and leaves the RST line floating (normal operation) even if S1 is closed. If the PIC processor outputs a high to the gate of Q5 then Q5 conducts, grounding the RST line (*reset* to *bypass* mode).

The 32 kHz crystal, X1, provides the processor clock and internal timer reference for the PIC processor. Resistor R_f is not normally needed. A place is provided for it on the PC board in the unlikely event that it is needed to increase the feedback to compensate for a slow starting crystal.

One of the critical issues in the development of any PIC circuit is to ensure the proper drive level to the crystal. Low frequency tuning fork crystals require very

little drive. Too much drive can cause the crystal to fracture and fail after a matter of weeks or months. Too little drive may cause the oscillator to fail to start under conditions of temperature extremes. The goal is to provide as high a drive level as possible without distorting the oscillator waveform on pin 3 of the PIC (U2). The value shown for resistor R8 was selected experimentally to provide the proper drive level and should work fine for the majority of crystals.

Capacitors C8 and C9 were selected to provide the specified load capacitance to get the crystal on frequency. Making C9 slightly larger than C8 assists the oscillator in starting when power is first applied to the PIC.

Operator Controls

Two operator controls are used to control the tuner; The LOCK switch on the interface and the TUNE button on the radio.

LOCK Switch

The only operator control on the interface is the LOCK switch. Leave it in the LOCK position if you do not want the tuner to respond to changing SWR. Put it in the NORMAL position if you want the tuner to retune automatically any time the SWR goes above 2:1 while you are on the air.

TUNE Button

If the tuner is properly tuned, the red LED on the '706's TUNE button is illuminated and a momentarily press of the TUNE button will place the tuner in bypass. If the tuner is already in bypass, the TUNE button is not illuminated and a momentary press will begin the tuning process. The tuner is also placed in *bypass* any time the band is changed on the '706.

If the tuner is already tuned, you can press and hold the TUNE button for about 2 seconds in order to place the tuner in *bypass* and immediately begin retuning.

During a tuning process you can press the TUNE button to cancel the tuning operation. The radio will immediately stop transmitting, the tuner will be placed in *bypass*, and the PIC processor will cancel all timing operations and go back to sleep.

Operating the Tuner-Transceiver Interface

Forcing a Complete Retune

If the tuner is properly tuned, then placed in *bypass*, and then tuned again on the same frequency it will assume that you were not satisfied with the SWR previously obtained from the memory settings. In this case the tuner will go through a complete retuning process to obtain the lowest possible SWR and load these new settings into its memory bin for that frequency. You might want to do this if the antenna conditions had changed a little and the settings loaded from the memory bin resulted in an SWR of 1.9:1, for example. It is not 2:1 so the tuner will not automatically search for a new solution but you may not want to operate at a 1.9:1 SWR, so you force a retune.

Radio Settings

Always set the radio menu item 27, A-TUNE STRT, in the (default) OFF position. If you want the tuner to automatically retune in response to a high SWR then use the LOCK switch on the interface instead of the A-TUNE STRT function on the radio.

If you want the radio to automatically request retuning at the first microphone PTT press after the frequency has been changed by at least 1 percent, set radio menu item 28, PTT TUNE, to the ON position. It is set to OFF by default. Personally, I find this to be a very convenient function.

PIC Programming

The code for the PIC processor was written in assembly language. I used the Microchip *MPLAB* assembler available for free download from their Web page at **www.microchip.com** to develop the code. I used the *P16PRO40* programmer board kit and *picallw.exe* software available from Amazon Electronics at **www.electronics123.com** to program the PIC. The complete hex and object code, along with a software flow chart, can be found at **www.arrl.org/files/qst-binaries/ICOM-SGC interface.zip**.

A pre-programmed PIC chip and a double-sided PC board with plated-through holes, solder mask and silkscreen is available from the author. See the end of the parts list of Figure 1.

Construction

All of the components for this project, except for the PC board, are stock items available from DigiKey and Mouser Electronics.

The interface is constructed on a 2× 3.15 inch double-sided PCB with plated through holes. The PCB slides into an extruded aluminum case measuring 2.126 wide × 3.15 long × 0.908 inches high. Two 4 pin, PC mounted terminal blocks are used to attach the wires from the radio and the tuner. It is highly recommended that the PIC processor (U2) be mounted in a good quality 14 pin IC socket in order to make its replacement easy. This chip contains the program memory and its replacement will allow you to upgrade the firmware in the future.

All of the components are standard through-hole devices except for the crystal (X1). The crystal is a 4-terminal surface mount device (SMD) selected for its good mechanical reliability in a mobile environment. It is important that the crystal be the first component installed on the PC board and that it be properly oriented. Soldering this device in place with other components mounted around it will be difficult. Removing it without destroying it will also be quite difficult so it is best to get it right the first time.

It is important that the FETs be installed with the proper orientation. They are not likely to survive the first application of power if they have been installed in the

Figure 2—SG-237 antenna tuner mounted inside the pickup truck bed, showing the antenna base and the homebrew Delrin insulator.

circuit backward. A magnifying glass can be a big help in determining which side of these devices is the flat side.

A Word about Whip Mounting

A short mobile whip antenna can develop some very high voltages at the base, especially at the lower frequencies. With 100 W, it would not be unusual to have 1000 V or more at the base at 3.5 MHz. SGC warns that the typical CB-type ball mount could arc over. The typical $^3/_8$ inch stud mount with nylon shoulder washers will certainly not stand up to these voltages, especially when wet or covered with road dirt.

My solution was to machine a piece of 1.5 inch diameter × 3 inch long Dupont *Delrin* rod. I have a 1 inch deep, $^3/_8$×24 hole threaded in each end. This leaves 1 inch of Delrin between the ends of the mounting bolts to provide insulation. The Delrin insulator serves to insulate the whip from the mount. The feed wire is connected to the base of the antenna at the top of the insulator so that no voltage is present on the mount.

Since I have a pickup, I purchased a very substantial stake pocket mount from GeoTool (**www.geotool.com/antmount.htm**) to provide a solid support for the custom insulator.

There are two key points to note about any mobile tuner/whip installation. One is to provide a very good RF ground connection between the tuner and the vehicle. The other is to use as short a feed line as possible between the base of the whip and the tuner. This wire must not be coax cable and it must be kept as far away as possible from any metal or other conductive surface. In this case, the feed line is part of the antenna and it is operating at high impedance (perhaps 2 kΩ or more) on the lower frequencies.

Figure 3—The tuner installation showing the homebrew Kydex protective cover in place.

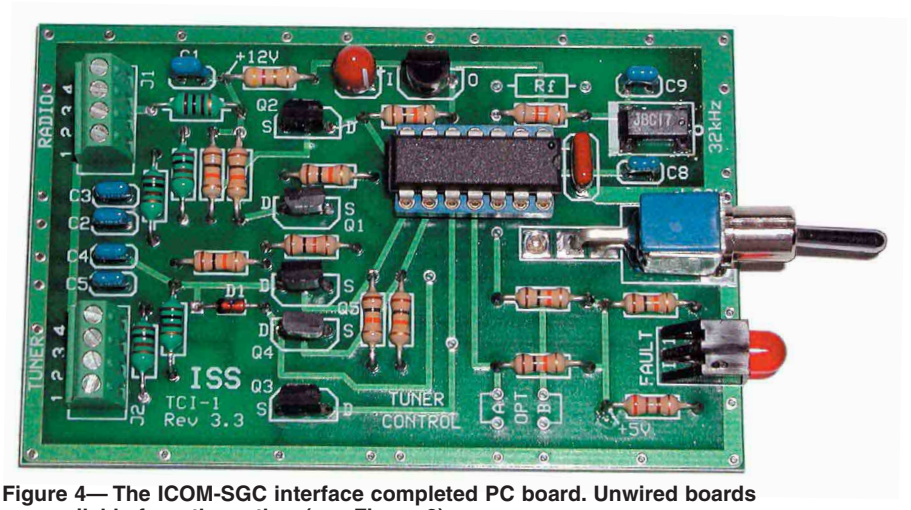


Figure 4— The ICOM-SGC interface completed PC board. Unwired boards are available from the author (see Figure 2).

Figure 2 shows the completed SG-237 and antenna installation. Note the Hustler QD-2 quick disconnect between the top of the Delrin insulator and the base of the SG-307 whip antenna. The connecting feed wire is the center conductor removed from a piece of RG-8 coaxial cable and covered with black heat-shrink tubing. All of the mounting hardware is stainless steel purchased from a local Boater's World store. I made extensive use of exterior tooth star washers that bite into the metal, even through paint, to make a good electrical connection. Behind the mounting plate, a 1 inch wide tinned braid runs down to make a good connection to the vehicle chassis as well as the bed of the pickup.

Even though the SG-237 is waterproof, SGC recommends that some type of cover be provided to prevent direct exposure to sunlight and rain. Figure 3 shows the homebrew Kydex cover that provides the added protection. Note that the cover is painted a light color to minimize heat buildup.

There has been some talk going around the Internet recently that a 102 inch stainless steel whip will not work on 75 meters and that a Ham Stick or similar type center loaded whip should be used with the tuner. I have conducted on the air tests that show absolutely no advantage to using a Ham Stick over the 102 inch whip on 75 meters with a properly installed SG-237 tuner. This tuner and a 102 inch whip will cover 80/75 meters through 6 meters quite well without using any additional loading coils.

Use with Other Radios and Tuners

I anticipate that the interface will work fine with any ICOM transceiver that is designed to interface with the ICOM AH-4 tuner. It should work with any SGC tuner model that has a TUNED indicator output that is pulled to ground to indicate a tuned condition and a combined LOCK/HOLD/RESET line. Looking at the schematics for the current SGC line, I expect that it will work with the SG-230 and the SG-239 as well as the SG-237. It will *not* work with the SG-231 or SG-235 as these models have separate LOCK/HOLD and RESET lines. I caution that I have only tested the interface with the ICOM '706 transceiver and the SG-237 tuner. My assumption that it will work with the SG-230 and SG-239 tuners is based on an inspection of their schematics that revealed that these tuners have the same internal interface hardware as the SG-237.

Conclusion

With the described interface and mobile setup, changing bands or frequencies within a band is very quick and easy. With PTT TUNE set to on, tuning is as simple as a quick push of the microphone PTT button. Tuning is fully automatic so you get to keep your eyes on the road where they belong. Because tuning is so fast and automatic, the potential for interference is minimized.

Bob Lewis, AA4PB, has been interested in Amateur Radio since his junior high school days in the late 1950s. His first call was K8KNI and he operated 6 meter AM in the Detroit area during those early days. His interest in radio led to a career in electronics as an air-transport radio mechanic and 10 years in the Navy as an aviation electronics technician. Bob has an Amateur Extra class license and enjoys low-power operation, the digital modes and homebrewing. He's retired from Civil Service and currently works part time in electronics consulting. You can contact him at PO Box 522, Garrisonville, VA 22463; **rlewis@midatlanticbb.com**. QST

By Dick Jansson, WD4FAB

An Integrated AO-40 Antenna System

You can build an effective system starting with off-the-shelf components, the Teksharp 1.2 meter dish and AIDC-3731AA downconverter.

Amateurs have found that talking to others all over the world on the microwaves of AMSAT-OSCAR 40 is *fun*! More and more hams are discovering AO-40, our newest amateur satellite. And, DXpeditions are including equipment for AO-40, as well. Long ragchews and rare DX are common. These amateur operations demand quality systems for communication through AO-40. These systems include not only antennas, but also high quality receiving converters, both of which are covered here.

Operators are finding an increased availability of components for their AO-40 stations, providing them with a broad selection of the needed equipment.[1] The products described here allow a single dish antenna to provide for the required dual-band operation, with an S band (2.3 GHz) downlink and L band (1.2 GHz) uplink to AO-40.

A new company has surfaced on the amateur equipment horizon, Teksharp. Teksharp is providing kits for both 1.2 and 1.8 meter diameter parabolic dish antennas. Additionally, S band receiving converters are available from a number of different suppliers, including Teksharp. For this project, however, I selected a well-proven converter, the modified AIDC-3731AA, from Bob Seydler, K5GNA. Bob takes commercial converters and modifies them for S band amateur service, including an upgrade of the front-end band-pass filtering. This downconverter was selected for its superior and proven passband filtering, allowing an L band transmitting uplink on the same antenna as the S band downlink.

The AO-40 antenna system to be described here will include the dish antenna, its dual-band feed system and the receiving converter. These three elements are critical for high quality communications through AO-40. This antenna system was combined with my proven 40 W, tower mounted L band amplifier, described in *The ARRL Handbook*,[2] resulting in a fully functioning AO-40 station.

Figure 1—The antenna components as received from Teksharp.

The Teksharp 1.2 Meter Dish

Let's start with the Teksharp 1.2 meter dish. The assembly methods are expected to be the same for the 1.8 meter dish. That larger antenna provides additional performance and flexibility, if desired. The gains for the 1.2 meter dish are 21.0 dBi at L band, and 26.6 dBi at S band.

The antenna arrived in a compact, 36×12×4 inch box of parts and I was like a kid with a new toy. Figure 1 shows these parts laid out for assembly. A set of well machined and formed aluminum ribs is the key to any parabolic dish design and these are well executed. I measured the dimensions of these ribs to understand the basic dimensional features of the dish. These figures are 1204 mm, 245 mm and 370 mm for diameter, depth and focus, respectively. The resulting focus to diameter ratio (F/D) is thus 0.307.

Separate plastic packages include the antenna assembly screws and the antenna mounting bolts. Teksharp also sent some well illustrated assembly instructions and a plastic template for the petals (or gores) for the hardware cloth covering the dish.

The included hex-head screws and nuts for the antenna assembly were high quality stainless steel. The U bolts and mast-mounting clamp hardware provided were also high quality, but the bolts and clamps were conventionally plated. Parts fabricated and finished in these materials quickly corrode and become unusable in my Florida environment. I was able to sidestep this situation for other reasons, however, and so it was not an issue for my station. The machined parts for these antennas were very well made and finished, and they were a pleasure to work with.

Teksharp provides a really neat bracket plate that supports the feed boom while also providing for the mounting of the dish to the elevation boom. In my installation, I decided to make use of a mount-

[1]Notes appear on page 41.

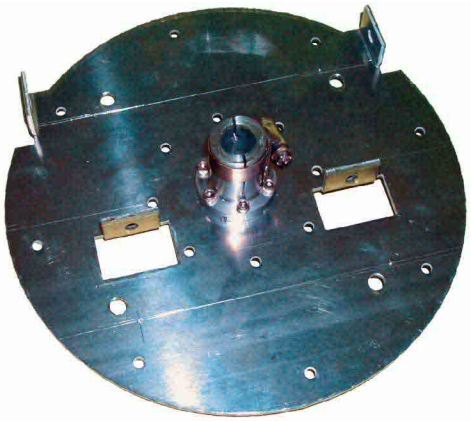


Figure 2—The antenna base plate assembly as modified by WD4FAB.

ing from a previous dish as described in the *Handbook*. If your arrangement is more conventional, you may be able to make use of the Teksharp mounting hardware without modification.

Before starting the assembly I decided to copy a rib shape to make some cardboard templates representing the dish surface. I also made a 602 mm circular radius template to help me shape the perimeter bands to dimension rather than by guess. The dish surface template was used to check and maintain the parabolic shape of the dish surface as I assembled the mesh cloth petals to the ribs. These petals do not always follow the rib shape in the space between the ribs and the use of the template helped me correct those surface inaccuracies while still under construction. Other parts of Notes 2 and 3 provide excellent information on dish antenna construction methods.

Following the excellent Teksharp instructions, I assembled the ribs to the circular hub plate and then closed the structure with the formed perimeter bands. In my shop, I arranged to be able to hold the framework in a shop vise, making the assembly task much easier. On one of the rib ends at the top of the dish, I replaced the nut with a riveted-in-place blind anchor nut to allow me to clamp the coax cables to the dish rim without having to fumble with too much loose hardware while performing that step.

Now it was time to create a parabolic dish out of this strong and lightweight framework. The constructor has to provide his own fabric cloth for this part of the assembly. The kit recommendations are to use 1/4 inch galvanized cloth, a low cost item available at most hardware stores. In my case I just happened to have some eight wires per inch aluminum cloth left over from a previous attempt to build a dish antenna. This was the most open-weave aluminum cloth I could find. I was all too happy to have this aluminum cloth for this job, as galvanized material has a habit of eventually rusting away in the Florida climate. Figure 3 shows the partially assembled dish in my shop.

Antenna Feed

Early dish antennas for these ranges used helical antennas as feeds. The experiences of other operators in the testing of AO-40 antennas has shown that low F/D parabolic antennas, such as this one, are most effectively fed using patch rather than helical antennas. (See the several articles by Jerry Brown, K5OE, at **members.aol.com/k5oe/**. Also see articles by Robert Suding, WØLMD, at **www.ultimatecharger.com/dish.html**.)

WØLMD provides some useful multiband patch antennas that can be purchased for this service, as does Teksharp. Since I enjoy constructing, I decided to follow K5OE's guidance as recently published (see Figure 4).[5] The sharp-eyed reader may observe that I have made some modifications to the original patch design, through the addition of some nylon screws on the L band patch. Please be advised to build this antenna *exactly* as in the original article unless you have some quality laboratory test equipment! Fortunately I had the use of a good network analyzer at the AMSAT Laboratory and this saved me from total shame.

AIDC-3731AA S Band Downconverter

The next element of this system is the AIDC-3731AA downconverter from K5GNA. This converter offers one of the lower-cost approaches to receiving AO-40's 2401 MHz downlink signal. Figure 5 shows the converter mounted directly to the male Type N connector on the S band patch antenna. The output port provides a 2 meter IF output through the F connector on the side.

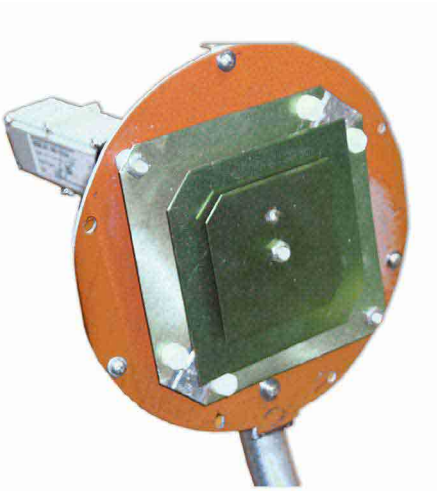
This converter is now available with a low overhead internal voltage regulator, allowing it to be powered by a 13.8 V dc supply source and still obtain proper regulation of the 12 V dc needed for the internal circuits. There is a considerable advantage in using this regulation scheme as it keeps the total power dissipation low, thus holding down the temperature rise from the 2.5 W of power dissipation. There is interest in keeping this power dissipation low to minimize frequency shift due to temperature rise. Converters exposed to the sun will have noticeable frequency shifts with clouds shading the sun. This 13.8 V dc power is supplied to the converter through a bias T in the shack and RG-6 coaxial cable to the IF connector of the converter.

Feed Assembly

Following the directions in K5OE's article for the dual-band patch antenna, I provided a mounting angle on the patch assembly using a piece of steel strapping angle. Although probably unnecessary, I also machined an aluminum sleeve adapter for mounting between the J-shaped feed boom and this steel angle; this can be seen in Figure 5. This angle also provided an added support for the AIDC-3731AA converter, shown strapped down with a plastic cable tie. As assembled, this is a robust feed assembly.

Mounting of the patch assembly was done with the patches aligned parallel to the plane of the dish and on the dish center line. Place the S band reflector at the focal distance, 370 mm (14.57 inches), from the dish surface at the center. This adjustment is made by moving the feed boom along its mounting clamps until the proper measurement is achieved. That is

Figure 3—Assembling the antenna dish.



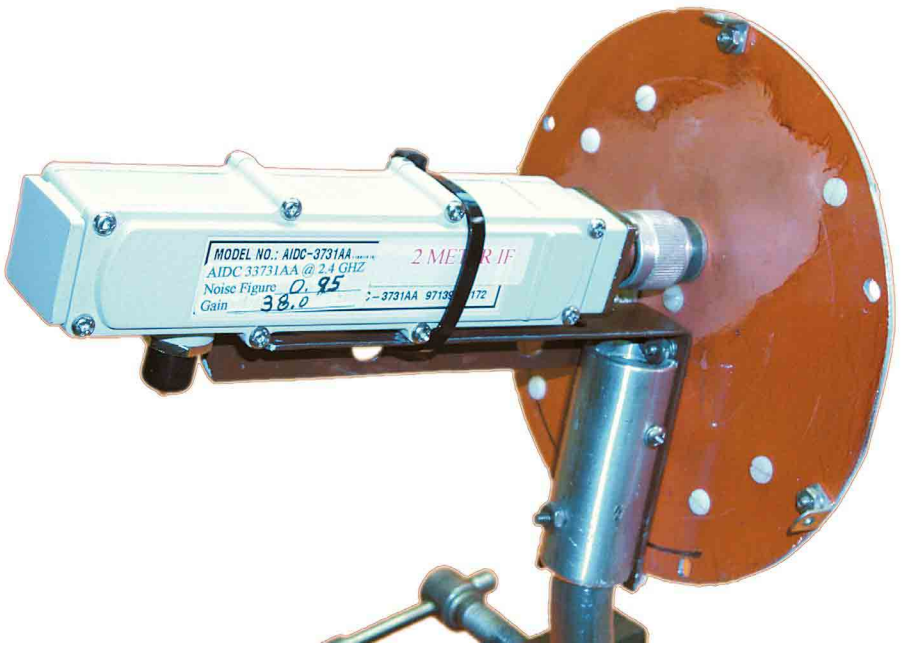


Figure 4—The dual-band patch feed system details.

all you have to do. You can play with mirrors, as in the instructions, to focus the sun on the patches, but doing this adjustment by measurement is easier and it is all that really needs to be done.

K5OE cautions that rain, bird droppings and bugs can mess up the tuning and operation of the patch feed antennas. He advises the use of some kind of protection for antennas. In addition, I have an aversion to having water in my hard-to-reach coaxial connectors. Water in these connectors does not ensure a good satellite signal! To solve both of these problems, I went shopping for an antenna cover at my favorite "antenna parts store," K-Mart. I found help from Martha Stewart, no less, in the form of a nice, clear styrene plastic "3.3 quart airtight canister."

I modified one of these canisters to fit over the patch assembly and the feed boom. This canister was also shortened to allow it to fit into the cover lip of an unmodified canister mounted on the "rear" of the feed. The modified canister was mounted to the patch reflector with three small angle brackets, as seen in Figure 5. Some of the cutoff plastic cylinder should be saved. This can then be glued to the end of the cutoff container, to shim that OD to fit into the inside diameter of the cover lip of the rear canister. I also epoxy bonded a set of blind nuts to the inside of the canister so that the screws through the cover lip of the rear-mounted canister will keep it together. That arrangement is shown in Figure 6. The slot in the front canister that passes the feed boom has space for the coaxial cables for L and S band.

A further protection measure was to cover the exposed plastic with aluminum foil tape, as seen in Figure 6. This was not done to area in front of the patch antennas. This tape is there to protect the plastic from sun damage, although this type of clear plastic has a good record in avoiding UV harm.

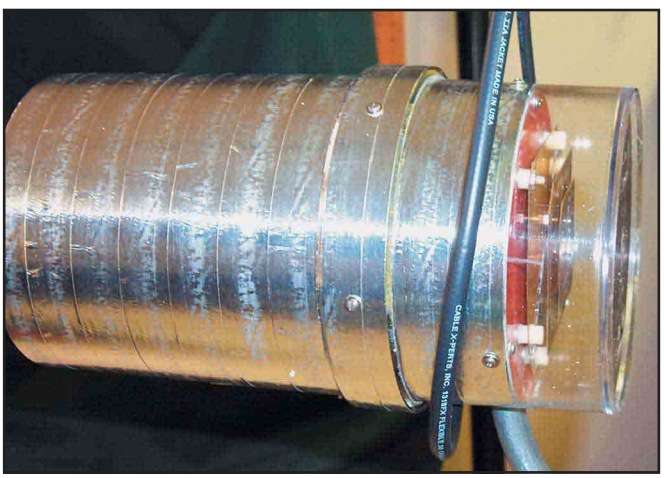


Figure 6—The radome—from the Martha Stewart collection!

Installation

With all preparations made, completion of the installation of the dish antenna and converter was a breeze. Figure 7 shows the dish assembly bolted to my old PrimeStar antenna mount. This antenna mounting design is that shown in Note 2. Just remember to use the built-in screw adjustment provided in the PrimeStar mount to aim the dish centerline along the centerline of your antenna pointing system. The beamwidths of L and S band operations in this assembly are fairly narrow, so your pointing precision will need to be pretty good. Many of the details of my elevation boom system are shown in Figure 7, too.

Before finally closing the protective plastic containers over the feed antennas, be sure that all of the coaxial cable connections are tight and the cables are dressed properly. This final closure will need to be done at this step in the assembly. Be sure to arrange the coaxial cables so that they don't drag on the feed boom. The cable clamps at the top of the dish are there to dress the cables and support the feed boom. This is shown in Figure 8.

Figure 8 also shows the dish system in operating position along with the U band (70 cm) cross polarized (CP) Yagi antenna on the far left, and the two smaller M² 23CM22EZA antennas that were tested last year. I have kept these two L band antennas in service for use on 1296 MHz. I placed a ground commanded relay to switch between the two antenna systems in the amplifier box on the top of the tower (Note 2). This is also convenient to use to compare the two L band antenna systems when in AO-40 operations (there is a difference).

On the Air

Testing the configuration showed that AO-40 downlink signals on S band, 2401 MHz, were really solid with this system. The pointing requirements are narrow, and have to be good to within 3° to 4°, based on the specified beam width at these frequencies. The noise floor of AO-40 is

Figure 7—Details of the AO-40 antenna system mounting.

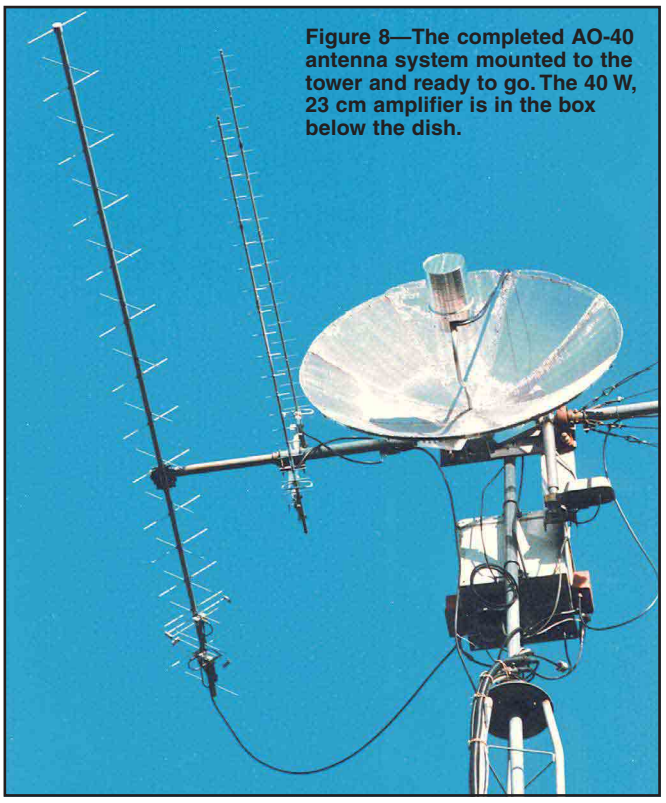


Figure 8—The completed AO-40 antenna system mounted to the tower and ready to go. The 40 W, 23 cm amplifier is in the box below the dish.

clearly detectable, about 2 dB above cold sky noise. For AO-40 operations, hearing the noise floor sets the system limits; you cannot do much better.

For the uplink, I have a usable return signal with 40 W of RF on L band when the satellite "squint" is ≈20° or lower, as reported in Note 3. When the squint is low, I am able to have quite good downlink signals with only about 5-10 W PEP of L band power. When I compare the Teksharp antenna on L band to the M² 23CM22EZA stacked antennas, as shown in Figure 8, I have better than an S-unit (>3-4 dB on my Kenwood TS-2000 transceiver) improvement in downlink signal. This improved performance is seen in the wider ranges of squint angles that can be used with the Teksharp antenna on the L band uplink. When the AO-40 squint angles are greater than 20°, I must still retreat and use my U band uplink transmitter with the CP Yagi antenna.

Measurements of Sun noise have been attempted with this antenna system. These have been disappointing, with values of around 2 dB seen. This is compared to the solid 5 dB of Sun noise measured with my previous PrimeStar dish. One of the probable reasons for the lowered performance can be attributed to the front-end band-pass filtering provided in the receive converter. The operating experience with this system has been absolutely solid, however.

In Summary

We have learned that it is important to consider all of the interrelated characteristics of an antenna system. It is insufficient to just whip up "any" antenna, marry "any" receive converter to that antenna and then use "any" transmitting scheme to operate with full-duplex signals from high-performance satellites such as AO-40. We have had the opportunity to employ computer analysis, as shown to us by Gene Marcus, W3PM, with his spreadsheet analysis: **www.amsat.org/amsat/ftp/software/spreadsheet/w3pm-ao40-v2.1.zip**.

Equally, we have had to learn more advanced uplinking methods to operate with AO-40. More and more operators are seeing the advantages of doing the uplink on L band with its superior signal performance rather than using U band. Configuring our stations to work effectively on AO-40 has taught us a lot and the experience has successfully removed the "microwave-scare-factor." In this regard, operating the amateur satellites has fulfilled one of the goals of AMSAT—education. AO-40 operation has been a real pleasure with this antenna system

Manufacturers: Antenna: Teksharp (Rick Fletcher, KG6IAL), **www.teksharp.com**, 5770 McKellar Dr, San Jose, CA 95129; **inquiries@teksharp.com**; Price: 1.2 meter dish, $165; feed boom, $40; dual-band (S/L) patch feed, $200. Down-converter: Bob Seydler, K5GNA, **members.aol.com/k5gna/myhomepage/**, 8522 Rebawood, Humble, TX 77346-1789; 281-852-0252, **bob@k5gna.com**. Price: $100, setup for 12 V operation add $20.

Notes

[1]R. Jansson, WD4FAB, "Product Review—M² 23CM22EZA 1.2 GHz Antenna," *QST*, Sep 2002, pp 59-61.

[2]*The 2004 ARRL Handbook for Radio Communications*, Chapter 23, pp 23.22-23.41. Available from your local dealer or the ARRL Bookstore. ARRL order no. 1964. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[3]*The ARRL Antenna Book*, 20th Edition, Chapter 19. Available from your local dealer or The ARRL Bookstore. ARRL order no. 9043. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[4]R. Jansson, WD4FAB, "Product Review—M² Enterprises 2M-CP22 and 436-CP30 Satellite Yagi Antennas," *QST*, Nov 1992, pp 69-71.

[5]G. Brown, K5OE, "Build This No-Tune Dual-Band Feed for Mode L/S," *The AMSAT Journal*, Vol 26, no.1, Jan/Feb 2003, pp 12-16.

Dick Jansson, WD4FAB, has been a devoted contributor and supporter of the amateur satellite program. He did all of the mechanical and thermal design on AMSAT Microsat program and the principal mechanical design and all of the thermal design for AMSAT AO-40. Dick is currently working on the thermal design for AMSAT-DL P3E program and the mechanical and thermal design for AMSAT Eagle. He has contributed to the satellite sections of both The ARRL Handbook *and* The ARRL Antenna Book *and is an ARRL Technical Advisor. Dick is principally interested in VHF/UHF, microwave and satellite operations and he upgraded to an Extra class license in 2000. You can contact him at* **wd4fab@arrl.net**.

By Dave Patton, NN1N, and Rick Lindquist, N1RL

ARRL Board Seeks Major FCC License Restructuring

Landmark meeting January 16-17 makes quick work of a full agenda.

The ARRL Board of Directors has made great strides over the past year to work more efficiently and less expensively—both during Board meetings and while completing committee assignments outside of meetings. The January 16-17 meeting in Windsor, Connecticut, was the first meeting to convene under a more efficient "consent agenda," which permits *en masse* consideration of reports without lengthy oral presentations. The consent agenda, one result of a strategic planning initiative, turned out to be a positive factor as the Board tackled such wide-ranging topics as restructuring standing committees, senior-member dues, WAS and DXCC awards, a mentoring program, elections, Broadband Over Power Line (BPL), and—the biggest issue—what's being called "Restructuring II."

The Board re-elected President Jim Haynie, W5JBP, to a third two-year term. There were no other nominees for the post, and the Board expressed its confidence in Haynie by re-electing him without opposition.

Winning new, two-year terms without opposition were ARRL First Vice President Joel Harrison, W5ZN; Vice President Kay Craigie, N3KN, and Vice President for International Affairs Rod Stafford, W6ROD. Board members agreed with a proposal to eliminate the third vice president's position being vacated by Fried Heyn, WA6WZO, who was named as the 23rd ARRL Honorary Vice President in recognition of his long-term service to ARRL. The Board indicated it was doing away with the third VP slot as a cost-saving measure and because the position was considered superfluous—positions that Heyn also endorsed.

Other ARRL officers elected without opposition were Executive Vice President/CEO/Secretary David Sumner, K1ZZ; Treasurer Jim McCobb, W1LLU; Chief Financial Officer Barry Shelley, N1VXY; Chief Development Officer Mary Hobart, K1MMH, and Chief Operating Officer Mark Wilson, K1RO. The Board created a new position of Chief Technology Officer and named Paul Rinaldo, W4RI, to fill it. Rinaldo heads the League's Technical Relations Office (TRO) in Fairfax, Virginia, and the Board's elevation of Rinaldo's position was to recognize the accomplishments of the TRO and the importance of encouraging new technology in Amateur Radio.

New England Division Director Tom Frenaye, K1KI (left), and Pacific Director Bob Vallio, W6RGG, flank Northwestern Division Vice Director Jim Fenstermaker, K9JF, who filled in at the center table for Director Greg Milnes, W7OZ, who was recuperating from illness.

As an expense-reduction move, the Board voted to only reimburse the costs of vice directors to attend one Board meeting per year—preferably the Annual Meeting in January.

Restructuring II: ARRL Proposes New Entry-Level License, Code-Free HF Access

The ARRL will ask the FCC to create a new entry-level Amateur Radio license that would include HF phone privileges without requiring a Morse code test. The League also will propose consolidating all current licensees into three classes, retaining the Element 1 Morse requirement—now 5 WPM—only for the highest class. The Board overwhelmingly approved the plan, developed by the ARRL Executive Committee following a Board instruction last July.

The proposals are in response to changes made in Article 25 of the international *Radio Regulations* at World Radiocommunication Conference 2003 (WRC-03). They would continue a process of streamlining the amateur licensing structure that the FCC began more than five years ago but left unfinished in the Amateur Service license restructuring that went into effect April 15, 2000.

"Change in the Amateur Radio Service in the US, especially license requirements and even more so when Morse is involved, has always been emotional," said ARRL First Vice President Joel Harrison, W5ZN, in presenting the Executive Committee's recommendations. "In fact, without a doubt, Morse is Amateur Radio's 'religious debate.'" The plan adopted by the Board departs only slightly from the Executive Committee's recommendations.

The "New" Novice

The entry-level license class—being called "Novice" for now—would require a 25-question written exam. It would offer limited HF CW/data and phone/image privileges on 80, 40, 15 and 10 meters as well as VHF and UHF privileges on 6 and 2 meters and on 222-225 and 430-

Summary of Major Board Actions

The Minutes of the 2004 Annual Meeting of the Board are published on the ARRL Web site, **www.arrl.org/announce/board-0401**. If you do not have Internet access, you may request a written copy of the Minutes by writing to ARRL Secretary, 225 Main St, Newington CT 06111.

Minute	*Purpose*	*Action*
Elections		
13-23	**Election of Officers** Elected: President Jim Haynie, W5JBP; First Vice President Joel Harrison, W5ZN; Vice President Kay Craigie, N3KN; International Affairs Vice President Rod Stafford, W6ROD; Executive Vice President/ Secretary David Sumner, K1ZZ; Treasurer Jim McCobb, W1LLU; Chief Financial Officer Barry Shelley, N1VXY; Chief Development Officer Mary Hobart, K1MMH; Chief Operating Officer Mark Wilson, K1RO; Chief Technology Officer Paul Rinaldo, W4RI.	**Elected**
24	**Honorary Vice President Heyn** Elected: Fried Heyn, WA6WZO	**Elected**
25	**Executive Committee** Elected: Directors Rick Roderick, K5UR; Jay Bellows, KØQB; Walt Stinson, WØCP; Frank Fallon, N2FF, and Dick Isely, W9GIG.	**Elected**
26	**ARRL Foundation Directors** Elected: Directors Frank Butler, W4RH; Walt Stinson, WØCP, and Frank Fallon, N2FF.	**Elected**
Organizational		
8	**Article 8** Removes the position of the Third Vice President.	**Amended**
9	**Bylaw 5** Raises senior dues from $34 to $36.	**Amended**
10	**Bylaw 37** Creates the position of the Chief Technology Officer.	**Amended**
11	**Article 6** Changes the number of Directors elected to the EC from four to five.	**Amended**
12	**Bylaws 38-44** Rewritten to accommodate committee restructuring and new work descriptions.	**Replaced**
28	**ARRL Strategic Plan** Update is part of ARRL's yearly review of its Strategic Planning process.	**Approved**
29	**Segmentation of Bands by Bandwidth Rather than by Mode** Executive Committee will continue to work on developing recommendations for segmenting amateur bands by signal bandwidth rather than by mode.	**To EC**
30	**VRC Field Organization Evaluation, Action Plan** Recommendations for completing the action items prescribed by the Volunteer Resources Committee in 2003.	**Approved**
32	**ARRL's Recommendations for the implementation of Article 25** Extensive plans for Amateur Radio that take into account the outcome of WRC-03 and adds a new, true, entry level license class while dropping CW testing requirements for the General class license and retaining a 5 WPM test for Amateur Extra.	**Approved**
35	**WAS Phone Award** Expands the options for the WAS Award program to include all the phone modes.	**Enhanced**
36	**ARRL Mentor Program** Plans move forward on four different mentoring plans that aim to keep licensees interested while providing answers from experts both local and wide-ranging.	**Approved**
37	**ARRL Position on Blanket Liability Waivers for Volunteers** Blanket liability waivers for volunteers are disfavored by ARRL as a matter of policy because they are contrary to the public interest and the promotion of volunteerism.	**Approved**
39	**Standing Order 92-1.75** Removes reimbursement for the attendance of Vice Directors at one Board meeting yearly.	**Amended**
40	**ARRL Endowment Fund Structure** Provides rules and structure to the ARRL Endowment to help the programs grow and be utilized.	**Approved**
41	**ARRL Financial Control Policies** Provide rules for the ARRL Funds and the Investment Portfolio.	**Approved**
42	**Requirement for Financial Documentation to Accompany New Proposals** Proposals for work, study or programs must have accompanying financials.	**Approved**
43	**2004 Operating Plan** Approves ARRL's operating budget for 2004.	**Approved**
44	**Standing Orders 4, 16, 18, 73, 78, 87, 95, 97, 103, 109, 110, 120, 123, 84-2.36, 84-2.39, 85-1.49, 85-2.36, 88-2.68, 89-1.127, 92-1.76, 96-2.25, 97-1.51 and 98-2.33** Generally cleans up ARRL's body of rules and regulations by removing obsolete items.	**Deleted**
45	**Study of Amateur Radio Specialty Groups** Will work in conjunction with the mentoring program to help identify and support Amateur Radio's special interest groups.	**Staff**
46	**ARRL Membership Sales Reps; Pilot Program** Testing another method for increasing ARRL's membership numbers.	**Staff**
47	**Special Interest Groups; ARRL Web Options** The Programs and Services Committee will look at supporting Special Interest Groups through the ARRL Web.	**To PSC**
48	**Brokerage Accounts Authorization** Authorizes the Treasurer to use the Brokerage firm Morgan Keegan & Co.	**Approved**
50	**Committee Appointments** The President appoints Director and officer members to the Administration and Finance, Programs and Services, Elections and Ethics, and Executive Committees.	**Appointed**
51	**Membership Promotional Video** A&F Committee to investigate funding sources for a video that will help promote membership.	**To A&F**
52	**Add a Youth Element to Field Day** Staff will look to enhance the participation of youth in ARRL's Field Day.	**Staff**
55	**DXCC Entity Criteria Rule Change** Removes the entity creation provision for IARU member societies from the DXCC rules.	**Approved**
56	**BPL Fact and Lobbying Kits** A materials kit will be created to help in the understanding of BPL issues.	**To EVP**
57	**Ad-Hoc Committee for Grassroots Lobbying Campaign** Committee will develop plans and procedures for an effective grassroots lobbying campaign.	**To President**
Awards and Recognitions		
38	**2003 ARRL International Humanitarian Award Conveyed to Charles M. "Mike" Young, KM9D, and Jan E. Heaton, KF4TUG** Young and Heaton helped save the life of a 16-year old girl at sea 100 miles west of Kanton Island.	
49	**2003 Bill Leonard, W2SKE, Professional Media Conveyed Award to Sari Krieger, Manassas Journal Messenger** Krieger's story highlights the issues Amateur Radio faces from BPL.	

International Affairs Vice President Rod Stafford, W6ROD, RAC President Daniel Lamoureux, VE2KA, and Atlantic Division Director Bernie Fuller, N3EFN, get the lowdown on "Restructuring II."

450 MHz. Power output would be restricted to 100 W on 80, 40 and 15 meters and to 50 W on 10 meters and up, thus avoiding the need for the more complex RF safety questions in the Novice question pool.

"The Board sought to achieve balance in giving new Novice licensees the opportunity to sample a wider range of Amateur Radio activity than is available to current Technicians while retaining a motivation to upgrade," said ARRL CEO David Sumner, K1ZZ. "It was also seen as important to limit the scope of privileges so the exam would not have to include material that is inappropriate at the entry level."

As an introduction to Amateur Radio, the Novice license served successfully for most of its 50-year history. The FCC has not issued new Novice licenses since the 2000 license restructuring, however. Under the ARRL plan, current Novice licensees—now the smallest and least active group of radio amateurs—would be converted to the new entry-level class without further testing.

Anticipating assertions that the new plan would "dumb down" Amateur Radio licensing, Harrison said those currently holding a ticket often perceive the level of complexity to have been greater when they were first licensed than it actually was. "Quite frankly," he said, "if you review the questions presented in our license manuals throughout the years, you will be surprised how they compare to those of today."

Technicians and Generals

The middle group of licensees—Technician, Tech Plus (Technician with Element 1 credit) and General—would be consolidated into a new General license

The ARRL 2003 International Humanitarian Award

The ARRL Board of Directors has named Charles M. "Mike" Young, KM9D, and Jan E. Heaton, KF4TUG, of Naples, Florida, to receive the 2003 ARRL International Humanitarian Award

Last April, Young and Heaton sailed from Kanton Island, the Republic of Kiribati, carrying medical supplies for a 16-year old girl—unconscious and bleeding and in desperate need of medical attention—who was aboard the MV *Te Taobe*. The vessel was adrift without power some 100 nautical miles west of Kanton Island. At great personal risk, Young and Heaton set out in their 10-meter sailing vessel *Don Henry* in an attempt to catch up with the distressed vessel and deliver the medical supplies. Once under way, they maintained Amateur Radio contact with amateurs in the Seattle, Washington, area—among them Bob Preston, W7TSQ, who contacted the US Coast Guard in California and was put through to the Joint Rescue Coordination Center in Hawaii. Preston provided the Coast Guard with the frequencies Young and Heaton were using.

"The supplies we carried were three bags of saline solution with necessary plumbing to make an IV supply, some iron tablets, a blood pressure cuff and a couple of sticks of tobacco from the people on Kanton," Heaton said in an account published last fall in *The DX Magazine*.

The *Don Henry* and a larger ship rendezvoused with the *Te Taobe*, but the second vessel carried no medical supplies to aid the ailing passenger, Heaton said.

"On instruction, *Te Taobe* set out a line with float and light attached, and I was able to maneuver *Don Henry*, under mainsail and engine, so that Mike was able to grab the line, tie on our bag and cast it all off well clear of our prop," Heaton reported in her *DX Magazine* account.

Not long after, the US Coast Guard cutter/icebreaker *Polar Sea*, returning from a tour of duty in Antarctica, intercepted the drifting ship to render additional assistance. The *Polar Sea* took aboard the young woman, an elderly man and an interpreter, provided medical treatment to the injured teenager and transported them to Kanton. The young woman and the elderly man subsequently were airlifted to American Samoa along with their interpreter.

The young woman reportedly has made a good recovery and returned to Kiribati. The *Te Taobe* was able to make it back to Tarawa under her own power. The captain of the *Te Taobe* is Tetabo, T3ØNAV.

The action by Heaton and Young generated some positive public relations for Amateur Radio when Seattle TV station KING interviewed Preston about the incident last April.

"I think this really is a great story about how Amateur Radio still plays a vital basic communications role here in the starting years of the 21st century," said Denny Bowman, W7SNH, one of the Seattle-area stations involved in maintaining communication with Heaton and Young.

As winners of the 2003 ARRL International Humanitarian Award, Heaton and Young will receive a plaque or medallion.

The 2003 Bill Leonard, W2SKE, Professional Media Award

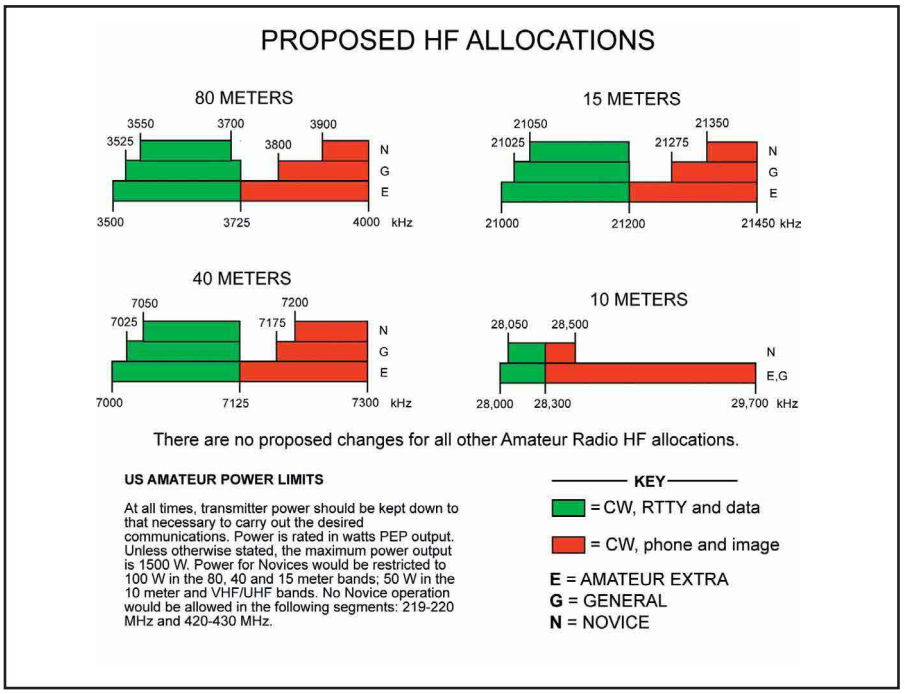
The Board selected Sari Krieger, a staff writer with Virginia's *Potomac News* and *Manassas Journal Messenger*, as the recipient of the 2003 Bill Leonard, W2SKE, Professional Media Award. This award goes annually to a professional journalist or group of journalists for outstanding coverage of Amateur Radio in TV, radio, print or multimedia. The winner receives an engraved plaque and a check for $500.

Krieger's winning submission was a story about the negative effects of Broadband Over Power Line (BPL) on Amateur Radio, and the concerns of ham radio operators nationwide. Her story focused on the city of Manassas, Virginia, and its plans to implement BPL citywide.

Members of the League's Public Relations Committee judged the Leonard Award nominations. Committee member Rich Moseson, W2VU, said the piece represented "excellent, accurate coverage of a complex but important issue." PRC member and *QST* Contributing Editor Diane Ortiz, K2DO, described Krieger's submission as "fresh, topical, accurate and well-written." Krieger's entry was judged the best of six entries received.

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

The Hudson Division team: **Re-elected incumbent Hudson Division Director Frank Fallon, N2FF, and newly elected Vice Director Joyce Birmingham, KA2ANF, who was attending her first ARRL Board meeting.**



that no longer would require a Morse examination. Current Technician and Tech Plus license holders would gain current General class privileges without additional testing. The current Element 3 General examination would remain in place for new applicants.

Morse Code Testing Retained for Extra

At the top rung, the Board indicated that it saw no compelling reason to change the Amateur Extra class license requirements. The ARRL plan calls on the FCC to combine the current Advanced and Amateur Extra class licensees into Amateur Extra, because the technical level of the exams passed by these licensees is very similar. New applicants for Extra would have to pass a 5 WPM Morse code examination, but the written exam would stay the same. The League's plan calls for current Novice, Tech Plus and General class licensees to receive lifetime Element 1 (5 WPM Morse) credit.

"This structure provides a true entry-level license with HF privileges to promote growth in the Amateur Service," Harrison said. "It also simplifies the FCC database by conforming to the current Universal Licensing System (ULS) structure and does not mandate any modifications to it." Sumner concurred. "The Board started out by recognizing that three license classes was the right number when looking down the road 10 or 15 years," he said. "We need a new entry-level license.

"On the other hand, there's nothing particularly wrong with the existing Extra class license," he continued. "The change in the international regulations notwithstanding, the Board felt that the highest level of accomplishment in the FCC's amateur licensing structure should include basic Morse capability."

Sumner and Harrison say the current Technician entry-level ticket provides little opportunity to experience facets of ham radio beyond repeater operation. "The quality of that experience," Sumner said, "often depends on the operator's location." Among other advantages, Sumner said the plan would allow new Novices to participate in HF SSB emergency nets on 75 and 40 meters as well as on the top 100 kHz of 15 meters. The new license also could get another name, Sumner said. "We're trying to recapture the magic of the old Novice license, but in a manner that's appropriate for the 21st century."

Proposal Includes "Novice Refarming" Band Plan

The overall proposed ARRL license restructuring plan would more smoothly integrate HF spectrum privileges across the three license classes and would incorporate the "Novice refarming" plan the League put forth nearly two years ago in a Petition for Rule Making (RM-10413). The FCC has not yet acted on that ARRL plan, which would alter the current HF subbands. The Novice refarming proposal would eliminate the 80, 40 and 15 meter Novice/Technician Plus CW subbands as such and reuse that spectrum in part to expand phone/image subbands on 80 and 40 meters.

The ARRL license restructuring design calls for no changes in privileges for Extra and General class licensees on 160, 60, 30, 20, 17 or 12 meters. Novice licensees would have no access to those bands.

Mentoring

To better assimilate people entering our ranks and to generally assist all of us to enjoy more of Amateur Radio, the Board approved a set of mentoring programs put forth by the Volunteer Resources Committee. These programs will be designed this year. The first, **ARRL Club Mentor**, will involve participation by affiliated clubs working in close cooperation with ARRL Headquarters. Affiliated clubs will be encouraged to actively participate in this program to get more people mainstreamed into Amateur Radio—ultimately increasing the club's membership as well.

The second program, **ARRL Mentor**, will be implemented through ARRL Headquarters. An ARRL mentor is a person with an interest in mentoring—or "Elmering"—new licensees who may or may not be members of an ARRL-affiliated club. ARRL Headquarters staff will support these mentors, who must be ARRL members.

The third program, **Interactive Mentor**, is intended to aid enterprising new hams via the ARRL Web site by providing answers to basic questions and through chat rooms where discourse between new hams and mentors would help get new hams on the air.

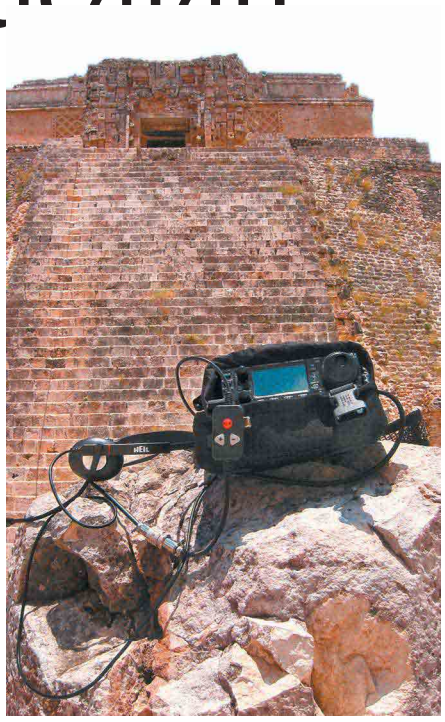
The fourth program, **Special Interest Mentor**, is intended to match people with interests in advanced, specialized areas of Amateur Radio technology with mentors who are experienced in these technologies. Special interest group pages on the ARRL Web site will accompany such work.

For additional information on the January Board of Directors meeting, see the Summary of Major Board Actions. The full minutes of the 2004 Annual Meeting are available on the ARRL Web site. QST

By David A. Rosenthal, N6TST

Three Flags Mobiling—from ALCAN to Yucatán

Part 2—After his northern journey, recounted in Part 1, the author sets his sights on operating from a small rental car in the steamy Yucatán.



It's over 105° and you're inching along a narrow dirt road. But the rental car's air conditioning is working great, 20 meters is wide open, and everyone is anxious to grab a contact with your/XE3 mobile.

If you're just tuning in, this was what I'd hoped to achieve when I first planned to assemble a compact, suitcase-portable HF/VHF/UHF radio system I could install in rental vehicles to operate mobile anywhere. In Part 1, I described the equipment suite for rental RVs that performed flawlessly throughout an actual tour through Alaska and Canada. Now, I took it a step further, trying out my system in a small rental car. For this trip I was N6TST/XE3 mobile, hunting for DX from southern Mexico.

Transceiver and Antennas

Today's ever-increasing selection of compact, all-band HF/VHF/UHF transceivers has put HF mobile operation within almost everybody's reach. The nucleus of my system is an ICOM IC-706—still the only compact product with the built-in ability to measure and display an antenna's SWR across a chunk of band. For a trim suitcase-portable approach, this makes it easy to manually pre-match a simple HF antenna to cover large band sections, eliminating tuners and their losses altogether. You can also exploit the improved radiation efficiency inherent with top-loaded HF mobile antenna designs.

But, too, during the Canada RV trip I spent long times adjusting my Spider HF mobile antenna while my wife read off SWRs and watched for bears. This revealed a need for an HF antenna that might be quicker to set up. Lots of reading, research, and talking to users led me to Comet's UHV-6 HF/VHF/UHF antenna, since it features excellent versatility at a surprisingly low cost. Besides, the Comet is quite a bit lighter than my 5-foot-plus, 4 pound Spider—and it also works on 50, 144 and 440 MHz.

At our home testing ground in California, I got a UHV-6 and tuned up all its resonators (80, 40, 20, 17, 15 and 10 meters) using the '706 internal SWR circuitry. It was touchy and a little narrow-banded (for example, SWR <2 dip about 125 kHz wide on 20 meters, though it matched all of 17 and nearly every bit of 15) but once tuned and used inside its window, it really sang. On one checkout trip, I worked VU2AU (yes, India!) on 20 with both of us 59 while I drove along the freeway. Early evening QSOs to Japan on 15 from anywhere in the state were effortless and all of the US was local on 17. On 2 meters, the UHV-6 is a 1/4 wave, two phased 5/8 waves on 440 MHz, and 1/4 wave on 6 meters. Extensive testing proved it worked well on all those bands. Of several non-base-loaded multiband mobile antennas now available, I discovered that the UHV-6 represents an excellent candidate for a universal mobile system—and the same hexwrench tunes it and disassembles it for the suitcase.

Another extremely handy item turned out to be a separation cable for the '706 control head, also an option for nearly ev-

Figure 1—As we passed through outlying towns south of Mérida, Yucatán's capital city, DX signals abounded, bringing an "at home" operating environment to the rental car, despite the exotic surroundings. The separated control panel of the '706 enabled me to tuck it into an easily accessible spot where I could safely operate and drive at the same time.

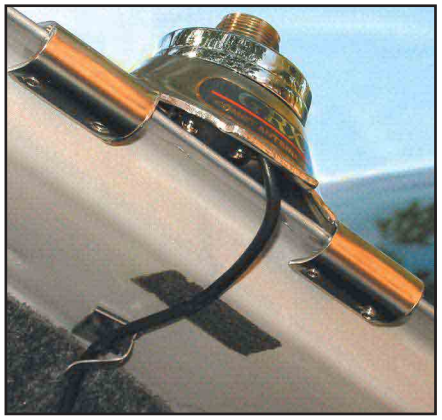


Figure 2—For mounting HF antennas on rental cars, the trunk lid is often the only option. Sturdy all-angle "lip mounts" are now available for SUVs and hatchbacks, too.

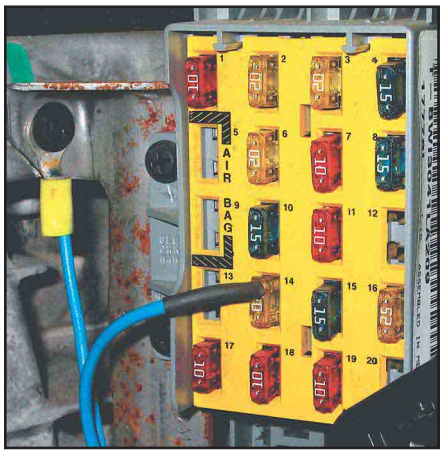


Figure 3—My modified mini-fuse replaced the 20 A cigarette lighter fuse in our rented Dodge Neon. Note the easy access to a solid chassis ground provided by the fuseblock's mounting bracket.

ery compact HF radio out there now. This enables you to tuck the main transceiver somewhere out of sight while dramatically widening the world of possibilities for temporarily mounting the much-smaller display/control module—a real boon, given the unpredictable sizes and shapes of today's rental car dashboard nooks and crannies. See Figure 1.

Mount

About the only practical antenna mounting location available on contemporary cars is the trunk lid. Fortunately, there are several products with sufficient heft to handle an HF antenna while still sufficiently compact for packing. An example is Comet's GR5M tilt-adjustable trunk lip mount, with its four heavy setscrews that provide the strength and excellent RF ground crucial to a mobile installation. See Figure 2. It met my own cost and versatility criteria, and it installed quickly and without damage to the vehicle. The only trace of its presence are the four out-of-sight spots where the set screws penetrate the paint, and they can be touched up with tiny dabs of fingernail polish.

As anyone who's mounted a reasonably sized antenna on a modern car will attest, body material isn't what it used to be, so don't forget Dacron or nylon line for guying your mobile installation. Forget aesthetics here; keep in mind that your traveling mobile setup *already* looks bizarre so focus on supporting it as you rumble through unfamiliar countryside. I run *two* guy lines and, on my homebrew Spider, use a hefty spring to minimize the surprisingly huge transient forces such an antenna can exert.

DC Power

Probably the greatest challenge for a universal mobile system is accessing clean dc power since few cars offer any practical means of through-the-firewall access to the battery. Nevertheless, nearly all cars now utilize new-generation plug-in fuses in under-dash-mounted panels. So I got some and modified them, fabricating my own wiring with lugs I could attach to a small terminal strip for the rig cable. Between this and a last-resort heavy-duty cigarette lighter plug adapter equipped with no. 10 wire, I covered 99.9% of the bases.

With the proliferation of cell phones, cigarette lighter sockets seem here to stay and so do their typically 20 A supply lines. Replacing the cigarette lighter fuse with my modified one provided adequate rig power and, by plugging in the fuse interface such that the lighter socket remains downstream of the fusible link, the car's existing circuit is still protected. Once you find the panel and the right fuse, power access time reduces to seconds and, when you're done, undetectable system restoration happens just as quickly. See Figure 3.

Admittedly, not connecting directly to the battery represents a possible hash and noise tradeoff. Most modern rigs have excellent filters and noise blankers (your mileage might vary here) to mitigate it, however.

Extras

Anyone familiar with ham radio trends would never disagree that the current king is the "aftermarket gizmo." From Antenna Analyzers to Zap Checkers, the candy case brims with goodies, some of which are surprisingly practical for the gypsy ham.

A very useful addition to my rental car system was the Gap Hear It DSP-assisted external speaker. Especially handy if you've remoted your radio's control head, its compact design accommodates an assortment of little automotive cubbyholes and, with the DSP function shut off, it works great as a standard speaker. Whether you're sitting still or driving along, the flick of a switch treats you to the delightful sound of the signal you want suddenly climbing out of disappearing background noise. Downsides include the fact you have to power it (I hooked it into my '706 terminal strip) and the signal you're trying to hear still has to be at least barely readable (ie, no DSP Santa Claus quite yet). Regardless, it's yet another tool in reducing electrical noise.

In the Jungle

We arrived in Yucatán during the hot-

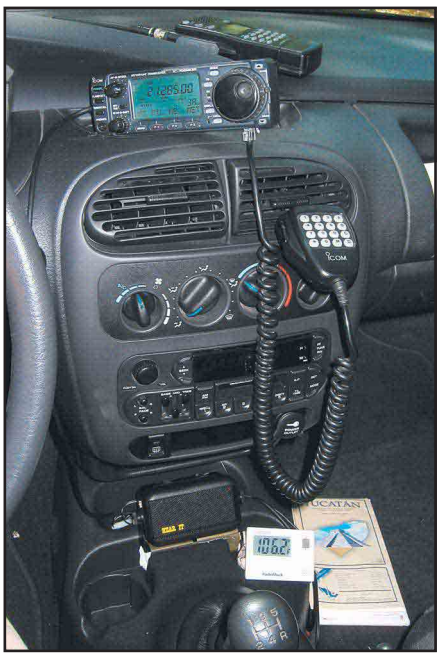


Figure 4—Far from any electrical noise, the Yucatán jungle is an almost ideally quiet DX venue. Note, however, the 106° outside air temperature on the LCD thermometer.

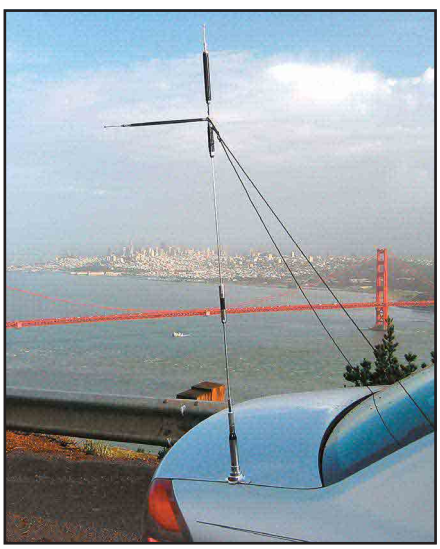


Figure 5—For a compact HF travel antenna, top-loaded vertical designs like Comet's UHV-6 are excellent choices, since they're light and strong while creating a good horizontal take-off angle for more efficient DX performance.

Plug-In Power

With the under-dash areas of today's vehicles increasingly resembling tightly packed circuit boards, direct access to clean battery power is every bit as difficult as finding a convenient hole in the firewall through which to run a hefty cable. Often, the next best approach to a score or so of amperes is via the fuse box—but tying into it can prove problematic.

With 99% of new vehicles now using plug-in fuses, my power access solution was to modify an actual fuse, soldering on some hefty multi-conductor wire and running a short lead to a terminal strip from which I powered my gear. See Figure A.

Because most cigarette lighter sockets provide 20 A, I bought some new fuses, got out my Dremel tool and soldering iron, and went to work. Photos B, C, D and E indicate the process.

It can be a little tricky since the side conductors of fuses aren't too beefy. But if you're careful, you can create a neat, safe, and highly efficient means to access power.

When you hook up, be careful to plug in your modified interface fuse so the side running to the car's cigarette lighter remains downstream of the fusible link. Your mobile radio's cable should contain its own fuses so the car's wiring is still protected.

If you're assembling a universal power access system for use in rental vehicles, be sure to make fuse interface wires not only for the standard-sized plug-in fuse (known as "ATO" fuses), but also for the yet harder to work on "Mini" fuses. Happy dc!

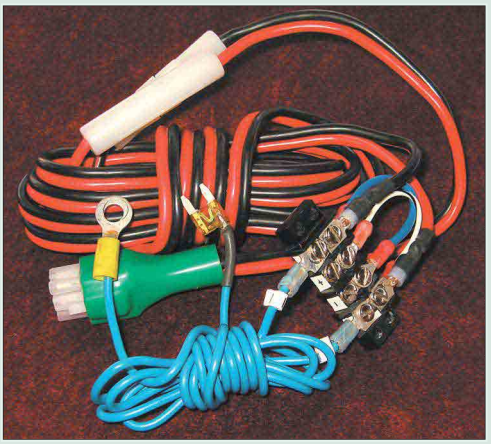
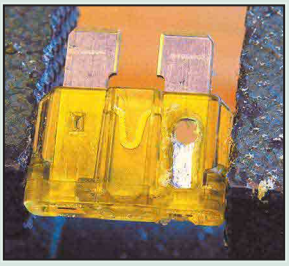
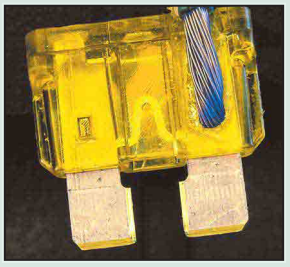


Figure A—The entire rental car power interface consists of the transceiver's 6 foot modular cable connected through a terminal strip to about 3 feet of 12 gauge lead wire. Extra terminals are jumpered and available to power accessories like my DSP-assisted external speaker.

(B)



(C)



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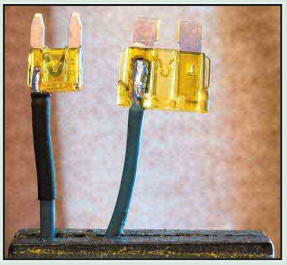


(E)

test time of the year and pre-departure checking with the rental agency had revealed we'd get a Dodge Neon. I started my installation just before dawn and, helped by earlier photo recons at Dodge dealer Web sites (and a little luck), I finished before breakfast—but still soaked with sweat.

The electrical connection took two minutes, the '706 chassis slid neatly beneath the passenger seat, and the control head anchored itself nicely in a dashboard nook. See Figure 4. With the Hear It speaker on the console and the UHV-6 on the trunk lid, I worked my first European station on 20 meters as we drove south from Yucatán's capital city of Mérida.

This trip's purpose was photographing archaeological sites for friends in the Maya academic world. We staged out of a central jungle location, getting predawn starts on daily trips to distant sites where we'd work DX both ways. With temperatures hitting 100 before noon, you quickly realize why folks there hide out for an afternoon siesta.

I alternated antennas daily between my homebrewed Spider mobile and the UHV-6. Early mornings (1100-1300Z) delivered signals on 15, 17 and 20 meters from Europe, the Middle East and even South Africa. I worked them with relative ease driving along winding roads through dense foliage. Later (1700-2000Z), more paths opened on 15 and 17 to Europe, South America, and all of North America. Conditions easily permitted a daily 1900Z sked on 20 with folks in and around my home town in the Mojave Desert and, sitting in the hotel parking lot at night (0000Z), I used that same band to work ZK1DD in the Cook Islands plus hitting most of the US on 40.

System trade-offs between a larger mobile antenna like my Spider and Comet's UHV-6 became obvious in this rental car application. Size and performance constituted the big one: the Spider tunes anywhere in any band and delivers one more S-unit at the other end. But it's large, needs an adapter to match its $^{3}/_{8}$-24 stud to the mount's SO-239 (Comet's AD-35 is ideal), and without my guy ropes and spring, its bulkiness could damage the painted tinfoil passing for car bodies these days.

Meanwhile, the compact UHV-6 HF antenna screwed onto its mount in seconds, making the total transition time from "unremarkable rental car" to "crowd-magnet" in well less than five minutes. See Figure 5. But its real strength was getting out a dynamite signal when used inside its bandwidth. If you can live with a narrower operational frequency range on HF, a sharply tuned travel antenna such as the UHV-6 performs like a laser beam.

Doable

Assembling a full-powered, suitcase portable mobile HF station is a project easily within the budget and ability of most hams. Overseas security is enhanced with today's handy antenna mounts, modular technology and separation cables. With the installation mostly out of sight, remaining components can quickly disappear beneath seats when the car is parked.

Keeping gear simple enables you to assemble key ingredients inside one of many handy "radio packs" now on the market, making everything easy to keep together and ready to travel. See the title photo.

With a system like this and a little pre-departure homework, you can add a fascinating new dimension to what might already be an exciting and exotic trip. I know that was certainly true in my case and I can't wait to do it again!

All photos by the author.

David Rosenthal, N6TST, has been licensed since 1989 and holds an Amateur Extra Class certificate. He's an EE and a physicist actively working in RF engineering. You can reach him at 840 W Springer Ave, Ridgecrest, CA 93555; **n6tst@ridgenet.net**; **www.ridgenet.net/~n6tst**.

By Seth Price, N3MRA

The Amateur Storm Chaser

A college student with a passion for severe weather spotting finds that you can study the science of weather from a classroom chair or by taking to the road to find the weather before it finds you.

I became interested in meteorology long before there was a movie called *Twister*. It didn't take me long to realize that if you're actively storm chasing, being able to communicate with others about the position of severe weather is not just a good idea—it should be the focus of the chase.

At Virginia Tech, where I am a student, there are (so far) only two meteorology courses. Applied Meteorology was taught by Dave Carroll, an experienced storm chaser. I soon learned that this course was followed by an optional chase to tornado alley.

The course covered everything from atmospheric basics to hurricanes, from Skew-T diagrams to supercell classifications. I informed Mr Carroll that I was a Skywarn spotter and an Amateur Radio operator, and that I was interested in bringing some equipment along for the trip. He agreed, as he had seen other storm chasers in past trips with Amateur Radio equipment and had heard a little about Amateur Radio during Skywarn training sessions.

2 Meter Radio

Upon researching Skywarn frequencies in Oklahoma, Texas, Arkansas, Kansas, Missouri, Louisiana, Nebraska, Iowa and several other states, I decided that a 2 meter rig was essential. I had an ICOM IC-2100H in my room that I used to check onto a few local nets. It has 50 W output and basically 100 memory channels, so I figured that would be adequate. I bought an atlas of the United States and went through my Skywarn frequencies and wrote down every new frequency. I found well over 100 possible frequency/tone combinations that were active, so I picked the 100 most used combinations and programmed them into my transceiver.

After using an atlas to roughly locate each repeater, I circled the town and wrote the corresponding memory channel next to it. This proved to be invaluable—there were several times that we were chasing a storm and needed to know the nearest repeater.[1]

The group of chasers had rented a Ford Windstar minivan. Since the vehicle was rented, NMO mounts were out of the question, and I knew the problems associated with a window mount; a RadioShack magnetic mount worked.

APRS

This was new to me: Automatic Position Reporting System. I hadn't heard of APRS until Jason Rausch, KE4NYV, told me about it. This system will link a global positioning system (GPS) to a radio via a terminal node controller (TNC) and send out a packet containing your position, speed and heading on 144.39 MHz. Other stations receive this signal, and through an Internet gateway (or I-Gate), place the data on-line. Then anyone on-line can go to **www.findu.com** or a similar site and get a map of your position. This was really neat, since our friends and families can see where we are. It would also be useful to any NWS office that was running APRS software.

I purchased an Alinco TR-135TP. It also has 50 W output, and the feature I liked the most, a built-in TNC. I already had a GPS, a Garmin E-Trex. This Garmin has a simple interface and produced NMEA out strings, which is all I needed.

Considering my lack of knowledge about TNCs, APRS and packet radio in general, I relied on Jason to help me get set up. There wasn't much to it to set up—a few commands to get the radio up and running. I was N3MRA-12, and on the air. The DB9 port allowed a P-120 laptop to be connected for programming the TNC, and for receiving packets. The computer was not needed for APRS—only if I wished to receive packets. I set up to receive packets, but the physical configuration in the van made the laptop more cumbersome than it was worth.

The physical connection of the APRS system was made possible by a cable that contained both a cigarette lighter power source and a data cable for connecting to the radio. The basic connection can be seen in Figure 1.

The data cable had to be made—the GPS had a four pin connection going to a DB9, so only a few of the DB9 pins were used. These pins were connected to a stereo plug, which was plugged into the front of the Alinco.

As far as the Alinco was concerned, I set the frequency on 144.390 MHz, unplugged the microphone and attached it to another magnetic mount 2 meter antenna. I removed the microphone because (a) it was unnecessary and (b) because it was just another cord to get tangled in while rushing in and out of the vehicle.

For the most part, it was no problem to get into a digipeater. There was a huge dead spot from the panhandle of Texas

[1]Notes appear on page 51.

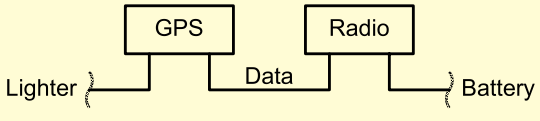


Figure 1—Basic APRS configuration.

to western Oklahoma; I was the only signal out there. As soon as we left Woodward, Oklahoma headed south or west, that was it—no more coverage until Amarillo, about 175 miles away.

Other Equipment

I brought along my Yaesu VX-7R handheld transceiver for the trip with a magnetic mount 6 meter antenna. This was for the sole purpose of entertainment, and is not essential to storm chasing. I found, however, that I could not hit any 6 meter repeaters, so on about the third day I gave up trying to talk on 6 and concentrated on 2.

Both vehicles had FRS radios, as I was the only licensed ham onboard. Each vehicle also had a police scanner and weather radio, which were useful in terms of letting us know which roads were closed and which warnings were already given on the storm.

The Chase Vehicle

The vehicle itself had to be wired for running all of the equipment. First, I would really like to recommend the use of Anderson Power Poles. I ran one line from the battery and power poled the rest of the equipment by branching lines. I ran a line from the battery near the windshield wiper, through the A-pillar through the driver's door, under the carpet to the rear of the minivan, where my equipment was set up. It was flawless; nobody could trip on it, there were no pinch points, and I did not have to find a spot to run the line through the firewall. Once to the back seat, I branched several lines out for the Alinco, the ICOM and a dual cigarette lighter, which ran the GPS and the charger for my Yaesu. To Ford's credit, the vehicle had ample cigarette lighters—most people had just cell phones to charge.

I had a vehicle cigarette lighter at my disposal, so I ran a 200 W inverter. It worked about 90% of the time; the battery voltage of the vehicle regularly dropped below 10.8 V, which stopped the inverter from working. An inverter with a different voltage regulator—maybe 10.5 V would have been better—but for $20 at Big Lots, I got what I paid for. It did work marginally well for charging camera batteries and running the laptops.

Antenna cables were run out the rear side windows, out of the way of sliding doors and moving luggage. It was seamless, no rain leaking in, and no real outside wind noise, and yet the coax was not pinched tightly. The result: The ultimate chase vehicles in western Oklahoma, not far from Elk City, are shown in Figures 2 and 3.

Figure 2—Our chase van, a specially modified Ford Windstar.

Figure 3—Our chase car.

The Chase

Coming from Virginia, it took a few days to get positioned, and we chased a few cells that did not develop into anything severe. A shortwave pattern in the jetstream was set to change all of that.

We headed toward Amarillo, Texas, as that seemed to be a good starting place. The dryline[2] had developed over the panhandle of Texas and they were in a slight risk area, according to the Storm Prediction Center (SPC). Halfway through Oklahoma, the cumulus towers began to develop. By the time we were near Amarillo, mesocylonic cells had already developed, some with severe thunderstorm warnings. Figure 4 shows a ragged wall cloud developing. This storm had a tornado warning, but only for a few minutes. This storm was located not far from Pampa, Texas.

We tracked this storm from the panhandle of Texas through to Oklahoma. The part of Oklahoma we were in—Arnett, Roll and other towns in the western part of the state, lacked digipeater coverage, so our position was not being displayed. We spent that night in Elk City, which did not have a digipeater either. When we left the next morning, most people had lost track of us outside of Pampa.

June 12 was a day of excitement. We had an outflow boundary, very visible on radar, headed south toward the Wichita Falls area, a shortwave looping through all of Texas at some point during the day, and a dryline between the panhandle and

Wichita Falls. We decided not to follow SPC's advice and we headed toward Wichita Falls.

By 2 PM, we were through Vernon, Texas and headed toward Mabelle. Towers were going up left and right and the capping inversion couldn't hold much more back. In Archer City, Texas, the cap broke and several cells shot upward. Soon, four centers of rotation were appearing on radar. We pulled out of Archer City, lost Internet connection, but by then we knew where we needed to be. Within a few minutes, a classic supercell had developed! Figure 5 was taken along Rte 79 outside of Archer City. This storm was spinning hard; striations were visible.

A few minutes after we left Archer City, the first rotating wall cloud dropped a tornado. We heard on a Skywarn net the phrase "rope on the ground!" After we cleared a line of trees, we could see it as well, so I responded saying that I was seeing the same thing, and net control said that there would be a warning issued. Soon after, the weather radio went off, followed by the Archer City, Texas tornado siren.

This storm also points out the amount of respect Skywarn spotters earn in the Great Plains. At one point, a Texas State Trooper was sitting on the side of the road, and as we stopped nearby to observe (with our Skywarn magnetics on the vehicles), we heard across the police scanner "Skywarn spotters have arrived; I'm moving on," and then that police officer drove away.

The Future

Hopefully, there will be more digipeaters running by spring. I will run APRS software on my computer so I can see where we are relative to other chasers and spotters who are also running APRS. Also, I hope to have another ham come with me and run some equipment from the other chase vehicle. I would like to compare a Tiny Trak 3 to my Alinco with a built-in TNC, since the Tiny Trak has smart beaconing (an adjustment of beacon times based on traveling speed) and corner pegging (a beacon is sent when there is a rapid change in direction).

Running HF for the purpose of entertainment and for the county hunters would be fun, too. I could talk to my parents on 40. I like 20 meters, too—last summer I ran 20 all night on my dad's radio.

I would like to get some portable weather equipment. Temperature and wind speed/direction would be nice, but the dew point is what will be most useful for locating a dryline.

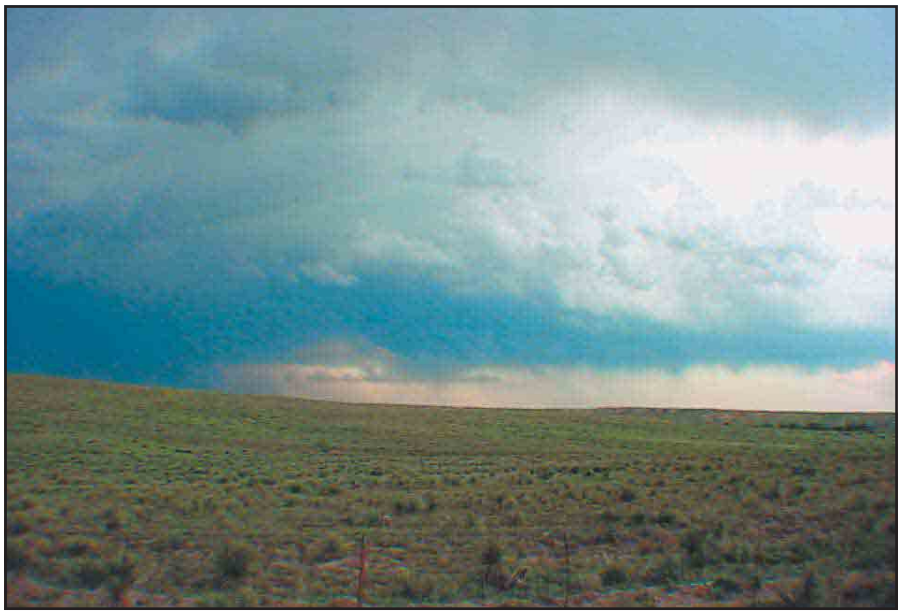


Figure 4—A ragged wall cloud near Pampa, Texas.

Figure 5—A classic supercell near Archer City, Texas.

There is so much that can be learned from our atmosphere; it's something man has explored but has never really understood. Combining my interest in meteorology and my interest in Amateur Radio has to be the greatest experience in my lifetime.

Notes

[1]The *TravelPlus for Repeaters* CD is designed to find repeaters along a particular route. It is available from your local dealer or from the ARRL Bookstore. ARRL order no. 8985; $39.95 plus shipping. Telephone toll-free in the US 888-277-5289, or 860-594-0355; fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]According to NOAA's *A Comprehensive Glossary of Weather Terms for Storm Spotters*, the dryline is a boundary separating moist and dry air masses, and an important factor in severe weather frequency in the Great Plains. The Glossary can be found at **www.srh.noaa.gov/oun/severewx/glossary2.php**.

Photos by the author.

Seth Price, N3MRA, was first licensed in 1992 at the age of 10, with the help of his father, Jim (N4ST, ex-AA3O). He is a now a General class operator studying to take the Extra exam. A student at Virginia Polytechnic Institute and State University (Virginia Tech), Seth is studying Materials Science and Engineering or Meteorology. He is a member of the Virginia Tech ARA (VTARA) and a charter member of the New River Wireless Association (NRWA). He maintains both the NRWA Web page and his own Web page (**www.n3mra.com**). *You can contact the author at* **sprice@vt.edu**.

By Bill Pasternak, WA6ITF

Once Upon a California Hilltop

The story of repeater pioneer Art Gentry, W6MEP.

Every day, tens of thousands of hams around the world slide into their cars and turn on a 2 meter, 1.25 meter, 70 cm or dual-band FM transceiver and drive off. They may be headed to work, headed home, headed to the market or where have you. No matter, friends and emergency assistance are never more than a microphone click away.

Today we take FM and repeaters for granted. The mode and the relay devices sitting on hilltops or tall buildings are seemingly there at our command, 24 hours a day. Communication is crystal clear and there always seems to be someone to chat with, but it was not always that way.

The K6MYK repeater control receiver. It was on 421.28 MHz and was built around an old military ASB-7 receiver with lighthouse tubes in the front end.

The Way It Was

About a half-century ago, in the "Neanderthal" days of ham radio mobile operation, radio amateurs struggled for contacts. Back then, all VHF communication was point-to-point. If you were running mobile, you hoped that the station you were talking with had a good directional antenna and the ability to rotate it to track you. It wasn't unlike the way we operate ham satellites today.

Of greater consequence, from the 1940s through the late 1960s the majority of hams on the VHF and UHF bands operated Amplitude Modulation—AM. AM and other modes that rely on varying the amplitude of a carrier wave (or suppressed carrier SSB) are prone to interference from natural and man-made noise sources. From the dawning of the ham radio mobile era, hams worked to devise noise-elimination schemes. Some installed shielded ignition systems. Others modified the noise-elimination circuits in their radios in hope of better performance. Each worked to varying degrees, but none were foolproof.

Something better was needed—a way to extend the range of mobile-to-base and mobile-to-mobile contacts, and eliminate the noise inherent to mobile operation. The adoption of Frequency Modulation (FM) would solve the noise problems for VHF/UHF mobile operators. A device that was new to Amateur Radio would solve the range issue. One of its earliest appearances was in a blockhouse just above the famed "Hollywood" sign overlooking Los Angeles. It was a radio relay system called a *repeater*, and it was the brainchild of a broadcast engineer named Arthur M. Gentry, W6MEP.

From Garage to Mountaintop Site

The first documented Amateur Radio repeater in regular operation was AM, not FM. It received weak 2 meter AM signals and retransmitted them at high power. This particular repeater, developed by the late Arthur M. Gentry, W6MEP, was licensed as "Remote Station" K6MYK. It first took to the air in 1956 from his home in Northridge, California as an experiment in radio-relay technology with roots going back two years prior. W6MEP told me about it in a tape-recorded March 1979 interview.

Gentry: "We went to the present site in October of 1958, but there were sites in-between. The original license for K6MYK was issued in 1954 for a site in Burbank, which we never used. It went remote control—I think it was June of '57 when we finally got onto a hilltop."

A Trip Back in Time

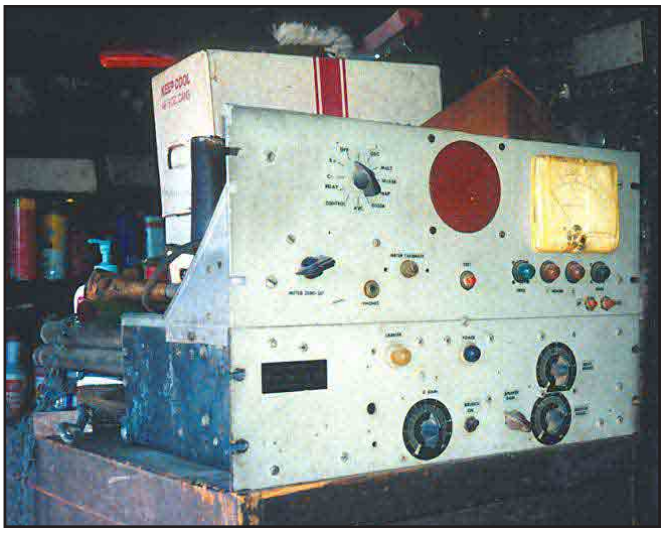
Art Gentry never laid claim to "inventing" the repeater. If he was still with us, he would be the first to tell you that he was the one lucky enough to make a remote-control ham station work for the masses.

Gentry: "I can't say that we were the first because in 1954—I think it was in San Jose—a group of people put up a 2 meter AM repeater in the Berkeley Hills and they left it. Later that year—along around August—we went on a vacation to Colfax above Sacramento and we worked through the repeater from Colfax down to Lemore. That's about 300 miles total distance and, of course, that was unheard of on 2 meters."

According to W6MEP, that machine was K6GW. In its original incarnation, it was on-site controlled and stayed on the air for a few months before it fell by the wayside. Gentry believed that this was because it was not an "open" machine, and because it only operated intermittently.

Gentry: "If you were lucky enough to get in there when the guys had it up, it was fine."

Art Gentry, W6MEP (left) and Bill Arens, N6NMC.



The original K6MYK AM repeater receiver.

So why did Art Gentry decide to build a repeater of his own? Because it was a way of extending the range of amateur VHF communication.

Gentry: "I have operated VHF mobile since probably about 1940 when I went to 112 Mc [the old pre-World War II 5 meter band—what today would be called 112 MHz.—*Ed*]. I was on 112 Mc at one time running quite high power, running a 35T-modulated oscillator. The receivers were all regenerative. After World War II, when the 2 meter band opened up—which if I remember right was January of '46—I had acquired an ARC-4, which I made into a crystal-controlled tunable (receiver) unit. It had a crystal-controlled transmitter with 10 W power output.

"That was a mobile rig and I can remember going up to Mt Wilson one time for a drive. I came on the air and I was like a foreign country. We talked our lungs out going from one station to another as fast as we could for over two hours. This pointed out the advantage of high elevation."

Gentry immediately contemplated putting up a voice repeater, but back then there was little information on how to do it. As a result, necessity became the mother of invention.

Gentry: "I would look for remote-controlled transmitter articles, but I would find very little. In the late '40s and '50s, the only thing you ever found was information on how to remote control a transmitter. Nobody had ever thought of a remote-controlled station. Only a transmitter somewhere. Never was there a receiver around."

So, W6MEP set to work to make it happen.

Gentry: "Marrying of a receiver to a transmitter to become a repeater took a lot of long, hard work and a lot of channel separations. A lot of megacycles in-between and a lot of tinkering and puttering to try to get things so that you didn't get interference and desense."

Making it happen in that era also meant rolling your own.

Gentry: "We built a whole new receiver. You couldn't buy anything. You couldn't find anything on how to do this. So, we used our ingenuity. We had to find ways of getting rejection on the receiver to get away from desense."

Steps Forward And Steps Back

While California had repeaters since the 1950s, the proliferation really began after the first low-cost radios began arriving from Japan around 1969. When I conducted this interview a decade later, there were already thousands of hams on over 250 open 2 meter repeaters in Southern California, and the local repeater coordinator had a list that was close to 200 more waiting. The same percentages were found in most other populated regions, and I asked Art if he ever dreamed that his early experiments would revolutionize the way hams communicate on the bands above 50 MHz.

Gentry: "I think I can say yes to that question. Logic told me that this was a good way to get better communication. If you can imagine a 10-W AM mobile running all over the greater Los Angeles area in the early 1950s and never being out of communication range with somebody, you'll understand why I had faith in the future of this technology.

"I observed the growth of commercial radio at elevated sites. Having seen that growth, I knew what eventually would happen with amateurs. I knew that this would be a very widespread thing, and with the adoption of FM (by both commercial and amateur communicators). I knew this would happen because I knew what the performance of FM was as compared to AM. For my own personal communications, I went to FM in the early '60s."

Even so, the original K6MYK repeater was an AM device and remained so into the early 1970s.

Gentry: "It did so because it served a great many people using AM. It was still 'their repeater,' if I may use the term. When the activity dropped to where there were no customers, then there was no sense in staying on AM.

"We knew that there would be new repeater rules out and we did not want to make a change until they were announced. Concurrent with that was the channelization of Southern California repeater frequencies. We applied for, and got, a (coordinated) repeater pair at that time with the intention of going FM.

"So it wasn't necessarily my personal desire to remain with AM. The control system has been FM since the beginning, and some of the original control equipment is still in operation because it is reliable."

K6MYK, by then on its way to becoming WR6ABN, began its conversion to pure FM operation in the early 1970s. Not long afterward it was assigned a frequency pair, and Art added a second receiver to detect FM signals and an FM exciter to the plate-modulated AM repeater. For a while, K6MYK was a one-of-a-kind dual-mode repeater, accepting and retransmitting both AM and FM signals. When the last AM signals disappeared from the 2 meter repeater sub-bands, so did the AM portion of the K6MYK/WR6ABN repeater.

The Man, His Life and His Career

If the repeater rules enacted in the

early 1970s were meant to stifle growth of FM relay systems as some claim, the effect on California in general and Southern California in particular was insignificant. While some hams to the East made lots of anti-FCC "noise," those in the Golden State pooled resources to make sure that every "i" was dotted and every "t" was crossed in their repeater license applications. Little did the people in DC know that much of the help in preparing these applications was coming from hams involved in the two-way and/or broadcast professions. These hams were used to dealing with the Washington bureaucracy and its myriad of paperwork.

By profession, Art Gentry was one of them. He started his career at Channel 13 (now KCOP a Fox-owned UPN affiliate), but spent most of it at KTLA channel 5, a station then owned by Gene Autry's Golden West Broadcasting.

Gentry: "I did not get into the broadcast industry until about 1951, but I got into it because of the extensive knowledge I have of communication and television. The people who hired me at channel 13 had known me for a good many years. I've been with Golden West for 10 years now, and was with this same channel for two years on an earlier tour of duty. I have about 12 years with that station."

His contributions while at Golden West are legendary. Working under the aegis of broadcast pioneer Klaus Landsberg, Gentry had the opportunity to be involved in many firsts. This included the first live telecast of an atom bomb test in the Nevada desert, the first live coverage of an actual police investigation, the first color telecast of the Tournament of Roses Parade and helping in the design and fabrication of the first helicopter-mounted TV news camera system, the "KTLA Telecopter." But in his off hours, his two main loves were his wife Millie, K6JJN, and the K6MYK repeater. Art and Millie were a team united not only in marriage, but in the world of Amateur Radio repeaters as well.

A Champion of the Little Guy

W6MEP was also the first advocate of the repeater user. In an age when many repeater owner-operators were setting strict user rules, Gentry placed his faith in his fellow man.

Gentry: "Very early in operating K6MYK I learned that 'users' are paramount for the simple reason that if they do not grant you permission to use the air, you have got a lot of trouble on your hands.

"We went through some very bitter battles to prove this to people—that you just could not come on (the air) as one individual and say 'I don't like what you are doing and I have the right to use the channel 3 kilocycles away.'

"And while we still have battles, it's the people who made the repeater stick. It's not the ownership of a repeater that enforces anything. It's the users, and this is particularly true in an open-channel machine."

Art's Essay on Repeater Growth

One of the questions I asked Art was why repeater growth in California had outpaced that of the rest of the country. He said there were two reasons he could think of: altitude and attitude.

Gentry: "I think an example is worth more than anything else. Take WR6ABN (the call sign that replaced K6MYK under the authoritarian 1970s repeater rules). At about 1800 feet above sea level, there were probably 5 to 7 million people within reach of that signal at the time. Today there are probably 20 million people. I doubt if there is any other repeater that covers a larger group of people. We happen to be roughly in the center of a heavily populated area with an ideal site.

"Also, California has unusual geography. It has lots of elevated sites. The early people (hams) who got into repeaters were the people in commercial two-way radio. Commercial relay systems led the way. Not so much as repeaters, but rather remotely controlled base stations. A telephone line would control them. This showed what the amateurs could do and it only took a few sharp ones to find that they could couple a receiver to a transmitter. This brought about the tremendous growth.

"Repeaters in the West have line-of-sight ranges of a couple of hundred miles. You go back East, or in the Plains states, and if you can get 500 feet up you are

Art and Millie Gentry

By Burt Weiner, K6OQK

I must have arrived on Earth with an inborn interest in radio. It didn't develop; it was just there from the very beginning.

It happened that my folks were close friends with Sam and Mildred Balter. Sam was a sports announcer on radio and television and quite aware of my interest in radio. One day, when I was about 5 years old, Sam took me to work with him. He introduced me to the announcers and engineers. This one event probably did more to turn my interest toward broadcasting than anything else.

I went back to the station as often as I could talk someone into taking me. When I was old enough, I would take the bus to the station. I went almost every Saturday and Sunday and just "hung around." I drove people nuts! Some, but not all, of the engineers found it easier to give me something to do than to make me go away.

One of the engineers was named Art. I sensed that Art thought I should be home, or at least somewhere else. When I would see Art coming, I'd go somewhere else. This was an often-repeated ritual.

When I was in junior high school, I received my ham call, KN6OQK, and found my way to 2 meters. Then one day I heard this "thing." It just stayed on the air and I could hear people talking to each other. Not only that, from time to time it beeped. I listened for a few days and finally figured out that this "thing" was called a repeater. I discovered the input frequency and climbed aboard. I remember a female voice welcoming me. Her name was Millie, K6JJN.

Millie's husband, whoever he was, had built the repeater thing. One day I struck up a conversation with Millie's husband, Art, W6MEP. Art and I got on well together. It never dawned on me, and I'm sure not to Art either, just who either of us really were. At least *I* never put the two Arts together. I was still going to the station, just not as often now. The distant relationship with the Art at the station remained.

One day a ham radio buddy told me he was going out to visit Art and Millie and invited me to go along. We arrived about four in the afternoon. Art had just called Millie on the radio to let her know he was leaving work. Who knew what he did for a living? I certainly didn't!

She handed me the microphone and told me to keep Art company. We had a great time. He was telling me about the "repeater thing" and "how he did it."

As Art got closer to home, I was getting really excited. I was finally going to meet him. He parked in the driveway, I heard the car door open and close, footsteps, the kitchen door opened and there he was. Art's mouth gaped. He just stared. I was trapped in a corner of the kitchen with nowhere to go!

Then something happened. He slowly started to smile, walked over to me and gave me a hug. One of the warmest hugs ever. This was the beginning of a very special bond between Millie, Art and myself that would last a lifetime.

On May 10, 1996, Art passed away. Millie joined him on August 5 the same year. I miss them more than words can describe. They changed my life in a way I could never have imagined.

doing good. New York City has a few sites at 1000 feet, but look at what you have to contend with. The 'concrete canyons' are one of the worst things in the world to try to get signals through.

"And it's a fact that the West has always been innovative. The West is a big, wide-open country with a strong sense of individualism. People bring that Western spirit to radio and do what they've always done—innovate. We're pioneers. The pioneer spirit that came West in the beginning is still here."

Honors to the Mind that Created the Medium

In April 1987, the Dayton Amateur Radio Association recognized Gentry's contributions to Amateur Radio by honoring him with its Hamvention Special Achievement Award. The proclamation published by DARA in the souvenir program that year read in part: "The technical achievements of Arthur M. Gentry, W6MEP, have touched the lives of more Amateur Radio operators than any other in the history of the hobby. Although Art lays no claim to being the first to put up a repeater, his research and development led to the operation as we know it today. A man of vision, Art foresaw the need for rulemaking and was instrumental in forming the first VHF Repeater Advisory Committee."

Passing On the Flame

On April 4, 1996, Art Gentry, W6MEP and his wife Millie, K6JJN, left the smog of Los Angeles to be near their children in Beaver, Oregon. Art was now 89 years old and Millie, 83. Both were in failing health. He passed away a month after the move; Millie followed in August.

Art's repeater lives on. About two years before his death he turned the day-to-day operation of the system over to Bill Arens, N6NMC. After Art passed on, Arens petitioned the FCC and obtained W6MEP as a club call for the machine. That's how it identifies these days. Arens says that this is a lasting tribute to the man who made repeaters available to all hams, many of whom have never even heard the name Art Gentry or the call sign W6MEP.

Bill Pasternak, WA6ITF, is a broadcast engineer with KTTV Fox 11 / KCOP UPN 13 Television in Los Angeles and a broadcast consultant specializing in the design and installation of video post-production systems. He is the co-founder and Managing Editor of the all-volunteer Amateur Radio Newsline *bulletin service and creator/administrator of the annual "ARNewsline Young Ham of the Year Award" program that each year honors the accomplishments of a radio amateur age 18 or younger with a trip to Spacecamp in Huntsville, Alabama. Bill is the only person ever chosen to be recipient of both the prestigious Dayton Amateur Radio Association's "Specific Achievement" and "Radio Amateur of the Year" awards. He also was presented the ARRL National Certificate of Merit in recognition of his contributions to the furtherance of the goals of the Amateur Radio Service. Bill and his wife Sharon, KD6EPW, reside in Santa Clarita, California. He is a member of the ARRL, QCWA and the Radio Club of America. In addition to being the author of three books, Bill is a production staff member for several educational films and videos. He writes a monthly column for* Worldradio Magazine*, is a contributing writer to several broadcast trade publications and is a frequent contributor to* CQ Magazine. *Bill can be reached by e-mail at* **billwa6itf@aol.com** *or* **wa6itf@arnewsline.org**.

NEW PRODUCTS

MFJ-1401 VHF MOBILE GROUND PLANE KIT

◊ This new kit converts most mobile VHF and UHF antennas into a ground plane base station antenna. It is said to handle up to 200 W and accepts mobile antennas with a UHF (PL-259) connector. The kit includes four 20.5 inch radials, stainless steel mounting hardware, two hose clamps and an Allen wrench. The kit is designed to mount on a 2 inch pole or pipe with clamps or mounting holes. Price: $19.95.

To order, or for your nearest MFJ dealer, call MFJ Enterprises at 800-647-1800 or order at **www.mfjenterprises.com**, fax 662-323-6551; or write MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759.

MACLOGGERDX V3.8 FROM DOG PARK SOFTWARE

◊ Dog Park Software has announced that version 3.8 of *MacLoggerDX,* logging software for Macintosh computers, has been released and can be downloaded from their Web site. A free upgrade for registered users of *MacLoggerDX* version 3.5 and newer, this release provides improved support for the Ten-Tec Orion transceiver. In addition, it adds popup support for multiple logs and provides a number of other fixes and upgrades. Check **www.dogparksoftware.com/MacLoggerDX.html** for the complete list.

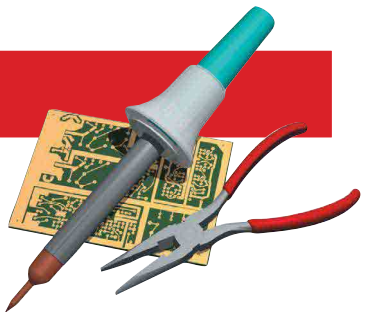
MacLoggerDX tracks DXCC, IOTA and WAS awards, and has a bands display panel that tracks activity by HF amateur band. For more information, contact Dog Park Software Ltd, **dagro@dogparksoftware.com**, **www.dogparksoftware.com**.

180s EAR WARMERS WITH HEADHONES

◊ 180s, a company providing clothing and accessories for winter sports enthusiasts, has a product that may be of interest to hams, especially those who enjoy operating outside year round. They offer ear warmers with special pockets for high fidelity ear phones. They're a pair of stereo headphones that fit inside special pockets in their warm fleece ear warmers. The ear warmer wraps around the back of the head, allowing the wearer to don a hat or scarf or to pull up the hood of a parka.

180s Ear Warmers feature a patented design with a custom band that adjusts to fit any size head. This design protects the user's ears from the outside elements. With a twist, the ear warmers fold and collapse to fit into a coat pocket.

Price: ear warmers: $25 to $30, headphones: $15.99. They are available at outdoor and sporting goods retailers. For additional information, see **www.180s.com**.—tnx *Scott Verity, KC2FBV*



The Doctor is IN

Q Here's a question from David, KC2JD: I need to calibrate my VTVM (vacuum tube voltmeter). I remember that I used to use a new mercury cell as a standard because they were an accurate 1.35 V dc. Since mercury cells are long off the market, is there a good replacement?

A The easy route is to borrow a good digital VOM and use it as a secondary reference. Today's better DVMs sport accuracies as high as ±0.025% and this will certainly be sufficient for your VTVM. Another way to go is to measure a fresh cell (battery) with that DVM and use the known cell voltage to calibrate the VTVM. You'd actually be employing a form of *transfer metrology*, in which you transfer a known measurement to calibrate an instrument.

Additionally, precision voltage regulator ICs have gotten better and cheaper. Perhaps the National LM4041 IC would meet your requirements. This has a reference voltage of 1.225 V dc and good accuracy. Point your Web browser to **www.national.com/pf/LM/LM4041.html**. You may also be able to obtain some true metrology voltage standards on the surplus market. These occasionally surface. Good luck!

Q KR4ST writes: I built a 2 meter antenna into a small Hula Hoop. The wire inside the hoop is 84 inches long. I use a shorted 3½ inch stub made of 300 Ω twin lead with a 9-35 pF capacitor as a matching system. Is this antenna vertically or horizontally polarized ?

A The polarization is horizontal. It will be vertically polarized if you stand it up and rotate it so that the feed point is midway between the top and bottom. By the way, you've a good idea and I've taken the liberty of including a picture of your antenna. It can be seen in Figure 1. A Hula Hoop makes for an interesting radiator!

KR4ST

Figure 1—KR4ST's Hula Hoop 2 meter antenna.

Q Merrill, KFØWL, writes: I bought a new Kenwood TS-450 transceiver in 1992. The memory battery is original and is still working okay. My question is how much longer can I expect this battery to last and how difficult would it be for me to replace it when the need arises? I do have the service manual but it doesn't give much detail on the replacement procedure. Thanks.

A According to one of the Internet equipment forum users groups, it takes about half an hour and some soldering ability to replace the battery in the TS-450, as it is soldered in with tabs. Some folks replace it with a different type of battery that has wire leads. It may be a good idea to replace it in spite of the fact that it's still functional. One suggestion is to put in a new replacement cell every 7 years, before the battery starts leaking. Leaking memory batteries can be a big problem with older electronics and they can do considerable damage. Some of the major battery manufacturers talk about storage lifetimes of 5 to 10 years for lithium cells, so 7 years appears to be a good compromise. NiCd batteries would need replacement more frequently, although lithium is usually the cell of choice for most equipment.

Q John, WA8FNJ, writes: I recently acquired a Collins R-390A receiver and I've seen references to a "diode load." I understand that it can be used as a source for audio output, but where does it come from, what is its purpose, and do all receivers have this?

A The R-390A receiver "diode load" is a pickoff point for audio. The jumper is electrically located directly after the R-390A receiver's detector. The audio frequency response is thus limited only by the selected IF filter and the detector circuit and not shaped by the audio amplifiers or the audio passband of the receiver. Hence, it's an ideal tap point for wideband audio. The term originally came from the location of the AVC load resistor, which is often fed from the detector, and that was frequently a diode. Not all receivers have a so-called "diode load," but most receivers have a spot, following the detector, where audio can be sampled.

Q Here's a question from Terry, W1QF: Like every wire-antenna freak, I have miles (well, yards, really) of old tarnished antenna wire, which I can't solder to. Any ideas how to get it shiny and tinable?

A A lot depends on whether or not the wire is stranded. Solid wire is easier to prepare. Stranded wire takes a little more effort, since most scraping techniques only clean the outermost exposed surfaces of the individual strands; the hidden strands remain oxidized. Here's where a good paste soldering flux comes in handy. Liberally apply the flux to the wire and then heat. A good flux will usually dissolve the oxide. Make sure to remove the remaining flux with a sol-

vent after doing this.

I've also used steel wool with success. Pinch the steel wool around the wire and rotate slightly as you draw it across the wire you wish to clean. For stranded wire, try unraveling the strands a bit to clean around the circumference of each strand. Carefully retwist the strands when you are done. One extra point about stranded wire—it can be difficult to clean all the way around the circumference of the strand—even with steel wool. If possible, I use extra flux (rosin not acid) to help remove any residual oxide I can't reach with the steel wool. Another thing that works in place of steel wool is fine sandpaper. I hope this helps!

Q David, N1ZHE, asks: I recently moved my ham shack from the basement of my house to the second floor. My question has to do with the grounding of my station equipment. I've been told that I should ground my equipment. Other than a good ground at the electrical plug (I checked it and it is good), I can run a ground line to a stake (copper clad) driven into the ground. I was also told that the line running to the ground rod should not be resonant at any frequency that I plan to use. With my current rig, I operate from 70 cm to 80 meters and may add 160 meters, too. What would be the easiest way to calculate a safe length for my ground line or what would you suggest?

A I assume that when you say that you checked the ground at the electrical plug and that it was good, you're referring to the dc ground. Unfortunately, this has nothing to do with a good RF ground, except at very low frequencies. That plug ground will probably be useless as an RF ground on the HF bands. At the very least, however, it could be effective as an ac ground for the station and can be used for that purpose. It will not be a good lightning ground, however, and it shouldn't be relied upon for that purpose. For lightning (if that's a problem at your location), the shortest direct path to ground, outside the house, using an 8 to 10 foot ground rod with at least 10 gauge wire from either the coax shield or an arc arrester is to be preferred. This can also serve as an effective dc ground for the station. Keep the wire gauge large and the run short.

A good RF ground would require the lead to be short relative to a wavelength—generally less than 1/4 wavelength at the highest frequency of interest. As a rule, it is best to keep ground leads as short as possible with a minimum of bends in the wire. It's also advisable to use a wide, flat braid for a ground wire, as the RF tends to travel on the outside of the conductor (the "skin effect").

MFJ ENTERPRISES

Figure 2—A commercial version of an "artificial ground" tuner.

As a practical matter, accomplishing a good RF ground is difficult at best, especially on the second floor. The good news, however, is that most installations do not necessarily require one. If you have a well balanced antenna/feed line system, you're probably okay. If you use a wire antenna and you do have a relatively poor RF counterpoise or ground system, you might look into an "artificial ground." One such device is shown in Figure 2. This can successfully resonate a random length ground wire and make the station "see" an effective counterpoise. These can work well, although every situation is unique, and it would have to be evaluated for your particular RF environment.

The bottom line: I suggest running the shortest ground lead that is practical for your station and keeping bends to a minimum. Make sure the station is at least at dc ground potential (ground all the equipment chassis to a common point and then to a good dc ground) and keep the lightning ground outside the house. If you're using a wire antenna and you're plagued with a poor RF counterpoise, try using the "artificial ground" device.

Q Here's an interesting question from Jack, WØNQ: I have acquired a black, US Navy, flameproof, type J-7-A, straight telegraph key, which was made by the L. S. Brack Manufacturing Company, Newark, New Jersey, per government order No. 141082, dated 1921. It has enclosed contacts as well as a removable dome-shaped metal hood, which encloses a large bayonet-base lamp socket. The hood has a large hole, through which, I believe, the lamp is viewed during operation. The lamp socket is permanently wired directly across the key contacts! The type of bulb used (I don't have it) and its purpose are mysteries that no one has yet been able to answer satisfactorily. Perhaps you can clear up the mystery.

ARTIFAXBOOKS.COM

Figure 3—The J-7-A "winker" key.

A That key, shown in Figure 3, is uncommon. The bulb used in this key was called a "winker" light and it provided the operator with visual feedback in a noisy environment such as an aircraft. These keys were used with early synchronous spark-type transmitters, as part of the radio equipment on US Navy "flying boats." Interestingly, the wireless equipment was powered by a wind-driven generator mounted on the aircraft's wing. The usual complement was two keys—one for the pilot and one for the observer, who sat immediately behind the pilot. It is thought that the "winker" keys were wired so that the observer would have visual feedback of what the pilot was sending.

The original bulbs are not easy to come by these days and most keys are found missing their "winker" bulbs. You have a nice key and a part of early radio history—I hope this clears up the mystery.

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/.

The A&A Engineering 5 A Smart Battery Charger

By Joel R. Hallas, W1ZR
ARRL Assistant Technical Editor
jhallas@arrl.org

I received quite a few comments from readers about my article in December 2003 *QST*, "Emergency Power at W1ZR."[1] A number of comments were related to my note that I had significant RFI from the charger to filter. Further investigation determined that the culprit in the "smart switching" charger was from the switching function rather than the "smart" function.[2] Reader David Ferris, K5NT, suggested that I look into the chargers from A&A Engineering. Their chargers are smart linear (non-switching) units and the 5 A model seemed just right for my station.

I called A&A and spoke to Stas Andrzejewski, W6UCM, who noted that their chargers are particularly well suited to this application, since by their nature they don't generate RFI. The design of the charger is based on a *QST* article[3] describing the "smart" chip around which this unit is based. Their 5 A model uses an additional current amplifier stage to drive the series regulating transistors. We bought a unit for lab evaluation and found that while it's not quite in the "no RFI" category (see Figure 1), in comparison to representative marine switching smart chargers (see Figures 2 and 3), it is remarkably quiet.

Unlike many items, I suggest that you read the instruction sheet before trying this out. I blissfully plugged it in and turned it on. When I put a voltmeter on the output terminals (two color coded banana plug or ring terminal connectors), I was surprised to read 0.0 V. After checking fuses (both ac and dc sides are fused) and scratching my head, I noted that the instruction sheet clearly indicates that if the "battery" voltage is less than 6 V, the smart charger figures it is dealing with a dead or defective battery and puts out no power. The corollary is that this unit can't be used as a power supply unless a battery is connected (some equipment is just *too* smart!).

I tried it at W1ZR in place of the filtered marine charger I had been using and found that I could hear the difference—although in fairness, I don't think the residual RFI from my filtering would cause much of a problem. The physical characteristics are different, which may make a difference in some installations. The marine chargers are designed for bulkhead (translate to "wall" for non-boaters) mounting and thus take no shelf space. The A&A unit sits on a shelf, but also provides a useful meter along with LEDs indicating charge state. The A&A unit is also heavier and delivers a maximum of 5 A (our unit actually limited at 4.8 A, within specified ±5% tolerance) charging current rather than the 10 A of the marine units. In the analysis of my station's requirements, I concluded that I would need 5 to 6 A to keep the station running during fairly intense HF and VHF operation. I think if I were starting over, I'd go for the 5 A charger for about the same money and avoid the RFI problems altogether.

A&A Engineering, 2521 W LaPalma, Unit K, Anaheim, CA 92801; tel 714-952-2114; fax 714-952-3280; **www.a-aengineering.com**. *Price: $139.95 plus shipping.*

1. J. Hallas, W1ZR, "Emergency Power at W1ZR," *QST*, Dec 2003, pp 41-44.
2. J. Hallas, W1ZR, "Re: Emergency Power at W1ZR," Technical Correspondence, *QST*, Feb 2004, p 82.
3. W. Dion, N1BBH, "A New Chip For Charging Gelled-Electrolyte Batteries," *QST*, Jun 1987, pp 26-29.

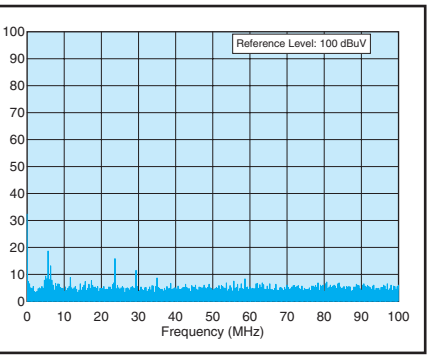


Figure 1—Spectral plot of the dc output of the A&A 5 A battery charger under load.

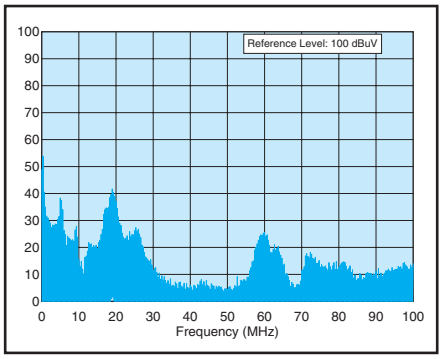


Figure 2—Spectral plot of the dc output of the Xantrex True Charge battery charger under load.

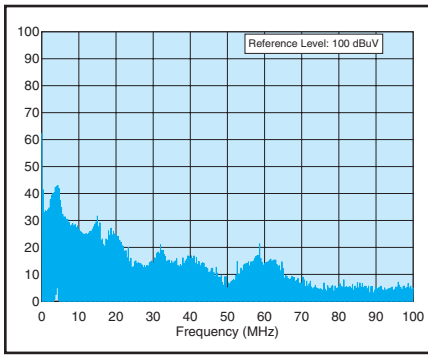


Figure 3—Spectral plot of the dc output of the Guest 2610 battery charger under load.

By Ronald Lumachi, W2CQM

Rescaling and Customizing Meter Faces

Rescale any meter face to meet your requirement and make meters that look good and work well.

Do you think sticker shock is restricted to new automobiles? Brace yourself and hold onto that hat before you look up the catalog listings for quality panel meters to complete your homebrew project. New panel meter prices are an eye opener and $3 military surplus meters look better by the minute.

Finding surplus meters with the right scale is, simply put, difficult. Most of the desirable meters were scooped up long ago by keen-eyed experimenters. From my perspective, though, that's not a concern. When a purchase opportunity for a general voltage or current meter presents itself at a hamfest, I (automatically) haggle the price, plunk down the money, carry it home and, unceremoniously, add it to my junk box. Any printed scale interests me—especially those that are a bit odd. Those meters are the cheapest to buy, as no one wants them. Although the seller of those weirdo meters probably thought I had lost my marbles, I can assure you… crazy, I'm not.

I realized that the flexibility of the computer and a simple photo-enhancing program could provide the means to customize any meter face. This project resulted from a variety of simple techniques and the availability of inexpensive, specialty mail order products.

Finding a Suitable Meter

I recall visiting with a Dayton Hamvention vendor a couple of years ago. He was offering thousands of meters with a first day price of $1 each—I picked up a bushel full. On a return visit the next day, the price was lowered to 50 cents for the remaining inventory. When I suggested (tongue in cheek) that a refund was in order as a result of the new price, he laughed hysterically.

Almost any meter capable of reading dc voltage will work. I prefer the 3 inch round Weston Model 301 meter, but others are equally suitable. Found in a full range of voltage scales, they're built like a tank and have a shallow depth with 1 mA full-scale movement. These meters were produced in vast quantities for the military. Other than being destroyed by a direct bomb blast, they've survived the ravages of time. As a result, they're relatively easy to find at hamfests by the sharp-eyed amateur.

Even more important than the shallow depth of the Model 301 is the ease by which the meter can be adjusted with series resistance to read any level of high voltage. For a full meter scale deflection, use 1000 Ω/V of resistance multiplied by the maximum voltage you want to read. To save you the computation with all those perplexing zeros, use 1 MΩ of resistance for each 1000 V dc. For example, a 5 kV full-scale reading in a typical 1 mA Weston Model 301 meter requires a series installed 5 MΩ resistor. For other meters with higher movement sensitivity, increase the resistance proportionally (shunt-making is discussed later). Two candidate meters ready for rescaling can be seen in Figure 1.

For ammeters, use the same selection procedure for meters that are factory scaled to lower values of current. Use a shunt (resistance) in parallel, rather than in series and, by dividing the current path between the meter and external shunt, the range of the meter can be increased. By decreasing the sensitivity of the internal meter with the additional shunt value, the meter takes on a new life and is capable of measuring any predetermined range of current.

Since full-scale meter deflections can be controlled with only a bit of effort and an easily determined value of resistance, all that remains to customize a surplus meter is to simply alter the meter scale.

Meter Disassembly

The first step in the process is to disassemble the meter and get to the faceplate. You'll notice that on the perimeter of the meter body there are three or four very small screws. They're often recessed and require a jeweler's screwdriver for removal. Keep a small-lidded container handy in order to safeguard this hardware when removed. They lose themselves easily and are

Figure 1—Two candidates for meter scaling. Note the new meter face, the painted meter mounting panel (white) and the newly scaled meter face affixed with the spray adhesive.

impossible to replace.

Grabbing the bezel in one hand and the two rear terminal bolts with the other, wiggle apart the two major components. It's a snug fit that may require some muscle to separate. Give the glass a good cleaning. Reset the glass in the bezel if it happens to be pushed in a bit. Carefully reset the friction fit ring against the inside of the bezel by gently pushing on it with a padded tipped screwdriver. A piece of electrician's tape works well on the blade. Put that component aside and carefully examine the meter/needle assembly. Two disassembled meters together with their old and newly installed scales can be seen in Figure 2.

Make certain the needle moves freely throughout its range, the zeroing mechanism is functional and the needle is not rubbing on the face of the scale. If you haven't done so yet, you can test the meter operation using a small 1.5 V dry cell and a 1500 Ω resistor. Full-scale deflection indicates that you're good to go.

Carefully remove the two miniature mounting bolts that secure the brass meter face to the main assembly. Find a secure place for all the parts except for the face.

Now the computer fun begins. Scan the face (or take a digital photograph) to get the meter image into the computer. Set the black and white contrast and brightness levels for the best viewing.

Usually the only alteration is applying a new set of numbers to the scale. Begin by digitally erasing all the extraneous printed data. Leave the index scale intact. Zoom in to ease this process. It's a good idea to save the results in a new file. If you make any subsequent mistakes, you won't have to redo all those tedious erasures—simply recall the saved file and start over.

Rename the meter scale if necessary (for example, *DC Kilovolts*) and insert the new set of integers. I once replaced a 4 kV dc scale with a 5 kV dc reading but maintained the same OEM printed scale. Since the number of integers had no equal relationship in terms of the major and minor line markings on the scale, I had to reposition the numbers slightly to compensate. In other words, 1 kV corresponded to the 8th index line (rather than where it was on the 10th line with the old 4 kV scale) and 2 kV at the 16th line. The 5 kV index was positioned at the far end at the scale.

In another retrofit, the original full scale was 15 so the numbers (0-5) fit without any adjustment. Experiment using bold type and a variety of fonts to achieve the most pleasing result. Make certain that the aspect ratio remains 1:1 or the resulting image will not be correctly sized. Use the program ruler to ensure this measurement. To check the quality and accuracy of your effort, make a test print. Lay it over the old meter facing and check for fit.

A Facelift for an Aging Meter

Three options will be discussed to transfer your customized computer meter face to the brass plate. Although the process of affixing the face to the backing is somewhat similar for the three techniques, the preparation of the brass plate is accomplished in exactly the same way for any of the choices.

Flip the die cut brass plate to the reverse side (scale down) and use 400 grit sandpaper or a wad of fine steel wool to prepare the surface for bonding to the new scale. Since your efforts are restricted to the reverse side, the old scale can remain intact if you decide to undo your project later. Either of these abrasive materials will scuff the brass to ensure a good bonding surface. Make certain that no residue or natural oils from your hands remain on the surface.

The first and least complicated procedure is to print the image on plain 16 pound bond paper. Trim the excess paper using the outline of the meter face as your guide. If it's oversized slightly, it can be trimmed with a sharp razor when you're done.

Using aerosol contact glue, lightly spray the two bonding surfaces. Position the new face on the plate, making certain to ensure a proper horizontal alignment. Press the two surfaces under a weight for a short period of time. Trim off any excess perimeter material, punch out the two mounting screw holes (from the rear) and carefully remount the entire assembly on the meter body. Fasten it with the original bolts. After checking for a free-floating meter pointer, reassemble the bezel and glass. Don't forget to align the front panel screwdriver zero adjusting pin mechanism during this reassembly process.

The second method is accomplished the same way, except inkjet compatible high gloss photographic paper is substituted for the plain bond paper. The resulting image has a pleasant sheen and is slightly reflective. On

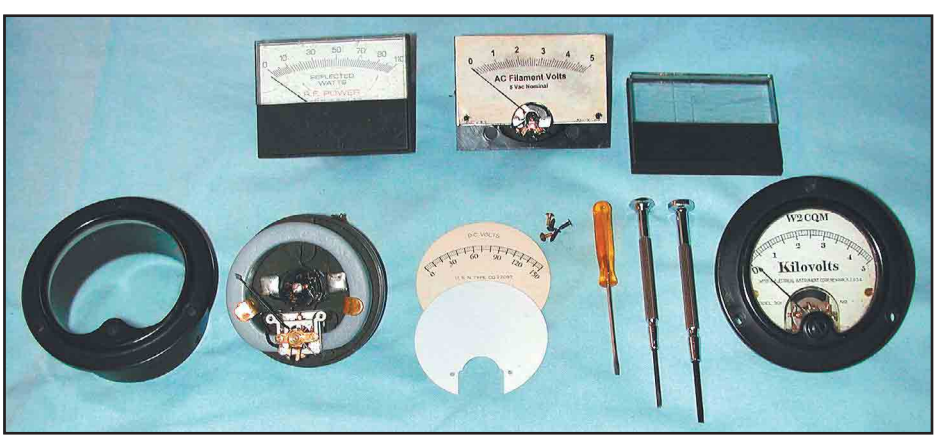


Figure 2—A jeweler's screwdriver is essential to disassemble the meter. Take care not to lose the small hardware. Note the installation of the customized meter faces. An old meter plate is shown for reference. If necessary, clean and reset the glass against the inside bezel.

very close viewing, this method produces a slightly sharper, more clearly defined image.

The third method utilizes the transfer of the new meter scale to a translucent film material—essentially a decal. When immersed in water, the film material separates from the backing and it can be slid into place on the surface of the meter plate. This process is used by many modelers to fit computer generated, customized decals on their model train and plane projects. If you decide on this process, there's one additional step requirement in the preparation of the backing plate. After the steel wool or fine grit sanding, prime the plate and spray on several coats of high gloss white enamel. The supplies needed to prepare the meter plate for the new scale are shown in Figure 3.

Figure 3—A view of the simple supplies needed to prepare the meter plate for the new scale. Spray-can white, primer and some fine steel wool. The airbrush is an alternative. The meter backing plate has been cleaned and ready for the new face.

Spray-paint in a small cardboard box with the front cut away to prevent dust from marring the newly painted surface. Use a good quality aerosol spray. For this project, I'd suggest you avoid cheap spray cans and their sputtering nozzles. Apply several light layers of paint after allowing for drying between coats. It also helps to burnish the finish before each new paint application. The painted surface process can be further refined if you substitute an automotive or hobby shop acrylic and an airbrush in place of the spray can.

Prior to ordering the decal material, you'll have to decide in advance whether you plan to utilize a laser or inkjet printer. The two products are not compatible and require different processes.

The inkjet option requires a spray-on fixative. Small bottles of brush-on laser process fixatives are optional and available in three levels of sheen. They range from dull to high gloss. Complete, inexpensive kits are available.[1]

Print the image on the decal sheet (laser or inkjet). Cut off the excess material and immerse the new image on its backing sheet in a bowl of water. After soaking for 20-30 seconds, carefully slide the translucent film off the backing and onto the freshly painted meter plate that's been dampened. The wet surfaces act as a lubricant and eases placement. Make your positioning adjustments by sliding the film and stretching out any wrinkles. Carefully blot off any excess water with a paper towel. Allow it to dry before applying the fixative. Reassemble the meter, and away you go.

Making a Custom Shunt

The *ARRL Handbook*[2] discusses, in detail, the process of calculating shunts using a variety of methods. I prefer to use a barebones (unscientific) approach to determine meter shunt values. I use a variable low voltage dc power supply, an automotive tail-light bulb, a VOM capable of accurately reading 2 A dc and a hunk of nichrome wire salvaged from a discarded toaster or hair dryer.

To determine a reference level of current, hook up the VOM in series with the positive leg of the dc supply line and one terminal on the bulb. Hook up the remaining leg from the supply to the other contact position on the bulb. Vary the voltage so the meter is reading exactly 1 A. Turn off the dc supply (or pull the plug) without altering the voltage setting and remove the VOM.

On your surplus meter candidate, attach a 2 inch (approximate) length of pre-tensioned nichrome wire shaped like a flattened horseshoe. Slip the ends of the nichrome between two washers on the rear meter terminal posts and use the meter nuts to secure the experimental shunt. Wire the meter in place of the VOM (same polarity orientation) and switch on the power supply.

If the meter will be scaled to 1 A, slide the nichrome wire in small increments either up or down its length (between the washers) while monitoring the reading on the scale for full deflection. It may take several cut and try efforts to get it right. If the meter slams to full deflection, reduce the resistance of your shunt by shortening the length of nichrome wire.

An assortment of inexpensive low value resistors in the 0.175 Ω to 0.5 Ω range can be substituted for the nichrome shunt. Keep in mind that a breadboard series/parallel combination of resistance can offer a wide variety of shunt ranges.

Some Final Thoughts

I had a vintage Heathkit SWR bridge with a defective meter. This relic is impossible to replace so my project seemed destined for the trash pail.

Since I'm reluctant to throw anything away, I located a surplus military 2 inch round meter—admittedly not aesthetically compatible. I scanned the old Heathkit meter face and fitted it to the plate of the replacement. In the tradition of Dr Frankenstein, I got the unit up and running and, as in the old movie, euphorically repeated his words, "It's alive, it's alive!" Silly as it sounds, it was a good feeling and one worth sharing, especially with those who thrill in restoring the glow to vintage gear.

The translucent film option offers some intriguing possibilities, especially if you'd like to experiment with custom design meter faces. For example, spray your meter plate in gold (or any other decorator color) rather than white for a unique look. The underlying color will show through the film and will highlight your special effort. Incidentally, I have also successfully used this film transfer process to custom label knob and meter functions in homebrew projects.

The application of this rescaling skill offers you the opportunity to save big bucks when retrofitting meters you'll need for that homebrew project. The technique is easy to master so the rest is up to you. Search out those orphaned meters and don't hesitate to apply some computer power to customize and rescale them for those special tasks.

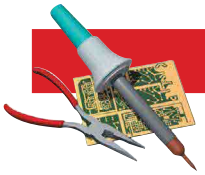
Notes

[1]Translucent decals are available from: MicroMark, 340 Snyder Ave, Berkeley Heights, NJ 07922-1595; tel 800 225-1066, **www.micromark.com**. Decal kit for laser printers #82373; TRY-IT PACK $8.95; laser decal fixative #82463 $3.29. Decal kit for inkjet printers #82325; TRY-IT PACK (contains aerosol fixative) $16.75; Deluxe Decal Finishing System #82400 (complete kit) $16.50. Send for free catalog for a more detailed listing of other combinations of material in kits and individual packs to refine the decal system.

[2]Most editions of *The ARRL Handbook* discuss the design of meter multipliers and shunts. The 2004 edition is available from the ARRL Bookstore or your local dealer. ARRL order no. 1921. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Photos by the author.

Ronald Lumachi, W2CQM, is a retired City University of New York adjunct professor and NYC vocational high school administrator. He is currently focused on building linear amplifiers, updating and retrofitting vintage RF decks to maximum output while scrupulously preserving the OEM exterior cabinet aesthetics. Ron can be contacted at **w2cqm@juno.com**.



Experiment #14—Optocouplers

Trying to pass a signal between two circuits that don't share a common ground would be quite difficult but for the *optocoupler*. Also called an *optoisolator*, these handy devices use light to transfer a signal between circuits without using a direct connection. You'll find them used to isolate sensitive circuits, provide safety barrier between operators and high-voltage circuits and replace relays in low-power applications. Let's learn how they work.

Terms to Learn

- *Current-Transfer Ratio (CTR)*—the ratio of output current to the LED input current expressed as a percentage
- *Rise Time and Fall Time*—rise time refers to increasing signals and fall time to decreasing signals. Both refer to the time it takes for a circuit's output to reach 90% of the final output level after a sudden change at its input
- *Isolation Voltage*—the maximum rated voltage difference between an optoisolator's output and input

Background

The optocoupler was a serendipitous discovery. Early transistors were contained in metal cans with wire leads. Where they passed through the can, tiny glass beads around the wire kept them insulated. Troubleshooting a mysterious current leakage problem, technicians discovered that light entering through the beads caused the transistor to conduct slightly—transistor junctions were light sensitive! After the invention of the LED, the modern optocoupler was created.

One of the most popular IC optocouplers is the 4N35, one of a whole family of similar devices. Inside the IC, an infrared LED is positioned so that it shines on an exposed transistor junction. The photons of light take the place of base current, turning on the transistor. Optocouplers are available with SCRs, FETs, diodes, logic gates and driver amplifiers for outputs.

Central to design with optocouplers is the *current transfer ratio (CTR)*, a factor specified in percent. CTR is very similar to a transistor's current gain, or beta. As in a transistor, for a given input or *forward current*, I_f, through the LED, the output current, I_C, can only reach CTR × I_f.

$$CTR\ (\%) = [I_C / I_f] \times 100 \qquad \text{[Eq 1]}$$

CTR depends on the level of I_f and is usually specified as a maximum and minimum value for a given value of I_f and voltage across the output transistor. For example, the Agilent data sheet for the 4N35 (Figure 4, as shown in **literature.agilent.com/litweb/pdf/5988-4114EN.pdf**) has a graph of CTR versus I_f showing that CTR is optimum for a range in I_f of between 5 and 40 mA, dropping rapidly above and below that range.

Typical CTR values for optocouplers range from 50 to 300, with I_f in a range of 1 to 20 mA. The 4N35 is specified to have a minimum CTR of 100% with an I_f of 10 mA and a V_{CE} of 10 V across the output transistor. On Figure 4 of the data sheet, find I_f of 10 mA and trace upward to the curve on the graph labeled "$R_{BE} = \infty$." All are comfortably over 100%.

What's up with those curves labeled "$R_{BE} = \infty$, 500k and 100k?" Figure 1 shows the internal connections or *pin-outs* of the 4N35. You'll see that the base of the output transistor is connected to pin 6. CTR can be controlled by connecting the base to the emitter with a resistor, R_{BE}, so that some of the current created by the LED's light is diverted around the base-emitter junction. Conversely, the base pin can be used to bias the transistor on. For most designs, this connection is left open—do not ground it or tie it to a power supply voltage.

Optocouplers may be a great solution to isolating circuits from one another, but they are much slower than a transistor to turn on and off. This is because the photons that fall on the phototransistor take some time to diffuse into and out of the base—more time than with direct connections to the base. *rise time*, t_r, and *fall time*, t_f, are the parameters used to specify the switching speed of the output transistor. You'll find them in the data sheet's "Electrical Specifications" table. Data sheet Figures 9 and 10 show the effect of the load resistance on switching speed and frequency response. As R_L is reduced I_C increases, which means that the transistor reacts quicker to the incoming photons and when turning off, gets rids of them faster. Switching speed is particularly important when the optocoupler is being used to transmit digital data where signal edges need to be clean and fast.

To design an optocoupler circuit, you need to know the output load and power supply voltage. For example, if you are going to drive a reed relay, the coil resistance, say 500 Ω, is R_L. If the power supply is 12 V, the optocoupler's output will have to sink 24 mA. For a CTR of 100%, that requires I_f = 24 mA. Assuming an input voltage of 5 V and the typical forward voltage drop of the LED, 1.2 V:

$$R_{in} = (V_{in}–V_f) / I_f \text{ and } I_f = (V_{in}–V_f) / R_{in} \qquad \text{[Eq 2]}$$
$$= (5–1.2) / 24 = 158\ \Omega\text{—use a 150 } \Omega \text{ resistor}$$

The speed of the optocoupler is often a concern, as well. If you are going to use it to transmit digital data (a common application) the sum of rise and fall times should be less than 10% of the duration of the fastest bit you will send. For ex-

Maximum, Minimum and Typical—The Data Sheet Specifications

Properly interpreting these figures from a data sheet can be crucial to a successful design, particularly if a run of several circuits will be built. Maximum and Minimum are *guaranteed values*. All parts will fall between these two values. Depending on your design, either may be the *worst-case* that your circuit should be able to accommodate. A "typical" value is usually the most common or an average value (they're not always the same). If you're only building one circuit, using a typical value is probably okay, but you may have to test a few parts for getting one with "typical" performance.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

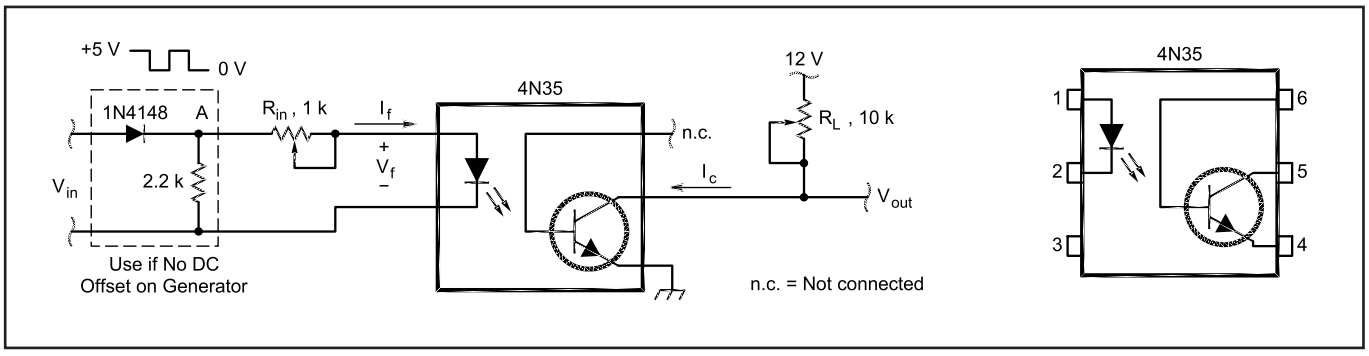


Figure 1—Adjust the input and output resistances to observe the effect of current levels on CTR and on switching speed.

ample, one bit of 9600 baud data is approximately 10 µs wide, so $t_r + t_f$ must be less than 1 µs. If you look at Figure 9 of the data sheet, you'll see that the 4N35 is not a good choice for 9600 baud data! For a load resistance of 1 kΩ, $t_r + t_f = 40$ µs, so the narrowest data pulse would be 400 µs—about 240 baud.

Working with Optocouplers

The first set of tests we'll do illustrate the effect of CTR and load resistance, R_L, on the ability of the optocoupler to transfer a signal.

Start by connecting the circuit shown in Figure 1. If your signal generator can add a dc offset to its output signal, you don't need the diode and 2.2 kΩ resistor. Set the signal generator to output a 3 kHz square wave and adjust the voltage so that the waveform at point A alternates between 5 V and ground. Set R_{in} to 1 kΩ and R_L to 5 kΩ. Use Eq 2 to calculate I_f.

Connect the oscilloscope to point A and to the output. You should see complementary waveforms with the output low with the input high, and vice versa. Once you have the circuit working, zoom in as shown in Figure 2. Notice that the rising edge of the output is rounded with respect to the falling edge. (Hint—trigger on the falling edge of the input signal and set the sweep speed to 20 µs/division.)

- Measure the delay from the falling edge of the input signal to where the output begins to rise. This is t_d. Estimate t_r and t_f. Reduce R_L to approximately 2.5 kΩ to see the effect of increasing I_C on t_r and t_f. Adjust R_{in} to 600 and 400 Ω and observe the effect of varying I_f. Return R_{in} to 500 Ω.
- Continue to reduce R_L. The minimum output voltage level will begin to rise above ground. Stop when it reaches 5 V and measure R_L. Calculate $I_C = (12\text{ V} – 5\text{ V}) / R_L$. Use the previously calculated value of I_f to calculate CTR using Eq 1. My 4N35 had a CTR of 113%, exceeding the specified minimum value.
- Return both potentiometers to their original values. Increase the frequency of the input signal to see what happens as t_r and t_f begin to eat up the signal.
- Experiment by changing input signal level and output voltage while observing the effect on output voltage levels. Try a design—pick a value of R_L, an input voltage, and a power supply voltage, then figure out R_{in} and try it!

Suggested Reading

Chapter 9 in *The Art of Electronics*, by Horowitz and Hill, discusses optocouplers as a means of interfacing with logic circuits. Agilent Technologies publishes a wide variety of excellent application notes and the *Optocoupler Designer's Guide* (Agilent part number 5988-4082EN) is worth the download at **literature.agilent.com/litweb/pdf/5988-4082EN.pdf**.

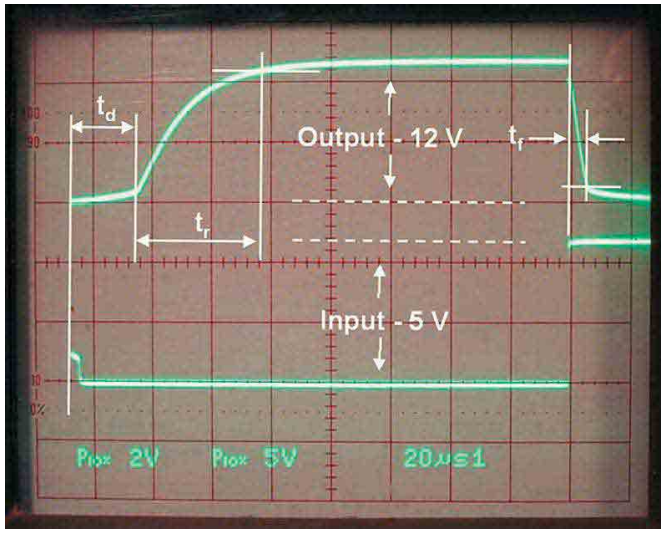


Figure 2—The upper trace shows the output waveform. Notice the significant rise and fall times of the output waveform.

Shopping List

- 4N35 optocoupler (available from many suppliers)
- 1N4148 diode
- 2.2 kΩ resistor, 1 kΩ and 10 kΩ potentiometers

Next Month

We return to power supply design with the first installment of a multipart experiment that will introduce you to switching power supply technology.

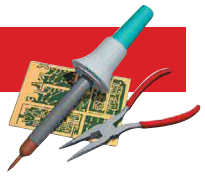
The Hands-On Radio Web site is **www.arrl.org/tis/info/html/hands-on-radio/**. QST

STRAYS

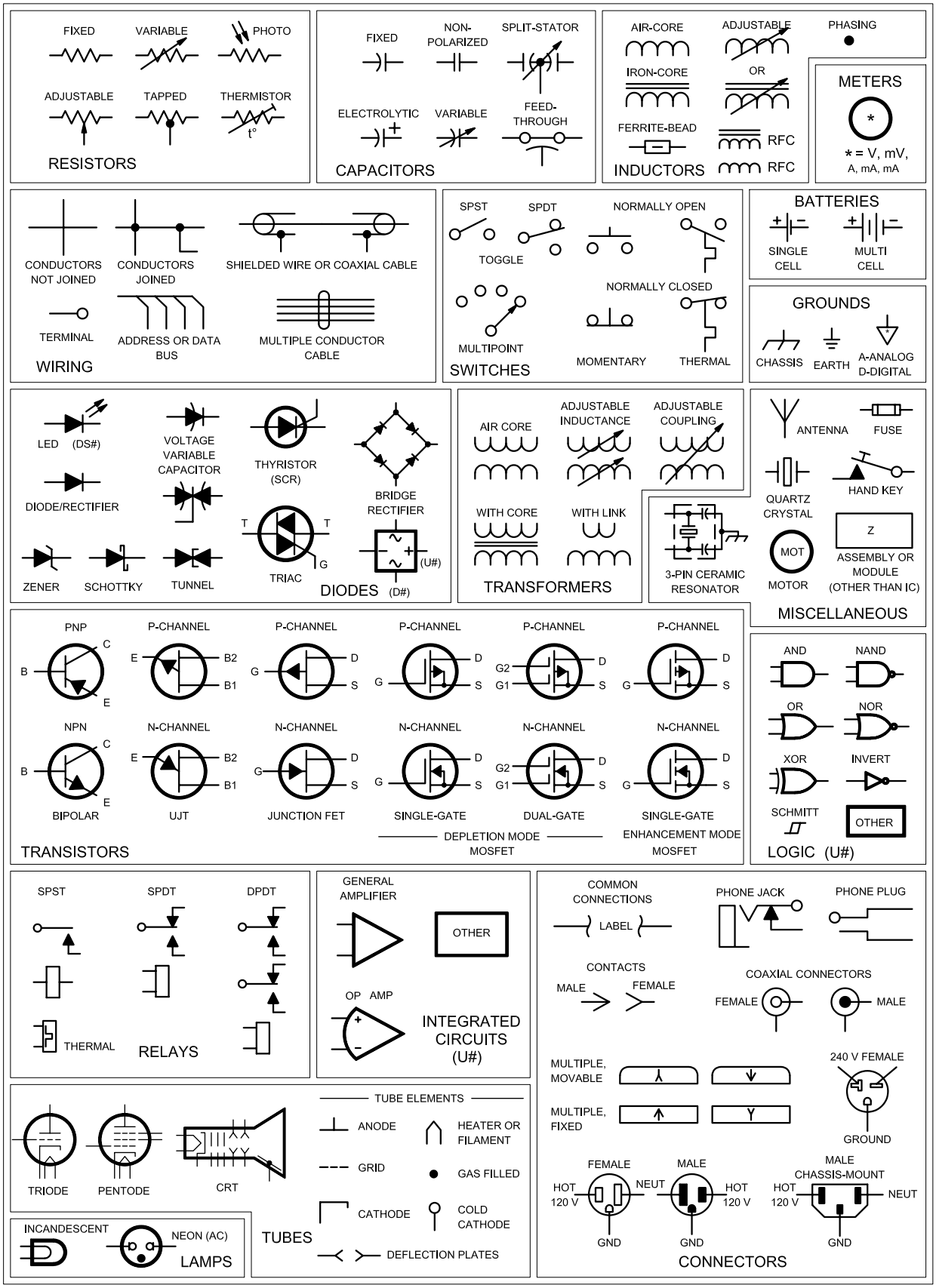
I would like to get in touch with...

◊ hams who have been involved, directly or indirectly, with organ and tissue donation to organize a special event to promote organ donation awareness and Amateur Radio. Please contact Art Trampler, W2QR, at **w2qr@arrl.net**.

◊ a Radioman who served aboard the submarine USS Medregal SS480 in Key West in 1955. He was my Elmer, and helped me get my Novice license, KN6MAZ, in 1955.—*Charles Tasker (IC3), K6MAZ; cctblt@infowest.com*.



Schematic Symbols



By Steve Ford, WB8IMY

The Classic Multiband Dipole Antenna

It's easy to understand why hams have had an almost 100-year love affair with wire antennas. They are inexpensive and remarkably easy to install. And for such little effort and expense, they are capable of surprising performance.

One of the simplest wire antenna designs is also one of the oldest: the random-length dipole fed with an open-wire feed line. You can put this antenna up almost anywhere, in almost any configuration and get on the air right away. The only trick is matching the input impedance of the antenna system to the output impedance of your transceiver (± 50 Ω). More about that in a moment.

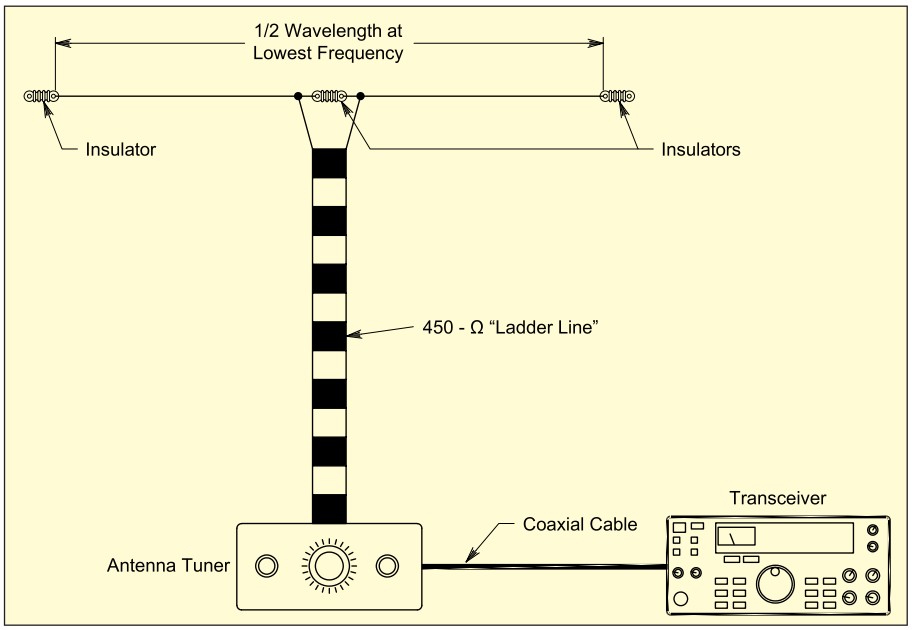


Figure 1—The classic open-wire feed line dipole antenna is easy to install and offers surprising performance on several bands. You can install it in almost any configuration; it doesn't have to be strung in the traditional horizontal "flat top" shown here.

Building the Antenna

Begin by cutting two equal lengths of stranded copper wire. These are going to be the two halves of your dipole (*di* pole = "two poles"). Don't worry too much about the total length of the antenna. Generally speaking, make it a half-wavelength long at the lowest frequency you hope to operate. Using the formula...

468 ÷ Frequency in MHz

...you'd make the antenna about 66 feet in total length if you chose 40 meters (7 MHz) as your lowest frequency band.

Connect one end of a length of 450-Ω *ladder line* (available from most ham dealers) to the center insulator of the antenna (see Figure 1). Feed the ladder line into your house, taking care to keep it from coming in contact with metal.

The next step is to connect the feed line to the transceiver. One way to do that is through an adjustable matching device known as an *antenna tuner*. Not just any tuner will do, though. Look for a "balanced" tuner, or a tuner with a *balun* (a balanced-to-unbalanced transformer) built in. The ladder line connects to two terminals on the back of the tuner and a short length of coaxial cable connects the tuner to your radio.

Tuning Up

Ladder line offers low RF loss on HF frequencies, even when the SWR is relatively high on the feed line going to the antenna. Just apply a signal at a low power level to the tuner and adjust the tuner controls until you achieve the lowest SWR reading. (Anything below 2:1 is fine.) You'll probably find that you need to readjust the tuner when you change frequencies. (You'll *definitely* need to readjust it when you change bands.)

You may discover that you cannot achieve an acceptable SWR on some bands, no matter how much you adjust the tuner. Changing the length of the feed line may resolve this problem.

But what if you own a radio with a built-in antenna tuner? These tuners aren't designed to work with open-wire feed lines, but a compromise is possible. Many *QST* advertisers sell external baluns. You can attach the ladder line to one side of the balun, then run a short (less than 10 foot) section of coax from the balun to the radio. As with the manual tuner, the built-in tuner may not achieve a match on all bands.

The Ladder Line Mystique

It's fair to ask why more hams don't use open-wire feed lines. The reason has much to do with convenience. Ladder line isn't as easy to install as coax. As I've already noted, you must keep it clear of large pieces of metal (a few inches at least). Unlike coax, you can't bend and shape ladder line to accommodate your installation. And ladder line doesn't tolerate repeated flexing as well as coaxial cable. After a few months of playing tug o' war with the wind, ladder line may break.

Besides, many hams don't relish the idea of fiddling with an antenna tuner every time they change bands or frequencies. They enjoy the luxury of turning on the radio and jumping right on the air—without squinting at an antenna tuner's SWR meter and twisting several knobs.

Even with the hassles, you can't beat a ladder-line fed dipole when it comes to sheer lack of complexity. Wire antennas fed with coaxial cable must be carefully trimmed to render the lowest SWR on each operating band. With a ladder line dipole, no pruning is necessary. Simply throw it up in the air and let the tuner worry about providing a low SWR for the transceiver.

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

Par Electronics SM-50 6-Meter Stressed Moxon Antenna

By Clarke Greene, K1JX
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Middletown, CT 06457-2135
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What looks like a broken archery bow, weighs about three pounds, has a turning radius of about four feet and works better on 6 meters than it looks like it should? Give up? (Hint: Look at the big photograph on this page.)

The Par Electronics SM-50 is a clever version of G6XN's antenna for 6 meters. In case you aren't familiar with the Moxon rectangle, it's essentially a two element Yagi that has its element ends bent back toward the opposite element to form a rectangular creature. Aside from shrinking the antenna dimensions, this shape shifting actually improves the electrical performance of the antenna (for more detail, go to **www.cebik.com/radio.html**). In a nutshell, what the Moxon antenna gives is gain within a tenth or two dB of a traditional two element Yagi, while at the same time providing similar front-to-back and front-to-side performance to that of a three element Yagi. A three element Yagi will give about 2 dB more gain than a Moxon design, but will also weigh twice as much, have twice as much wind area and about one and a half times the turning radius. Not a bad trade-off.

The driven element of the SM-50 is made of a 7 foot section of $^{3}/_{4}$ inch square aluminum tubing, with a solid fiberglass center insulator. The stainless steel mast mounting hardware passes through the fiberglass insulator, and the box housing the matching components and the SO-239 UHF receptacle for the coaxial feed line attach to the driven element near the center as well.

The tricky part of the design is how the "bent" element ends and the reflector are constructed. The bent element ends are made from $^{5}/_{16}$ inch diameter round aluminum tubing, with center insulators of short sections of fiberglass rod. This keeps the element end spacing, a critical electrical dimension, stable regardless of any element flexing from the wind. When assembling the antenna, one end of each of the bent element ends is inserted into a hole in the square driven element aluminum tubing. The portion of the reflector that is parallel to the driven element is made from insulated Flex-Weave copper wire, with ring lugs soldered onto each end. Aluminum screws through these ring lugs into threaded holes in the bent element ends fasten the Flex-Weave wire to the rest of the reflector. The dimensions of the assembly are such that the Flex-Weave wire is taut; the bent element ends are placed under stress by the wire pulling them inward, holding them in place. Get it? It's a *stressed* Moxon antenna.

How Well Does it Work?

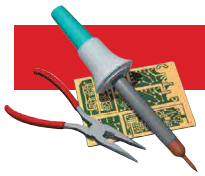
The SM-50 was brought to Mohawk Mountain in western Connecticut on Sunday afternoon of the 2003 ARRL September VHF Contest. Sunday afternoon isn't the most active of times, especially when the conditions are average as they were on that day. The wind was blowing and the rain was falling, both pretty hard at times. The wind gusts were over 30 miles per hour, and the rain was pouring to varying degrees.

My operating partner, W1XX, was quite skeptical of the whole thing, especially the small size of the SM-50, but he did like how easily the antenna went together; it took less than five minutes to assemble. The antenna was installed at the top of a 21 foot WonderPole. Using the 100 W output from an FT-847, close to 100 contacts were made in the approximately two and a half total hours of operation. Even on a dead band (somewhat of a major understatement), contacts were made out to about 400 miles to as far as the Pittsburgh, Pennsylvania area. Stations as far away as Montreal answered our CQs. Pretty good, eh?

The antenna did have a substantial null to the rear, as evidenced by how weak K1DG was off the back of the antenna, and how much stronger he was when the beam was turned toward him. The SWR was pretty low across the bottom of the band (50.0-50.5 MHz; as far as was checked), at least based on the in-van wattmeter. The rain didn't seem to affect the performance, and the wind didn't appear to make the antenna even flinch.

All the cleverness in the electrical and mechanical design of the SM-50 yields an antenna with performance almost as good as a three element Yagi in a package that is lightweight and durable, as well as easily and quickly assembled and disassembled.

Manufacturer: Par Electronics, Inc, PO Box 645, Glenville, NC 28736; tel 828-743-1338; fax 828-743-1219; **www.parelectronics.com/**, **w4op@parelectronics.com**. *Available from Amateur Electronic Supply and Universal Radio. Suggested list price: $79.*



HINTS & KINKS

BETTER FEEDLINE-LOSS MEASUREMENTS WITH ANTENNA ANALYZERS

◊ Various publications through the years have shown how the SWR measured on a shorted (or open) feed line can be used to calculate feed line attenuation. One of the claims made in the manual for my SWR analyzer is that it can be used in a similar fashion to measure feedline attenuation. While that claim is technically true, I found that those measurements are only feasible if the feed line has more than 3 dB of attenuation.

The practical concept behind the theory is simple to illustrate. We start with a transmitter feeding 1 W of incident power into a transmission line. That is, FWD = 1 in Eq 1.

If the line is shorted or open at the far end and the line attenuation is zero, 100% of the forward power becomes reflected power, making REF = 1 in Eq 1.

Since FWD = REF, the SWR calculated by the standard formula Eq 1 is infinite. (Actually any value divided by zero is undefined but in electronics, we bend the math rules to make undefined the same as infinity.)

$$SWR \quad \frac{1+\sqrt{\frac{REF}{FWD}}}{1-\sqrt{\frac{REF}{FWD}}} \qquad \text{[Eq 1]}$$

For similar reasons, if the feed line had infinite attenuation, all of the incident power is attenuated before it can be reflected back to the wattmeter. As a result, REF = 0 in Eq 1, and the measured SWR would be 1:1.

Zero feed line attenuation manifests itself as infinite SWR and infinite feed line attenuation shows up as 1:1 SWR. Any other attenuation values show up as SWR values between 1:1 and 8:1.

As an example, consider that a 1 W transmitter feeds a line with ½ dB attenuation. The 1 W forward power is attenuated to 891 mW by the time that it reaches the open end. The 891 mW is reflected at the open end and further reduced by the ½ dB attenuation to 794 mW as it travels back to the wattmeter. Using Eq 1, an approximate SWR of 17.4:1 is measured; that is, ½ dB correlates to an SWR of 17.4:1. Table 1 shows some correlations between SWR and feed line loss.

Various charts have been created to convert SWR measurements to feed line attenuation. This was a handy method in the days when a wattmeter was a luxury and most hams only owned an SWR meter. (With a wattmeter, attenuation can be calculated directly from FWD and REF. There's no need to calculate SWR.)

Unfortunately, when I tried to use my antenna analyzer for the same measurement, I ran into a significant flaw right at the point where theory meets practice. A 3:1 SWR is the highest usable value calibrated on my antenna analyzer; an SWR of 17.4:1 is beyond the useful range of measurement.

A 3:1 SWR corresponds to a 3 dB feed line loss. Since all of my feed lines are good quality, my feed line loss is less than 1 dB. The SWR measured using my analyzer always fell somewhere between 3:1 and infinity. This made reading and estimating my feed line loss difficult to impossible using my antenna analyzer.

Table 1
Feed Line Loss versus SWR

Loss (dB)	*SWR*
6	1.6:1
3	3.0:1
2	4.4:1
1	8.7:1

Table 2
SWR Equivalent to Several Attenuation Levels

Attenuation (dB)	*Max SWR*
3	3.0:1
4	2.3:1
5	1.9:1
6	1.6:1

Table 3
Actual Line Loss and SWR fro SWR Measured with 4 dB of Attenuation

Line loss (dB)	*SWR + 4 dB*	*SWR (0 dB attenuation)*
3.0	1.50	3.0
2.0	1.67	4.4
1.0	1.92	8.7
0.75	2.0	11.6
0.50	2.1	17.4
0.25	2.2	34.8
0.10	2.3	86.9

My solution is reasonably simple. I happened to find a 4 dB attenuator for 50 Ω line in my junk box. I connected the attenuator to the SWR analyzer and the feed line to the attenuator. If a feedline has zero attenuation, the 4 dB attenuator alone will cause the measured SWR to be approximately 2.3:1. Let's use a 1 W transmitter to prove that the reduction in SWR as measured at the transmitter is true. The 1 W FWD power is reduced by 4 dB to 398 mW when it reaches the open end. That 398 mW is reflected and then as it passes through the attenuator a second time it is reduced by an additional 4 dB to 158 mW before reaching the meter. Again using Eq 1, if FWD = 1 W and REF = 158 mW then SWR = 2.3:1. Any additional feed line loss causes the measured SWR to be reduced to less than 2.3:1 since it further reduces the REF power reaching the wattmeter.

The calculated SWR for some common attenuators and zero feed line loss is included in Table 2.

Now reconsider the original example using the 1 W transmitter connected to an open feedline with ½ dB of attenuation. Without the 4 dB attenuator, the SWR measured 17.4:1. The attenuator by itself reduces the measured SWR to 2.3:1. The 4 dB attenuator plus the additional ½ dB of feed-line loss reduces the measured SWR to approximately 2.1:1. This value falls within the usable calibration range of my antenna analyzer. Table 3 provides some comparison values.

By measuring the SWR with the line connected through the attenuator, I can now get a much clearer picture of feed line attenuation. Because all of my measurements now fall within the calibrated range of my analyzer, it is now much

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ h&k@arrl.org

easier to make reasonably accurate measurements of feed line attenuation.

One final point needs to be mentioned regarding the electrical length of the line being measured. Notice that an open or shorted feed line also acts as a resonant circuit. This phenomenon can affect the accuracy of your measurement. Make your measurement at a frequency where the line acts as an open circuit (maximum impedance).—*Dan Wanchic, WA8VZQ, 1209 13th St N, St Cloud, MN 56303;* **wa8vzq@arrl.net**

WATER AND HYGAIN TH-7 TRAPS

◊ After having my TH-7 in the air for almost a year, I began encountering a rising SWR during long, heavy rainstorms. At first, I suspected that water was getting into the BN-86 balun enclosure. So I lowered the antenna and inspected the balun, but it showed no signs of water having settled in it. After some head scratching, I raised the antenna back to the top of the tower. A few days later, another heavy rainstorm came along, and again my SWR rose to above 3 to 1 on 15 and 20 meters. This time I suspected that I was getting water into the traps of the dual driven elements. I again lowered the antenna; and when I pulled off one of the end caps from a trap, water came pouring out. I had found the problem, but how was water collecting in the traps when they have drain holes on the bottom? Furthermore, what would be the solution?

As illustrated below (see Figure 1), I surmised that water was collecting on the outside of the traps and that the droop of the element caused the traps to lay somewhat less than fully horizontal. Thus, any water that accumulated in the trap enclosure would settle toward the outside. The pitch of the trap made it impossible for all the water to make it to the drain holes. This was certainly the case; as all of the traps I inspected, the ones that showed signs of water collecting in them was always found to be on the outside half of the trap.

Actually, the solution is quite simple. At the bottom of each plastic trap cover, I drilled a 1/8 inch hole to drain any water. I did this to all of the traps throughout the antenna. Don't be fooled into thinking that sealing the trap covers will solve the problem. If moisture accumulates in the trap, sealing will make it impossible for water to make its way out. If you do seal the covers, add the drain holes too. Since making this adjustment to my TH-7, I have had no problems with SWR during long, heavy rainstorms.—*William J. Thomas, K1XT, 810 Selma, Webster Groves, MO 63119*

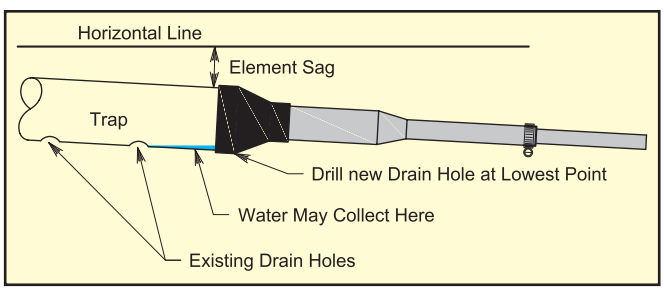


Figure 1—Element sag permits water to accumulate in traps away from the existing drain holes. By drilling an additional hole as shown, the trap can drain.

STORING THE "LOOSE SCREW" IN AN ICOM IC-706MKIIG

◊ When the ICOM IC-706MKIIG mobile transceiver is being used with the optional OPC-581 front-panel separation cable, a small (2×5.5mm) screw is used to secure this cable to the transceiver. This leads to a problem: Where do I store this screw when this cable is removed, and will I remember where it is when required, possibly for use by other ham members of my family?

There is a perfect solution! On the backside of the front panel, just above the factory applied "caution" sticker there is a 6 mm diameter, 7 mm deep recess with a small screw beneath it. This recess is just the right size for storing the "loose" screw! To be completely below this surface, however, this screw needs to be placed in this recess with the head facing out.

To ensure that this screw is not lost when the front panel is removed, place a small piece of transparent tape over this hole to retain the screw. A small label identifies and points to this "loose screw" as a reminder! I printed the label on plain paper, and then glued it over the factory "caution" label with a small amount of rubber cement. I did not want to use a permanent self-adhesive label, in case I may want to remove it at some point. Rubber cement does not attack the plastic or the printing on the factory label. The new label does not interfere with the attachment of the front panel to the radio because the label area is recessed below the surface of the front panel. Figure 2 shows transparent tape over the screw in the "storage" area and my new reminder label.—*Karl T. Schwab, KO8S, 30752 Ridgefield Ave, Warren, MI 48088-3174;* **ko8s@arrl.net**

Figure 2—KO8S stores the cable retaining screw for his ICOM's remote front panel kit in a recess on the back of the panel.

DATAPORT CABLE FOR YAESU FT-920

◊ I discovered something that may be of interest to some Yaesu owners. My FT-920, and other models, use a five-pin DIN connector on the rear panel for the data port. A nice source for a five-pin DIN cable with a molded connector is an old AT/XT keyboard. These old keyboards are usually free for the taking wherever you can find them, because they are obsolete. Where I work, we had a storeroom of old junk computer parts with a stack of these keyboards. It does not matter whether the keyboard works or not; all you need is the cable. It is easy to open the keyboard and release the cable from its header connector. If you like, the header is also easy to remove from the circuit board to be used in your project, such as a homebrew sound card interface. The DIN pin out is easy to determine using an ohmmeter to check for continuity.—*James Matis, K2TL, 11 Moss Haven Way, Howell, NJ 07731;* **k2tl@arrl.net**

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

NEW BOOKS

TEN DAYS IN UTAH: THE SEARCH FOR ELIZABETH SMART

By Andrew McGregor, N7XQY

5×8 inches, soft cover, 120 pages. CD including book text and over 175 pictures also available. Ordering information: **www.tendaysinutah.com**.

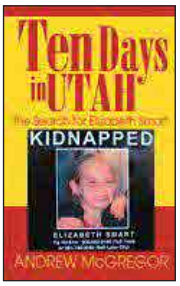
Reviewed by Dan Miller, K3UFG

◊ We all saw the headlines and watched it on TV—on the nightly news and on America's Most Wanted. When the call went out for help to search for Elizabeth Smart, a 15 year old girl who had been kidnapped from her Salt Lake City home, Andrew McGregor, N7XQY, was assigned by his volunteer organization, the Abby-Jennifer Recovery Foundation, based in Grand Junction, Colorado, as the senior incident commander. In this book, he provides an insider's view of what was involved with organizing and conducting a massive volunteer search that covered much of the state of Utah and beyond.

This easy-reading book describes how the local ARES group responded immediately to the call for support. Joel Neal, KC7UBP, the local organization's leader, received an urgent call at 10 PM Thursday, June 5, 2003. McGregor had requested ARES support from his logistics chief, Jeremy Utter, KCØOJX. After getting the necessary authorization from Salt Lake City Office of Emergency Management, Jeremy called Joel at home. By midnight, Joel was on scene at the Shriners Hospital, setting up the command center that would stay active for 10 more days.

An active ham, McGregor had worked with ARES/RACES groups on other missions. Although no one on the ARES team had any idea at this point just how expansive this search was going to become, the team was virtually attached to McGregor at the hip. Together they continued to pursue the search—checking each and every tip—for 10 days, 12 to 14 hours each day.

Since a crime had been committed, a different set of rules applied. In a crime investigation, volunteers are generally no longer invited to assist—law enforcement agencies control everything, from evidence to rescue/recovery. Having over 14,000 volunteers stumbling through their crime scene would be nothing shy of a nightmare. In this case, for the first time, the Salt Lake ARES team was called upon to assist in a crime investigation. Special rules were established to protect against any legal action that may have occurred from the search. One of the requirements from law enforcement was that no search team would leave the operations center until it could be determined that there was a 100% guarantee there would be a direct communications link with law enforcement officials. The fear was that civilian searchers might be confronted by armed kidnappers with a child hostage. It was crucial to maintain constant direct contact with each team in the field to maintaining safety and to keep the leadership updated.



McGregor and his team knew what needed to be done, and how to make it happen. Crossband mobiles, linked repeaters, simplex links and hams with portables were set up and used in the field. Teams with no other means of communications with the command center were assigned a ham. Over 100 Amateur Radio operators aided in the search, and no complaints or negative issues were received from search personnel or the police. The FBI was completely impressed with the quality of volunteer service during the one mission in which they participated. For the hams—who never knew it was FBI on the other end of the microphone—it was all in a day's work.

For 10 long days, the ARES teams each took their turn at the radio, the logging computer and supporting teams in the field. Regardless of the task or legal requirements involved, every team completed each mission with professionalism and success. When it became necessary to move the command center to the church ward across the street, the team was already on the roof setting up antennas and assisting an Internet company position a satellite dish. Oh yes, this took place at 10 PM using flashlights in the dark. Logbooks included all the ham traffic, phone calls into the command center and the local 900 MHz staff radios. When necessary, runners were dispatched to deliver important messages to the staff.

Andrew McGregor has been supporting search and rescue teams in south central Colorado and emergency services for 16 years. He teaches a two day licensing class to emergency managers and professional firefighters in the Colorado Rockies, where communications can be difficult. His model for large scale searches using volunteers has caught the eye of professional managers, and he has been asked to present the Elizabeth Smart Search case at the Governors' Conference for Emergency Management in February. This book is a testament to the capabilities and ingenuity of Amateur Radio volunteers.

NEW PRODUCTS

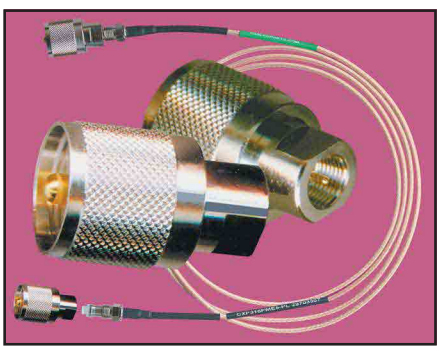
VEHICLE MOUNT FOR SMALL DEVICES FROM PRO.FIT INTERNATIONAL

◊ Pro.Fit International, Inc has announced the introduction of a new vehicle mount for small devices called the *BUG*. The BUG is a mount for securing narrow profile radio control heads for Amateur Radio and other equipment to an auto dashboard or console. The BUG has two arms, which rotate on a solid shaft and pivot independently to align with a variety of hole patterns. Double-faced adhesive is pre-cut for each arm to secure devices without using screws if desired.

The BUG is secured with an adhesive backed flexible mounting pad and can be later removed without residue or damage to the vehicle. The body design allows for adjustment by a twist of a thumbscrew. The Bug can be purchased at **www.pro-fit-intl.com**.

LIGHTWEIGHT CABLES FOR BACKPACKERS AND QRP FANS

◊ A new line of lightweight cable assemblies for back packing, QRP, vehicle installation, and limited space applications has been announced by Cable X-Perts Inc. The new lightweight line is specified for up to 100 W at HF or 50 W at VHF/UHF. 50 feet of cable with connectors attached weigh less than 1 pound. Connectors can be snapped and unsnapped for quick installations and adapters for UHF, N type, BNC and SMA are available. For more information, check New Products in the view catalog section of **www.cablexperts.com** or call 800-828-3340 for details.



Ten-Tec Titan III HF Linear Amplifier

Reviewed by Jim Parise, W1UK
ARRL Technical Advisor

Early in 2003, Ten-Tec introduced their third generation Titan amplifier, the Model 417 Titan III. The new Titan, like its two predecessors, is a legal limit amplifier designed for the HF bands. This new Titan marks a return to a two tube design while retaining similar features to its predecessor.

The Titan III makes use of a pair of Russian made 4CX800A ceramic tetrodes in a grid driven configuration to produce 1500 W on most bands. Like the Titan II,[1] the power supply and RF deck are combined in one beefy enclosure. While the two models share a similar front panel layout, the Titan III is in a larger cabinet. This is no diminutive amplifier. You will need quite a bit of real estate on your shack desk to accommodate its 19×20 inch footprint. It better be a strong desk, too, because the Titan weighs in at over 80 pounds! The cabinet is finished in a flat black color and looks terrific sitting next to the new Orion transceiver.

Figure 1—Front view of the Ten-Tec Titan III while it is pumping out 1500 W.

Getting started with the new Titan

The Titan arrives in two boxes. One contains the amplifier unit and the other the MCI Limited 3 kV transformer. The transformer needs to be unbolted from a piece of plywood, which holds it securely in the carton during shipping. Ten-Tec thankfully only initially installs 10 of the 34 screws used to attach the cabinet cover. Once the cover is removed, a side chassis rail must be removed to allow access for the power transformer. The transformer weighs nearly 50 pounds, so extra care must be exercised when installing it on the four studs protruding from the floor of the chassis. There is less than 1/4 inch of clearance to connectors on the metering circuit board, so you can't afford to lose control of the heavy iron while maneuvering it into position.

Once it is bolted down with nuts from the hardware pack, two connector attachments complete the installation. The tubes are preinstalled at the factory. Provide Ten-Tec with a copy of your license and they will include an input matching circuit board that will allow operation on 10 and 12 meters. Installation is a simple swapping out of the standard input filter. Attach your preferred 240 V, 20 A plug and the amp is ready to be put into service.

The amplifier chassis is quite roomy, well laid out and divided roughly in half between the power supply and the RF deck. On the left side an aluminum squirrel cage blower sits directly behind the plate transformer and pressurizes a raised sub-chassis. Cool air is drawn in through vents on the right front side of the chassis cover. Another transformer provides screen and filament voltages. The two Svetlana tubes are cooled by forced air from below through a composite material two-part chimney. The chimney extends right to the cabinet cover cutouts for venting and to prevent hot air from circulating within the cabinet. Band changing is accomplished by a heavy-duty three stage rotary ceramic band switch. The eight position switch has two 160 meter and two 40 meter positions, and one position each for 80, 20 15 and 10 meters.

The tubing used for the tank circuit coils is silver plated and is of a large diameter. Large wide spaced air variable capacitors sit one above the other for the TUNE and LOAD controls. The plate choke juts out horizontally from the aluminum partition that runs through the center of the chassis.

As with most any legal limit amplifier, the Titan requires a 240 V ac power connection rated at 20 A. The manual recommends a dedicated circuit. Connecting the amplifier to your transceiver and antenna is straightforward. The instructions in the *Operators Manual* are simple to follow and offer wiring diagrams for connection to Ten-Tec transceivers as well as those of other manufacturers.

Connection arrangements are offered for both QSK and PTT operation. For QSK operation with a Ten-Tec, or some late model Yaesu transceivers that are equipped with a full break-in keying loop, connection is made to the KEY IN and KEY OUT phono jacks on the rear panel. Keying is accomplished by the transceiver. To use with a transceiver that does not offer full break-in loop functionality requires that the station keyer to be connected directly to the amplifier KEY IN jack and the KEY OUT connected to the radio key jack. In this configuration the amplifier controls the keying sequencing. If you do not desire QSK operation, all that is needed is a connection from your radio's PTT OUT to the PTT/VOX jack on the back of the amp. The Titan has an ALC output available for older tube type rigs or transceivers with a negative going ALC system. Most solid state rigs do not require an external ALC connection.

Bottom Line

The Titan III rounds out the Ten-Tec line with a high quality legal limit amplifier that supports their QSK operation and should provide years of service.

[1]D. Patton, NT1N, "Product Review: Ten-Tec Model 416 Titan II HF Amplifier," *QST*, Sep 2001, pp 76-78.

Joel R. Hallas, W1ZR ♦ Assistant Technical Editor ♦ w1zr@arrl.org

Table 1
Ten-Tec Titan III, serial number 08C10023

Manufacturer's Claimed Specifications	Measured in ARRL Lab
Frequency range (US units): 1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99,[1] 28-29.7[1] MHz.	As specified.
Power output: 1500 W continuous in SSB, CW, AMTOR/PACTOR (50% duty cycle or less); 1000 W RTTY/SSTV up to 10 min, 160-40, 20, 15 and 10 meters; 750 W on 30,[2] 17 and 12 meters.	As specified for SSB and CW.
Drive power required: 60 W typical.	Typically 75 W (band dependent).
Input SWR: <2:1.	1.5:1 maximum (typically 1:1).
Spurious signal and harmonic suppression: meets or exceeds FCC requirements.	43 dB. Meets FCC requirements.
Intermodulation distortion (IMD): Not specified.	See Figure 3.
Primary power requirements: 216-252 V ac, 20 A.	
Size (HWD): 8.5×19×20 inches; weight, 84 pounds.	

Notes

[1]As shipped from the factory, operation on 12 and 10 meters is disabled. The Titan III can be modified for operation above 15 meters. Information on this kit is available by written request, which should include a copy of the owner's valid Amateur Radio license.

[2]Note that in the US the limit on 30 meters (10.1-10.15 MHz) is 200 W PEP output.

Figure 2—View of the Ten-Tec Titan III with top cover removed. The quality components are evident.

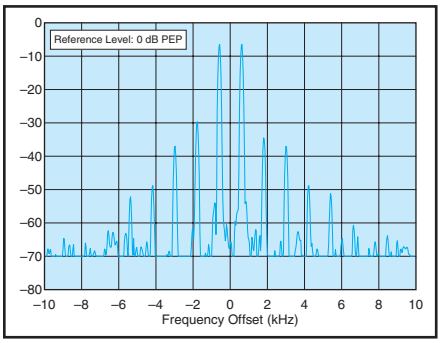


Figure 3—Worst-case spectral display of the Ten-Tec Titan III during two-tone intermodulation distortion (IMD) testing. The worst-case third order product is approximately 30 dB below PEP output, and the worst-case fifth order product is down approximately 37 dB. The transmitter was being operated at 1500 W PEP output at 14.020 MHz.

The front panel includes two large, easy to read illuminated meters. The left meter displays plate current and the right meter offers four choices: screen current, plate voltage, and forward and reflected power. A red warning zone is marked to show screen grid current in excess of 75 mA, the safe limit for the 4CX800A tubes. There are also two LED indicators that warn you if the amp is being overdriven with either excessive screen current or grid current. If you see either of these light up, the manual warns to reduce your transceiver drive power immediately and retune the amplifier to avoid tube damage.

A green LED bar graph displays peak RF output power. At the 1500 W level the LEDs are red, making for a quick visual check that the amplifier is fully tuned to the maximum legal limit.

There are three large rocker switches at the bottom left side of the front panel. The first is for power ON/OFF, the center switches between OPERATE and STANDBY and the third chooses QSK or PTT/VOX. The right third of the front panel contains the eight position band switch and the TUNE and LOAD capacitor controls. Both the TUNE and LOAD controls have smooth vernier tuning and large easy to grip rubber edged knobs. Position indicators are imprinted on the knobs themselves and read against a white reference mark on the panel.

Ten-Tec wisely includes protection and safety circuits to prevent the accidental dumb move that could destroy your tubes or otherwise seriously damage the amp. The Titan has a detection circuit that will "trip" the amplifier into standby mode if you overdrive it with excessive plate current. Step start current inrush protection is provided and a three minute wait is required at initial power up before it can be tuned or used.

Tune-up

Tuning the amp is pretty straightforward. After the three minute warm up and the WAIT light goes out, a quick check for correct plate voltage is followed by application of a small amount of drive power. The manual suggests between 10 and 20 W of initial drive for tuning. I found at least 15 W was necessary to get the plate current to increase enough to begin tuning. The process as outlined in the manual is to adjust the TUNE control for maximum screen grid current and RF output, while making sure not to exceed 75 mA. Then the LOAD control is adjusted for minimum screen grid current. A little more drive power followed by

another round of adjustments produced near the legal limit on all bands. I never got close to the 75 mA limit, but did manage to trip the plate current protection circuit a few times while trying to coax the legal limit out on the higher bands with a little too much drive power.

Changing bands and retuning reminded me somewhat of my late '80s Titan sitting nearby on the operating table. Both Titans are very simple to tune and operate. One difference that became apparent was the optimum settings for the TUNE and LOAD controls on several bands were very close to zero on the knob dials resulting in some squinting to find the right spot. Since the vernier knobs turn numbered skirts, there are no moving pointers to use for adding your own index marks directly on the face of the front panel. This is a favorite method for quick band changes during the heat of battle in a contest. The manual provides starting points for the tuning controls and Ten-Tec also provides a test result sheet for your particular amplifier, although these settings are accurate for a perfect 50 Ω load. For quick band changes and reduced wear and tear on your equipment, a "cheat sheet" with your optimized settings is always a good idea.

Operation

I used the Titan III in a variety of operating conditions including CW DXing, casual QSOs and in the CQWW CW contest. A couple of issues cropped up early on with the amplifier. During the CQWW contest, a bad smell and a sizzling sound caused me to immediately shut it off. After removing the cover, I noticed the plate choke was badly burned around its center. Ten-Tec quickly shipped out a replacement, which differed in the design of its winding. The new choke did the trick. (New Titans will have chokes of the new design. Ten-Tec does not expect many early amplifiers to have this problem, but if they do a new choke will be provided.) After tune up on some bands I noticed that even though high power output was achieved, the screen current metering showed little or no screen grid current. A check of the operating manual revealed that this is not abnormal behavior and is dependent on how you have the amplifier loaded. I did experience negative screen current on some bands, which the manual indicates requires retuning for more optimized settings of the TUNE and LOAD controls. Once I resolved those questions, I found that the Titan performed well. I also experienced slightly less than specified output power on 17 and 12 meters (1400 W). Following discussion with Ten-Tec, a new screen control board was provided and full output was achieved on all bands. The blower is fairly quiet as is the keying relay, and the amplifier runs quite cool. Using QSK was smooth and quite enjoyable thanks to the quiet 7 ms TR relay.

Considering Ten-Tec's reputation for backing up their products, this new Titan is worth a look if you are in the market for a high-end full power amplifier offering QSK, rugged construction and high quality components. It offers good performance and should give years of service as a workhorse amplifier backed up by Ten-Tec's excellent customer support.

Manufacturer: Ten-Tec Inc, 1185 Dolly Parton Pkwy, Sevierville, TN 37862; tel 800-833-7373; **sales@tentec.com**; **www.tentec.com**. Price: $3565.

Kenwood TM-271A 2 Meter FM Transceiver

Reviewed by Dave Hassler, K7CCC
News Editor, QST

Adopting the axiom "Less is More," Kenwood has introduced a no-nonsense 2 meter FM transceiver that packs a big 60 W punch—the TM-271A. This radio has all the functions that the vast majority of hams are likely to need, and delivers it all in a rugged package.

First Impressions

I was delighted the second I opened the box, because right on top, with the instruction manuals (yes, plural—more on this below), was a CD ROM. Popping this disk into my iMac resulted in learning that the English version of the manual is available as an Adobe PDF file. Nothing else was on the disk, which is a shame, because it would have been so easy for Kenwood to include the free programming software there and not require that users download the program off the Kenwood Web site (at **www.kenwood.net**). Still, the ability to print out a page or two of the manual to stick in the glove box or leave out at the operating position is a welcome plus.

My Kenwood TH-F6A tri-band FM handheld came with a manual that weighs in at 116 full-size 8 × 11 inch pages, half in English and half in Spanish. What a pleasure to see the manual cut into two separate pieces (English and Spanish) in the TM-271A box, each in a handy 5½ × 8 inch size, at 78 pages. This easily fits in my glove box without folding, spindling or mutilating. The manual is well written, with a table of contents, index and many embedded page references, so you don't have to keep flipping to the index.

Bottom Line

The Kenwood TM-271A provides basic 2 meter FM mobile capability in a rugged package with just the features most amateurs need.

The radio is small—about 6 inches square and less than 2 inches high. It weighs 2.6 pounds. About half of the package is the cast aluminium heat sink/chassis. I never cease to be amazed at how manufacturers today can cram so much into such small packages. Anyway, the

Table 1
Kenwood TM-271A, serial number 50700629

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 137-174 MHz; transmit, 144-148 MHz.	Receive and transmit, as specified.
Power requirement: Receive, 1.0 A; transmit, 13 A (high power).	Receive, 0.56 A; transmit, 8.5 A. Tested at 13.8 V.
Modes of operation: FM.	As specified.
Receiver	***Receiver Dynamic Testing***
FM sensitivity, 12 dB SINAD: <0.18 μV.	For 12 dB SINAD, 0.16 μV.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing: 77 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 73 dB; 10 MHz channel spacing: 98 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	80 dB.
S-meter sensitivity: Not specified.	S9 indication: 1.2 μV.
Squelch sensitivity: 0.1 μV.	At threshold: 0.1 μV.
Receiver audio output: 2.0 W at 5% THD into 8 Ω.	2.4 W at 5% THD into 8 Ω.
IF and image rejection: 70 dB.	First IF rejection, 135 dB; image rejection, >146 dB.
Transmitter	***Transmitter Dynamic Testing***
Power output (H/L): 60/25 W.	59/24 W.
Spurious-signal and harmonic suppression: ≥60 dB purity.	73 dB. Meets FCC requirements for spectral purity.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 88 ms.[1]
Receive-transmit turnaround time (tx delay): Not specified.	72 ms.
Size (height, width, depth): 1.7×6.3×5.4 inches; weight, 2.6 pounds.	

Notes
Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.
[1]Squelch on; squelch off is 32 ms.

TM-271A looks as rugged as its MIL-STD rating implies, and it has the look and feel of a commercial radio, rather than typical amateur gear. The front panel has five buttons, a front-firing speaker, two rotating controls and a mic jack. That's it. The supplied microphone is a no-nonsense job, too, with a beefy feel, big illuminated buttons and a hefty PTT switch that reminded me a little of the radios I used in the '80s driving buses back in Portland. The microphone connector is a modular RJ-45 type, which seems to be today's prevailing design choice. A mounting bracket and hardware rounded out the contents of the box. I thought, "Hmmm...all I need now is an antenna and 13.8 V..." With that, I gathered up the lot and headed up to my attic shack.

Applying Power

I would have been remiss if I'd not tried to operate the rig without looking at the manual first. I had a modicum of success. After the 60 seconds it took to hook the radio up to a 12 A power supply, it took a number of more minutes and guesses to get into the menu system.

Once there, I was a little unclear on the abbreviations and didn't want to transmit from murky waters. But I felt OK with jumping over to 146.520 MHz, the national simplex calling frequency, by simply twirling the VFO knob and making a contact with a fellow a few towns over. Beyond that, I knew I needed to hit the manual, at least briefly.

Before going into the specific functions of the radio, let me say that I was presented with a very quick learning curve when examining the menu system. It's really not a "system" at all; rather, you activate the menus and the 43 options are presented sequentially, with most of the options you'll want to tweak available in the first six selections.

All the basics are there for typical repeater operation. Transmit power is selectable in two settings: 25 W low and 60 W high; there is no 5 W setting. Squelch doesn't have a separate control, but is accessible from the front panel buttons. VFO step is adjustable in 11 settings from 2.5 to 100 kHz. The subaudible tone and CTCSS (Continuous Tone Coded Squelch System) options include 42 frequency choices, while 104 DCS (Digitally Coded Squelch) codes are available. While a regular subaudible tone is necessary to access many repeaters, CTCSS and DCS only allow reception of signals that carry the tone or code you set. Basically, it filters those who don't know what tone you're using. The radio can also scan for sent tones and codes, handy when you're in unfamiliar territory and caught without your *ARRL Repeater Directory*!

The radio also features automatic repeater offset so you don't have to worry about remembering if the machine you're working through listens on plus or minus from the repeater's output frequency. There is also a provision to change the offset, anything from 0 to 70 MHz—although you'll most likely want to leave it at the default of 600 kHz. There are two ways to see if the station you're working through a repeater could be worked via simplex. There's a "reverse" button that swaps your reception from the output to the input frequency of the repeater you're using. If the station is strong on both, you could move off the repeater to a simplex channel and work directly. Alternatively, you could activate the automatic simplex checking

system to do the work for you.

What's in a Name?

The TM-271A sports 200 channel memories. If you want to use the alphanumeric naming function, the memory capacity drops to 100. Frequency, tone, offset, reverse function, narrow or wide FM and beat shift—a way to silence any CPU harmonic images—can all be saved in a memory. Programming into memory is a snap. Set up the frequency, shift, etc, push a button and select an open memory channel, and push the "memory write" button. Switching between the VFO and the memory can be done from the panel or from the microphone, the latter better while operating mobile. Clearing a memory channel is not so intuitive. First you recall the memory channel, then turn off the rig, and then turn it on while holding down another button, and then confirm the erasure. Whew! Copying a programmed memory channel to an open memory channel is simple, though, and works just like regular programming, but in memory mode instead of VFO mode.

Scanning options are numerous on the TM-271A. You can scan the whole band, one of three user definable frequency ranges or within a 1 MHz range. Memories can be scanned as groups or *in toto*, and there are options to scan the call channel and user-set priority channels along with a set VFO or memory frequency. For those wanting to take advantage of a repeater's autopatch facility, the TM-271A has 10 dedicated DTMF memories, allowing the user to store up to 16 DTMF tones per channel, essentially giving the operator 10 "speed dial" numbers. Tone transmission speed and pause duration is adjustable, as well as locking out the DTMF functions of the microphone, for those who have no occasion to use an autopatch.

The "bells and whistles" have been mercifully kept to a minimum, but what has been included is useful. There is an automatic power off setting ranging from "never" to three hours. The Beat Shift function (mentioned above) thoughtfully takes into account the CPU in the radio, understanding that birdies can result from the CPU clock oscillator's harmonics. This function can help cancel that potential problem (although, in over a week of use, I noticed no birdies on either the 2 meter amateur band or while monitoring the public service band above 150 MHz).

The squelch can be approached two ways: either as an absolute value set from the front panel, or as an S-meter level, set in the menu system. I found the former, set at 1 was quite adequate, but those who operate in highly active conditions (read: "live in Intermod Alley") may find the latter option desirable.

For those fans of Star Wars, the responsive sounds of the TM-271A may remind one of the loveable sidekick robot R2-D2—the rig beeps and boops with every button press. If it's not your cup of tea, you can turn the auditory response off, as well as set the level of illumination on the display. There are also four user-definable buttons on the microphone keypad, and for those using the radio in a packet or data node application, data speed can be set at either 1200 or 9600 bits per second.

One of the coolest "bells" is the "Busy Channel Lockout." This prevents the operator from transmitting on a frequency that is currently in use. When turned on, it's impossible to double over anyone. Sure, no one means to transmit on top of anyone else, but this little safeguard (Menu Item Number 22!) should be turned on by even the most vigilant operator...just in case.

Finally, in addition to an extended receive range of 136 to 174 MHz, there's a NOAA Weather Alert facility that transparently monitors a selected NOAA station for a 1050 Hz alert tone. Should the radio detect an alert, it will switch over to the NOAA station. While it monitors only one (selectable) of the seven NOAA frequencies, the others could be programmed into a memory group and scanned, as well as any other frequency in the receiver's range.

Operating

In three different places in the manual, Kenwood advises against prolonged transmit at 60 W. That's a lot of power packed into such a compact package as the TM-271A. Remember, there is no fan on this radio, which also means it's as quiet as a church mouse, but the heatsink does all of the work of heat dissipation. In the hilly country of Connecticut, I found that I needed 60 W at times to hit "distant" machines 30 and 40 miles out. If you live in a flat area (such as my former QTH of Central Oregon), feel free to at least double those figures.

When I got into distant machines at high power, I found that the radio would get warm after about five minutes of operation, and hot after about 15 minutes; the heatsink was too hot to touch at that latter point. On low power, I found that the unit would get warm with prolonged QSOs, but not overly hot. Clearly, the heatsink does its job—just don't overdo it. Kenwood has confirmed that even though the radio gets hot, it is protected by an overtemperature shutdown mechanism. It never shut down in our testing.

As noted above, I had no trouble making a simplex contact and repeater operation was also trouble free, with the TM-271A feeding a 5/8 wavelength mobile antenna with a baseboard heater in the attic as my ground plane. I was able to hit all of my favorite machines from home, and quite a number that my old Azden PCS2000 just can't. I even once managed to get into a repeater in Queens, New York from my Southington, Connecticut home, a distance of 85 miles, albeit with an S3 reading on the TM-271A. I was also able to easily get into a machine in Great Barrington, Massachusetts on high power (48 miles northwest of me over very hilly terrain), and had a fun 10-minute contact with a ham up that way.

Going Mobile with the TM-271A

Installation was pretty easy, once I figured out where on my dashless Ford Ranger pickup the mounting bracket could go. Kenwood thoughtfully provides all the hardware you'll need to get the radio mounted securely in your vehicle. Four sheet metal screws with lock washers for the bracket, along with appropriately sized machine screws with lock washers for the sides of the radio, are packed into the TM-271A's box. The bracket is drilled in such a way as to allow numerous ways to install the radio. In my case, having numerous spacing options was critical in letting me get the bracket fixed securely to the limited metal and plastic I was afforded in the truck.

Additionally, there are several attitudinal positions you can choose to position the radio for best viewing of the display, in relation to where you're forced to put the bracket in your modern composite and plastic wonder wagon. The power cable supplied was long enough to get from the battery through the firewall and to the radio. However, the cable is actually two separate wires and I did choose to use electrical tape to make a single cable out of the pair of wires. It sure helped in threading the cable through the firewall and snaking it down the side of the engine compartment.

Whether local or "DX," I always got solid audio reports from those I spoke with. Many remarked on the clarity and fullness of the audio, a pleasing commentary, especially since I did not reveal what radio I was using. For the price, the Kenwood TM-271A provides a lot of value, especially considering the output power of the rig.

Manufacturer: Kenwood USA Corp, 3975 Johns Creek Ct, Suwanee, GA 30024-1265; tel 310-639-4200; **www.kenwood.net**. Price: $189.99. QST

Organizations' Comments Augment Alarm over BPL

Two organizations have filed comments with the FCC that augment previously expressed worries about potential interference from and to Broadband over Power Line (BPL) systems. Picking up on the "grave concerns" the Federal Emergency Management Agency (FEMA) expressed over BPL December 4, the nonprofit Disaster Preparedness and Emergency Response Association (DERA) called on the FCC to require impartial BPL field testing as well as additional public comment and full and open public hearings.

"DERA concludes that serious interference to and disruption of critical emergency communications systems in several licensed services throughout North America would almost certainly result from BPL implementation as currently proposed," the comments said. Endorsing the earlier FEMA remarks, DERA said BPL systems don't just pose a risk of interference, they've already been shown to actually cause harmful interference to licensed radio services.

Meanwhile, the Amateur Radio Research and Development Corporation (AMRAD) filed additional test data with the FCC to support preliminary findings suggesting that BPL systems are susceptible to interference from even modest Amateur Radio HF signals. AMRAD said its newest data demonstrated that amateur operation in the test neighborhood would cause many homes to lose their Internet service.

"At least an area out to a radius of 0.51 miles from the transmitting station could have their Internet connection interrupted," AMRAD said. "Closer-in homes would almost certainly have their Internet service interrupted."

For its RF susceptibility experiment, AMRAD used the Potomac Electric Power Company system test site. It features a mid-1960s vintage home with unshielded interior electrical wiring and overhead power lines.

AMRAD found that at a distance of just over one-half mile, data transfer ceased in the face of a 100-W signal on 3980 kHz from a mobile transmitter. Adjacent to the test property, AMRAD said data transfer ceased in all but one instance at a transmitter power of just 4 W in the BPL operating band of from 4 to 21 MHz.

The ARRL is expecting to complete its independent BPL engineering study early this year. It will explore how BPL might affect HF and low-VHF amateur operation as well as how Amateur Radio operation could affect BPL systems.

Additional information about BPL and Amateur Radio is on the ARRL Web site, **www.arrl.org/tis/info/HTML/plc/**. To support the League's efforts in this area, visit the ARRL's secure BPL Web site, **https://www.arrl.org/forms/development/donations/bpl/**.

A BPL TALE OF THREE CITIES

A Virginia community is going forward with plans to deploy a city-owned BPL network, while a California city has decided against BPL for its own municipal broadband system.

The Washington, DC, suburb of Manassas, Virginia, is inaugurating BPL service in four subdivisions—a total of some 2100 homes. Manassas—with a population of some 35,000—hopes to be the first community in the US to deploy BPL citywide.

Amateurs in the Manassas vicinity have pointed to FEMA's "grave concerns" that BPL could interfere with HF communications systems critical to national security and public safety. They've also cited Japan's banning of BPL deployment in the wake of Amateur Radio pressure as well as a 2003 British Broadcasting Corporation (BBC) study that described HF interference from the same technology Manassas plans to employ.

City officials seem unimpressed. "Nobody has proven it's a problem," City Councilman Ulysses X. White told *Potomac News*. "If it is a problem, then we re-evaluate it. There's no reason not to go forward with it." The same article quotes City Utilities Director Allen Todd, W4VUB, as saying that the city would monitor the system and rectify any problems that crop up. No field testing for RF interference took place during the system's pilot program.

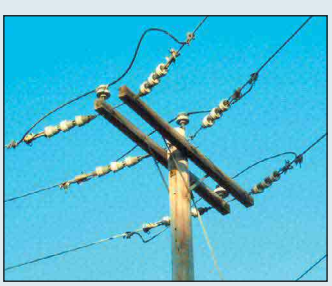
Potomac News also quoted ARRL CEO David Sumner, K1ZZ, saying that ignoring the risk of disrupting worldwide and emergency communications for BPL is shortsighted and, as FEMA already has noted, carries potential national security implications.

Meanwhile, the city council in Lompoc, California—a city of some 42,000—opted December 16 to go with a wireless and fiber optic cable-based broadband network, rejecting BPL and other possible options. ARRL Santa Barbara Section Technical Coordinator Paul Andreasen, K1JAN, said he and other members of the local Amateur Radio community lobbied hard to ensure that Lompoc would not pick BPL.

After contacting Lompoc Mayor Dick DeWesse to spell out the downside of BPL, Andreasen said he subsequently received assurances from City Manager Gary Keefe that Lompoc officials would not entertain technology that would radiate in the HF/low-VHF spectrum.

A report from McKibben Consulting noted the "ongoing controversy" about BPL and cited the BBC study that, McKibben said, "made it clear that there is very good reason to be concerned about RF interference." The consultant concluded that BPL's advantages failed to outweigh its disadvantages.

In Europe, the Austrian Amateur Transmitter Federation (ÖVSV) reports that a BPL field test in the city of Linz was asked last fall to halt HF emissions that were resulting in excessive radio interference, in some cases to radio amateurs. ÖVSV, Austria's International Amateur Radio Union member-society, said the Government Ministry for Commerce, Innovation and Technology issued the request because the Linz Power Company's BPL pilot project was generating interference on HF. Shortwave broadcaster Radio Austria's *futureZone* service cited a Red Cross report that emergency services radio traffic during a disaster response drill last May was the victim of massive interference from the BPL system.



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

HAM ANTENNA SUPPORT STRUCTURES NOT MIGRATORY BIRD HAZARD, ARRL SAYS

The ARRL has asked the FCC to specifically exempt Amateur Radio antennas and support structures less than 400 feet tall from routine environmental processing relative to their impact on migratory birds. In reply comments filed December 1, the League said there is no scientific evidence that antenna structures below that height contribute significantly to migratory bird mortality. An FCC *Notice of Inquiry*, WT Docket 03-187, released in August seeking information on the effects of communications towers on migratory birds, drew more than 250 comments.

"The comments in this proceeding to date support the conclusion that communications towers less than approximately 400 feet do not contribute substantially to migratory bird kills," the ARRL said, adding that no regulatory action is justified beyond what's already in place for aviation safety. The League added that a review of scientific literature reveals that communications towers below 400 feet "are almost universally considered not to be contributors to bird mortality."

The League noted that typical ham radio fixed antennas and support structures are located mostly in residential areas and range from 50 to 120 feet—although some may go as high as 200 feet. The ARRL also pointed to US Fish and Wildlife Service (FWS) guidelines released in 2000 that urge communications service providers to utilize towers less than 199 feet above ground level. The FWS conceded, however, that "tower height alone may not necessarily be a critical issue that results in mortality" and that bird kills documented at tall TV towers might be due to the effects of tower lighting rather than height.

KRISTEN LINDQUIST

A chipping sparrow, a migratory bird, visits a feeder in Maine.

The migratory bird issue often arises at municipal land use hearings and in the drafting of ordinances regulating antenna structures. Those opposed to communications antennas for aesthetic reasons "typically raise issues such as migratory bird mortality as one of several arguments against permitting antennas or limiting their placement," the League said.

Based on the record, ARRL concluded, "unlit Amateur Radio antennas cannot be considered candidates for regulation under any circumstances."

FCC News

FCC BEGINS "INTERFERENCE TEMPERATURE" PROCEEDING

♦ The FCC has begun an inquiry and proposed rule making proceeding focusing on the concept of "interference temperature" as a means to quantify and manage interference among different services. The FCC released the *Notice of Inquiry and Notice of Proposed Rule Making*, ET Docket 03-237, on November 28. The interference temperature model, the FCC said, "takes into account the actual cumulative radio frequency energy from transmissions" and would "set a maximum cap on the aggregate of these transmissions."

The Commission's current primary approach to manage interference is to specify and limit the power output of individual devices. The interference temperature approach, the FCC said, "could represent a fundamental paradigm shift in the Commission's approach to spectrum management." The FCC added that the new metric "could provide radio service licensees with greater certainty regarding maximum permissible interference and greater protections against harmful interference."

At this point, the proceeding involved no Amateur Radio bands. The FCC is seeking comment on various technical rules that would establish procedures and use the interference temperature model on a limited basis in the 6525-6700 MHz band and portions of the 12.75-13.25 GHz band.—*FCC*

Amateur Enforcement

♦ **FCC threatens convicted killer's ham ticket on "character qualifications":** The FCC has issued an *Order to Show Cause* to a Texas Amateur Radio licensee who's now serving a 32-year prison sentence for killing his wife in 1996. The show cause order released November 21 was the opening bell in a hearing process that could end with the revocation of the Advanced class license of Roger Thomas Scaggs, W5EBC.

"Mr Scaggs' murder conviction raises very serious questions as to whether he possesses the requisite character qualifications to be and to remain a Commission licensee and whether his license should be revoked," the FCC said. At one time reserved for assessing the fitness of broadcast applicants and licensees, the FCC's "character qualifications" standard to date has extended into the Amateur Radio arena only in a handful of cases. The *Order* asserts that the Commission has "consistently applied" character qualifications to Amateur Radio Service applicants. Three of the four examples it cites to support that claim involved telecommunications-related offenses, and one involved indecent assault upon and corruption of minors.

The *Order* cites §312(a)(2) of the Communications Act that says the FCC may revoke any license on the basis of "conditions coming to the attention of the Commission which would warrant it in refusing to grant a license or permit on the original application." Scaggs, 64, renewed his ham ticket in the spring of 1998—the same year in which he was later convicted of murdering his wife, Penny. The FCC granted Scaggs' application for an administrative update—apparently a change of address from Austin to Gatesville, Texas. His license expires in 2008.

The FCC only last year became aware of Scaggs' murder conviction, which could keep him behind bars at least until he's 75.

A hearing before an administrative law judge would consider evidence concerning the effect of Scaggs' felony conviction on his qualifications to remain an FCC licensee and, in light of the evidence, whether his license should be revoked.

COOPERATION BEST APPROACH AT 2390-2395 MHz, ARRL SAYS

The ARRL has told the FCC that it can support Amateur Radio sharing of 2390 to 2395 MHz on a co-primary basis with flight test telemetry stations. The Amateur Service has 2390 to 2400 MHz on a primary basis. In a *Fourth Notice of Proposed Rule Making* (*NPRM*) in ET Docket 00-258, the FCC last year proposed permitting federal government aeronautical mobile and non-government aeronautical flight test telemetry to operate in the first 5 megahertz of the band. In reply comments in the proceeding filed December 1, the League told the FCC that it has agreed in principle with the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) to develop coordination procedures.

"ARRL believes and continues to believe that this will result in a harmonious arrangement that will not significantly disrupt ongoing and developing amateur operations," the League's reply comments said. The allocation shift is part of the FCC's efforts to accommodate users displaced from other bands reallocated for Advanced Wireless Systems. AFTRCC initially had called on the FCC to preclude "any new amateur use" of the 2390 to 2395 MHz segment and grandfather any existing usage on a secondary basis. At the time it commented, however, AFTRCC was acting on the presumption that amateur use in the band consisted solely of ATV. The ARRL noted that amateurs also are developing wideband data systems for that portion of the spectrum.

In its comments filed in November, the ARRL expressed confidence that the co-primary allocations envisioned for 2390-2395 MHz will, in the end, prove compatible, provided the FCC affirms the need for cooperative frequency coordination. It reiterated that position in its December reply comments. The League asserted, however, that 2395 to 2400 MHz "must remain an exclusive amateur primary allocation."

MICHIGAN HAMS WIN ANTENNA EXEMPTION VICTORY

Amateurs in Troy, Michigan, scored a major victory for that community's hams November 24 after convincing the city council there to reject the planning commission's restrictions on the height of Amateur Radio antennas and antenna support structures. A Detroit suburb of some 81,000 inhabitants, Troy boasts an amateur population of more than 225.

"When the time came for a vote, the original proposal of the planning com-

DEAN EMERITUS OF ARRL SECTION MANAGERS JOE T. KNIGHT, W5PDY, SK

Former ARRL New Mexico Section Manager Joe Knight, W5PDY, of Albuquerque died December 28. He was 76. Until he stepped down last July after his health began to fail, Knight had provided leadership to the New Mexico Section for nearly 27 years—longer than any of his peers. ARRL President Jim Haynie, W5JBP, called Knight an exemplary amateur and volunteer and said he was saddened to said to learn of his passing.

"You couldn't ask for anybody who was more dedicated to Amateur Radio and to the League than Joe Knight," Haynie said. "He was the consummate ham."

An ARRL Life Member, Knight had belonged to the League for 55 years. For several years through 2002, Knight was a regular participant at the workshops held each fall for new section managers, at which he would share the wealth of expertise derived from his many years of Field Organization leadership experience.

Knight was the subject and chief narrator of an article, "The Luckiest Man Alive," which appeared in the January 2003 issue of *QST*. In it Knight said, "Amateur Radio will exist as long as there are people who love the art and science of communicating by radio." The article also outlined the vast emergency communication resources that Knight and hundreds of other dedicated volunteers built up over the years in New Mexico.

Joe Knight, W5PDY, at W1AW during a 2002 visit to ARRL Headquarters for a new section managers workshop.

During Knight's tenure as SM, New Mexico amateurs convinced state lawmakers to pass The Emergency Communication Preservation Act—an Amateur Radio antenna bill—signed into law in 2002. Knight also was at the helm as amateurs in New Mexico assisted in response and relief efforts during devastating wildfires in 2000 and in 2002.

Last July, the ARRL Board of Directors created the Knight Distinguished Service Award and named Knight as its inaugural recipient. The award honors "exceptionally notable contributions" to the health and vitality of the League by an SM.

In addition to his lengthy service as New Mexico's SM, Knight was a past president and long-time member of the Upper Rio FM Society. He belonged to the Albuquerque Amateur Radio Club, the Albuquerque DX Association and the A1 Operator Club, and he served on the board of the Duke City Hamfest. He also was active in the Quarter Century Wireless Association.

Survivors include his wife, Lois, KC5CXO, who often accompanied Knight on his hamfest and convention visits and was a tireless recruiter for new ARRL members.

The family has invited memorial contributions to the Knight Distinguished Service Award or to the ARRL Foundation Scholarship Fund. Memorials may be made to either fund on the ARRL Memorial Gifts Web page, **www.arrl.org/development/memorial.html**, or to ARRL, 225 Main St, Newington CT 06111-1494.

mission was not even considered," reported Hazel Park Amateur Radio Club Director of Instruction Jeff Albrecht, N8WR. Instead, council voted unanimously to accept a proposal drafted by Mayor Matt Pryor and HPARC President Phil Ode, AA8KR, that calls for an exemption of city regulation for structures up to 75 feet and compliance with federal preemptions regarding Amateur Radio. Troy City Council passed a final ordinance governing Amateur Radio antennas January 5 on a 5-2 vote.

The planning commission had proposed to increase allowable antenna and antenna support structure height from 20 to 25 feet but wanted to impose additional requirements and have final say on applications.

Ode initiated the effort to obtain a better municipal ordinance some six years

In Brief

• **Vote on *QST* Cover Plaque Award:** The winner of the *QST* Cover Plaque Award for December was Chip Margelli, K7JA, for his article "Field Day 2003 from Cuba." Congratulations, Chip! The winner of the *QST* Cover Plaque award—given to the author—or authors—of the best article in each issue—is determined by a vote of ARRL members. Voting takes place each month on the *QST* Cover Plaque Poll Web page, **www.arrl.org/members-only/qstvote.html**.

• **ARRL member turns 100!** The ARRL conveyed its congratulations and best wishes to League member Cliff Fay, K7BQ, of Peoria, Arizona, who turned 100 December 2. On the big day, NBC *Today* show weatherman Willard Scott included Fay among his list of centenarians and mentioned that Fay was a ham radio operator and considered himself an active DXer. He's also a regular participant in the Lions Club's annual Hunting Lions in the Air contest. First licensed as 9ARG in 1919 when he was 16 and living in St Louis, Fay has held his ticket continuously since then, which means he's been an Amateur Radio licensee for 84 years!—*thanks to Arden Nelson, KA9WAR, and Bob Reed, W2CE, for this information.*

• **Amateurs complete 82-mile two-way DSSS link on 2.4 GHz:** ARRL High Speed Multimedia (HSMM) Working Group member Ken Cuddeback, NT7K, reports that his students at Weber State University in Ogden, Utah, late last fall completed two-way direct-sequence spread spectrum (DSSS) communication on 2.4 GHz over a distance of 82 miles. The WSU student group—which included one ham, Brandon Checketts, KG4NZV, and several prospective licensees—broke the current world record of establishing a wireless link on 2.4 GHz with DSSS (using IEEE 802.11b "Wi-Fi" protocol). Cuddeback says his students used PrimeStar dishes with unamplified Cisco Aironet 350 cards—which run about 100 mW—in each laptop. "We set up a *NetMeeting* session and transferred a 2.5 MB MP3 file successfully," he said. ARRL HSMM Working Group Chairman John Champa, K8OCL, congratulated the group on "this fantastic accomplishment!"

• **Californian brings home ARDF gold from "Down Under":** Bob Cooley, KF6VSE, of Pleasanton, California, struck gold twice at the Fifth International Amateur Radio Union (IARU) Region 3 Championships of Amateur Radio Direction Finding (ARDF) in Australia. Hosted by the Wireless Institute of Australia (WIA) and organized by the Victoria ARDF Group, the competition took place November 28 through December 3 near Ballarat—a historic gold mining town in northwestern Victoria province. Cooley competed in the M60 "Superveteran Category" for men 60 and older. On the 2-meter course, he found the required three hidden transmitters in 1:30:25—seven minutes ahead of the second-place finisher. He did even better on the 80-meter course, finding all three foxes and reaching the finish line in 1:15:22. The Region 3 event drew 50 male and 9 female competitors from Australia, Japan, China, Korea and New Zealand, with KF6VSE as the only participant from North America. The Santa Barbara Amateur Radio Club will host the fourth annual 2004 USA ARDF Championships in June. More information on US ARDF events is available on the Homing In Web site, **www.homingin.com**, of ARRL ARDF Coordinator Joe Moell, KØOV.—*Joe Moell, KØOV*

• **Bennett R. "Ben" Adams Jr, K4EZ, SK:** Former ARRL Southeastern Division Director Ben Adams, K4EZ (ex-W4APU and ex-W4EV), of Cincinnati, Ohio, died November 28, a few days shy of his 95th birthday. While living in Alabama, Adams served as Southeastern Division Director from 1935 until 1940. First licensed as 4EV in 1926, Adams attended Georgia Tech, where he was president of the school's Amateur Radio club. After graduation, he worked for AT&T in a variety of capacities. An ARRL Life Member, Adams in his younger years was a very active DXer, contester and traffic handler. He served three terms as president of the Birmingham Radio Club. Following service in World War II, Adams moved to Decatur, Georgia, and subsequently was named a member of the Southeastern DX Club's DX Hall of Fame. A DXCC Honor Roll member, he had belonged to the ARRL for almost 70 years. In 1995 Adams moved from Georgia into a long-term care facility in Cincinnati.—*some information from Dave Thompson, K4JRB, and Sandy Donahue, W4RU*

• **Emanuel G. "Manny" Papandreas, W4SS, SK:** Former long-time ARRL Southern Florida Section Emergency Coordinator Manny Papandreas, W4SS, of Lake Worth, died December 26. He was 80. Papandreas served as Southern Florida's SEC for 20 years—longer than any of his predecessors. He also was an ARRL Southeastern Division assistant director. During his tenure as SEC, he oversaw the Amateur Radio emergency communications in the wake of Hurricane Andrew in 1992. A life member of both the ARRL and the Quarter Century Wireless Association, Papandreas was first licensed in 1941 as W8VKS. After a career in appliance sales and service, he became operations coordinator for the Palm Beach County Division of Emergency Management. There he assisted in designing a new Emergency Operations Center. Papandreas also founded and led the Palm Beach Amateur Radio Council, which coordinates the county's ARES/RACES activities.—*information supplied by Jeff Beals, WA4AW*

• **Robert S. Bennett, W3WCQ, SK:** Bob Bennett, W3WCQ, of Baltimore, Maryland, died December 6. He was 67. Bennett was an ARRL Atlantic Division Assistant Director and, as president of the Baltimore Radio Amateur Television Society (BRATS), was well known within the Amateur TV community. "W3WCQ was our expert on ATV," said Atlantic Division Director Bernie Fuller, N3EFN. "He will be missed." An acknowledged expert on weak-signal VHF work, Bennett once served as the Atlantic Division representative to the now-defunct VHF-UHF Advisory Committee (VUAC). ARRL Vice President Kay Craigie, N3KN—a past Atlantic Division Director—called Bennett "a valued advisor to several Atlantic Division directors." Bennett also belonged to the Quarter Century Wireless Association and served as a local chapter president.

ago. HPARC First Vice President Murray Scott, KE8UM says he joined forces with Ode about three years ago after he was denied a permit to put up a 50-foot tower.

"We have gone to meetings almost every week dealing with the zoning board, the planning commission and the city council," Scott said. "The city administration put up a good fight, but the council was on our side." He noted that support from various local amateurs and clubs was a big factor in the amateurs' success.

In their presentation, 10 hams from HPARC and the Utica-Shelby Emergency Communications Association used ARRL's "Antenna Height and Communications Effectiveness" study and ARRL's *Amateur Radio Today* CD presentation as part of their testimony. Troy Fire Chief Bill Nelson, KC8IWQ, also testified to the importance of Amateur Radio to his department's preparedness plans.

The amateurs also convinced city council members that the planning commission's restrictions would violate PRB-1, the limited federal preemption of local statutes that directs municipalities to "reasonably accommodate" Amateur Radio communication with respect to ordinances regulating antennas and antenna support structures.

Media Hits

■ *Rural Missouri* in Jefferson City ran an article on Amateur Radio emergency communications. Bob Clinton, WØBUX, submitted most of the information for the story, and an editor handled the rest. *Rural Missouri* is the publication of the Association of Missouri Electric Cooperatives. It goes out to more than 400,000 rural electric cooperative members. After the article appeared, Clinton said, he heard from two prospective new hams.

■ ARES members in Clackamas, Oregon, were mentioned in *The Oregonian* for their help when a severe winter storm gripped the area in early January. ARES members helped coordinate rides for doctors, nurses and other hospital personnel during the storm. ARRL Clackamas County Emergency Coordinator David Kidd, KA7OZO, organized the ham radio response.

■ ARRL Public Information Officer Kevin Halloran, W8KPH, sent in an article he had written for the daily *Kenton Times* in Kenton, Ohio. Using some general information from the League's public information pages, Halloran's piece publicized assistance offered by local ham radio operators during a tri-county emergency preparedness exercise.

CHIAO TO REPLACE McARTHUR AS NEXT ISS COMMANDER

Veteran NASA astronaut Leroy Chiao will replace William McArthur Jr, KC5ACR, as the commander Expedition 9, the next mission aboard the International Space Station. NASA says the change in crew assignment resulted from "a temporary medical issue" related to McArthur's qualifications for the long-duration flight. Chiao will join Russian cosmonaut and flight engineer Valery Tokarev for the six-month mission. The Expedition 9 crew is scheduled for launch aboard a Russian *Soyuz* spacecraft in April.

NASA PHOTO

Leroy Chiao will head the Expedition 9 crew aboard the International Space Station.

"Because we are very cautious in our approach to crew health, we train backups for this kind of situation," said NASA Astronaut Office Chief Kent Rominger. He indicated that NASA plans to assign McArthur to another ISS crew increment.

For his part, McArthur expressed disappointment in the turn of events but said he understood the necessity of the medical criteria in place for long-duration space flight. "I know that Leroy will ensure all of the Expedition 9 objectives are met," McArthur said, "and I look forward to flying soon on another space station mission."

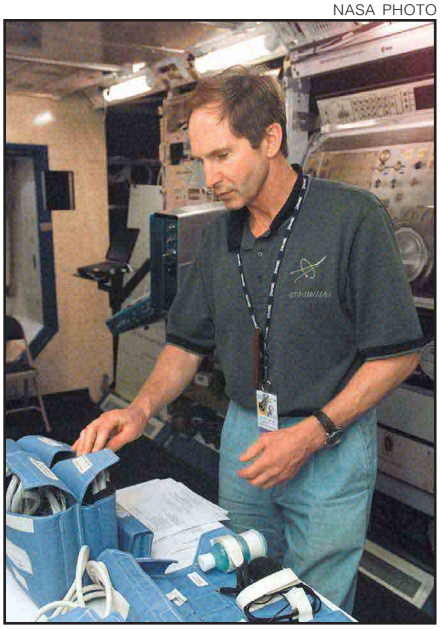
As a member of the Expedition 9 backup crew, Chiao has been training with McArthur for months. He will also serve as NASA ISS Science Officer.

Since the switch would leave the ISS without an Amateur Radio licensee aboard during the next crew's tour, it's hoped that Chiao will become licensed before he goes into space. At press time, Amateur Radio on the International Space Station Chairman Frank Bauer, KA3HDO, said ARISS was "working hard on this issue with NASA."

European Space Agency astronaut Andre Kuipers of the Netherlands will round out the three-member *Soyuz* crew. He will return to Earth eight days later with the Expedition 8 crew of Mike Foale, KB5UAC, and Alex "Sasha" Kaleri, U8MIR.

An astronaut since 1990, Chiao, 43, holds a doctorate in chemical engineering from the University of California-Santa Barbara. He has had prior flight experience aboard space shuttle missions in 1994, 1996 and 2000. On his last shuttle flight, Chiao was part of a seven-member crew that helped to prepare the ISS for its first resident crew. During that mission, he completed two space walks.

NASA PHOTO



Valery Tokarev trains on a mockup of the ISS Destiny laboratory at Johnson Space Center.

Tokarev, 51, has been a cosmonaut since 1987. Since 1997, he has served as a test cosmonaut at the Yuri A. Gagarin Cosmonaut Training Center. Tokarev flew on a 1999 shuttle mission that delivered four tons of logistics and supplies to the ISS in preparation for the arrival of the Expedition 1 crew.

During its stay aboard the orbiting research laboratory, the Expedition 9 crew will continue scientific studies in the earth and life sciences as well as in fundamental biology and microgravity. —*NASA*

The San Diego Cedar Fire

By Theodore Hamm, W6GMQ

In San Diego County, the Coronado Emergency Radio Operators (CERO) responded to the request for Amateur Radio support to the Amateur Radio Emergency Service (ARES) during the San Diego Cedar Fire, from October 26 to November 1, 2003.

Cedar Fire fringe off Highway 8, in San Diego County

Coronado Communications

The City of Coronado and the Coronado Fire Department under the leadership of Fire Chief John Traylor and Division Chief Dismas Abelman have supported the CERO group for the past ten years. Their funding and support has enabled the CERO group to establish the emergency operations center's (EOC) and portable systems for voice, packet (digital communications) and slow scan (sending color photographs over the voice link) and two portable communication systems. We have a 2-meter repeater and a digipeater on a Coronado high-rise building. The main communications rooms are at the City of Coronado's EOC at the Coronado Police Station and a backup EOC at the Coronado Cays Fire Station 8 miles south of the city. We have 50-mile radio communications coverage. The CERO group is fully integrated with Division Chief Dismas Abelman's CERT (Community Emergency Response Team) of over 200 trained Search and Rescue and First Aid personnel with monthly meetings and drills twice a year.

Callout

When it became clear that there was a major fire problem on October 27, 2003, the CERO group started its callout list at 8 AM and identified members who were available. Radio and telephone calls went out to RACES and ARES / Red Cross identifying our personnel and resources. Teams of two were deployed with our CERO Portable 1 and Portable 2 systems. These were suitcase-sized communications systems with an IC-2100 (55 W on 2 meters) transceiver, packet and slow scan color picture transmission, 20 foot self-supporting mast with a Diamond X-50A collinear antenna and a Honda 1 kilowatt gas generator. Members with their personal mobile transceivers were also deployed. ARES/Red Cross responded first requesting two teams. By 9 AM, the San Diego telephone communication was out between Coronado and the Red Cross San Diego. Circuits were overloaded, so we used our Amateur Radio communications for our deployment information from the ARES/Red Cross. We deployed our teams from the Coronado EOC by 11 AM to our assigned ARES/Red Cross areas.

N6QKE

Mountain Empire Site where W6GMQ and N6QKE were setup in a soccer field on the school campus.

Cedar Fire Callout

This is an overview of one team's deployment at 11 AM from Coronado by Fred Nusbickel, N6QKE, and Ted Hamm, W6GMQ.

We were requested to report to the town of Julian. The highway and side roads were completely fire blocked, so we were reassigned to the Red Cross Shelter at Mountain Empire High School on S1 road east of Highway 8 near Laguna summit, at 4055 ft. Unclear on how to get to Mountain Empire since most of the roads were closed, we put out a call on the Lyons Peak repeater and Greg, KD6YQR, helped us with directions over the back roads to the Mountain Empire School. We arrived at 4 PM using back roads. On a normal day it should have taken one hour to drive from Coronado to the Mountain Empire School, but it took four hours this time. We were on the eastern edge of the fire zone and had clean air. We set up our station in a soccer field near the high school gymnasium where the Red Cross was set up.

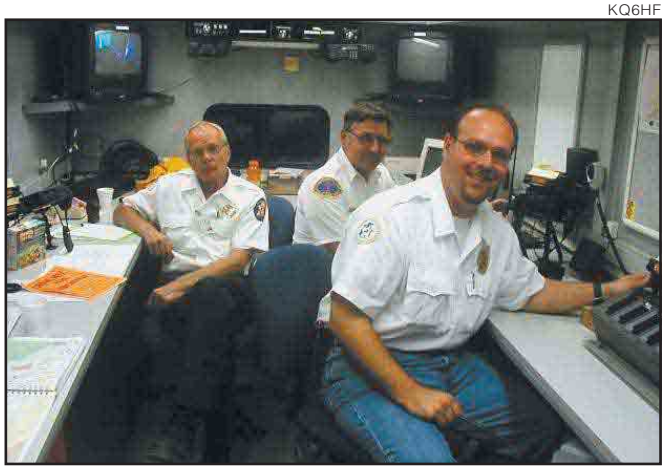
After a briefing from Jesse, KG6SLN, who provided the shelters early communications, we reported to the Red Cross shelter manager and settled into our 8-hour shift that turned into a 24-hour shift. At that time, it was like a zoo. There were 1700 people at the shelter. All highway traffic in both directions on this major (Highway 8) was stopped. Everything was very orderly and very well run. In the soccer field, there were a few hundred cars and campers. Every few hours, 24 hours a day, security, chaplains and Red Cross nurse teams toured the area checking on everybody.

Amateur Radio Communications

When we arrived, the only communications the center had was Amateur Radio and one phone line that worked maybe 5% of the time. Cell phones did not work at this location. The only power was by emergency generator. We established the communications link from the Mountain Empire Shelter to San Diego

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

KQ6HF



(L-R) Ken Nelson, W6NEL, James Nagel, AB0WM, an ARES Emergency Coordinator, and Renny Thomas, KC6LQV, at work in the San Bernardino County Fire Department Communications Support Unit 502.

In the Simi Valley area of Los Angeles, the scene at West Cochran Street is a safe vantage point where the main part of the fire already passed. The fire had threatened a county park and a trailer park in Moorpark. (Used by permission of Tracy Justus, **www.freqofnature.com**.)

Red Cross through the Lyons Peak SANDRA repeater, 146.265 MHz, a very good signal. Communications traffic were permitted or approved only by the Red Cross shelter manager. We handled 20 shelter business and medical messages over two 24-hour shifts. Most of the traffic was by the shelter nurses to the medical staff at Red Cross San Diego.

The American Red Cross did a wonderful job. Everybody was very caring and helpful. There was food 24 hours a day, and I heard one person comment that he was gaining weight. I was impressed with the local community. Disneyland sent a few trucks with entertainment and party favors for the children. I can't begin to list all the help, support and donations from the local business. We worked and interfaced with a lot of great people.

Other Coronado Emergency Radio Operator team members who deployed were Dick Hoffman W6ALJ; Don Bloom, KG6QSQ; Dick, AD6Y, and Annetta Townsend; Dr Don Compton, KG6NDX; Kent Tiburski, K6FQ; Dan Briggs, KD6OKR; Fred Nusbickel, N6QKE, and Ted Hamm, W6GMQ. Other members who helped out in Coronado were Coronado Net Control Russ Downer, KA6INT; Andy Perrin, W7AP; Jerry Wellnitz, N6VAK; Eric Crosser, N6SUB; Mitch Simmons, KD6KPI, and Glenn Gerbrand, WM6B.

The Next Time

In our critique of the San Diego-area fire, we all reviewed where we were and what we did and how could we do it better. The main problem was that the fires were all over Southern California from Los Angeles to the border of Mexico.

When working with the incident commander or shelter manager, it is best to have a one-page information sheet stating your capabilities and what you can do for them. How do they want to operate? Remember they change shifts about every 10 to 12 hours as we should and the new people should be brought up to date.

The Simi Valley CERT (Community Emergency Response Team) waits to be deployed to this fire hazard neighborhood. (Used by permission of Tracy Justus, **www.freqofnature.com**.)

Emphasize the material in the ARRL's Amateur Radio Emergency Communications Course (Level I). Establish an operations traffic net, resource net, and an information net. In addition, have a safety officer who oversees where the communicators are, where the fire is and the safest road entrance and road egress for every deployment. For example, in the early hours of the fire the road access changed every half hour. Stay in communications.

Be self sufficient and have reliable transceivers, power source, antenna gain and an antenna mast. The hilly country is a challenge for our communications. Prior approval for repeater use is recommended, too. Practice your communications skills on a regular basis, and plan that you will not be relieved after your eight hour shift.

HAMS RESPOND TO SOUTHERN CALIFORNIA FIRES

Editor's Note: HQ Staff members Rick Lindquist, N1RL, and Steve Ewald, WV1X, interviewed Section Leaders to learn how Amateur Radio assisted in fire relief efforts in other parts of San Diego, Orange and Los Angeles sections.

In late October and early November of 2003, a dozen fires, some of them massive, burned some 600,000 acres and claimed 16 lives. Most of them were in the hard-hit San Diego area. Thousands of residents had to be evacuated. ARRL San Diego Section Manager Kent Tiburski, K6FQ, said, "This is by far the worst disaster we've ever experienced." He estimated that approximately 200 Amateur Radio Emergency Service (ARES) and Radio Amateur Civil Emergency Service (RACES) volunteers participated in the fire emergency.

Tiburski says hams assisted American Red Cross relief efforts, primarily in terms of logistics and working with damage assessment teams. Others provided liaison between the California Department of Forestry and the Red Cross,

which provided meals and shelter for firefighters. Nearly 13,000 firefighters and support personnel were deployed in California to battle the fires.

The fires claimed nearly 1200 homes in San Diego County alone, Tiburski reported, and burned some 450,000 acres. "Everybody I've talked with knows someone personally or knows of someone who has lost a house," he said.

San Diego Salvation Army Team Emergency Radio Network (SATERN) Coordinator Paul Cook, N6RPF, reported he and other SATERN members had been providing communication assistance for The Salvation Army's relief efforts. They had help from other amateurs as well, he said. At least a half-dozen Salvation Army emergency disaster services canteens were providing meals to evacuees and firefighters

Orange Section

Elsewhere in Southern California, ARRL Orange Section Manager Carl Gardenias, WU6D, said that Amateur Radio operators worked with relief agencies throughout Riverside, San Bernardino and Orange Counties including the EOC in San Bernardino. "The intensity of these fires has never been at this level before," Gardenias said, comparing the current situation with fire emergencies in the recent past.

At the Red Cross shelters radio amateurs "shadowed" shelter managers, communicating shelter supply requests, and helping with health-and-welfare inquiries for shelter clients, Gardenias said. Amateur Radio also served to keep some 26 shelters in touch with the Red Cross regional headquarters. At least 1000 evacuees took refuge in a former TWA hangar at the San Bernardino airport. Amateur Radio SSTV equipment was used to assist firefighters in San Bernardino. The radio equipment and operators were on the fire trucks and reported what they saw back to the command center. Communication is important to locate resources and direct them to the places that need help, Gardenias said, and hams in the Orange Section pulled together to provide it and to assist relief agencies.

Los Angeles Section

In the Los Angeles Section, Section Manager Phineas Icenbice, W6BF, reported firefighting helicopters and crews used water from Magic Mountain Amusement Park and from golf courses in the vicinity to help douse the flames. However, Icenbice said at the height of the fire emergency, the Santa Ana winds made it difficult for some of the "super scoopers" firefighters use to try to douse the flames to fly and pick up water. He called it the worst fire situation he had seen in four decades of living in the Los Angeles area and said the smoke was so thick at times that firefighting aircraft could not get off the ground or navigate.

Icenbice said the problem areas appeared to be in the outer areas of Los Angeles County and in the mountains. Radio amateurs helped locate people who had been left homeless because of the fires. Los Angeles District Emergency Coordinator Dennis Smith, KA6GSE, said that Amateur Radio operators also assisted at Red Cross shelters in the Los Angeles area as well as helping the relief agency to locate and establish new shelters.

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll
December 2003

This listing is to recognize radio amateurs whose public service performance during the month indicted qualifies for 70 or more total points in the following 6 categories (as reported to their Section Managers). Please note the maximum points for each category:
1) Participating in a public service net, using any mode. —1 point per net session; maximum 40.
2) Handling formal messages (radiograms) via any mode. —1 point for each message handled; maximum 40.
3) Serving in an ARRL-sponsored volunteer position: ARRL Field Organization appointee or Section Manager, NTS Net Manager, TCC Director, TCC member, NTS official or appointee above the Section level. —10 points for each position; maximum 30.
4) Participation in scheduled short-term public service events such as walk-a-thons, bike-a-thons, parades, simulated emergency tests and related practice events. This includes off-the-air meetings and coordination efforts with related emergency groups and served agencies. —5 points per hour (or any portion thereof) of time spent in either coordinating and/or operating in the public service event; no limit.
5) Participation in an unplanned emergency response when the Amateur Radio operator is on the scene. This also includes unplanned incident requests by public or served agencies for Amateur Radio participation. —5 points per hour (or any portion thereof) of time spent directly involved in the emergency operation; no limit.
6) Providing and maintaining a) an automated digital system that handles ARRL radiogram-formatted messages; b) a Web page or e-mail list server oriented toward Amateur Radio public service —10 points per item.

Amateur Radio stations that qualify for PSHR 12 consecutive months, or 18 out of a 24- month period, will be awarded a certificate from Headquarters upon written notification of qualifying months to the Public Service Branch of Field and Educational Services at ARRL HQ.

675 N2LTC
565 KC2HUV
480 W7TVA
460 W2MTA
415 N9VE
335 KA2ZNZ
329 KC2DAA
299 N2YJZ
290 AB2IZ
270 KB2KOJ W2LC
265 N7TOD
252 KA2GJV
239 K4WWV
230 KB2SNP
227 NN2H
210 VE3EUI
206 WA1QAA
204 K9JPS
196 WA5LQZ
194 N2IK
KA9HRO
188 KB2ETO
185 KB5ILY
177 K2ABX
176 KW7DSP
175 N2OPJ
173 N2YBB
170 N5IKN W7ARC
160 KK3F
155 KB8ZYY
150 WB1CHU N2GJ
149 W4AUN
146 KA0DBK
W2DWR
145 KB2RTZ K4FQU
141 NN7H
140 KB3GFC W4EAT KE4UOF K7BFL
135 KK1A N2JBA
130 WB2UVB AG9G KB2VRO K4KAM
131 KO4SY
130 KA5KLU AC5XK KB2VRO
129 KA2BCE
126 W5OMG
125 W3YVQ K4RLD W3ZQN K9FHI WA9ZTY
120 W3BBQ N5WSW K4IWW N8IO N5BSD AB4XK WB0TAQ N3RB WX4J W6IVV KA4FZI W8YS W6QZ
118 K4DND
115 KV4AN AD5KE K9LGU WB2KNS
WX4H
114 KB0DTI
112 WD4LSS
111 N2JRS
110 AC5VN K5MC K0IBS KG4OTL K4BEH AF4NS W5IM W5GKH KE4JHJ N3SW W8MMN K2UL WA2YL KC5OZT K5UPN W4NTI N7YSS NJ5M AG4DL KD4GR W7GB K3JL N7EIE W7QM N7YSS N8NMA N2RTF WA2ZCM KG4ZID
109 W5PY KB5JBV
106 KB9KEG
105 W5ARS
104 W0HXB W4YTC WA1JVV
103 W4ZJY WB2LEZ WA5KQU
102 K1HEJ
101 W7RRC
100 NF5B KE0XQ KA4UIV KA4LRM K3SS W9NXC AA8SN N5SIG N2AKZ KC2GOW KB2KLH WA8SSI W9CBE KD4CQJ AF2K KC2EOT WB2QIX WI2G K4SCL N7CM NR2F N9MN WN0Y WA4EIC K7GXZ W7GHT W7LG W7SMC N8FXH WA2WMJ N1VXP NM1K AB0WR
99 W7TC W5JYJ N0ENO
97 K5DPG W9BHL KJ7SI
95 K3CN K7UGT KB8NDS AB0UY
94 W3CB
93 KG4CHW
92 K8ZJU AA4BN
91 KO4OL W5CU
90 WA9JWL W4DLZ K2VX K4FUM W4WXA K1FP K4WKT WB4GGS AA3GV N3OR K3IN K8KHZ N8DD KC8UTL KC2IYC WA2CUW KB5TCH W5RDM K2YYF W4CKS KG2D WB2IJH N1JX KC7SGM W8IM K1JPG KF4WIJ W5UYH WB7VYH W7ZIW WD8DHC KA8WNO KA1GWE KA1RMV WA0LYK
89 N8QVT KD5YMW
88 W4LN KE2SX W2CC W8CPG
87 WA0KAQ W7VSE WB4PAM
86 KG4FXG N0ZIZ WB6UZX
85 KC8VQA KF4OCU W2QOB AG4AC
84 N8OD
WD9FLJ W6JPH
83 KA9RZL
82 WB8RCR AL7N W2GUT
81 N8JAT
80 K4DZM AA4YW KF7GC KC4ZHF W2MTO KD7ONS K8KV KG4MLC K7MQF NX1Q W1ALE
79 K5ER K8CQF
78 WA2GUP
77 KB8TNU WB4BIK
76 K4BG N3WK KG4MLD WD9F
75 K4GA AA2SV W4DGH WA2YBM
74 KA0O W7DPW KC6SKK
73 KK7TN
72 N5KWB
71 K8VFZ N2VQA K2PB
70 W5NK KD6FED WA5OUV

The following stations qualified for PSHR in previous months, but were not recognized in this column: (November) KD5YMW 124.

Section Traffic Manager Reports
December 2003

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, DE, EB, EPA, EWA, GA, ID, IL, IN, KS, KY, LA, MDC, MI, MO, NC, NFL, NH, NLI, NNJ, NNY, NTX, NV, OH, OK, OR, ORG, SC, SD, SFL, SJV, SNJ, STX, TN, VA, VT, WCF, WI, WMA, WNY, WPA, WTX, WV, WY.

Section Emergency Coordinator Reports
December 2003

The following ARRL Section Emergency Coordinators reported: AK, AR, AZ, ENY, EWA, GA, IL, IN, KY, LA, MI, MN, MO, NC, NNJ, NV, SC, SD, SFL, SJV, SNJ, SV, TN, WMA, WTX, WV.

Brass Pounders League
December 2003

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 points or a sum of 100 or more origination and delivery points for any calendar month. All messages must be handled on amateur frequencies within 48 hours of receipt in standard ARRL radiogram format.

Call	*Orig*	*Rcvd*	*Sent*	*Dlvd*	*Total*
KK3F	31	2420	2376	44	4871
W4ZJY	0	1526	1412	0	2938
WB5NKC	30	73	1377	6	1530
N2LTC	0	715	686	45	1446
W4EAT	1	709	694	3	1407
WX4H	-	26	620	11	1100
NM1K	383	122	434	5	944
W6IVV	0	439	460	0	908
KF4WIJ	0	400	389	29	818
WA9VND	31	428	268	76	803
N9VE	0	351	35	335	721
AB0WR	0	362	334	0	696
K9JPS	0	316	33	303	652
KA4FZI	1	370	195	15	581
WB4GGS	0	280	295	3	578
W6DOB	2	129	389	35	555
K5UPN	23	249	273	8	553
KA2ZNZ	25	233	244	18	520
W0WWR	0	296	211	0	508
WB2IJH	0	253	251	1	505

BPL for 100 or more originations plus deliveries: NJ5M 210, K4FQU 175, W9IHW 158, and KB2RTZ 126.

VHF on the ARRL Web

Everyone knows that the Internet is a wonderful source of information for almost any activity. Many are unfamiliar with the rich resource at the ARRLWeb (**www.arrl.org**). This month, I want to look in some detail at the site and the information you can find there. This site has not changed much since I became conductor of this column, so at the conclusion of this survey I also want to look at some possible enhancements of the site.

Navigation

The main source of weak-signal information can be found at **www.arrl.org/qst/worldabove/**. Once you have reached the main page, you will find at the bottom a short history of "The World Above 50 MHz" (WA50). Just above it are two columns containing links to a variety of Web resources and to other aspects of the VHF+ world. In the upper right-hand corner is another, smaller box that provides links to VHF+ records and band-by-band standings—a complete record of the abbreviated standings boxes that you see published in the column. Let's look at these links.

Web Resources

Several groups of useful sites appear here (see Table 1). To get club information, *V/U/SHF Clubs* provides links to US VHF+ clubs based on data provided in the January 2003 WA50 column. Jason, N1RWY, maintains a list of newsletters at *VHF+ Newsletters*. Information about propagation, real-time propagation forecasts, solar data and other aspects of space weather can be found at the *Solar Terrestrial Dispatch*, *Space Environmental Center* and *SpaceWeather* sites. The *UK Six Metre Group* (UKSMG) site is one of the world's most complete 6 meter sites covering propagation, DX clusters, reflectors and an extensive set of magic-band links. Microwave enthusiasts have a choice of two premier microwave sites: those of ARRL microwave columnist Tom Williams, *A Domain for Microwave Amateur Radio*, and of Peter Day, G3PHO, *Welcome to the World Above 1000 MHz*. Here you will find introductions to microwave operation, microwave hardware, software and many very useful links.

Other VHF+ Web Resources

As listed in Table 2, this panel provides links primarily to other parts of the *ARRLWeb*. Except for *Contests and Radio Direction Finding (RDF)* each page provides links to selected *QST* articles; a searchable bibliography; lists of ARRL publications in the given area; and links to other selected Web resources. In addition, *FM Repeaters* provides Part 97 Repeater rules, ARRL band plans and lists of repeaters in foreign countries. *Satellites* provides an extensive list of satellite tracking software. *Fox (Transmitter) Hunting* is a link to Joe Moell's (KØOV) RDF site *Homing In,* which contains links to basic RDF articles, homebrew and commercial equipment and foxhunting radiosport in the US and abroad. The Contests link provides VHF contest rules and results, a description of grid squares and the June VHF contest section records (by class) compiled by Curt Roseman, K9AKS.

The *Contest* page now provides a rich source of information about contest results. In addition to .pdf files of the last six years' VHF contest results, the last two years contain detailed downloadable lists of all contest scores. Under the *Scores* link, you have the equivalent of an *Excel* file that can be searched on-line by call sign, score, class, Section and Division. Each listing can be expanded to give band-by-band breakdowns by checking the "List-per-band-counts" box in the "Select Entries to List" box at the bottom of each *Score* page. Entries can be sorted hierarchically by up to three categories. So for instance, if you are interested in sorting all the West Gulf Division entries in the June 2003 contest by class and score within class, you can easily do that. Do you want to know how you did in your section, your Division or nationally, in terms of score, contacts or grid multipliers? You can do that too.

Table 1

Web Resource Links Listed at the WA50 Web Site

Amateur Radio Information
A Domain for Microwave Amateur Radio
Ham-Links
Open Directory Project
RSGB Propagation Studies Committee
Solar Terrestrial Dispatch
Space Environmental Center
SpaceWeather
UK Six Metre Group
V/U/SHF Clubs
VHF+ Newsletters
Welcome to the World Above 1000 MHz

Table 2

Links to Other facets of the VHF+ World at the WA50 Site

Other VHF+ Web Resources
FM and FM Repeaters
Satellites
Packet
Amateur Television
Fox (Transmitter) Hunting
Contests

Table 3

Links to Records and Band by Band Standings at the WA50 Site

Records and Standings
- 6 Meter Firsts
- DX Records
- Grid Chase
- VHF/UHF/µwave/EME Standings

This Month

March 6-7	European EME Contest 0000 UTC March 6 to 2400 UTC March 7
March 7*	Good EME conditions*

*Moon data from W5LUU

Records and Standings

The WA50 Web page has been the repository not only for many of the North American distance and initial records but also for the band-by-band standings boxes (see Table 3). *Six Meter Firsts* details initial contacts between the continental 48 US states and the rest of the world. As of early January, claims for initial contacts with 227 countries are listed. The "Grid Chase" lists stations with the largest number of confirmed grids on bands between 50 MHz and 241 GHz and via satellite.

The *VHF/UHF*/µwave/EME Standings are a complete listing of stations, by band, with their states worked, countries worked, grids worked and longest DX contact. Anyone can be listed by sending this information to **standings@arrl.org** by e-mail or by submitting the information to ARRL headquarters by regular mail. The EME standings should shortly have a much more robust look thanks to help from Bruce Clark, KØYW, who has been canvassing the EME community

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Table 4
Comparison of DX Records in North America and Region 1 (Europe / Africa)

Mode	*Area*	*Stations / Grids*	*Date*	*DX(km)*
TropoA	NA	W1JSM / FN43nc—VP5D / FL31ut	05-10-1988	2365
TropoC	NA	WB4MJE / EL94hq—VE1KG / FN84cm	11-05-1994	2715
TropoP	NA	KH6HME / BK29go—W1LP / MM / DL51ce	08-21-1999	4754
Tropo / A	R1	GMØKAE / IO86cd—EA8BML / IL27gx	09-09-1988	3264
Aurora	NA	WAØTKJ / EM18ct—KA1ZE / FN31tu	02-08-1986	2178
Aurora	R1	PA3ELL / JO32HA—UA4ANV / LO44	05-10-1992	2724
AU-E	NA	WB7UZO / CN78qi—VE3KNI / EN38hn	08-15-1989	2295
AU-E	R1	DK3BU / JO33no—UA1ZCL / KP78tx	08-25-1987	2254
E_s	NA	WA7GSK / DN13so—W4FF / EL96am	05-29-1998	3635
E_s	R1	OE1SBB / JN88ff—RI8TA / MM37te	07-21-1989	4281
FAI	NA	KXØO / DM78pu—WA4CHA / EL88qa	06-19-1993	2370
FAI	R1	YU7GW / KN05hp—EB4TT / IN70xj	06-02-1995	2084
MS	NA	K5UR / EM35wa—KP4EKG / FK68vg	12-13-1985	3162
MS	R1	GW4CQT / IO81lp—UW6MA / KN97ve	08-12-1977	3101
IFS	NA	K5JL / EM15dp—VE1ALQ / FN65vh	11-08-1999	2856
IFS	R1	DF9PY / p / JO30ff–SM2EKM / KP05uw	06-09-1989	1947
TE	NA	KP4EOR / FK78aj—LU5DJZ / GF11lu	02-13-1978	6327
TE	R1	I4EAT / JN54vg—ZS3B / JG73	03-30-1979	7784

here and abroad. I have no intention of having the most comprehensive EME listings, but I do hope to have a more representative sample of what actually exists than we have had in the past. Al Ward, W5LUA, maintains the North American *DX Records*. All bands from 144 MHz through laser light are represented. Modes include aurora, E_s, auroral E, FAI, Ionoscatter (IFS), TE and rain scatter. Tropospheric refraction and ducting are currently divided into three categories: A (across the Atlantic), C (continental) and P (across the Pacific).

What can we do with data like these? The "DX Records" allows us to generate an interesting comparison (Table 4) between distance records in North America and in Europe/Africa (Region 1) using data from **www.ham.se/vhf/dxrecord/dxrec.htm** updated on October 6, 2003. Many of the records are of the same order of magnitude between the two regions. The differences in tropo records are in the distances between landmasses covered by the ducts that generate the contacts: the Hawaiian Pacific duct versus the known duct between the British Isles and the Canaries. Perhaps because it has more land area and a higher density of operators, Region 1 has longer auroral and E_s records. Yet there is little difference between the distances covered on FAI or on auroral E where the presence of a fair number of stations at higher geomagnetic latitudes in OH, SM and LA might argue for the possibility that longer-distance contacts could be made. The one real anomaly is ionospheric forward scatter where the North American record is almost 900 km longer. IFS is the province of big stations, and all involved have EME capabilities, but it may just be that no Region 1 stations located at sufficient distances have tried.

Going Forward

In reviewing the ARRLWeb it is clear that more could be added. The question is what the VHF+ community would like to see. Let me give you a few examples. These Web resources could be substantially enhanced and perhaps rearranged by subject, but how many should be added and which ones? A list of contest records currently exists only for the June VHF QSO Party. I would like to see a similar presentation for the January VHF Sweepstakes and the September QSO Party. Perhaps we could also have something like the presentation of the all-time HF Sweepstakes records. I would also like to see a list of maximum QSOs and grids per band broken down at least to the Division level. Some of the information in the column is a useful resource. For instance, I have now added a link to a list of VHF+ clubs. Other pieces of the column could be put on the Web, but which ones? A historical list of major EME stations who are no longer active has been suggested. I think it is a good idea. If someone will take on the project, I will find space on the Web.

While we're dreaming, it would be nice to see a list of numbered VUCCs by band. The 6 meter Standings list quite a few of the active 6 meter stations worldwide. But what of the ones who are not listed? Who are the country leaders on 6 and 2 meters that are not listed?

Are any of the foregoing suggestions of interest? What are your ideas on this subject?

ON THE BANDS

The winter solstice on December 21 is the center of the winter E_s season. While never anywhere as good as the summer season, it can produce some interesting results. As befits perhaps the best summer E_s season in recorded history, this one had a surprise. Read on.

DAN GAUTSCHI, HB9CRQ

Figure 1—The 15.28m dish at HB9Q. The station is available for QRP EME schedules.

DAVE COLLINGHAM, K3LP

Figure 2—W3ARS at FS/W3ARS in November. Clint made 144 QSOs to the US and Canada on the 20th and contacts with South America and the Caribbean on the 24-25th. Later Larry, N7DD, worked over 30 PYs on the 25th.

E_s on 2 meters (and Above)

A strong single-hop E_s session had been occurring on 6 meters for some time on December 29. In the early hours of December 30 (GMT) many stations noticed very short skip. Pat, WA5IYX (EL09), noticed the appearance of stations in the Carolinas and Georgia on 107 MHz at 0155 UTC on the *Propagation Logger* (**dxworld.com/144prop.html**). Immediately afterward Gary, KE8FD (EM84ku), worked John, W5UWB, and a rare 2 meter winter E_s session was underway. Stations from Texas, Oklahoma, Arkansas and Kansas to the west worked into Florida, Georgia, North Carolina, South Carolina and Tennessee. Also unusual was the significant amount of FAI from south Texas into all parts of Florida from the Panhandle south. John, W5UWB (EL17ax), capped off a spectacular year for E_s with 24 contacts in five states between 0155 and 0316 UTC. Two contacts into Florida were via FAI. His ODX was KD4JRX in FM14ab at 2021 km and his contact with K4QI (FM06ja) was the farthest northeast of any during this opening. Perhaps the most interesting contact was the one he did

EME Annual Standings

Published Earth-Moon-Earth annual standings include stations with a minimum number of unique initial contacts as of January 1. For a complete list of all reporting stations check the VHF/UHF/Microwave Standings Boxes at **www.arrl.org/announce/standings**. To ensure that the Standings Boxes reflect recent activity, submit reports at least every two years by e-mail to **standings@arrl.org**. For printed reporting forms, send a request with SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

Call	Initial QSOs	DXCC Entities	US States
6 meters (50 to 50 MHz)			
WA4NJP	39	13	13
K6QXY	31	13	10
W7GJ	30	76	2
W7FN	18	6	5
2 meters (144 to 148 MHz)			
VE7BQH	1301	135	50
N5BLZ	836	101	50
WØHP	665	86	50
WA4NJP	612	76	50
W7FN	459	67	50
K1CA	425	109	50
K6AAW	381	55	48
AA7A	342	54	50
KL7X	296	38	50
WØPT	279	43	32
W5RCI	278	38	50
SV1BTR	250	54	34
WA4MVI	217	59	50
W7EME	204	30	46
W7MEM	203	39	37
W9JN	200	12	43
K8BHZ	195	44	32
K6PF	169	34	43
W7GJ	151	110	50
WA2FGK	150	35	45
AF1T	128	28	46
W8PAT	114	38	28
K1UHF	112	29	20
W3EME	100	26	50
1.35 meters (222 to 224 MHz)			
W5LUA	31	4	35
W1JR	24	3	27
70 cm (420 to 450 MHz)			
DL9KR	774	84	50
KØRZ	312	47	41
W7FN	289	58	50
W1JR	243	41	50
OE9ERC	231	38	28
W5RCI	227	41	47
WA4NJP	202	41	40
W5LUA	201	33	46
KL6M	129	22	28
WA4MVI	115	36	38
K1CA	108	31	30
K4EME	92	22	25
SV1BTR	64	25	17
KJ7F	54	16	18
W7EME	44	15	16
33 cm (902 to 928 MHz)			
W5LUA	9	2	6
AF1T	7	1	6
K2DH	7	2	6
23 cm (1240 to 1300 MHz)			
OE9ERC	279	44	30
W5LUA	220	41	33
HB9BBD	196	36	16
K2DH	156	31	28
KØYW	119	28	22
KL6M	16	6	6
W7EME	13	6	5
13 cm (2300 to 2310, 2390 to 2450 MHz)			
OE9ERC	58	25	9
W5LUA	52	22	10
K2DH	11	8	3
9 cm (3300 to 3500 MHz)			
W5LUA	7	6	2
K2DH	1	1	1
5 cm (5650 to 5925 MHz)			
OE9ERC	25	16	4
W5LUA	21	14	4
K2DH	1	1	1
W7EME	1	1	1
3 cm (10 to 10.5 GHz)			
W5LUA	50	19	7
AA5C	33	16	4
OE9ERC	11	7	3
WA6EXV	6	3	2
1.25 cm (24 to 24.5 GHz)			
W5LUA	3	3	—

—Not given

not make. Carl, AA4H (EM86tn), tried and failed to work John on 222 but a few minutes later, while still listening on 222.110 MHz, Carl heard a short burst of "EL17" while John was trying to work someone else. Carl also notes a 2 meter contact with K5DYY (EL07). Gary, KE8FD, had five contacts all with south Texas as far westward as EL09. Sam, K5SW (EM25hr), reports contacts into EL96 and EL94 (W4WHN) in the Keys, the farthest south station reported. The farthest northwest station seen was KCØHFL (EM17io) in Kansas working W4WHN. All in all, it was quite a show for winter E_s worthy of the remark made by Pat, WA5IYX, on the 2 meter propagation reflector "been on 2-m since 1980, can't recall a Dec event like this."

Six Meters

Reports indicate that continental E_s was observed on at least 14 days: December 7, 12-17, 22, 23, 26 and 28-31. Single hop E_s was the rule as mentioned by Dave, N3DB (FM18); Jim, KG4QWC (FM18); Mark, K5AM (DM62); Chuck, K5IX (EL19); Steve, N5TEY (EM16); Roger, K6LMN (DM04); Jim, KB8GOY (EN72) and Jon, NØJK (EM17). About the only double-hop E_s was Russ, K4QI, into western Mexico on Dec 30 right before he worked W5UWB on 2 meter E_s. Midmonth brought some interesting propagation to VK and ZL. On the 14th, NW5E (EL98) worked ZL4AAA and VK2ZXC. Late the following day and not long after local sundown, the Florida peninsula was strong into VK and ZL, and later western Texas and Arizona made it. KØGU (DN70) had a partial contact with Norman, VK2ZXC, and Dennis, K7BV/1 (FN31), heard Norman weakly in Connecticut. Dave, N3DB, reports a rare tropo opening to Wisconsin well after all the E_s had disappeared on the 14th and an odd backscatter event to W1 with all stations pointed 15° south of VP9 and the VP9 beacon audible.

Tropospheric Ducting

Early December was quite cold to the east, and so tropo ducting was quite limited until later in the month. Gary, KE8FD, reports that he and WO4DX (EM74we) worked Oscar, CO2OJ (EL83td), between 0300 and 0400 UTC on Dec 12 at 1300 km. Early on Dec 16 and extending into the local morning hours of Dec 17, a strong tropo opening developed from as far southward as the Keys—W4SHN (EL94)—up the East Coast as far northward as Russ, K4QI (FM06ja) and from the east coast of Florida westward at least as far as K5UR (EM35). Gary KE8FD reports contacts with NN4AA (EL97qx) on 23 and 13 cm and strong Florida signals up through 70 cm.

Meteor Scatter

The *Geminids* came and went with hardly a murmur on the analog modes—no reports were submitted and essentially no activity was noted. However, FSK441 activity was good, spurred on by the NAHSMS (North American High Speed Meteor Contest) sponsored by the WSJT Group. Shelby reports that Bob, K1SIX (FN43ad), set a new digital North American MS record by working Dave, WW2R (EM13qd), at 2418 km. Tip, WA5UFH, reports that as of Dec 24, the logs reflect a total of 92 unique calls in 69 unique grids, with one Mexican and two Canadian participants. Essentially all activity was on FSK441. One of the larger logs worked 83 contacts on 50, 144 and 222 MHz. QSO breakdowns reported in the current logs are: 232 (144 MHz) 107 (50 MHz) and 14 (222 MHz). John, WA5UWB, made a long 2 meter contact with N3FZ (EN90xh) 2137 km to go along with two other long-range WSJT contacts in the August *Perseids* with KN4SM (FM16qtf) at 2226 km and W3KWH (EN90wj) at 2137 km. The results of this contest will be posted at **www.qsl.net/wa5ufh/Rally/NAHSMS.htm** along with the results of the past three contests.

Microwaves

Mike, KMØT reports working Gene, NØDQS/R in two new grids on 24 GHz at distances up to 183 km, leading to the first VUCC with 10 grids. Al, W5LUA, has 11 grids, 2 on EME, but Mike has the first application to reach the 10 level.

EME

Lance, W7GJ, a leader in digital 6 meter EME contacts, reports insufficient signals for a contact with the Europa TO4E expedition, although he had partial copy with a K index of 6 during the attempt. Lance, Russ, K2TXB, and Hal, ZS6WB, remind us that EME DXpeditions especially in Europe commonly transmit during the first period, regardless of what direction on Earth they are working. This standard should be adopted worldwide if it has not been already.

HERE AND THERE

WSJT Group

The WSJT Group is an organized supporter of digital meteor-scatter communication. Besides the NAHSMS Contest mentioned above, they sponsor Random Hours each Saturday and the Fall/Winter Sprints. Further information about high-speed meteor scatter and the associated Random QSO Award can be found at their Web site **www.qsl.net/wa5ufh/WSJTGROUP/WSJTGROUP.htm**.

Spring Sprints

Do you want to see how well your station is working? Jeff, WU4O, reminds us that the 2004 Spring VHF/UHF Sprints sponsored by the East Tennessee DX Association (ETDXA) begin on April 5. Further details can be found at their Web site **www.etdxa.org**. There will be more information in next month's column.

European EME Contest

This contest sponsored by the German VHF magazine *DUBUS* and the French National Society REF is one of the premiere events on the EME calendar. The first weekend is March 6-7 from 0000UTC to 2400UTC. More information should be available at the *DUBUS* site **www.dubus.org/**.

HB9Q

QRP EME on 432? Dan Gautschi, HB9CRQ, chief operator at HB9Q (JN49cg), is interested in CW schedules with QRP stations on 432 EME.As you can see from Figure 1, HB9Q has one of the largest EME antennas in the world. Running 1 kW into a 15.28 m dish, HB9Q (**www.hb9q.ch**) has a reasonable chance of working typical satellite stations or tropo stations with as little as 50 W into four modest 4-meter-boom Yagis or 200 W into a single Yagi. The station is also available on 144 and 1296 MHz, and it has digital EME capability. Please contact **dan@hb9q.ch** if you would like a schedule.

The MICAMOLD XTR-1 Transmitter and a Real 1940s Station

By Scott Freeberg, WA9WFA

Scott contacted me with the idea of an article on his rare transmitter. Since the XTR-1 that I have is not completely original, I jumped at his offer. And since reading about his, I feel motivated to restore mine and work him on the air.—*John Dilks, K2TQN*

I first saw the Micamold XTR-1 in a *CQ Classics Calendar*. The more I looked at it, the more I fell in love with her simple 1940 lines, modest appearance and minimal parts count. Looking closer, I saw she sported some small luxuries like a built-in power supply, a band switch for 20/40/80 meters instead of individual coils, a pi-network output, a nice looking plate tuning meter and a buffered 6AG7 oscillator to reduce or eliminate chirp. Hmmm, she also sported a 6L6 output tube with an input of 45 W, which is nice enough power for 20 through 80 meter CW.

I contacted the owner of the XTR-1 in the calendar and asked about it. He had not seen or heard of another XTR-1, and I wondered why. I thought it was likely that Micamold sold a ton of these competitively priced transmitters. I started checking magazine ads, asking around, networking and putting out "Want To Buy" ads on the Internet. Two other XTR-1 owners saw my ads and contacted me. No, they weren't selling, but were interested in finding other owners as well. Finally a friend, WØVX, heard about a local XTR-1 and passed along the information to me. I ended up buying that transmitter and I simply couldn't believe my good fortune in finding this rare transmitter.

What the heck was Micamold? Micamold was a major capacitor manufacturer from the 1920s through the 1950s. In the late 1940s they made a brief foray into the transmitter market—apparently very brief, for the XTR-1 was their only ham product I've been able to find.

The typical ham in the late 1940s still built his transmitter, so buying a transmitter kit, even a modest one like this, was likely a big step up. Looking at other transmitters from the same time frame, the buyer could choose from a small variety, including a Meck 60T for $150, Hallicrafters HT-19 for $359, Meissner Signal Shifter for $49.75, WRL Globe Trotter for $69.95 or a Stancor 203A for $44.70. So the XTR-1 was a lower cost transmitter. It still didn't come as a complete kit, as you would have to purchase the tubes, a crystal and key separately.

SCOTT FREEBERG, WA9WFA

Figure 1—The Micamold XTR-1 transmitter, introduced in the late 1940s, is a rare find today.

In early 1948 the bare Micamold would have cost you $34. Buying just a transmitter wasn't going to get you on the air; you still needed to buy a separate receiver. A typical receiver of the time, the Hallicrafters S-40, cost around $110 for a grand total of $150 for transmitter and receiver. Adjusting for inflation, I multiplied by 7.8 and came up with $1170 in today's dollars. An interesting observation is that by 1949, Newark Electronics was advertising the XTR-1 for only $19.95. That's a huge drop from $34. I believe this tells us that by mid-1949 the XTR-1 was already being heavily discounted, and was likely leaving the market after only a short run. Why? I believe that there were better, more affordable transmitters coming on the market.

SCOTT FREEBERG, WA9WFA

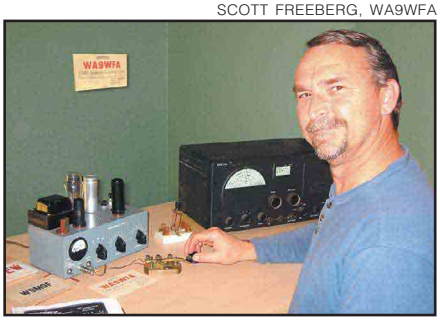

Figure 2—WA9WFA with his Micamold XTR-1 transmitter and vintage Hallicrafters S-40B receiver. In front of the XTR-1 is a solid brass spark-gap Morse code key.

Giles Crabtree, W3PR

It turns out that I wasn't the only one cruising the Internet looking for Micamold XTR-1 information. Giles Crabtree, W3PR, came across photos of my XTR-1 on my vintage Web site (**www.qsl.net/wa9wfa**). His motivation

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GILES CRABTREE, W3PR

Figure 3—The 1948 W9DEW station of Giles Crabtree, now W3PR.

Figure 4—An ad for the XTR-1.

was different than mine: Giles was searching for an XTR-1 in order to recreate his first ham radio station from 1948. Here was a real ham who actually used the XTR-1 when they first came out. I immediately replied to Giles and peppered him with a ton of questions. "When did you use the Micamold? Do you have any pictures of your original station? What was it like to use it on the air? Did you work any DX with it? What was your best DX?"

I was very excited for the chance to hear the adventures from someone who actually experienced using a XTR-1. Luckily, Giles was very happy to share his adventures with me. He sent me a nice letter describing his ham station from 1948 to 1952. He included a photo of the station, a copy of his first logbook contacts and some QSL cards.

He was W9DEW from Peoria Heights, Illinois in the late 1940s and early 1950s. Giles said he had the XTR-1 assembled and ready for the first transmission by March 5, 1948. His first contact was W1CY in Connecticut and later that evening he contacted WØCEN in Davenport, Iowa. Spending all his time on 40 meters, his farthest contact was California. In 1948, 40 meters had no foreign AM broadcast stations to cause interference, so it was likely quite enjoyable. He said 40 meters was all CW then and it was jammed full of CW stations from end to end, resulting in a lot of interference. Giles told me that he and his Elmer, W9BMD, were in the shack on December 7, 1941 after Pearl Harbor was bombed. They were on 160 meter AM phone and wondering if they should be on the air or not. Official word came out the next day that ham radio was to be shut down for the duration of World War II.

The W9DEW photo shows his ham station in 1948. This is what a modest commercial station that was capable of working around the world looked like.

Giles describes his station:

> The receiver is a Hallicrafters S-40 with the green plastic dial. I purchased it in the spring of 1946 with money I received at discharge from the Navy. I think it cost $79.50. It wasn't too selective but did the job. I had to listen to several stations and copy the one I was working, using the "brain filter." I later built a Heathkit Q-Multiplier and that was a great improvement. On top of the receiver is a VFO I built from an article in Sept 1946 *QST*. To the right is a control panel with an open knife switch main switch, a line voltage meter and transmit/receive switches with large red and green "jewel" pilot lights—used mostly to impress visitors! The XTR-1 is at the far right on the table. Also on the table is an ashtray, logbook, pencils and key. All the QSL cards on the wall were from contacts made with the XTR-1 and Hallicrafters S-40.

Scott Freeberg, WA9WFA, is an ARRL Life Member and has been licensed since 1968. An avid Boat Anchor collector since 1996, besides this Micamold station he enjoys operating his Johnson Viking Ranger transmitter and Viking Courier amplifier and his classic Collins 75A2 CW and AM receiver. He was a radioman in the Navy during the 1970s, and is now an engineer designing pacemakers and programmer systems for a major medical manufacturer.

Scott said, "I know of only four other XTR-1 owners. I wonder where the rest of them are. If you own one, or you know of someone who does, I'd love to hear from you to compare notes and information. It would be nice to find out just how many XTR-1s are still out there, and still on the air. I'd also like to find out more information on the Micamold Company's transmitter venture." You can e-mail Scott at **wa9wfa@qsl.net**.

If you want to see additional Micamold transmitter material plus the rest of Giles' XTR-1 history, you can visit Scott's vintage Web site, **www.qsl.net/wa9wfa**. *He will have the Micamold schematic diagram, factory parts list and more close-up photos of the XTR-1 there. He'll also add more Micamold information as it comes in.*—K2TQN

Doubling the Ham Population of Albania while Having Serious DX Fun

By Martti J. Laine, OH2BH

It was another brisk November day in Tirana when a multinational task force arrived there to undertake several interesting Amateur Radio-related sub-projects. A group of 41 specially chosen and eager Polytechnic University of Tirana fourth and fifth year students was ready to learn the magic of Amateur Radio as another course of their regular studies and to meet many hams from a variety of countries and cultures. In total, more than 40 hams were invited to take part in this historic undertaking under the watchful eyes of Albanian telecom and education administrators.

Two Basics

It is understood by all that Amateur Radio is in competition with numerous exciting educational hobbies with no entry barrier, so our natural intake of future Amateur Radio operators is decreasing sharply. Offering a professionally organized entry to our world is a key to our future success. In Albania, the highest level of education was approached with the incentive of elevated course credit offered for a foreign language course. Each and every student applied. We had won the first battle of the competition.

For much of our future, we should draw a profile of the people we need to be able to safeguard this great hobby of ours. The age group of 21-22-year olds was chosen, with language capability and the desire to study electronics and telecommunications—the fundamentals of Amateur Radio. These students will have a profile for international Amateur Radio—we should all consider what our formula for success is to spur sufficient interest among the people we would like to invite to our ranks, now that the natural intake has diminished.

Educational Structure

We were very fortunate to draw the best possible academics from our ranks to secure continuity of the educational stream and sometimes be able to delve much deeper into our subjects than is required typically in basic Amateur Radio education.

John Share, G3OKA, and Uli Weiss, DJ2YA, together with a local teacher and soon-to-be ham, Sonila Agako, ZA1YL, made that happen. But another very important "second stream" of motivation was required to provide hands-on practical experience with our subjects and, even more importantly, learn about Amateur Radio's role in society at large.

It was rather interesting to see that there were an unlimited number of hams from many countries ready to fly to ZA-land at their own cost to be on site to support this very important "second stream." We were very proud to present more than 10 nationalities with a variety of messages from all walks of life. It was Giorgio Goggi, I2KMG, who had the university faculty as well as the students listening with serious attention when he presented the discovery of electromagnetic waves and their role in shaping the evolution of the universe, at least for the time being. While the students studied antennas and propagation theory under Carl Luetzelschwab, K9LA, a sense of excitement filled the air.

On-the-Air Fun at ZA1A and ZA1UT (University of Tirana)

What motivated those 40 hams to visit ZA was in part the fact that Albania is still much sought-after on the bands as a rare country on a number of modes, including the excitement of ZA1A showing up in the CQWW Contest and making ZA available on all bands. We would all like to be once in the limelight of a DX pileup—on stage, so to speak.

Many of the teachers took a weekend off and moved to the seaport city of Durres where the major operating site was located as an addition to a powerful station at the Tirana hotel. While ZA was active with

DL6LAU

Figure 1—At the front table at the opening ceremony (from left): Eduard Andoni, Vice Minister of Education; Martti Laine, OH2BH; Spartak Poci, Minister of Transport and Telecommunications; Perparim Hoxa, Rector of the Polytechnic University, and Giorgio Goggi, I2KMG.

Figure 2—The Amateur Radio-related program was extended by sharing the experiences where this passion can lead in life and its role in society. From left: Paul, WF5T; Carl, K9LA; Vicky, AE9YL; Dan, NA7DB; Warren, K7WX, and Barb, wife of K7ZV in front of the class.

Figure 3—The course lead-teacher handover from John, G3OKA (left) to Uli, DJ2YA while the local teacher, Sonila Agako was in between to secure a smooth transition and continuity. Geni Mema, ZA1B (right) made sure that all local arrangements would jell.

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Figure 4—A line-up of a small beach hotels were used to facilitate a six-station activity for the multinational contest effort as well as for student's hands-on practice. Selection criteria was based on the quality of electricity from their generator.

Figure 5—Eric, K3NA (left) and Pertti, OH2PM, were definitely "movers and shakers" at ZA1A. Eric led the complex *WriteLog* logging network build-up over the microwave link while Pertti spent several weeks in Albania getting all the logistics in place.

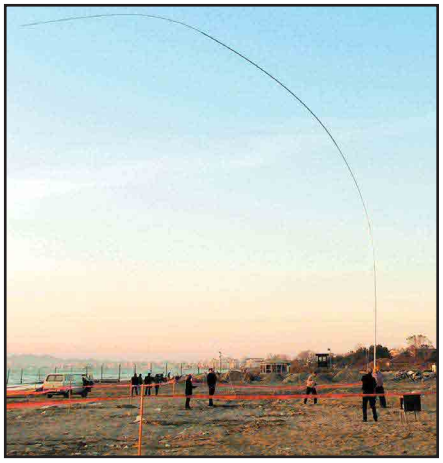

Figure 6—Is it going up or just flying away? Rich, K7ZV had built the phased verticals in such a way that they not only survived the terrible weather but also boosted the low-band signals to an impressive strength. It was low-band magic at the Adriatic coast!

meteor scatter on 2 meters and PSK31 on HF, the highest penetration was probably provided on the low frequencies (160 and 80 meters), where Albania was still rare.

The US operating team led by Robin Critchell, WA6CDR, and Rich Chatelain, K7ZV, built up a major low band antenna site with phased verticals. It was no wonder that DX contacts were easy to come by. Working through to the US West Coast via long path needs a lot of hardware and a serious effort. In all, 85,000 QSOs were made during the program—of these some 15,000 at ZA1A during the CQWW CW Contest by multi-national group. The entire contest site was used as a training ground following the contest, providing Albanian students with a welcome break from a classroom setting.

About the Project Team

Project Goodwill Albania 2003 was the brainchild of Martti Laine, OH2BH, in his mission to promote Amateur Radio through DX. He secured a powerful international task force of Geni Mema, ZA1B; Ole Garpestad, LA2RR; Pertti Simovaara, OH2PM; Carsten Esch, DL6LAU; Roger Brown, G3LQP; Giorgio Goggi, I2KMG; Toni Linden, OH2UA; Warren Hill, K7WX; Angel Padin, EA1QF, and many others who traveled to Albania and represented the International Amateur Radio Union (IARU) and its member societies, and made this happen.

Credit is also due to the Northern California DX Foundation, Yasme Foundation, Radio Society of Great Britain, Vertex Standard (Yaesu) Co Ltd, and Allen Baker, W5IZ, for contributing to this project.

All Fun Comes to an End

It came as no surprise that 39 students passed a full CEPT A level license exam and are now ready for the bands. But it was also extraordinary what 40 volunteer Amateur Radio operators carried back home. It was a once in a lifetime, highly emotional experience that would make us all very different persons. It makes us all think differently about Amateur Radio and particularly about the DX that we are all very fond of. The entire University staff was stunned. What made these very professional Amateur Radio operators act like this? Why were they doing things like this? Should they come back soon? Could we indeed incorporate Amateur Radio as a permanent course into our official syllabus?

Ole Garpestad, LA2RR, Chairman of the International Amateur Radio Union, Region 1, put it nicely in his closing speech: "Successful cooperation between University, Telecom Administration and the Amateur Radio team will set an example of how to boost Amateur Radio among young people in many other countries."

Soon, these 39 students will be there locally to represent our ranks, and hopefully they will carry Amateur Radio in Albania to new heights. Sharing this experience globally may have prompted some other Amateur Radio operators to try out the potential domestic or international powers of the DX community or other communities willing to live up to the task of protecting Amateur Radio for the future.

Figure 7—The graduation ceremony followed academic procedure. Ole Garpestad, LA2RR, IARU Region 1 Chairman, welcomes students on the bands and congratulates the project organizers for taking Amateur Radio systematically to a university setting.

Figure 8—Best Student of the course: Eugelent "Geni" Kola, ZA1BS, and his new radio, a Yaesu FT-847 transceiver. The BS in Geni's call obviously stands for Best Student.

The Last Call is Yours

If you wish to discover the essence of Project Goodwill Albania 2003, take a look at the Web site **www.za1a.com**. If you wish to be part of this undertaking, you may go straight to the profiles of 39 Albanian Amateur Radio graduates, their call signs and ambitions in life in their evolving society; for background, see *QST*, June 2003 and November 2003. Ultimately, you may wish to encourage one of these students to become active on the bands by helping with their radio equipment needs, which are still out of reach for Albanians (see **www.za1a.com/help/help.htm**).

Or, maybe establishing a personal contact in Albania can be beneficial to you or to your radio club regardless of your specific interests in Amateur Radio. Our future lies entirely in our own hands—let innovation be a key in Amateur Radio the way it has always been.

All photos by the author, except as noted.

Microwave Low Noise Amplifiers—*Part 2*

In the first installment of Microwave LNAs (January 2004 *QST*) we explored circuits and construction. While writing this installment, I discovered that it would take several issues to do at least a minimal job of explaining noise and system performance. So, please forgive me in advance for stretching the topic over so much time.

In order to decide whether we should spend the extra money and effort to obtain that last tenth of a decibel of noise figure, we will look at what these numbers mean and what is happening in front of the LNA. I wish to also mention that the equations and tricky concepts in this and subsequent columns might seem daunting. This column gets the most positive feedback when it bends toward the technical, and although some of this may be new to you, it is probably no more complicated than problems on your license exam—so here goes.

Gain and dB

The important characteristics of LNAs are gain and noise figure. In order to be useful, LNAs must amplify at the frequency of interest, and not oscillate. The gain, usually measured in the logarithmic scale of dB, is a measure of the output power relative to the input power. We want our LNAs to have sufficient gain to overcome losses that come after the LNA, but not so much gain that its components will distort the signal or overload the subsequent stages. Our ability to copy a signal compares the noise to the signal, hopefully ending up with more signal than noise. The signal-to-noise ratio can be expressed as a linear factor or in decibels.

Noise Figure and Temperature

The noise figure is also expressed as dB, but relates to the power radiated by objects at a "standard temperature," which is usually 290 kelvins (the Kelvin scale starts at absolute zero) or just about 62°F. Some texts will use 293 or 295 K because it is closer to room temperature, but the IRE (and therefore the IEEE) adopted standard is 290 K.[1] The results are nearly the same. It is helpful to understand the concept of noise figure and temperature, so here is a brief explanation.[2]

Every object in the universe emits broadband electromagnetic radiation. Both the amount of that radiation emitted, and the upper frequency at which it stops, increase with temperature. This is a property of physics—as described by Planck's radiation law. At all temperatures that we deal with, and frequencies below a few hundred GHz, the power of the emitted radiation is directly proportional to the temperature. (Some objects are more reflective than others, and just like a mirror reflects the scene around it, perfectly reflective objects have an apparent temperature of the objects they reflect.) We can conduct an experiment with an enclosure, lined with good absorber (which because it is non-reflective, is also good "emitter") and kept at 290 K. Into this enclosure we place an antenna and measure the power at the antenna terminals. Regardless of the frequency or size of the antenna, we would measure –173.98 dBm ($10^{-17.4}$ mW) of power over each Hz of bandwidth. Temperature is a linear measure of power, so twice as many degrees represent twice the power.

It turns out that a matched resistor (usually 50 Ω) also at 290 K, if substituted for our antenna and room will produce exactly the same power level. This power level is the standard-temperature power that is referenced when we describe the noise figure of an LNA.

Noise Figure Example

When an LNA, with its input properly terminated to a resistor at 290 K produces exactly twice as much output noise as it would if it were only amplifying the input noise from the resistor, we say that the LNA has a noise figure of 3 dB. We would also say that it has a *noise factor* of 2 (noise factor is the linear version of noise figure). To avoid confusion, the rest of this column will use noise figure (not noise factor) because it is the most common way of expressing LNA noise. In the next column, noise factor will reappear.

The output we measure in this case has exactly twice the power than we would expect if the amplifier were contributing no noise itself, and a linear factor of two is 3 dB ($10 \times \log(2) = 3$). In this situation, the LNA output has half of its power coming from the resistor and half from the noise generated in the amplifier. Although the amplifier-generated noise might come from places other than the input circuit, we treat the LNA as though all the internally generated noise at its output were coming from its input circuit and amplified with the same gain as the input signal. This way the gain and the noise are separate quantities, both relating the output to the input.

If there were no noise being contributed by the amplifier, then the output would simply be the terminating resistor

The Decibel...

Recall that a decibel is one tenth of a bel, and that one bel represents a power ratio of 10. So, an amplifier with a gain of 20 dB would have an output that is 100 times the power of the input (10 raised to the 2.0 power is 100). In another example, a linear gain of 50 would be about 17 dB (because 10 times log(50) is 17). dB is a power ratio, so for amplifiers we measure the ratio between the output and input power as the gain, and for signal-to-noise is the ratio between the signal and the noise. The formulas are:

$$\text{Gain}_{dB} \quad 10 \cdot \log\left(\frac{P_{out}}{P_{in}}\right)$$

$$\text{Signal-to-noise}_{dB} \quad 10 \cdot \log\left(\frac{P_{signal}}{P_{noise}}\right)$$

$$\text{Gain}_{linear} \quad 10^{\frac{\text{Gain}_{dB}}{10}}$$

$$\text{Signal-to-noise}_{linear} \quad 10^{\frac{\text{Signal-to-noise}_{dB}}{10}}$$

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power (times the amplifier gain) times the linear factor of 1. We would characterize this fictitious (perfect) LNA as having a noise figure of 0 dB. This is 0 dB because the output power is a linear factor of 1 times the input resistor power (times the gain), and $10 \times \log(1) = 0$.

Noise Temperature Example

Another way of expressing the noise of an LNA is by its apparent *noise temperature*. Here, the LNA is characterized by the equivalent temperature (in kelvins) that a properly matched input resistor (or enclosed antenna) would have to be set to in order to produce the same power if the LNA had no internally generated noise at all. In the case of the 3 dB noise figure LNA, we would say that it has a noise temperature of 290 K. If a (perfect) LNA had no noise contribution, its noise temperature would be 0 K. Just as with noise figure, we pretend that all the LNA generated noise is present at its input and amplified along with the input signal and noise.

Amateur radio LNAs and microwave receivers are most often characterized in dB noise figure, whereas satellite LNAs and systems are most often characterized in noise temperature. There are exceptions, and some are characterized both ways. As you will see below, there are times when it is more convenient to think of LNA noise one way than the other. In fact, to comprehend and calculate realistic situations, both measures are sometimes used. See the equations and Table 1 to convert between these measures.

Table 1
Some Noise Figures and Equivalent Noise Temperatures

Noise Figure (dB)	*Noise Temperature (K)*
0	0
0.3	21
0.6	43
1	75
1.3	100
1.6	129
2	170
2.3	202
2.6	238
3	290

You can easily convert between noise figure and noise temperature. Noise figure is a logarithmic measure, in decibels. Noise temperature is a linear measure, in kelvins. To go from noise figure to temperature use this formula:

$$T[\text{Kelvin}] \quad 290 \times 10^{\frac{nf[dB]}{10}} - 290$$

To go from temperature to noise figure, use this formula:

$$nf[dB] \quad 10 \times \log\left(\frac{T[\text{Kelvin}] + 290}{290}\right)$$

Are LNAs Needed?

So, just when are LNAs useful? They can be expensive, especially at the highest frequencies and lowest noise figures. The only way to really understand the value of an LNA is to put one into service and measure the performance before and after. Short of this, it is often very instructive (and cost effective) to analyze the system, and predict performance before spending money or effort.

Just how does the installation of an LNA in your system improve performance? Of all the things that bear on the analysis, two are probably the most important. The first is the temperature of the area where the antenna is pointed. The second is loss—and the most important losses are those between the antenna and LNA, and from the LNA output to the next electronic stage, usually a mixer or additional amplifier. The next installment of this column will deal with losses. For simplicity, let's assume that there is sufficient gain in the LNA to overcome performance weaknesses in subsequent receiver stages, but not too much as to introduce distortion, and concentrate on understanding LNA noise effects.

The Temperature your Antenna "Sees"

Most of us who are eking out another contact on the microwave bands communicate terrestrially, that is, point our antennas toward other places on Earth. Some of us are not, because we are pointing into space at active or passive satellites (e.g. OSCAR or the Moon). First, let's examine the situation where the antenna is pointed into space. The majority of the beamwidth of the antenna is subtended by empty space. Except when the antenna is pointing at the energetic galactic center or the Sun, the noise (temperature) from space is quite low, and because the antenna is pointed up, the beam penetrates only a few miles of atmosphere.

The temperature a perfect antenna sees will be under 8 K from 1 GHz to 10 GHz when pointing at angles from straight up to 60° down from zenith, and rises as the beam approaches the horizon and encounters more atmosphere. Real antennas, because they receive some energy from sidelobes, will see slightly higher temperatures of about 15 K. The signal from the satellite, even if very weak may still be stronger than the extremely low thermal noise entering the antenna. This is important to satellite broadcasting. A reasonably sized satellite-borne transmitter provides sufficient energy to cover most of a continent because the background noise experienced by the up-pointing receivers is so low. Mass production of these receivers is a contributing factor to the availability of inexpensive components that achieve low noise in the microwave region.

An LNA that adds minimum noise will be very useful in amplifying these weak signals, keeping the signal stronger than the combination of noise from the antenna and from the LNA. In fact, the lower the LNA noise, the better, until the LNA's input noise is at or below the noise that the antenna sees. The very best practical LNAs in the 1 to 10 GHz region have noise temperatures of about 20 K, and therefore generate at least slightly more noise than a space-pointed antenna receives.

Compare the space situation to a terrestrial one. Now we are pointing at the horizon, so half of the beamwidth is occupied by warm Earth and the other half by dozens to hundreds of miles of atmosphere before it "sees" cold space. The noise power at the antenna will vary with frequency, because the emissions of the atmosphere also vary with frequency. The minimum total, if the atmosphere were completely transparent, would be 150 K, but in temperate climates the noise power would typically be equivalent to over 200 K. If it is a warm and moist day, it will approach 290 K, perhaps even be exactly that number. The signal must be stronger than this background thermal noise in order to be heard—even with a perfect LNA that introduces no noise at all. Any additional electronic noise will further mask the signal.

Next Time

In the next few columns we will continue our LNA understanding by looking at the loss in front of the LNA (between the antenna feed and the amplifier), and review the complete microwave receiver to see where performance problems might exist, including a calculation of total noise figure.

I wish to thank Paul Wade, W1GHZ, and Jim Mead, WB2BYW, for their help in reviewing this column.

Notes

[1]"Noise Figures of Radio Receivers," *Proc of the IRE*, July 1944, pp 419-422, by H. Friss, is the definitive paper for those interested in the scientific and mathematical relationships that establish noise figure and factor measurements.

[2]Agilent Technologies, Inc, has an excellent application note on noise figure measurement. If you want a copy, go to **www.agilent.com/** and enter "AN 57-1" into the search box. QST

Getting On-line with *Linux*

During the last winter solstice, I broached the subject of *Linux* for hams in "Surfin'," the weekly column I write for the ARRLWeb (**www.arrl.org**). In the days that followed the posting of my *Linux* Surfin' columns, I received more mail than about anything I have written in over a quarter of a century. Most of the writers were happy to see something in the Amateur Radio press about *Linux* and encouraged me to write more about the subject. Since this column provides more space than Surfin,' I will write more about *Linux* here.

For starters, "*Linux* is a free *Unix*-type operating system originally created by Linus Torvalds with the assistance of developers around the world. Developed under the GNU General Public License (**www.linux.org/info/gnu.html**), the source code for *Linux* is freely available to everyone," according to The *Linux* home page at *Linux* Online (**www.linux.org/**).

The N9NU.net *Linux* 4 Hams Web page (**www.n9nu.net/linux/linux.php**) is a great place for information about using the *Linux* operating system for Amateur Radio applications, specifically for folks using the Mandrake 9.x distribution of *Linux*. The page includes software installation tips and news regarding the latest Mandrake distribution and describes the various *Linux* Amateur Radio applications that are available. Each description includes links related to the application, for example, links for downloading the application files and links to other Web pages that support the application. There are applications for antenna modeling, APRS, AX.25 packet, beam heading, call-sign server, contesting, DX packet cluster, GPS, grid locating, Morse code training, propagation predicting, PSK-31 and other digital modes, rig control, RTTY, satellite tracking, SSTV, TCP/IP packet, WEFAX and more.

The big attraction is that the *Linux* operating system and the ham-radio applications that you run with it are free! How "free" depends on how you get *Linux*. Typically, it is free if you download it, but if you want it on a CD, you pay for it. For example, the Mandrake 9 distribution is free if you download it from **www.mandrakelinux.com/en/ftp.php3**. I checked some of the other distributions of *Linux,* and they, too, are free if you download them. For example, you can download the Debian distribution from **www.debian.org/distrib/**, the Red Hat's Fedora distribution from **fedora.redhat.com/download/** and the SUSE distribution from **www.suse.com/us/private/download/suse_linux/index.html**. Daniel Gunderson, N9MUF, suggests visiting **www.linuxiso.org** where you can download the many distributions of *Linux*.

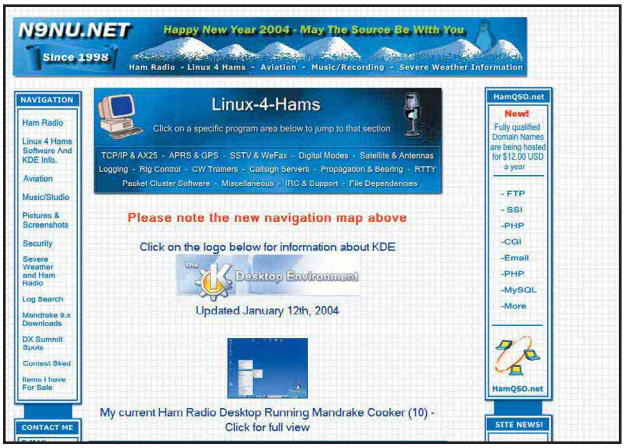

Figure 1—The N9NU.net Linux 4 Hams Web page (www.n9nu.net/linux/linux.php) will help you get up and running ham radio software on the *Linux* operating system.

What's a Distribution?

So what's with all these different distributions of *Linux*? Texx Woodworth, KG6ATH, explains, "Several of us sat down recently to count the number of *Linux* distributions. We lost count after 300 distributions."

"The *Linux* kernel is the heart of the operating system and it's pretty similar in all the distributions. Your local machine may need a kernel tweak here and there for your local hardware, but the base code is the same.

"Where the distributions differ is what user applications they include. Most *Linux* distributions include at least some of the ham radio applications."

A plug for the Debian distribution is in order because it is probably the most ham-radio oriented distribution. Jaye Inabnit, KE6SLS, points out that ham radio applications are prepackaged with Debian and "can be automatically downloaded and installed with a simple click of a button (or command line for geeks like myself!). There is also a bootable Debian Ham CD (**debianham.sunsite.dk/**) tailored to contesting. Exciting stuff really!"

Kris Gainsforth, KBØSTG, wrote, "I have been using *Linux* for almost as long as I have been on the air, and *Linux* fits in perfectly with the do-it-yourself attitude of hams. It's great that I can take the software as-is, or learn how it works, then reprogram it to fit my needs. If more hams would look at *Linux*, there would be a great platform to help push the hobby into a new and more connected direction."

However, installing *Linux* on a computer is not for the faint of heart. Eric Branson, KG6SHB, admits, "Many hams will still be hesitant to try and install an unknown (and quite difficult for beginners) computer operating system." He suggests trying one of the LiveCD distributions of *Linux* that load into your computer's RAM leaving your hard disk and installed operating system untouched, yet giving the user a fully functional, competitive operating system with a beautiful GUI. This permits you to run *Linux* without upsetting the Apple or Windows operating system already installed on your computer. Some popular LiveCD *Linux* distributions are Gentoo (**www.gentoo.org/**), Knoppix (**www.knoppix.net/**) and SLAX (**www.slax.org/**).

How Do You Say "*Linux*?"

Here is some *Linux* trivia: There are varying opinions on how to pronounce "*Linux*." I have heard the "lin" in "*Linux*" pronounced with a short "i" as in "Linda" and with a long "i" as in "line." Both are incorrect. According to Linus Torvalds, the father of *Linux*, the "i" in *Linux* is pronounced like a long e, that is, "lee-nux." (Go to **www.paul.sladen.org/pronunciation/** and hear Linus pronounce it himself.) QST

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India's Hamfest 2003 a success

The "Dayton Hamvention" of India was held November 8 and 9, 2003, at the town hall in Gandhinagar, the capital city of Gujarat. The 13th Hamfest of India was attended by about 450 people from all over the country. It was organized by the Gujarat Institute of Amateur Radio with assistance from members of the National Institute of Amateur Radio. Organizers called Hamfest "a festival wherein individual hams, clubs, and national associations attend as one group leaving aside their individual affiliation." Hamfest is an annual event with its beginnings in 1991, and features exhibitions, technical presentations, flea markets and equipment and operational demonstrations. The Best Presentation Award went to Mr S. Suri, VU2MY, and Mr R. Sarath Babu, VU3RSB, for their presentation "Echolink: A New Revolution in Amateur Radio." Other presentations covered national disaster communications planning, electrical components, AMSAT India transponder, computer interfacing, antennas, and internet via satellites.

Hamfest India 2004 (date(s) to be determined) will be held in Mumbai (Bombay) and organized by the Mumbai Amateur Radio Society **www.mumbai-hams.org/**.

VU2SLL

Figure 1—A ham family gathers during the Hamfest (l-r) Saleel, VU2SLL; Saleel's father, VU3YGN; Artee, VU2RTE; her husband Pradeep, VU2PCD, and Deepak, VU2DCD.

Briefs

IARU Region 1 recognizes WRC-03 contributions of Jan Verduijn: International Amateur Radio Union Region 1 (IARU-R1) has honored Jan Verduijn of the Netherlands Radiocommunication Agency with the IARU Region 1 Medal. IARU-R 1 Chairman Ole Garpestad, LA2RR, presented a medal and certificate October 22 during the Dag voor de Amateur (Day of the Amateur) sponsored by the VERON (*Vereniging voor Experimenteel Radio Onderzoek in Nederland*), the Netherlands' IARU member-society. Verduijn, who was CEPT coordinator and spokesman for the 7 MHz agenda item (Agenda item 1.23) at World Radiocommunication Conference 2003 (WRC-03), was recognized for his outstanding work in preparation for and during the conference. "Jan was totally committed to finding a solution, not only for radio amateurs but for broadcasters and the fixed and mobile services as well," said an IARU-R1 announcement. "His dedication, extremely hard work and not forgetting his outstanding diplomatic skills were a major contribution to the successful outcome of WRC-2003 Agenda Item 1.23 for the Amateur Radio community."—*IARU*

IARU

Figure 2—Jan Verduijn (right) receives the IARU R-1 certificate from IARU R-1 Chairman Ole Garpestadt, LA2RR.

Wireless Institute of Australia hosts "Welcome to HF QSO Party" on January 1: On New Year's Day 2004, all Australian radio amateurs, whether or not they had passed a Morse code examination, gained access to the high-frequency (HF) bands. The Wireless Institute of Australia (WIA) sponsored the on-air celebration to mark the occasion. VK radio amateurs appearing on HF bands for the first time will have three-letter call sign suffixes beginning with H, T, U, X, Y or Z. There's more information on the WIA Web site at **www.wia.org.au/**.

In other news from Australia, Australian Amateur Radio operators have been authorized to use additional frequencies on 75 meters. VK stations now may operate between 3776 and 3800 kHz. And the Australian Communications Authority has announced the elimination of the Morse testing requirement starting January 1, 2004. "This decision was made considering public comments at the meetings and initial analysis of submissions to the discussion paper," the ACA said, adding that it would make interim changes to its rules to allow immediate access to privileges previously available only to those satisfying the Morse code proficiency requirements. The change will give holders of Intermediate and Limited Amateur licenses access to the same frequency bands as Unrestricted Amateur licensees, and holders of the Novice Limited Amateur license access to the same frequency bands as Novice licensees. The Wireless Institute of Australia says dropping the Morse requirement will mean no changes in existing licenses or call signs.

CW testing requirements falling all over the globe: Countries whose governments have decided to eliminate the Morse code exam from their requirements and/or grant access to the HF spectrum for licensees without CW exam credit include: Australia, Austria, Belgium, Denmark, Finland, Germany, Ireland, Luxembourg, Netherlands, New Zealand, Norway, Papua New Guinea, Singapore, Switzerland and the United Kingdom.

IARU-R1 and CEPT Electronic Communications Committee to cooperate: International Amateur Radio Union Region 1 (IARU-R1) and the Electronic Communications Committee of the European Conference of Postal and Telecommunications Administrations (CEPT) this month signed a Letter of Understanding. The LoU sets out a number of areas for cooperation between Region 1 and CEPT whereby both entities "will work toward common European approaches on radio matters and will exchange information and hold meetings for this purpose," IARU-R1 said in a news release. The LoU, initially for a three-year period, is renewable by mutual agreement. IARU Region 1 Chairman Ole Garpestad, LA2RR, said the Letter of Understanding "reinforces the already positive and constructive working relationship between IARU Region 1 and CEPT."—*IARU*

Radio Amateurs of Canada announces 2004-2005 executive officers: The Radio Amateurs of Canada (RAC) Board of Directors has announced the organization's executive officers for the 2004-2005 term. The board elected Daniel Lamoureux, VE2KA (ex-VE2ZDL), to succeed William Gillis, VE1WG, as RAC's president. Gillis decided not to run for re-election. Lamoureux outpolled Robert Burns, VE1VCK—the only other candidate for RAC president—by a 4-3 vote. An ARRL member, Lamoureux is the longtime RAC Director from Quebec and has been an RAC delegate to the past two IARU Region 2 Conferences. In 2001 he qualified to teach the United States Telecommunications Training Institute Amateur Radio Administration course. He also has been active with the Amateur Radio on the International Space Station (ARISS) program. Other executive officers elected without opposition include Robert Nash, VE3KZ, first vice president; James Dean, VE3IQ, vice president regulatory affairs; Pierre Mainville, VA3PM, vice president field services and international affairs; and Noel Marcil, VE2BR, secretary. The RAC says there were no eligible nominees for the position of treasurer, which is declared vacant as of January 1. QST

Reconstituting the Packet Network

By John Clifford, KD7KGX

Emergency communications is often presented as the primary reason for the existence of the Amateur Radio Service and our exclusive access to reserved frequencies. Especially in this day and age, when terrorism has replaced the various natural disasters as the primary threat in our lives, the ability of Amateur Radio to supplement our regular means of communications in the event of a major calamity is a real benefit that we provide to our fellow citizens. However, in the past decade we have let one of our primary assets, the packet radio network, waste away to a point where it is more of a plaything than a valuable nationwide communications network. I believe that we need to change this, and reconstitute the amateur packet radio network quickly…and make it better than it ever was.

Killing Two Birds with One Stone

The ARRL has realized that, without new hams, Amateur Radio's days are numbered. While there are more hams now than ever before, the majority of today's licensees are Technicians without HF privileges and many let their licenses lapse after the initial 10 year period. In order to increase the number of new hams, and to get younger people involved in Amateur Radio as a lifelong activity, the ARRL has created the Amateur Radio Education and Technology Program.[1] Also known as "The Big Project," its purpose is to encourage teachers to use Amateur Radio as a tool in the classroom.

The Stations in Schools program is a key part of The Big Project. Qualifying schools are provided with complete Amateur Radio stations, at no charge. Here's where we can kill two birds with one stone. *Provide a complete 9600 baud packet radio node to each Station in Schools participant* that is set up and ready-to-go out of the box. Imagine how quickly the packet radio network could be re-established if one school in each community had a packet radio node!

Fixing Packet Radio

Of course, we need to look at more than just sheer availability of nodes to reconstitute the packet radio network. Our goal should be to create a national network of packet radio nodes that allows transferring messages between every community in the country without using non-Amateur Radio infrastructure (like the Internet). We had a network before and it withered away from lack of use. So, how do we change things so that this doesn't happen again?

First, *we need to increase the rate at which data is transferred*. After using the Internet at 56k or running DSL, the current VHF-based 1200 baud packet radio network is excruciatingly slow. However, being text-based, it doesn't have to be *that* much faster to *feel* a whole lot faster. How fast is fast enough? Fast enough so that text appears on your screen at a faster rate than you can read. If the packet radio network ran at 9600 baud (960 characters per second) that would be fast enough. So…we go with 9600 baud modems, which are widely available at inexpensive prices[2] so current packet radio operators can easily upgrade. One benefit: 9600 baud FSK packet radio modems are slightly more spectrum-efficient than 1200 baud AFSK modems, resulting in less interference to others.

Second, *we need to increase the number of amateur stations that are equipped to run 9600 baud packet radio*. One way might be to require ARES organizations to establish 9600 baud packet radio nets and run them on a weekly basis, perhaps after the traditional VHF voice repeater-based net. Another might be to award significant bonus points to Field Day stations with 9600 baud packet radio stations that make contact with at least one EOC. Perhaps the ARRL can create an award for receiving a message via 9600 baud packet from each state, a Packet Radio Worked All States (PWAS) award—no Internet forwarding allowed! And, special recognition should be given to each 9600 baud packet radio node that can send a message to the ARRL's W1AW 9600 baud packet radio node *without* having to piggyback that message onto the Internet.

Third, *we need to better integrate packet radio with our computers*. Although the new network will *not* be the Internet, that this is so should be relatively invisible to us as users. We need to develop the necessary software to allow common e-mail programs like Microsoft's Outlook Express and Outlook, and Qualcomm's Eudora, to send and receive e-mail via packet radio. We also need to develop the necessary software to allow us to read and post packet radio bulletins, and upload and download files, via our Web browsers. We should also create a chat tool that automatically determines the routing from our station to a desired node and then establishes the link, so that chatting with users a long distance apart is much easier.

Summary

Let's fast-forward to the near future, when the High Speed Amateur Packet Radio Network is fully functional. A hurricane devastates south Florida…but amateurs are quickly on the air, and the new network quickly and efficiently relays health and welfare messages. A massive earthquake rocks the Pacific Northwest, knocking out phone communications and closing highways…but amateurs are able to communicate from emergency shelters via the new network, sending long lists of shelter residents, detailed requests for food and medicine, and health and welfare messages. A combination of computer viruses and physical attacks from terrorists manage to destroy several crucial Internet backbone sites and shut down the Internet, but the new network allows Homeland Security agencies to utilize ARES and RACES organizations and transfer important information.

I fervently hope that as amateurs we are *never* required to use any of our resources for emergencies, but "stuff happens" is an unfortunate truth. Wouldn't an Amateur Radio-based alternative to the Internet be an enjoyable resource for us, and a valuable tool for our country? Let's build it now!

John Clifford Jr, KD7KGX, has been licensed since August 2000. His main interests are in HF QRP CW and the various digital modes. He's worked at a variety of development and management positions at several startup and established companies since the early 1980s. He retired from the software industry in 1994 to try his hand at entrepreneurialism. You can reach the author at 12727 NE 32nd St, Bellevue WA 98005; **kd7kgx@arrl.net**.

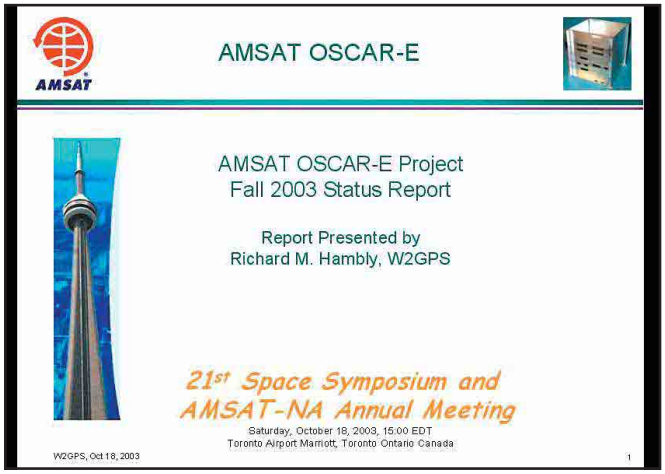
[1] **www.arrl.org/FandES/tbp/faq.html**.

[2] "9600 Baud Packet Handbook," Mike Curtis, WD6WHR, at **www.tapr.org/tapr/html/pktf.html**.

Echo to Launch this Month!

The amateur satellite community has been eager for a new low-Earth-orbiting bird. With the failure of popular LEOs such as RS-12/13 and UO-14, hams with minimal satellite capability have seen dwindling options. But, if all goes as planned (never a "given" in satellite work!), a powerful new satellite will soar into orbit at the end of March: Project Echo.

Project Echo from AMSAT-NA is a *microsat*, a 10 kg cube with solar panels on each side and antennas on the top and bottom. At the time of this writing, Echo was scheduled to fly aboard a Russian Dnepr LV rocket (a converted SS-18 ICBM) from the Baikonur Cosmodrome on March 31.



You can see an informative Echo *PowerPoint* presentation on the Web at www.amsat.org/amsat/sats/echo/AMSAT-Symposium-2003-Echo.ppt. It may take a minute or two to load, depending on your connection speed.

Echo differs substantially from every amateur microsat that has come before, although it carries the legacy of space-proven technologies. Of greatest interest to hams is its multiband array of receivers and transmitters.

Echo will be able to relay a variety of signals, including FM voice, in several uplink/downlink combinations:

V/U—2 meters up and 70 cm down

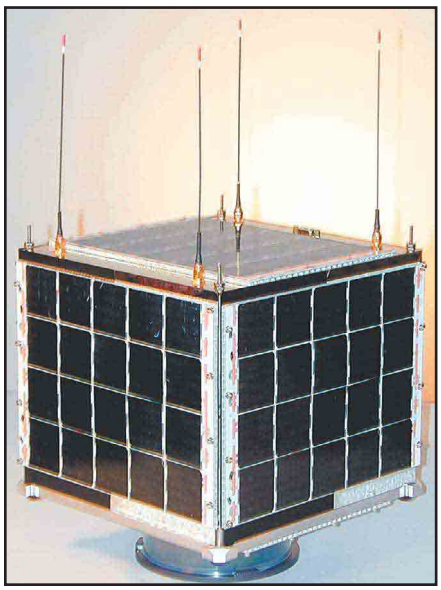
L/S—1296 MHz up and 2.4 GHz down

HF/U—10 meters up and 70 cm down.

Echo offers exciting possibilities for both analog and digital communication. FM enthusiasts will appreciate the Mode V/U voice repeater. With a maximum output of 8 W, Echo will be a powerful amateur FM repeater satellite. You should be able to hear it easily with a handheld transceiver and a "rubber duck" antenna. Depending on the on-board power budget, Echo may be able to operate two uplink/downlink channels simultaneously. A dual-channel repeater would certainly help reduce the crush of signals, especially when the bird is over North America.

PSK31 enthusiasts will be intrigued by Echo's unique "PSK31 repeater" that will listen on 10 meter SSB and repeat on 70 cm FM. Using FM on the downlink will minimize Doppler frequency shifting, allowing operators to track and decode the received signals without too much effort.

Echo will also offer high-speed digital communication at 9.6, 38.4 and 57.6 kbaud. Like other microsats, it will be possible to upload and download messages and other files to Echo. Simultaneous voice and data operation may become a reality as well.



Your Help is Still Needed

An astonishing amount of work went into designing and building Echo. AMSAT has managed to shoulder the cost thanks to member contributions and other generous donations, but $110,000 is still needed to defray the expense of the launch itself. At the AMSAT-NA home page on the Web (**www.amsat.org**), you'll see a graphic "Echo Launch Campaign" thermometer in the upper right hand corner. When this column was written in early January, the thermometer indicated that less than half of the $110,000 total had arrived. We need to push the "mercury" much higher.

I don't know about you, but if I don't contribute something to the launch campaign, I am going to feel awfully guilty about using Echo once it reaches orbit. That's why I'll be writing a check to AMSAT this week.

Think of it in the same context as public radio or television. I enjoyed both and, like many people, didn't contribute a nickel for years. It was easier to follow the path of least resistance (or effort)—at least until the pangs of guilt became overwhelming. Frankly, I grew weary of being a freeloader and decided that it was time to support the programming.

Yes, you can freeload on Echo, too. I'm sure many will. But when you hear its signal in your radio for the first time, think of the satisfaction you'll enjoy by knowing that you made it possible. There is still time left to pitch in. Send your check to:

AMSAT-NA
850 Sligo Ave
Suite 600
Silver Spring, MD 20910-4703

…or call toll-free to 1-888-322-6728. QST

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

LABRATS Club Fosters Technology—*Part 2*

[See the first installment of this column in January 2004 *QST*, page 89. In Part 2, Lollie Garay, KD5WZM, concludes her description of the LABRATS project at the Redd School in Houston, Texas.—*Ed.*]

By the time summer arrived, we were down to five students and three adults preparing for the test. We were on a quest! We met afternoons, evenings and weekends. By the end of June, we had three students, two teachers and one volunteer licensed. The group was ecstatic!

Now the focus turned to finding a way to buy the equipment we needed. The school provided funds for some of the project materials, but we needed a radio and equipment. Dr Reiff directed us first to the ARRL Web site. There I found information about the Victor C. Clark Youth Incentive Program grant. We immediately went to work on our proposal and submitted it. Our proposal was accepted this past summer, and the club went shopping!

Dr Reiff then suggested we attend a meeting with her and the Northwest Amateur Radio Society. Mrs Cantrell, my husband Rey, KD5YLN, and I went, and by meeting's end, we were official members. I spoke before the group and explained our journey in getting there. After the meeting, we were overwhelmed by the support and help offered by so many new friends. We also made contacts with members for equipment that was eventually purchased.

An especially enthusiastic group of NARS members have stepped up to the plate for the LABRATS: John Ellis, W5PDW; Cal White, WF5W, and Paul Franz, W5PF. They, along with KD5YLN, came out on Open House day to set up antennas and equipment to make the Open House contact possible. Our grant had enabled us to buy an ICOM IC-2100 2 meter transceiver, and a Kenwood TS-820S transceiver and tuner. Our antenna was donated by John Ellis. On Open House night, Daniel was the first to speak on our new radio, followed by KD5WZM and KD5YLN. The smiles on all faces and the energy flowing made all those months of hard work worth it!

Since that night, Mrs Cantrell has also made her first contact. Our new class of HAMS is 11 strong. This year we are meeting two days a week, and plan to turn this into a semester course, with many hands-on activities as well as test preparation. Our NARS volunteers are helping us, and have already presented several classes to our group. They have also provided many wonderful ideas, suggestions for structuring our club and donated materials for our antennas. We are now organizing a CW class, and will work together to submit our application for the ARISS school project. As we move forward, more volunteers are coming in to work with us. The enthusiasm is palpable!

This venture has proved to be a tremendous and generous collaboration between our school, Rice University and the local community. The efforts of so many individuals are bringing a wealth of experience and enjoyment to the students at Redd School. Plans are already being made for developing school nets, broadening our test preparation work and developing more community outreach. The LABRATS Radio Club thanks the Victor C. Clark Youth Incentive Program for helping us develop our potential and enabling us to turn dreams into reality!

LOLLIE GARAY, KD5WZM

Daniel Scarlett, KC5YIT, listening to the response to his first radio contact! Seated next to him are LABRATS sponsor Lollie Garay, KD5WZM, and NARS member Rey Garay, KD5YLN.

Contributor's Corner

We wish to thank the following for their generous contributions to:

Barry Goldwater Scholarship Fund
C. W. Chong

The Al Hix, W8AH Memorial Scholarship Fund (pending)
Olie and Louise Rinehart, WD8V and KA8ZGY

Paul and Helen L. Grauer Memorial Scholarship Fund
C. W. Chong
Allen Webber, in fond memory of Helen Grauer, N0BCI

The Jesse Bieberman Meritorious Membership Program Fund
Steel City ARC, Inc, in fond memory of Leonard F. Marino, W3IOH
J. Clark Van Bloom, KD4ED, in fond memory of William Louden, W8WFH
Heritage Village Radio-Electronics Club (Connecticut), in fond memory of Charles O. Koehler, W2ENF, and Benjamin Gelfand, WB2CRK
Gene, WB0KXP, and Anne M. Wilson, Pat and Ken Oidzman, Larry and Henora Larson, Ervin Junkins and Leonard Jaegers, in fond memory of Steven C. Klenc, KC0ACQ

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Dr Edward S. Eby, KF1B, and Mrs Dorothy H. Eby, in fond memory of Robert York Chapman, W1QV
Max E. Norman, W2IQE, in fond memory of Lloyd Rigg, W6AJJ

As received and acknowledged during the months of **November and December 2003**.

Mary E. Lau, N1VH ♦ Secretary, ARRL Foundation Inc ♦ n1vh@arrl.org

COMING CONVENTIONS

NORTH CAROLINA SECTION

March 13-14, Charlotte

The North Carolina Section Convention (Charlotte Hamfest and ComputerFair), sponsored by the Mecklenburg ARS, will be held at the Charlotte Merchandise Mart, Independence and Freedom Halls, 2500 E Independence Blvd (US 74); I-77 to Exit 11, Brookshire Freeway E to Independence Blvd at Exit 2B. Doors are open Saturday 8:30 AM to 5 PM, Sunday 8:30 AM to 2 PM. Features include giant indoor flea market with over 425 tables (**fleamarket@w4bfb.org**); dealers (**dealers@w4bfb.org**); over 100 commercial exhibitor booths with major equipment manufacturers; new and used radio and computer equipment; great forums; VE sessions; Wayne Mills, N7NG (ARRL HQ Membership Services Manager); pre-paid parking $3 (good for both days); daily parking $6; refreshments. Talk-in on 145.29. Admission is $6 in advance, $8 at the door (under 13 free). Tables are $22 (good for both days). Contact Tim Slay, N4IB, 141 Queens Cove Rd, Mooresville, NC 28117; 704-948-7373 (hamfest info line); **hamfest@w4bfb.org**; **www.w4bfb.org/hamfest**.

OKLAHOMA SECTION CONVENTION

March 19-20, Claremore

The Oklahoma Section Convention, sponsored by the Green Country Hamfest Assn, will be held at the Claremore Expo Center, 400 Veterans Pkwy; about 20 miles E of Tulsa off historic Rte 66 at Hwy 20 (Will Rogers Blvd). Doors are open for setup on Friday at noon and Saturday at 7 AM; public Friday 5-9 PM, Saturday 8 AM to 5 PM. Features include Radio, Electronics and Computer Show; flea market; commercial vendors; dealers; demos; forums (ARRL, ARES, OK DX, Weather, and more); foxhunt; VE sessions; free test table; on site RV parking. Talk-in on 147.09, 444.35. Admission is $8 in advance, $10 at the door (under 13 free); good both days. Tables are $8 in advance, $10 at the door (electricity $15, cords not provided). Contact Merlin Griffin, WB5OSM, Box 470132, Tulsa, OK 74147-0132; 918-520-7668; **info@GreenCountryHamfest.org**; **www.GreenCountryHamfest.org**.

WEST TEXAS SECTION CONVENTION

March 20-21, Midland

The West Texas Section Convention (49th Annual St Patrick's Day Hamfest), sponsored by the Midland ARC, will be held at the Midland County Exhibit Building, 2445 E Business Loop 20; ½ mile E of the intersection of Fairgrounds Rd and old Hwy 80 (also called Front St or Business 20); westbound on I-20, Exit 144; eastbound on I-20, Exit 143. Doors are open Saturday 8 AM to 5 PM, Sunday 8 AM to 1 PM. Features include huge indoor flea market, many dealers, large tailgate area ($10 per space, includes 1 table), ARRL forum (Saturday, 7 PM, MARC Clubhouse, hosted by WTX SM John Dyer, AE5B), Hospitality Room (Saturday, 7 PM, MARC Clubhouse), VE sessions (Saturday, 1 PM, all classes, Extension Service Bldg; $12 fee), QLF Contest (Sunday), Sunday Lunch (11:30 AM; Johnny's BBQ, $6), RV parking, refreshments. Talk-in on 146.76, 147.3. Admission is $8 in advance, $9 at the door. Tables are $14 each (for the first 4), $20 (for each additional table over 4). Contact Joe Coldewey, KK5ZG, 4510 Fairbanks Dr, Midland, TX 79707; 432-697-7846; **kk5zg@caprok.net**; **www.w5qgg.org**.

February 22
Virginia State, Richmond*

February 28
Vermont State, Milton*

April 16-18
Eastern VHF/UHF Conference, Enfield, CT

April 23-24
Southeastern VHF Conference, Atlanta, GA

April 30-May 1
Midwest Division, Lebanon, MO

May 1
San Joaquin Valley Section, Fresno, CA

***See February *QST* for details.**

MAINE STATE CONVENTION

March 26-27, Lewiston

The Maine State Convention (25th Annual "Andy" Hamfest and Computer Fair), sponsored by the Androscoggin ARC, will be held at the Ramada Conference Center, 490 Pleasant St; take Exit 13 off I-495 (Maine Tpk) to traffic light, take first left after light. Doors are open Friday 7-9 PM, Saturday 8 AM to noon. Features include exhibitors, vendors, new and used radio and electronics gear, computers, forums, VE sessions (Saturday, registration 10 AM, exams start at noon). Talk-in on 146.61. Admission is free Friday evening, Saturday $5, under 16 free. Tables are $8 (additional $6 each). Contact Rick James, N1WFO, 7 Judkin Ave, Lewiston, ME 04240; 207-784-1266; **n1wfo@adelphia.net** or **n1wfo@arrl.net**; **www.mainearrl.org/convent.htm**.

MARYLAND STATE CONVENTION

March 27-28, Timonium

The Maryland State Convention (33rd Annual Greater Baltimore Hamboree and Computerfest), sponsored by the Baltimore ARC, will be held at the Maryland State Fairgrounds, York Rd; I-83 to Exit 17 (Padonia Rd to the E), turn right at York Rd. Doors are open Saturday 8 AM to 5 PM, Sunday 8 AM to 3 PM. Features include giant indoor electronics flea market, vendors, major manufacturers, commercial exhibitors and displays, outdoor paved tailgating (opens at 6 AM both days), forums, VE sessions (Sunday, 9 AM, Vista Room; pre-registration requested, John Creel, 301-572-5124; **creewb3gxw@aol.com**), QSL card checking, banquet, free parking, refreshments. Talk-in on 146.67 (107.2 Hz), 449.625. Admission is $10 in advance for a weekend pass, $6 per day at the door. Contact Doug Wittich, N3VEJ, Box 95, Timonium, MD 21094; 410-426-3378 or 410-256-0257; **info@gbhc.org**; **www.gbhc.org**.

NORTH CAROLINA STATE CONVENTION

April 4, Raleigh

The North Carolina State Convention, sponsored by the Raleigh ARS, will be held at the North Carolina State Fairgrounds, Jim Graham Building, 1025 Blue Ridge Blvd; I-440, Hillsborough St Exit 3, go W. Doors are open 8 AM to 4 PM. Features include huge electronics flea market; dealer booths; vendors; forums (ARRL, ARES/NTS, MARS, QRP, PSK-31); VE sessions; hospitality supper (Saturday eve, 7-8 PM); QSL card checking by Dan Henderson, N1ND (ARRL HQ Contest Branch Manager); contests (homebrew, QLF, QBH); special guest speaker Riley Hollingsworth (FCC Special Counsel for Enforcement); RV parking ($15 per night); free parking. Talk in on 146.64, 146.88. Admission is $5 in advance, $6 at the door; under 17 free when accompanied by paying adult. Tables are $14 each in advance (by Mar 27), $15 each after Mar 27. Contact Chuck Littlewood, K4HF, 2005 Quail Ridge Rd, Raleigh, NC 27609; 919-872-6555; **k4hf@arrl.net**; **www.rars.org/hamfest**.

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance.

HAMFEST CALENDAR

Attention: The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **March 1** to be listed in the **May** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

(Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.)

†**Arizona (Scottsdale)—Mar 13**, 6 AM to 2 PM. *Spr:* Scottsdale ARC. Scottsdale Community College, 9000 E Chaparral Rd; Loop 101, Exit 46, go E ¼ mile to campus, E parking lots. VE sessions, programs, self-contained RV parking, refreshments. *TI:* 147.18 (162.2 Hz). *Adm:* $2 (parking donation). Tables: $10. Ed Nickerson, WU7S, 902 N 73rd Pl, Scottsdale, AZ 85257; 480-947-9343 (days) or 480-949-5162 (eves); **enickerson2004 @aol.com**.

†**Arkansas (Harrison)—Mar 13**, 8 AM to 1 PM. *Spr:* North Arkansas ARS. Northwest Arkansas District Fairgrounds, US Hwy 65 Business; from the S intersection of US Hwys 412/65 S and the Hwy 65 Business Rte, go N on Business Rte for approximately ¾ mile, Fairgrounds are located on right (E) side of Hwy. Forums, VE sessions. *TI:* 147.0. *Adm:* $5. Tables: $10. Bill Rose, N5VKF, 1007 N Maple St, Harrison, AR 72601; 870-741-7074 or 870-741-

†ARRL Hamfest

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

6968; **billrose@cox-internet. com**; **naars.org/**.

†Colorado (Longmont)—Apr 3; set up Friday after 4:30 PM; public Saturday 8 AM to 1 PM. *Spr:* Longmont ARC. Boulder County Fairgrounds Exhibition Bldg, 9595 Nelson Rd; corner of Hover and Nelson Rd, N of Walmart. VE sessions (10 AM). *TI:* 147.27 (100 Hz). *Adm:* $4. Tables: $12 (includes chair, limited number available). Brian Steege, KØBRS, Box 86, Longmont, CO 80502-0086; 303-678-0406; **larc@qsl.net**; **www.qsl.net/larc**.

†Connecticut (Pomfret)—Mar 20, 8 AM to noon. *Spr:* Eastern Connecticut ARA. Pomfret Community School, corner of Rtes 169 and 101; 4 miles W of Rte 395. VE sessions, refreshments. *TI:* 147.225 (156.7 Hz), 146.52. *Adm:* $2. Tables: $10. Paul Rollinson, KE1LI, 182 Wrights Crossing Rd, Pomfret Center, CT 06259; 860-928-2456; **ke1li@arrl.net**; **www.qsl.net/k1muj/**.

†Florida (Ft Walton Beach)—Mar 20; set up Friday noon to 5 PM, Saturday 7:30-8 AM; public 8 AM to 3 PM. *Spr:* Playground ARC. Okaloosa County Fairgrounds, 1958 Lewis Turner Blvd (State Rte 189); from I-10 exit S onto SR 85 at Crestview, go about 11 miles and exit S onto SR 123 bypass, which 4 miles later brings you back to SR 85, turn right onto SR 189 (intersection with traffic light). Amateur Radio and Computer Show/Swapfest, vendors, RV sites (850-862-0211). *TI:* 146.79. *Adm:* $5 (accompanied ladies and under 15 free). Tables: $10 (includes 1 admission). Mahlon Haunschild, K4OQ, c/o PARC, Box 873, Ft Walton Beach, FL 32549; 850-243-4315; **parcfest@w4zbb.org**; **www.w4zbb.org**.

†Florida (Jacksonville)—Apr 3, 7:30 AM to 2 PM. *Spr:* Greater Jacksonville Hamfest Assn. Dog Fanciers Association Field, Morse Ave; I-95 S to I-295, exit at Blanding Blvd, turn right, go N approximately 2 miles to Morse Ave, turn left, proceed 1 mile to field on left, just before I-295. Good old-fashioned tailgate only, self-contained camping, refreshments. *TI:* 146.76. *Adm:* $5. Deborah Lusk, KG4ADZ, 4459 Hudnall Rd, Jacksonville, FL 32207; 904-739-9713; **rsmythe2@bellsouth.net**; **www.jaxhamfest.com**.

†Florida (New Port Richey)—Mar 27; set up Friday. *Spr:* Gulf Coast ARC. Ridgewood High School, 7650 Orchid Lake Rd; I-75 N or S to SR 52, W to Little Rd, S to Ridge Rd, W to Lemon Rd, then S to the end of road, left into school parking lot. VE sessions. *TI:* 146.67. *Adm:* $6. Tables: $6. Donald Patee, AA4EK, 4811 Rowan Rd, Apt 401, New Port Richey, FL 34653; 727-372-3811; **aa4ek@arrl.net**; **www.gulfcoastarc.org/**.

†Florida (Plantation)—Mar 27, 7 AM. *Spr:* Motorola ARC. Motorola, 8000 W Sunrise Blvd; from I-95 or Tpk, exit Sunrise Blvd, go W. Cy Harris W4MAQ Memorial Free Flea, refreshments. *TI:* 146.79. *Adm:* Free. Richard Block, KG4CHW, 5080 SW 64th Ave, Apt 201, Davie, FL 33314-5214; 954-275-0652; **kg4chw@arrl.net**; **www.geocities.com/bcepn/freeflea.html**.

†Florida (Stuart)—Mar 20, 8 AM to 2 PM. *Spr:* Martin County ARA. Martin County Fairgrounds, 2616 SE Dixie Hwy; from I-95 take Stuart Exit (Rte 76), follow Rte 76 E to Indian St, turn right onto Indian St, go to SE Dixie Hwy, Fairgrounds on left. *TI:* 145.15. *Adm:* Free. Tables: bring your own. Peter Lynch, W1MNY, 7003 SE Cutler Trail, Stuart, FL 34997; 772-288-1048; **w1mny@arrl.net**.

†Georgia (Marietta)—Mar 13; set up Friday 1-7 PM; public Saturday 8 AM to 5 PM. *Spr:* Kennehoochee ARC. Jim Miller Park, Cobb County; from Windy Hill Exit, I-75, go W on Windy Hill Rd until it deadends at Austell Rd, go S to County Farm Rd, turn W to Jim Miller Park. 51st Annual Hamfest, flea market, boneyard, vendors, exhibits, seminars, VE sessions (9 AM on site; you must provide your own copies of license, no copier on premises; approximate $10 fee), RV parking with hookups adjacent to building ($10 per night, requires advance registration), free parking. *TI:* 146.88 (100 Hz). *Adm:* $6, under 12 free with adult. Tables: $20 (inside flea market), boneyard space $10 (open, includes 1 admission), $15 (covered). Bob Butler, W4RBB, 770-579-9420; fax 770-973-1423; **w4rbb@arrl.net**; or Elliott Kanter, W4PGI, 770-815-1570; **w4pgi@arrl.net**; **www.w4bti.org**.

†Illinois (Grayslake)—Mar 28, 8 AM to 1 PM. *Spr:* North Shore RC. Lake County Fairgrounds, at the intersection of Rtes 120 and 45; from Chicago go N on I-94 to Rte 120, go W for 4.4 miles to Rte 45. VE sessions. *TI:* 147.345, 146.52. *Adm:* advance $5, door $7. Tables: $20. Jacob Fishman, NEØNS, 834 Bach St, Northbrook, IL 60062; 847-291-4160; **jaf@lwt.net**; **www.ns9rc.org**.

†Illinois (Sterling)—Mar 14, 7 AM to 3 PM. *Spr:* Sterling-Rock Falls ARS. Challand Middle School, 1700 6th Ave. VE sessions. *TI:* 146.85 (114.8 Hz). *Adm:* advance $4, door $5. Tables: $7 (w/wo electricity). Lloyd Sherman, KB9APW, c/o SRFARS, Box 521, Sterling, IL 61081-0521; 815-336-2434; **lsherman@essex1.com**; **www.sterlinghamfest.com**.

Indiana (Columbus)—Mar 27. Marion Winterberg, WD9HTN, 812-342-4670.

†Indiana (Michigan City)—Mar 27; set up Friday eve (by request), Saturday 5 AM; public 8 AM to noon. *Spr:* Michigan City ARC. Diamond Cove Hall, 716 US Hwy 212, on E side of US Hwy 212; I-80 to N US 35 to W US 20 to N US 212, E side of road after railroad tracks. Vendors, ARRL table, free parking, refreshments. *TI:* 146.97 (131.8 Hz). *Adm:* $5. Tables: $1 per ft (limited electricity $2). Ron Stahoviak, N9TPC, 5802 N 400 W, Michigan City, IN 46360; 219-325-9089; **rstahoviak@adsnet.com**; **home.comcast.net/~w9ly/Hamfest.htm**.

†Indiana (Terre Haute)—Mar 13, 8 AM to 1 PM. *Spr:* Wabash Valley ARA. Northside Bingo Hall, 7339 N Clinton Rd. Software-defined radio forums, foxhunting, VE sessions. *TI:* 146.685 (151.4 Hz). *Adm:* $3. Tables: Free. Don Pine, K9DRP, 56 Archer Ave, Marshall, IL 62441; 217-826-1111; **donpine@abcs.com**; **www.qsl.net/k9dur/tailgate.htm**.

†Kentucky (Cave City)—Mar 13. *Spr:* Mammoth Cave ARC. Cave City Convention Center, Hwy 70; I-65, Exit 53, go to first light and turn left, Convention Center is ¼ mile on left. MARS forum, 3.960 MHz Meeting, VE sessions. *TI:* 146.94. *Adm:* $6. Tables: $8. Larry Brumett, KN4IV, 108 Withers Dr, Glasgow, KY 42141; 270-651-2363; **lbrumett@glasgow-ky.com**; **www.ky4x.org**.

†Kentucky (Elizabethtown)—Apr 3, 8 AM to 2 PM. *Spr:* Lincoln Trail ARC. Pritchard Community Center, 404 S Mulberry St; exit off I-65 to Hwy 62 W. New and used vendors, VE sessions, refreshments. *TI:* 146.98. *Adm:* advance $4, door $5. Tables: $7 (with chair). Archie Mack, AF4EB, 102 Primrose Ln, Radcliffe, KY 40160; 270-351-6159; **amack1@bbtel.com**; **www.qsl.net/ltarc/index.html**.

†Louisiana (Rayne)—Mar 12-14; Friday 1-8 PM, Saturday 8 AM to 3 PM, Sunday 8 AM to noon. *Spr:* Acadiana ARA. Rayne Civic Center, 300 Frog Festival Dr, just S of I-10 at Exit 87; go S on LA 35, go to first traffic light and turn right onto Oak St, go to the second street and take a right onto Gossen Memorial, follow the street to the end. Flea market, dealers, forums (ARRL, AMSAT, LCARC), VE sessions, Crawfish Boil (Friday). *TI:* 146.82. *Adm:* advance $3, door $4. Tables: $15. Al Oubre, K5DPG, 3011 Sugar Mill Rd, New Iberia, LA 70563; 337-367-3901; **k5dpg@w5ddl.org**; **www.w5ddl.org/hamfest/**.

Maine (Lewiston)—Mar 26-27, Maine State Convention. See "Coming Conventions."

†Maryland (Easton)—Apr 10, 7 AM. *Spr:* Easton ARS. Talbot County Community Center, 10028 Ocean Gateway; on W side of US Rte 50, ½ mile N of Easton. Eastern Shore Hamfest and Computer Show, electronics flea market, tailgating (open at 6 AM; $5 per space), vendors, handicapped accessible, free parking, refreshments. *TI:* 147.045 (156.7 Hz), 146.52. *Adm:* $5. Tables: $15 (includes admission). Tinsley Meekins Jr, K3RUQ, 5538 Mt Holly Rd, E New Market, MD 21631; 410-228-8888 or 410-770-3715; **k3ruq@arrl.net**; **www.k3emd.com**.

Maryland (Timonium)—Mar 27-28, Maryland State Convention. See "Coming Conventions."

†Michigan (Marshall)—Mar 20, 8 AM to 2 PM. *Spr:* Southern Michigan ARS. Marshall High School, 701 N Marshall; I-94 to Exit 110, go S on old US-27 to North Dr, go E on North Dr, 2 blocks to school. 43rd Annual Michigan Crossroads Hamfest. *TI:* 146.66. *Adm:* $5. Tables: $1 per foot. Chuck Williams, WD8LJF, 15202 Ackerson Dr, Battle Creek, MI 49014; 269-964-3197; **bevolin@msn.com**; **www.qsl.net/w8df**.

†Minnesota (Buffalo)—Mar 27, 7:30 AM to 1 PM. *Spr:* Robbinsdale ARC. Buffalo Civic Center, 1306 County Rd 134, Hwy 55 to County Rd 134, go N ¾ mile on left. VE sessions. *TI:* 147.6. *Adm:* advance $5.50, door $7. Tables: $20 (plus $15 for electricity if required). Jerry Dorf, NØFWG, Box 22613, Robbinsdale, MN 55422; 763-537-1722; **k0ltc@k0ltc.org**; **www.k0ltc.org**.

†Missouri (Joplin)—Apr 9-10; Friday 5-9 PM, Saturday 8 AM to 3 PM. *Spr:* Joplin ARC. John Q. Hammons Trade Center, I-44 and US Business 71; I-44 at Exit 8-B (Rangeline Rd N). VE sessions; ARRL forum; DXCC, VUCC and WAS card checking, free parking, refreshments. *TI:* 147.21. *Adm:* advance $5, door $6. Tables: $10. Jim Johannes, NØZSQ, 1930 E 34th, Joplin, MO 64804; **jjohannes@joplin.com**; Jim Scott, WBØIYC, 417-781-2211; **www.joplin-arc.org/**.

†New Hampshire (Henniker)—Mar 28; set up 7 AM; public 8 AM to 1 PM. *Spr:* Contoocook Valley RC. Henniker Community School Cafeteria, 15 Western Ave; from Concord take I-89 N to Exit 5 (left exit), follow Rtes 202 and 9 to Henniker, take Rte 114 Exit (New England College), turn left at end of ramp, turn right at flashing light, School is 5th building on left. Flea market, VE sessions (registration 9 AM, testing promptly at 9:30 AM; Al Bardwell, NS1O, 603-228-1407; **ns1o@arrl.net**), speakers. *TI:* 146.895 (100 Hz). *Adm:* $3 (buyers), $10 (sellers, includes 1 table). Tables: $10 (additional tables $8 each). Jim McElroy, NS1E, 34 Rush Rd, Henniker, NH 03242; 603-428-7436; **ns1e@arrl.net**; **www. qsl.net/k1bke**.

†New Jersey (Clinton)—Mar 13; set up 6 AM; public 8 AM. *Spr:* Cherryville Repeater Assn. North Hunterdon Regional High School, Rte 31 at Regional Dr; Rte 78 to Exit 18, go S on Rte 31 to Regional Dr. Indoor flea market, vendors, VE sessions, SKYWARN training. *TI:* 147.375 (151.4 Hz). *Adm:* $6. Tables: $30. Barry Campbell, W2CGX, Box 308, Quakertown, NJ 08868; 908-788-4080; **w2cra@qsl.net**; **www.qsl.net/w2cra**.

†New Jersey (Parsippany)—Mar 6; sellers 6:30 AM, buyers 8 AM. *Spr:* Splitrock ARA. Parsippany PAL Building, Smith Field, Rte 46 and Baldwin Rd; I-80 Eastbound, Exit 45, left on Beverwyck Rd, left at Rte 46, take jughandle left at Baldwin Rd; or I-80 Westbound, Exit 47, follow Rte 46 W to jughandle left at Baldwin Rd. Vendors, tailgating ($15 per space, weather permitting; includes 1 admission), VE sessions (registration 8:30 AM, exams 9 AM sharp), DXCC QSL card checking. *TI:* 146.985 (131.8 Hz). *Adm:* $6, non-ham YLs and harmonics free with ham admission. Tables: $20

(includes 1 admission). Michael Greenfeld, K8BQ, Box 610, Rockaway, NJ 07866; 866-457-6687; **hamfest@splitrockara.org**; **www.splitrockara.org**.

New York (Newark)—Apr 10. Calvin Bruzee, KC2HUP, 315-331-0281.

†**New York (New Windsor)—Mar 14**; set up 6 AM; public 8 AM to 1 PM. *Spr:* Orange County ARC. Temple Hill School, 525 Union Ave; I-84 to Exit 7S (Union Ave, Rte 300 S), go through 5 lights and at 6th light take a left at "T" in road, continue on Union Ave (Rte 300) S for 2 more lights (½ mile), at 2nd light take a left onto Union Ave, continue for ½ mile to school on right. Tailgating ($8 per space), VE sessions (8-11 AM), ARRL table, free parking, refreshments. *TI:* 146.76 (100 Hz). *Adm:* $5 (nonham spouses and under 12 free). Tables: 7½ ft $13 (advance only, by Mar 12); you supply table $8. Ed Moskowitz, N2XJI, 123 Harold Ave, Cornwall, NY 12518; 845-534-3492; **n2xji@arrl.net**; **www.bestweb.net/~ocarc/**.

North Carolina (Charlotte)—Mar 13-14, North Carolina Section Convention. See "Coming Conventions."

†**North Carolina (Kinston)—Mar 21**; set up Saturday 4-9 PM (overnight security provided), Sunday 6 AM; public 8 AM to 3 PM. *Spr:* Down East Hamfest Association. Lenoir County Fairgrounds, Fairgrounds Rd; Hwy 11 S, follow signs from US 70 E. Indoor flea market, dealers, tailgating, VE sessions (11 AM; walk-ins only), meetings (ENC Traffic Net, SKYWARN), free parking, refreshments. *TI:* 146.685 (88.5 Hz), 145.21. *Adm:* advance by Mar 15 $4 (3 for $10), door $5 (3 for $12). Tables: 8 ft $10 (electricity $5). Jean DuPree, KB4OHX, Box 1778, Kinston, NC 28503; 252-523-2703; **jeanhd@icomnet.com**.

North Carolina (Raleigh)—Apr 4, North Carolina State Convention. See "Coming Conventions."

†**North Dakota (West Fargo)—Mar 13.** *Spr:* Red River Radio Amateurs. West Fargo Red River Valley Fairgrounds, W Main Ave; from I-94, Exit 343, go E on Main for ½ mile, right onto Cass 28 by white church, go S 1/4 mile, right into Fairgrounds. ARRL seminar, VE sessions, refreshments. *TI:* 147.255 (82.5 Hz). *Adm:* advance $5, door $8. Tables: $8 (flea market), $25 (commercial). Jody Kruft, KCØHIG, 1220 Monte Carlo Dr, Fargo, ND 58102; 701-280-0700; **kc0hig@hotmail.com**; **www.rrra.org**.

†**Ohio (Madison)—Mar 28**, 8 AM to 2 PM. *Spr:* Lake County ARA. Madison High School, 3100 Burns Rd; I-90 to Rte 528 (Exit 212), go N to Middle Ridge Rd, turn left to Burns Rd, follow signs to High School. 26th Annual Hamfest/Computerfest, flea market, vendors, new and used Amateur Radio equipment, computer and assorted electronics equipment, VE sessions, paved parking, refreshments. *TI:* 147.21. *Adm:* $6. Tables: 6 ft $9, 8 ft $12. Rocky, 440-209-8953; **rocky@lcara.org**; **www.lcara.org**.

†**Ohio (Maumee/Toledo)—Mar 21**, 8 AM to 2 PM. *Spr:* Toledo Mobile Radio Assn. Lucas County Recreation Center, 2901 Key St; S of Heatherdowns Blvd at Key St; Exit 6 off I-475/US 20 or Exit 59 off I-80/US 90. Hamfest/Computer Expo, all indoors (2 large heated halls), handicapped accessible, free parking, refreshments. *TI:* 147.27. *Adm:* $6 (under 13 free with paying adult). Tables: $20-$25 (depending on location within building). Brian Harrington, WD8MXR, 4463 Holly Hill Dr, Toledo, OH 43614; 419-385-5624; **wd8mxr@arrl.net**; **www.tmrahamradio.org**.

Oklahoma (Claremore)—Mar 19-20, Oklahoma Section Convention. See "Coming Conventions."

†**Oklahoma (Elk City)—Mar 6**, 8:30 AM to 5 PM. *Spr:* West Central Oklahoma ARC. Elk City Civic Center, E Hwy 66; Exit 41 off I-40, go 1 mile W, on S side. VE sessions. *TI:* 146.76. *Adm:* advance $5, door $8. Tables: $5. Earl Bottom, N5NEB, Box 2023, Elk City, OK 73644; 580-821-0633; **n5neb@dobsonteleco.com**.

Ontario (Brampton)—Mar 20. Peter Taylor, VE3DRS, 905-453-6096.

†**Pennsylvania (Boston/McKeesport)—Mar 14**, 8:30 AM to 3 PM. *Spr:* Two Rivers ARC. The Spectrum, 6001 Smithfield St; from PA Tpk take Rte 48 S to McKeesport, stay on Rte 48 S to Boston, cross bridge, take first left onto Smithfield St. Forums, VE sessions. *TI:* 146.73. *Adm:* $5. Tables: $10. Bill Hetrick, N3LQC, 696 King St, McKeesport, PA 15132; 412-751-1937; fax 412-754-0562; **n3lqc@attbi.com**; **www.qsl.net/w3oc/hamfest.htm**.

†**Pennsylvania (Greensburg)—Mar 28**. *Spr:* Foothills ARC. Fire Department Hall (Hose Co No 1), 10 McLaughlin Dr; Rte 66 N of Greensburg, turn right onto Old Salem Rd, turn right onto McLaughlin Dr. Refreshments. *TI:* 147.18 (131.8 Hz). *Adm:* Free. Tables: $10. Al Compton, N3LQX, 555 Agnew Rd, Greensburg, PA 15601; 724-523-3727; **Albert_555@msn.com**; **www.W3LWW.org**.

†**Tennessee (Tullahoma)—Mar 20-21**. *Spr:* Middle Tennessee ARS. Tullahoma Business Incubator, 410 Wilson Ave; I-24 to Exit 111, take Hwy 55 S for 12 miles to Hwy 41A, go N to 4th traffic light, take left onto Wilson Ave, go ¾ mile to facility on right (across from Wendy's). Forums (ARES, ARRL, DX, and more), ARES EMCOMM training and testing, VE sessions. *TI:* 146.7 (114.8 Hz). *Adm:* $5. Tables: $10. Jimmy Floyd, NQ4U, c/o MTARS, Box 932, Tullahoma, TN 37388; 931-393-0095; **nq4u@bellsouth.net**; **www.mtars.org**.

†**Texas (Brenham)—Mar 20**, 8 AM to noon. *Spr:* Brenham ARC. Brenham Fairgrounds, 1305 E Horton; just E of Brenham on Loop 577. Commercial vendors (tables are free), RV hook-ups available, coffee and donuts (25 cents each). *TI:* 145.39. *Adm:* Free. Tables: $10. Dan Lakenmacher, N5UNU, 10312 Hwy 36 N, Brenham, TX 77833; 979-836-8739; **llakenmacher@yahoo.com**; **www.alpha1.net/~barc**.

†**Texas (Irving)—Mar 13**, 8 AM to 2 PM. *Spr:* Irving ARC. Betcha Bingo Hall, 2420 W Irving Blvd No 125; State Hwy 183 E/W at Story Rd Exit, go S to Irving Blvd, cross intersection southbound, behind Eckerd's Drugstore. VE sessions. *TI:* 146.72 (110.9 Hz). *Adm:* advance $3, door $4. Tables: advance $8, door $10. Coleta Taylor, KD5QFH, c/o Irving ARC, Box 153333, Irving, TX 75016-3333; 972-579-9089; **kd5qfh@arrl.net**; **www.irvingarc.org/**.

Texas (Midland)—Mar 20-21, West Texas Section Convention. See "Coming Conventions."

†**Texas (Sugar Land)—Feb 28**, 8 AM to 2 PM. *Spr:* Brazos Valley ARC. Sugar Land Community Center, 226 Matlage Way; take Hwy 59 S from Houston to Sugar Land and to State Hwy 6, exit Hwy 6 and turn right, take Hwy 6 and turn right on Brooks St, turn left on Guenther St, go 1 block and turn left on Matlage Way, Community Center is 1 block on right. VE sessions. *TI:* 145.47 (123 Hz). *Adm:* $1. Tables: $5. Ross Lawler, W5HFF, Box 1630, Missouri City, TX 77459-1630; 281-342-3340; **w5hff@juno.com**; **www.hal-pc.org/~bvarc/**.

†**Texas (Weatherford)—Mar 27**. ARC of Parker County. Texas National Guard Armory, 716 Charles St; I-20 to Weatherford, Exit at 406 on Bowie, go N to 4-way stop sign, turn right on Charles St. New and used Amateur Radio equipment, VE sessions, refreshments. *TI:* 147.04. *Adm:* advance $4, door $5. Tables: $10 (in advance by Mar 23). James Adams, AD5KG, 4500 Old Springtown Rd, Weatherford, TX 76085; 817-341-1979; **ad5kg@arrl.net**.

†**West Virginia (Charleston)—Mar 20**, 9 AM to 3 PM. *Spr:* Charleston Area Hamfest and Computer Show. Cookskin Armory, 1707 Coonskin Dr; I-77, Exit 99, Greenbrier St, veer right past airport, at stoplight at GoMart, turn left onto Coonskin Dr, Armory is ¾ mile on left. WV State Radio Council Meeting, VE sessions. *TI:* 145.35. *Adm:* $5. Tables: $5. William H. (Jack) Kibler, Jr, K8WMX, Box 916, St Albans, WV 25177-0916; 304-722-3150; **k8wmx@juno.com**.

†**Wisconsin (Jefferson)—Mar 21**; set up 7 AM; public 8 AM to 1 PM. *Spr:* Tri-County ARC. Jefferson County Fairgrounds Activity Center, Hwy 18 W. Vendors, VE sessions (9 AM, on site), refreshments. *TI:* 145.49. *Adm:* $4. Tables: 8-ft space $6. John Satterlee, WA9SAB, 213 Frederick St, Ft Atkinson, WI 53538; 920-563-6381 (eves); fax 920-563-9551; **jsatt@ticon.net**; **www.cmdline.com/tcarc/**.

†**Wisconsin (Milwaukee)—Apr 2-3**; Friday 2-7 PM, Saturday 9 AM to 3 PM. *Spr:* Amateur Electronic Supply. AES Headquarters, 5710 W Good Hope Rd. "AES Superfest," all indoors, major manufacturers, forums, VE sessions (Saturday, 9-11:15 AM, $8 fee), refreshments. *Adm:* Free. Ray Grenier, K9KHW, 5710 W Good Hope Rd, Milwaukee, WI 53223; 414-358-4088; **rayk9khw@aol.com**; **www.aesham.com/**.

STRAYS

COURTESY JAY MUSIKAR, AF2C

At a recent meeting of the Flagler Emergency Communications Association, an ARRL affiliated club, the club donated a new 2 meter antenna to Flagler County Emergency Services, replacing one that had self-destructed. Presenting the antenna is (left) FECA President Merrill Musikar, KG4IDD. Accepting on behalf of the county EOC is Troy Harper, KE6MCO.

CONTEST CORRAL

W1AW Qualifying Runs are 10 PM EST Friday, Mar 5 (0300Z Mar 6), and 7 PM EST Tuesday, Mar 16 (0000Z Mar 17). The K6YR West Coast Qualifying Run will be at 9 PM PST Wednesday, Mar 10 (0500Z Mar 11). Check the W1AW Schedule elsewhere in this issue for details.

SO—Single-Op, M2—Multiop—2 Transmitters, MO—Multiop, MS—Multiop, Single Transmitter, MM—Multiop, Multiple Transmitters, AB—All Band, SB—Single Band, S/P/C—State/Province/DXCC Entity, HP—High Power, LP—Low Power, Entity—DXCC Entity, HP—High Power >150 W, LP—Low Power >5 W and <150 W, QRP is <5 W

No contest activity on 30, 17 and 12 meters. Refer to the contest Web sites for information about awards. Unless stated otherwise, regional contests only count QSOs with stations in the region. Publication deadline for Contest Corral listings is the first of the second month prior to publication. In order to publicize the maximum number of contests, readers will be referred to an earlier issue of *QST* if the rules have been published within the past year.

Mar 1

Spartan Sprint—CW—sponsored by the Adventure Radio Society from 0200Z-0400Z Mar 4 (Monday evening in the US). Held on the first Monday of every month. Frequencies (MHz): 3.560, 7.040, 14.060, 21.060, 28.060 (QRP calling frequencies). Categories: SO. Exchange: RST, S/P/C, and power output. Score: "Skinny" division—total QSOs / total station weight, "Tubby" division—total QSOs. For more information: **www.arsqrp.com/ars/pages/spartan_sprints/ss_rules_new.html**. Logs due on Wednesday after the contest via the ARS Web site or to **hjohnc@core.com**.

Mar 6-7

ARRL International DX Contest—Phone—0000Z Mar 6-2400Z Mar 7 (see Dec 2003 *QST*, p 96, or **www.arrl.org/contests/rules**).

DARC 10-Meter Digital "Corona"—RTTY/AMTOR/PACTOR/PSK31/Clover, sponsored by Deutscher Amateur Radio Club from 1100Z-1700Z Mar 2 (see Nov 2003 *QST*, p 102, or **www.darc.de/referate/dx/**).

EU EME Contest—any mode—sponsored by DUBUS and REF, 0000Z Mar 6-2400Z Mar 7. Frequencies: 432 MHz, 2.3-5.7 GHz (144 MHz, 1.3 and 10 GHz on Mar 27-28). Categories: QRP, QRO, Pro—based on ERP and equipment, send e-mail for more information. Exchange: call signs TMO/RST and "R." QSO Points: 144/432/1.3—100 pts for random, 10 pts for scheduled QSO, 2.3 GHz and higher—100 pts/QSO. Score: QSO Points (×2 for QSOs at 2.3 GHz and above) × DXCC entities and US states from random QSOs (or any QSOs at 2.3 GHz and above). For more information: **info@dubus.de**. Logs due 30 days after the contest to **f6hye@ref-union.org** or Patrick Magnin, F6HYE, Marcorens, F-74140 Ballaison, France.

Mar 13-15

RSGB Commonwealth Contest—CW—sponsored by the RSGB from 1000Z Mar 13-1000Z Mar 14. Open to British Commonwealth stations only, work stations once per band outside your own call area. HQ stations may be worked by everyone and count as a separate call area. Frequencies: lower 30 kHz of 80-10 meters. Categories: SO—open (full-time), —restricted (12 hrs max), Headquarters-MO and SO, no spotting assistance. Scoring: 5 pts/QSO, first 3 QSOs with a call area count 25 pts. For more information: **www.rsgbhfcc.org**. Logs due Apr 5 to **commonwealth.contest.logs@rsgbhfcc.org** or G3UFY, 77 Bensham Manor Rd, Thornton Heath, Surrey CR7 7AF, England.

Wisconsin QSO Party—Phone/CW—sponsored by the West Allis RAC from 1800Z Mar 14-0100Z Mar 15. Frequencies (MHz): CW—3.550, 3.705, 7.050, 14.050, 21.050, 10 meters; Phone—3.890, 7.230, 14.290, 21.350, 28.400; All modes—6/2 meters, UHF. No repeater QSOs. Categories: SO, MS, MM and Mobile. Mobile operators may not operate on county lines. Exchange: S/P/C or WI county. QSO Points: Phone—1 pt, CW—2 pts. Score: QSO pts × WI counties (max 72) + S/P/C (WI stations only) ×2 (< 5 W), 1.5 (<150 W). WI mobiles/portables add 500 bonus points for each county with 12 or more QSOs. For more information: **www.warac.org**. Logs due Apr 14 to **k9kr@powercom.net** (in WARAC Cabrillo format—see Web site) or Wisconsin QSO Party, West Allis RAC, PO Box 1072, Milwaukee, WI 53201.

Oklahoma QSO Party—Phone/CW/Digital—sponsored by the Oklahoma DX Association (OKDXA) from 1400Z-0200Z Mar 13 and 1400Z-2000Z Mar 14. Frequencies (MHz): SSB—3.860, 7.260, 14.260, 21.360, 28.360; CW—3.530, 7.030, 14.030, 21.030, 28.030. Categories: SOHF-HP (>100 W), -LP, -QRP (<5 W), SO-VHF, MS, MM, Rover (OK only). Exchange: serial number and SPC or OK county. QSO points: Phone—2 pts, CW/Digital—3 pts. Score: QSO points × OK counties (OK stations use States + Provinces), counted only once. For more information: **www.okdxa.org**. Logs due April 30 to **k5yaa@okdxa.org** (ADIF or CABRILLO format preferred) or OKDXA, PO Box 2591, Claremore, OK 74018-2591 (<100 QSOs only).

North American RTTY Sprint, sponsored by *NCJ*, from 0000Z-0400Z Mar 14. Frequencies 80-20 meters. North American stations work everyone; others work NA stations only. Exchange both call signs, serial number, name, and S/P/C. The same station can be worked multiple times provided 3 contacts separate the contact in both logs, regardless of band. QSY rule: Stations calling CQ, QRZ, etc, may only work one station in response to that call; they must then move at least 1 kHz before working another station or 5 kHz before soliciting another call. Once you are required to QSY, you may not make a new QSO on the previous frequency until you have made a contact at least 1 or 5 kHz (as required) away. For more information: **www.ncjweb.com**. Logs due 7 days after the contest to **rttysprint@ncjweb.com**. Check Web site for expected changes to contest manager and log submission addresses.

YL International Single Sideband System QSO Party—Phone, 0000Z Mar 13-2400Z Mar 14 (see Feb *QST*, p 104, or **www.qsl.net/yl-issb/**).

Mar 20-22

Russian DX Contest-CW/SSB—from 1200Z Mar 20-1200Z Mar 21. Frequencies: 160-10 meters. Categories: SOAB -HP and -LP (<100 W), SOSB, MS (10 minute rule), SWL, SO may enter Mixed Mode, CW, or SSB, MO and SWL are Mixed only. Exchange: RS(T) + serial number, RU stations—RS(T) + Oblast designator. QSO points: own entity—2 pts, different entity, same continent—3 pts, diff cont—5 pts, with Russians—10 pts. Score: QSO points × DXCC entity + Oblasts, counted once per band. For more information: **www.rdxc.org**. Logs due 45 days after the contest to **rusdxc@contesting.com** or to Russian DX Contest, PO Box 88, 119311 Moscow, Russia.

Virginia QSO Party—Phone/CW—sponsored by the Sterling Park ARC 1800Z Mar 20-0200Z Mar 22. Frequencies (MHz): CW—1.805 and 50 kHz up, Phone—1.845, 3.860, 7.260, 14.270, 21.370, 28.370, Novice/Tech—28.370, VHF/UHF—50.125, 144.200, 146.58, 223.50, 446.00. No repeater or cross-mode QSOs. Categories: SO, MS, MM fixed station and Mobile. Exchange: serial number and SPC or VA county/city. QSO Points: Phone—1 pt, CW—2 pts, VA Mobile—3 pts. Score: QSO Points × VA city/counties + SPC (counted only once). VA mobiles add 100 pts per VA city/county activated. Add 500 pts for QSO with K4NVA. For more information: **www.qsl.net/sterling**. Logs due April 15 to **nq4k@arrl.net** or Virginia QSO Party, Call Box 599, Sterling, VA 20167.

Spring QRP Homebrewer Sprint—CW/PSK31—sponsored by New Jersey QRP Club, 0000Z-0400Z Mar 22. Frequencies: QRP CW and PSK31 frequencies on 80-10 meters, CW and PSK31 are considered separate bands. Exchange: RST + S/P/C + Output Power. QSO Points: Commercial Equipment—2 pts, Homebrew Xmtr or Rcvr—3 pts, Homebrew Xmtr and Rcvr or Xcvr—4 pts. Kits okay as homebrew. Power Multiplier: 0>250 mW = ×15, 250 mW>1 W = ×10, 1>5 W = ×7, >5 W = ×1. Score: QSO Points × S/P/C (counted once per band) × power multiplier. For more information: **www.njqrp.org/data/qrphomebrewersprint.html**. Logs due 30 days after the contest to **n2cq@arrl.net** (text format) or Ken Newman, N2CQ, 81 Holly Dr, Woodbury, NJ 08096.

10-10 Mobile Contest—any mode—sponsored by 10-10 International, from 0000Z-2359Z Mar 20. Frequencies: 10 meters only. Categories: Fixed, Mobile. Exchange: call, name, S/P/C, county (US, Canada and England) and 10-10 membership number, if any. QSO Points: 1 pt/QSO. Score: Fixed—QSO Points × counties, Mobiles—QSO Points × counties worked + counties activated. For more information: **www.ten-ten.org**. Logs due Apr 3 to **tentencontest@alltel.net** or Steve Rasmussen NØWY, 312 N 6th St, Plattsmouth, NE 68048.

CLARA and Family HF Contest—Phone/CW—sponsored by the Canadian Ladies ARA, from 1700Z Mar 20-1700Z Mar 21. Frequencies (MHz): CW—14.033, 21.033, 7.033, 3.688, Phone—28.300, 21.225, 14.120 14.285, 7.033, 7.200, 3.750, 3.900, work CLARA and YL stations once per band/mode. Crossmode contacts count as Phone for both stations. Categories: SO only, no time limit. Exchange: RS(T), name, QTH and whether CLARA member, Family member, non-member YL or OM. QSO Points: 5 pts for CLARA members, 2 pts for CLARA family members, 3 pts for non-CLARA YLs, 1 pt for OMs. Multipliers are VE provinces and DXCC entities (only if QSO with YL) counted only once. Score: QSO points × multipliers. For more information: **www.qsl.net/clara/contest.html**. Logs due April 24 to **ve7vpe@rac.ca** or Paulette Schouten, VE7VPE, c/o VECTOR, 3301 East Pender St, Vancouver, BC V5K 5J3, Canada.

Mar 27-28

CQ WW SSB WPX Contest—SSB—sponsored by *CQ* Magazine, from 0000Z Mar 27- 2400Z Mar 28 (CW is May 29-30). Frequencies: 160-10 meters. Categories: SOAB, SOSB, SO-Assisted, -HP, LP, and -QRP, MS (10 minute rule), MM, SO-Rookie, SO-Tribander-and-Single-Wire, SO-Band-Restricted. SO operate 36 hours max with off times at least 60 min. Exchange: RS(T) + serial number. QSO Points: different continents—3 pts (14-28 MHz) and 6 pts (1.8-7 MHz), with North America—2 pts (14-28 MHz) and 4 pts (1.8-7 MHz), with own country—1 pt. Score: QSO points × prefixes worked (ie, N8, KA1, HG73, JD1) counted only once. For more information: **www.cqwpx.com**. Logs due May 1 (CW, July 1) to **ssb@cqwpx.com** (**cw@cqwpx.com**).

EU EME Contest—144 MHz, 1.3 and 10 GHz—see Mar 6-7.

H. Ward Silver, NØAX ♦ 22916 107th Ave SW, Vashon, WA 98070 ♦ n0ax@arrl.org

SPECIAL EVENTS

Arlington Heights, IL: US Peace Corps ARC, KA9NLX. 1700Z **Mar 1**-2200Z **Mar 7**. 43rd Anniversary of founding of United States Peace Corps. 28.500 21.375 14.325 7.283. Certificate. John Paskevicz, 1423 North Ridge Ave, Arlington Heights, IL 60004.

Various, England: Royal Signals Amateur Radio Society, GB6OT. 0700Z **Mar 5**-2359Z **Apr 1**. 60th Anniversary of Op Thursday Burma 1944. 21.070 21.056 14.070 14.056. QSL. Mike Humphrey, GØSWY/KF4OFR, 4 Bluebell Rd, Bassett Southhampton, Hampshire, England SO16 3LQ. **www.rsars.org.uk**.

Weeki Wachee, FL: Spring Hill Amateur Radio Club, W4W. 1000Z **Mar 5** and 2400Z **Mar 7**. Celebrating the 11th Annual Weeki Wachee Swamp Fest. 14.260 7.260 7.040. QSL. W4W/ Spring Hill ARC, PO Box 6083, Spring Hill, FL 34611. **www.kf4ixu.com**.

Chesapeake, VA: Chesapeake Amateur Radio Service, W4CAR. 1500Z-2100Z **Mar 6**. 142nd Anniversary, *Monitor-Merrimac* Battle of the Ironclads. 28.362 21.362 7.262 146.82. Certificate. W4CAR, PO Box 6867, Chesapeake, VA 23323. **www.qsl.net/cars**.

Naples, FL: Amateur Radio Association of Southwest Florida, K4YHB. 1400Z **Mar 6**-2000Z **Mar 7**. Annual Spring Swamp Buggy Races. 12 m 17 m. Certificate. Mark Kennedy, K4SWF, 1241 12th St N, Naples, FL 34102. **www.araswf.org/**.

Hermann, MO: Hermann Bearcat Amateur Radio Club, KØS. 1400Z **Mar 9**-2100Z **Mar 10**. Science class study of radio spectrum. 14.250 14.246 147.135. Certificate. Saint George Catholic Elememtary School, 133 W 4th St, Hermann, MO 65041.

New Port Richey, FL: Gulf Coast Amateur Radio Club, K4C. 1200Z **Mar 18**-2000Z **Mar 28**. The 82nd Annual Chasco Fiesta. 28.360 21.250 14.250 7.245. Certificate. GCARC-Chasco, PO Box 595, New Port Richey, FL 34656-0595.

Princeton, NJ: Mercer County ARES/Central NJ American Red Cross, N2ARC. 2300Z **Mar 19**-2300Z **Mar 21**. March is Red Cross Month, celebrating ARES/ARC partnership. 28.445 14.255 7.240 3.952 2 m 220 MHz APRS. Certificate. Gerry Jurrens, N2GJ, POB 147, Kingston, NJ 08528. **users.tellurian.com/gjurrens/n2arc_special_event.htm**.

Macon, GA: Macon Amateur Radio Club, W4BKM. 1500Z-2200Z **Mar 20**. 22nd Annual Cherry Blossom Festival. 14.240 21.335 7.055 14.055. Certificate. Macon ARC, PO Box 4862, Macon, GA 31208.

Virginia Beach, VA and Moss, Norway: Virginia Beach Amateur Radio Club, Inc and Mossegruppen av NRRL, W4UG and LA5M. 1300Z **Mar 20**-2200Z **Mar 21**. 113th anniversary of the Norwegian Lady. 14.278 14.040 7.280 7.040. Certificate. VBARC, PO Box 62003, Virginia Beach, VA 23462.

Wellsboro, PA: Nessmuk Amateur Radio Association, W3BGK. 1500Z **Mar 24**-2100Z **Mar 28**. 200th anniverary of Tioga County. 14.240 7.240. Certificate. Nessmuk ARA W3BGK, PO Box 101, Wellsboro, PA 16901. For more information contact **jantonio@epix.net**.

Ebensburg, PA: Conemaugh Valley Amateur Radio Club, W3C. 1300Z **Mar 26**-0300Z **Mar 27**. Cambria County Bicentennial. 21.300 14.250 7.230 3.985. QSL. David Knepper, PO Box 34, Sidman, PA 15955. **www.cambriacobicentennial.com**.

Waco, TX: Lake Whitney Amateur Radio Society, WA5BU. 1600Z-2000Z **Mar 27**. Activating the Baylor University Ham Club Radio Station. 28.425 21.300 14.250 7.250. QSL. Allen Newton, PO Box 1181, Whitney, TX 76692.

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.

Special Events Announcements: For items to be listed in this column, you must be an Amateur Radio club, and use the ARRL Special Events Listing Form. Copies of this form are available via Internet (**info@arrl.org**), or for an SASE (send to Special Requests, ARRL, 225 Main St, Newington, CT 06111, and write "Special Events Form" in the lower left-hand corner). You can also submit your special event information on-line at **www.arrl.org/contests/spevform.html**. Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; that is, a special event listing for **May** *QST* would have to be received by **Mar 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

NEW PRODUCTS

THREE RF SWITCHES FROM MFJ

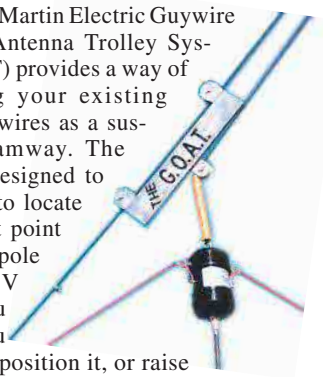
♢ The MFJ-1703 antenna/transmitter RF safety switch connects two rigs and two antennas, and switches between the two. This device is designed to keep your transceivers from transmitting while unterminated. It can be used over the range of 1.8 to 30 MHz and is rated at up to 300 W PEP SSB, 150 W CW on 50 to 75 Ω unbalanced lines. Mounting tabs are provided on the all-metal cabinet. Price: $19.95.

The MFJ-1706 selects one of six different balanced feed lines. It is rated for the full legal limit and can be used from 1.8 to 30 MHz. Connections are made via heavy duty five-way binding posts that mate with MFJ-7709 dual banana plugs. Price: $89.95, MFJ-7709: $5.95.

The MFJ-1706H is similar to the MFJ-1706 but connects via high-voltage glazed ceramic feed-through insulators. Price: $99.95.

To order, or for your nearest MFJ dealer, call MFJ Enterprises at 800-647-1800 or order at **www.mfjenterprises.com**, fax 662-323-6551; or write MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759.

GUYWIRE OPERATED ANTENNA TROLLEY SYSTEM



♢ The new Martin Electric Guywire Operated Antenna Trolley System (GOAT) provides a way of employing your existing tower guy wires as a suspended tramway. The GOAT is designed to allow you to locate the support point for your dipole or inverted V where you want it. You can then reposition it, or raise and lower your wire antenna for adjustments. If you have arrays side-mounted on a tower, the GOAT is designed to permit you to maneuver your wire antenna to a spot that's clear of the side-mounted antennas.

The GOAT can also operate on almost any rope or non-electrified wire support. Support line strung from a single tall tree or building to a smaller structure, or stretched between other high objects, is all you'll need. The GOAT can also be used to haul hardware or tools to the top of your support structure.

Several different versions are available, with prices starting at $99.95. For more information, contact Martin Electric, PO Box 810033, Dallas, TX 75381; tel 972-241-9139; **kb5hov@goatsystem.com**; **www.goatsystem.com**.

SOUNDS SWEET COMMUNICATIONS SPEAKER

♢ Sounds Sweet announces their entry into the communications speaker arena with their new base station speaker. The speaker's features include a tuned port bass reflex cabinet, 3/4 inch thick tongue and groove construction, a dual cone driver and a frequency response designed for Amateur Radio use.

Price: $99. For more information, see **www.soundssweet.com**.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

W1BSX, Albert M. Wentworth, Lexington, MA
*KB1D, Marc S. Webb, Jupiter, FL
KA1MKF, John E. Kish, Phoenix, AZ
ex-KA1OPO, Peter Platanitis, Chatham, MA
W1UOL, Francis M. McKernon, West Haven, CT
WA1VNN, Milton L. Bloomquist, Portland, CT
NE1X, William E. Harding Sr, Danvers, MA
N2HYU, Ronald Allocco, Rochester, NY
W2KFB, Julian D. Hirsch, New Rochelle, NY
W2MOF, Frank A. Hernandez, Newton, NJ
*W2UNS, Wayne R. Stone, Radford, VA
*WB2WGV, Richard F. Kreusch, Mohrsville, PA
WB2WYU, Fred W. Prindle, Afton, NY
K2ZBP, Fred D. Clair, Whitestone, NY
*W2ZBY, Stephen E. McCallum, Lexington, KY
ex-N3CES, Thomas E. Dawson, Harrisburg, PA
W3DR, Carl E. Johnson, Woolrich, PA
N3EH, Emil E. Hrivnak, Boalsburg, PA
*W3EW, Edwin P. Westbrook, Oxon Hill, MD
WB3JNX, George L. Grimes Jr, Harrisburg, PA
K3KYN, Charles C. Fawcett Jr, Ambridge, PA
WN3M, Herbert O. Elletson, Erie, PA
KF3T, Lashley H. Mann II, Brandywine, MD
W3WCQ, Robert S. Bennett, Baltimore, MD
KI4AD, Hugh W. Hosmer, Milton, FL
WA4AXO, Philip H. Morrison, Bristol, TN
WD4DFX, Hamner F. Collins Jr, Germantown, TN
W4DQV, Walter D. Acuff, Jacksonville, FL
KF4EBU, Oscar B. Simms, Panama City Beach, FL
AB4FE, Alfred S. Crisson, Belews Creek, NC
W4FOD, John V. Bush, Lynchburg, VA
*K4GKJ, J. D. Bennight, Huntsville, AL
WB4HCI, Pat West, Louisville, KY
KA4HFL, Robert J. Fennell Jr, Savannah, GA
KD4IDF, James E. Wascomb, Tuscaloosa, AL
W4KIP, Loyce A. Turner, Smyrna, GA
K4KN, Roland M. Wood Jr, Signal Mountain, TN
KO4KU, Andrew F. Lewis, Louisville, KY
KB4KZG, Clarence H. Steen Sr, Sparta, NC
N4LRD, Samuel A. Munnerley, Pensacola, FL
AG4LT, Kenneth E. Pride, Ooltewah, TN
KA4MFF, John N. Street, Alexandria, VA
WA4PID, Grover W. Cook, Allegan, MI
‡ex-W4PP, Andrew F. Thompson, Cochran, GA
*W4SS, Emanuel G. "Manny" Papandreas, Lake Worth, FL
WU4V, J. Ralph Davis, Seymour, TN
W4VX, James Walker, Columbus, GA
KD4ZSA, Robert McGovern, Henderson, NV
W5AUM, Henry L. Schulze Jr, Brenham, TX
WD5BSY, Donald M. Morrow, Austin, TX
W5DKC, George W. Bunce Sr, Piedmont, OK
N5FYB, Joann Akin, Lubbock, TX
AA5MA, Horace W. Rand, Alexandria, LA
N5NOY, Philip T. Palmer, Ingram, TX
*W5PDY, Joe T. Knight, Albuquerque, NM
K5QEW, Earle B. Brown, Kenedy, TX
WA5QJQ, Lowell M. Frazier, Las Cruces, NM
W5QKT, Walter L. Sutherland, Gun Barrel City, TX
WA5RDS, John L. Pittman, Smithville, TX
W5TWA, Benny Cobb, Bartlesville, OK
KK5W, Alfonso Zermeno, Houston, TX
K5YWJ, Perry W. Thomas, Silverton, TX
WA5ZFQ, Roger B. Jolly, Port Neches, TX
*W6ART, Glen Akins, Los Angeles, CA
K6BR, John C. Naylor Jr, Boynton Beach, FL
*W6FVT, Albert Solomon, Fullerton, CA
KC6HET, Paul Holmes, Auburn, CA
K6HVU, Wilhelmus T. Losekoot, Kensington, CA
KF6LGQ, Albert Schneider, Fresno, CA
*WB6QDC, Jack W. Forbes, Los Altos, CA
W6TYD, Robert C. Huber, Los Angeles, CA
W6WB, Clayton F. Bane, San Francisco, CA
W6WDW, William D. Watt, Oceanside, CA
W6YHM, G. Don Eberlein, Los Gatos, CA
K6ZF, James D. Groves, Ojai, CA
W6ZID, Adolph T. Beyer, Escondido, CA
N7BAL, Greg B. Almgren, Portland, OR
KD7BLJ, Paul W. Durbin, McMinnville, OR
KE7CN, Robert H. Lloyd, Payson, AZ
W7ELR, John L. Feldhausen, Spokane, WA
*W7GVX, Sidney S. Williams, Bend, OR
AF7J, Anthony R. Manser, Centerville, UT
W7OIF, Cameron A. Allen, Phoenix, AZ
AA7PN, Evelyn C. Heaps, Bellingham, WA
W7TUO, David S. Rennie, Anaconda, MT
K7VCA, George E. McCracken, Billings, MT
W7VZS, Kenneth J. Heine, Las Vegas, NV
W7YEQ, H. William Madison, Bellingham, WA
W8ANO, Waldo A. Sayles, Grafton, OH
N8AZA, Robert Young, Maryville, TN
WD8BBK, Gail L. Brenner, Gahanna, OH
W8KLZ, Elizabeth West, Flushing, MI
KC8KZQ, Dennis C. Traeder, Redford, MI
KB8LLH, Harold F. Pruden, Dunbar, WV
WB8QVE, William W. Ellis, Columbus, OH
*K8UJO, Earle M. Giesey, Dunbar, WV
‡W8WUT, Avis E. Miracle, Three Rivers, MI
W8WUU, Wilfred Miracle, Three Rivers, MI
WB9BBI, Myron W. Jackson, Appleton, WI
WA9CVR, Lorenzo D. Goodrich, Beloit, WI
ex-N9DZR, William Marlin, Franklin, IN
WB9FNN, Harold A. Wilson, Evansville, IN
W9IQV, John J. Novak, Dundee, IL
KA9KAB, Frank J. Brown, Chippewa Falls, WI
K9LBX, James H. Burcum, Onalaska, WI
W9NSE, Clarence L. Graff, Appleton, WI
W9SRZ, Joe Munizza, Allenspark, CO
W9VYW, Harvey M. Johnson, Milton, WI
K9WTF, Ronald W. Hooker, Big Bend, WI
*WAØAFY, Larry R. Gillespie, Elberon, IA
KØBKE, Charles R. Schwab, Raytown, MO
WØCES, Ernest A. Bowerman, Omaha, NE
NZØD, Armin R. Diestler, Sahuarita, AZ
*WØFFY, David T. Wofford, San Antonio, TX
WØGJT, Dale E. Locker, Gilman, IA
‡ex-WØGLT, Howard Rees, Grand Junction, CO
WØKOW, Robert E. Hempy, South Saint Paul, MN
WAØMNL, Rosemarie Calaway, Colorado Springs, CO
WØRSM, Glenn M. Underhill, Riverdale, NE
KØSVH, Walter T. Claeys, Walcott, IA
VE3ASU, Robert F. Peacock, Mississauga, ON, Canada
VE3ENN, Leo Nadalin, Windsor, ON, Canada
VE5EK, Bryce C. Eckstein, Regina, SK, Canada
VE6ND, Norman D. Lockhart, Calgary, AB, Canada
G8CGK, Grant Dixon, Ross On Wye, Great Britain

*Life Member, ARRL
**Charter Life Member, ARRL
‡Call sign has been re-issued through the vanity call sign program.

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Kathy Capodicasa, N1GZO ♦ Silent Key Administrator ♦ n1gzo@arrl.org

STRAYS

QST congratulates. . .

◊ Tim Mauldin, WA5LTM, an ARRL life member from Norman, Oklahoma, who has been elected to the board of directors of the American Cancer Society, Heartland Division. Mauldin is a professor at Oklahoma City University.

◊ Bobby V. Rogers, KB1LN, of Charlestown, Rhode Island, who has been elected the first Base Commander of the United States Submarine Veterans Inc (USSVI, or SubVets) newly formed Rhode Island Base. If you are a former Submariner and want information about how to join this national organization, contact Bob at **kb1ln@arrl.net** or at 401-364-6375.

◊ Dr Charles Harpole, K4VUD, of Geneva, Florida, who served as Series Editor for a recently completed 10 volume set of books documenting the history of American cinema.

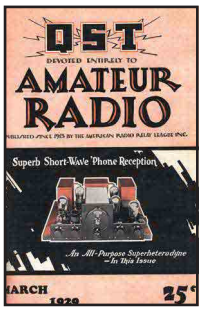
◊ Constance K. Barsky, WD8ODC, of Granville, Ohio, who has been elected to her first political office as a member of the Granville Village Council. A life member of the ARRL and licensed since 1976, Constance has lived in Granville since 1977 with her husband Steven G. Katz, N8WL.

WAC AWARDS

◊ Sponsored by the International Amateur Radio Union (IARU), the Worked All Continents award is issued for working and confirming all six continents (North America, South America, Oceania, Asia, Europe and Africa) on a variety of different bands and modes. A 5-Band WAC certificate and a 6-Band sticker are also available. For US amateurs, cards are checked at ARRL HQ. Displaying this certificate on your wall is a great way to demonstrate the capabilities of Amateur Radio. For more information about applying for WAC, see **www.arrl.org/awards**, or send a business size self-addressed, stamped envelope for an application form.

75, 50 AND 25 YEARS AGO

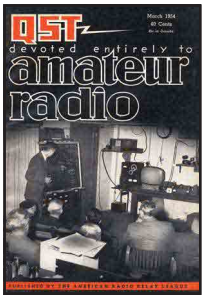
March 1929



♦ The cover photo shows "An All-Purpose Superheterodyne [with] Superb Short-Wave 'Phone Reception." The editorial discusses the basics of the new plan of affiliation between the US Army Signal Corps and the country's amateurs, saying "The plan [presents] many advantages to both parties."

Ross Hull writes the cover article, "Improving Short-Wave Phone Reception" with a 1929 type superheterodyne. A five-page article tells how "The Army-Amateur Radio System Is Revised." "Revised U.S.A. Amateur Regulations," gives the new 1929 frequency-band limits and other regulations. D. R. Clemons discusses "The Design of Inductance Coils," in Part II of his exhaustive discussion. OM "Felix," W5LS, makes us laugh with his story, "The Return of the Native." "Message Handling between U. S. A. and Canada" reports that the new agreement allows amateurs to pass message traffic between the two neighbor countries. The article notes that "The A.R.R.L. has also asked the Department of State to endeavor to negotiate similar agreements with other nations in which there is considerable amateur activity." In "What Price Television?" M. B. Sleeper points out the many factors that stand in the way of successful commercial television. L. W. Hatry discusses "The Effect of the Regeneration Control upon Tuning." The column "Expeditions" reports that amateurs are handling a large amount of traffic for the Byrd Expedition.

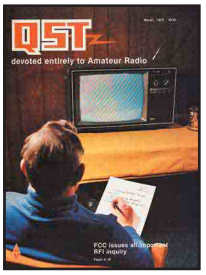
March 1954



♦ The cover shows members of the FCC visiting the ARRL Lab, with George Grammer, W1DF, explaining the current TVI problems facing amateurs. The editorial discusses the problem of non-amateur interference in the ham bands.

Dana Griffin, W2AOE, and Don Fryklund, W2HLP, present a new application of "Delay-Line Phase Shift" for S.S.B. transmitters. By Goodman, W1DX, teaches us how to best use our present receivers, in "Selectivity and 'Phone Reception." Orville Bauer, W2TEX, tells about "A Simple 2-element Beam for 20." J. P. Neil, VE3PN, describes "Dressing up the Antenna Coupler." Ed Tilton, W1HDQ, writes about "A Crystal-Controlled Converter for 21 Mc." T. H. Puckett, W2JXM, tells how to get "Break-In with One Antenna." R. D. Lee, W5AYU, and R. J. Loofbourrow, W5HPC, describe "R.F. Amplifiers for 420 Mc." using the 6AN4. "Strays" reports that W6OPU, Ray Middleton, was surprised to see his call sign used in a Mickey Mouse comic strip. When Ray wrote Disney Productions to inquire about it, they responded with a specially designed W6OPU QSL card featuring Mickey. Also in "Strays," a photo shows Ed Handy congratulating Bob White, W1WPO, on his Novice WAS. Bob's Minnesota QSL is from WNØBT, one of a few two-letter Novice call signs issued in error (but later replaced with a three-letter call sign).

March 1979



♦ The cover photo shows a ham and his TVI'ed television, as he writes a letter to the FCC—General Docket 78-369 has asked for the public to write with comments on the current RFI situation. The editorial urges hams to write FCC in response to that docket.

George Downs, W1CT, tells about "The Code Speedometer," which will take an audio input of a Morse signal and give a meter reading of the code speed. Don Dorson, W1GBO, describes "A CMOS Control Circuit for Repeaters." Doug DeMaw, W1FB, tells how to help the sensitivity of an older receiver on 10 and 15 meters by adding an external amplifier, in "FET 'Soup' for Tired Receivers." Jim Westboro, K1FD, uses "A Simple 10- and 15-Meter Converter" to accomplish the same thing. Tony Dorbuck, K1FM, tells how to perform "Matching-Network Design" using an inexpensive calculator. Jerry Hall, K1TD, presents "Zip-Cord Antennas—Do They Work?" Jim Bartlett, K1TX, and Stan Gibilisco, W1GV, present "The 3-Element 10-Meter Cheapie," made by modifying a three-element CB Yagi. "Hams Can Influence RFI Inquiry" urges hams to write FCC to tell them of the magnitude of the current RFI problem in cheaply made consumer electronic goods. George Hart, W1NJM, and former ARRL Communications Manager, discusses "ARES and You." QST

Al Brogdon, W1AB ♦ Contributing Editor

W1AW Schedule

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	TELEPRINTER 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	TELEPRINTER 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				

W1AW's schedule is at the same local time throughout the year. The schedule according to your local time will change if your local time does not have seasonal adjustments that are made at the same time as North American time changes between standard time and daylight time. From the first Sunday in April to the last Sunday in October, UTC = Eastern Time + 4 hours. For the rest of the year, UTC = Eastern Time + 5 hours.

♦ **Morse code transmissions:**
Frequencies are 1.8175, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13 and 15 wpm.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 wpm.

Code practice text is from the pages of *QST*. The source is given at the beginning of each practice session and alternate speeds within each session. For example, "Text is from July 2001 *QST*, pages 9 and 81," indicates that the plain text is from the article on page 9 and mixed number/letter groups are from page 81.

Code bulletins are sent at 18 wpm.

W1AW qualifying runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted on approximately 3.590 MHz by K6YR. See "Contest Corral" in this issue. At the beginning of each code practice session, the schedule for the next qualifying run is presented. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. The fee structure is $10 for a certificate, and $7.50 for endorsements.

♦ **Teleprinter transmissions:**
Frequencies are 3.625, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz. Bulletins are sent at 45.45-baud Baudot and 100-baud AMTOR, FEC Mode B. 110-baud ASCII will be sent only as time allows.
On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:**
Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **Miscellanea:**
On Fridays, UTC, a DX bulletin replaces the regular bulletins.
W1AW is open to visitors from 10 AM until noon and from 1 PM until 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy.
In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

Headquarters and W1AW are closed on New Year's Day, President's Day (Feb 16), Good Friday (Apr 9), Memorial Day (May 31), Independence Day (Jul 5), Labor Day (Sep 6), Thanksgiving and the following Friday (Nov 25-26), and Christmas Day (Dec 24). QST

By Jeff Klein, K1TEO

2003 September VHF QSO Party Results

What a difference a week makes...

Of all the VHF contests, the September contest offers the greatest opportunity for diverse propagation enhancement. Aurora, tropospheric ducting, and E-skip have all occurred in past September contests. In particular, September is a prime month for tropospheric ducting in much of North America. And September 2003 didn't disappoint with outstanding tropo conditions the weekend *before* this year's contest! Tropo conditions from the Midwest to the Southeastern US and later to the Northeast allowed for record setting DX conditions.

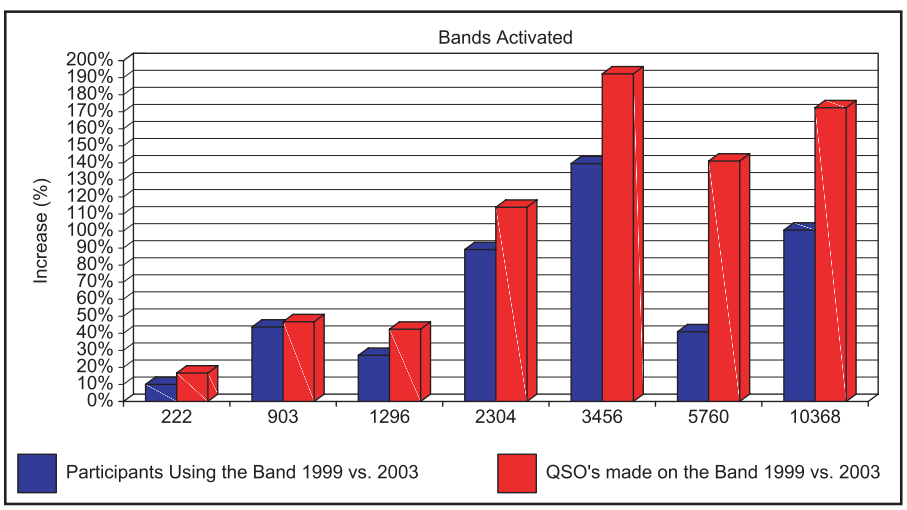
Alas, those conditions did not hold for the contest. Colder, rainy weather prevailed for much of the Eastern half of the country on the contest weekend ending any chance for tropo ducting. While the weather in the Western US was better, competitors generally noted average conditions. Eric, N7EPD did find some enhancement in the Pacific Northwest helping him achieve a new Division record score, And, some New England stations noted tropo ducting to the Canadian Maritime Provinces. Otherwise, as Pete, K9PW (operator at LM K9NS) noted conditions were "average" throughout the country.

2003 Summary

Submitted logs were 521 versus 534 in 2002. Despite the level activity and lack of propagation enhancement, a total of 18 all-time Division records were set this year. And, the average top 10 score in several categories was significantly higher in 2003 versus 2002. Jim, W4RX, noted great activity levels and the number of rovers as among the reasons helping his Division-record effort. On the West Coast, K6MI had a big score increase as national leader in single operator portable. John found the Rovers to be

COURTESY AE7RW

Chuck, AC7QN, operates the W7DK station on 144 MHz SSB with Mt Rainier looming in the background.



Expanded Results, Line Score Printouts Available

For complete contest results online, please visit **www.arrl.org/contests/results**. ARRL members without Internet access may obtain a printout of the complete line scores by sending a self-addressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington, CT 06111. Please be sure to include the contest name and year.

Top Ten

Single Operator, Low Power

K1TR	211,662
K2DRH	186,504
N1DPM	123,424
WB1GQR (W1SJ, op)	103,897
K4TO	80,106
AF1T	76,505
K5MA	76,049
KB8U	70,626
WA3GFZ	57,680
KT8O	54,692

Single Operator, High Power

K3EAR (KA1ZE, op)	562,848
K1TEO	535,800
K1RZ	424,410
W4RX	314,825
WA2FGK (K2LNS, op)	256,360
KM0T	190,080
K1GX	156,672
K2SMN	135,840
WB9Z	112,969
W0GHZ	108,188

Single Operator, Portable

K6MI	87,300
K1ZE	34,776
KF0Q	27,056
N7OEP	10,000
KA0TP	7,236
N8XA	7,176
WB0LJC	5,236
W9GKA	5,192
KQ6EE	4,292
KA1LMR	4,250

Limited Multioperator

K3YTL	381,684
W3SO	375,947
K9NS	310,308
AA4ZZ	276,089
W4IY	210,188
K8CC	140,686
WV8E	127,942
W3OR	117,450
W1QK	110,898
N8ZM	110,094

Multioperator

W2SZ	1,830,686
K1WHS	947,961
W2FU	653,250
N2PA	333,579
W9ICE	156,996
N2NK	150,547
N8KOL	127,534
W3KWH	120,960
W2EA	109,864
K3EOD	107,965

Rover

N6NB	378,756
N6MU	309,510
W3IY	306,459
W6TOI	198,669
N6TEB	176,326
N6DN (+logger)	142,710
N0DQS	102,440
VE3OIL/R	81,190
NI6M	76,985
K0PG	72,921

Regional Results

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

K1TR	211,662	A
N1DPM	123,424	A
WB1GQR (W1SJ, op)	103,897	A
AF1T	76,505	A
K5MA	76,049	A
K3EAR (KA1ZE, op)	562,848	B
K1TEO	535,800	B
K1RZ	424,410	B
WA2FGK (K2LNS, op)	256,360	B
K1GX	156,672	B
K1ZE	34,776	Q
KA1LMR	4,250	Q
WB2AMU	2,220	Q
WA2BAH	864	Q
W8IJ	80	Q
K3YTL	381,684	L
W3SO	375,947	L
W3OR	117,450	L
W1QK	110,898	L
N3JFM	91,450	L
W2SZ	1,830,686	M
K1WHS	947,961	M
W2FU	653,250	M
N2PA	333,579	M
N2NK	150,547	M
N2MH	55,755	R
WA2IID	32,472	R
W3HMS	27,720	R
KB1EKZ	23,246	R
K2QO	15,372	R

Southeast Region (Delta, Roanoke and Southeastern Divisions)

W4SHG	32,200	A
W4WA	28,392	A
KD4HIK	22,878	A
N4KFT	17,457	A
K0VXM	11,221	A
W4RX	314,825	B
K4QI	102,087	B
K2UOP	80,798	B
KE8FD	54,229	B
KE2N	34,602	B
K4SV	3,540	Q
AA4ZZ	276,089	L
W4IY	210,188	L
WV8E	127,942	L
W4NH	86,564	L
W4LJS	22,720	L
K4EJQ	39,750	M
WD4OAR	16,425	M
AG4V	4,074	M
N4JQQ	2,592	M
W3IY	306,459	R
N4FLM	20,736	R
KG4LEV	15,364	R
NT4L	8,316	R
AA4GA	6,400	R
K9JK	39,675	R
WB8BZK	26,609	R

Central Region (Central and Great Lakes Divisions; Ontario Section)

K2DRH	186,504	A
K4TO	80,106	A
KB8U	70,626	A
N9DG	41,106	A
KE8RO	29,014	A
WB9Z	112,969	B
K8TQK	106,577	B
K8MD	74,176	B
K9EA	73,386	B
W9GA	65,962	B
N8XA	7,176	Q
W9GKA	5,192	Q
N8OBB	99	Q
K9NS	310,308	L
K8CC	140,686	L
N8ZM	110,094	L
W9ICE	156,996	M
N8KOL	127,534	M
N2BJ	92,950	M
K9RN	66,045	M
NG9R	10,988	M
VE3OIL/R	81,190	R
K0PG	72,921	R
K9ILT	72,468	R

Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

KT8O	54,692	A
N0KP	32,850	A
K0MHC/0	23,800	A
W0JT	20,971	A
N0LL	7,076	A
KM0T	190,080	B
W0GHZ	108,188	B
K5LLL	20,382	B
K0CJ	19,832	B
N0URW	19,502	B
KF0Q	27,056	Q
WB0LJC	5,236	Q
N0HJZ	222	Q
VO1NO/W0	2,675	L
N5XYO	2,013	L
N0KIS	1,204	L
AB5K	555	L
W0EEA	18,830	M
W5LCC	7,392	M
KC0IYT	4,836	M
KA0MR	4,005	M
W5AC	3,060	M
N0DQS	102,440	R
W0AMT	42,877	R
KI0SK	4,898	R
N5RUX	3,808	R
K0NY	2,646	R

West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

VE7DXG	46,632	A
WA7JTM	20,370	A
K7MI	18,340	A
KC6ZWT	17,100	A
KF6KDA	8,400	A
AF6O	53,010	B
N7EPD	34,342	B
K6TSK	31,284	B
W6KBX	21,070	B
WA7TZY	15,618	B
K6MI	87,300	Q
N7OEP	10,000	Q
KA0TP	7,236	Q
KQ6EE	4,292	Q
K7TM	602	Q
AD6IJ	22,650	L
VA7MM	3,248	L
W2VJN	2,244	L
W7DK	2,212	L
KE6GFI	637	L
W6MMM	38,320	M
KF6YYV	24,354	M
N6ZE	5,504	M
W6TE	5,453	M
N6NB	378,756	R
N6MU	309,510	R
W6TOI	198,669	R
N6TEB	176,326	R
N6DN (+logger)	142,710	R

"the life of the party," providing half his QSOs and multipliers. Newer modes of operation such as WSJT are also helping competitors increase their scores.

Without a doubt, one of the biggest changes impacting VHF contesting scores is the number of bands activated by participants. Looking at the last five September contests shows that total QSOs made by all log submitters has stayed fairly level (though log submissions are down). However, QSO points are up a good deal. The use of 50, 144 and 432 MHz, the three bread and butter bands, has stayed relatively flat over the last five years. The vast majority of contesters are on 6 and 2, and over three-quarters consistently operate on 432. But the other bands have seen increases in usage and in some cases an explosion of activity! Looking at the chart on the previous page, we see a nice increase in 222 MHz participation and large increase on 903 and 1296. From 2304 MHz on up the rates show nearly double the number of participants and in some cases more than double. And, QSO totals on these bands are up even a larger percentage. The availability of equipment for these bands has clearly made a difference and as is typical on VHF and above, activity breeds activity. Ever creative and energetic VHF contesters continue to find ways to keep their scores going up and at the same time multiplying the fun!

Nationwide Perspective

It took a much higher score to place near the top of each category in 2003 versus 2002 results. 2001 Low power champ K1TR came back to regain the title from 2002 leader, K2DRH. Ed and Bob both topped DRH's September 2002 score in a close battle. The SOLP category was highly competitive this year with average scores up nearly 50% for the top-ten. And the tough competition was widespread—six new Division records were set in this category. Great job guys!

In the Single-op High power category, Stan, KA1ZE, operating the K3EAR station in Southeastern Pennsylvania, took

top honors and set a new all time record for single ops in the process. With the help of station owner Walt, WA1HHN, Stan reconfigured the usually multioperator station to allow a single operator, 12 band effort. Stan combined his excellent operating skills honed over many successful VHF contest efforts with the great station to set the record without the benefit of enhanced conditions. Congratulations Stan! K1TEO gave Stan a battle with his second place finish and defending champ K1RZ placed third setting a new personal record with his effort. The top five all scored over a quarter-million points as the competition really heated up this time. Special note to KMØT, WB9Z and WØGHZ for making the top 10 from the Midwest despite poor conditions in their area of the country.

Defending champ K6MI led the way in the single op portable category, more than doubling his score from the prior year. K1ZE beat MI's 2002 score to finish second. In his third try at the category, KFØQ finished third.

The Limited Multioperator category saw the closet competition of the categories as K3YTL defeated their Pennsylvania challengers at W3SO by a razor thin 6000 points. Hats off to both groups for a great job! The Easterners better watch out in the future as HF superstation competitors from the Midwest are challenging from K9NS and K8CC. And the boys from the mountains of NC, at AA4ZZ saw their score go up 40% from 2002 to hold on to fourth place for the second straight year.

In the Multioperator category, the MGEF group at W2SZ did it again with a winning effort of over 1.8 million points. They were chased by an outstanding effort from Down East with Dave and his crew at K1WHS improving their score by over 60% from the prior year. A major effort at improving the microwave setups at the WHS site really paid off, with outstanding grid totals on the bands at their location. The Rochester VHF Group was well represented in this category as W2FU repeated their third place 20002 standings and N2PA was fourth. The W9ICE group moved up a few notches to place fifth this year.

The rover category saw great competition this year as 3 stations broke the 300k barrier! Wayne, N6NB, led the way breaking the all-time record with over 378k. Travelling companion N6MU finished second just ahead of W3IY. Competition was fierce in this category, especially in California with 6 of the top 10 scores from W6-land.

Regional Highlights

Regional top scores are summarized in the accompanying table. Additional detailed breakdowns are available in the web report.

Affiliated Club Competition

Medium Category		
North East Weak Signal Group	2,317,932	20
Potomac Valley Radio Club	1,687,673	23
Rochester VHF Group	716,636	10
Society of Midwest Contesters	662,447	14
Northern Lights Radio Society	611,179	22
Yankee Clipper Contest Club	403,522	6
Mt Airy VHF Radio Club	325,328	5
Carolina DX Assn	288,316	4
South Jersey Radio Assn	212,753	4
Mad River Radio Club	172,436	5
Contest Club Ontario	171,068	10
Pacific Northwest VHF Society	160,254	19
Badger Contesters	152,207	11
Western States Weak Signal	115,982	8
Northern California Contest	88,115	4
Tennessee Contest Group	25,860	3
Lawton Fort Sill ARC	6,128	8
Local Category		
Delaware Valley VHF Society	96,837	5
Rappahannock Valley Amateur	69,790	3
Dominion DX Group	28,881	4
Dauberville DX Assn	5,849	3

Northeast Region

As usual, top Northeast scores are highly competitive on the national level. In addition to scores noted in the national summary, SOLP stations N1DPM, WB1GQR, AF1T and K5MA were among the overall Top 10, as were WA2FGK and K1GX in the SOHP category, W1QK in Limited Multioperator and Multioperators W2EA and K3EOD. N2MH led the rovers in the Northeast with a score of 55k.

Southeast Region

W4SHG led the way in the SOLP category followed closely by W4WA. SOHP station K4QI just missed a National top-10 score with 102k. The ML category was especially competitive in the Southeast with AA4ZZ, W4IY and WV8E all among the national leaders.

Central Region

In addition to K2DRH's national no. 2 score for SOLP, K4TO and KB8U were no. 5 and no. 8 respectively. SOHP was very competitive with Jerry WB9Z topping Bob K8TQK by 6k. N8XA and W9GKA fought it out for top SO- Portable, with XA winning by a narrow 2k. LMs K9NS, K8CC and N8ZM and Multioperators W9ICE and N8KOL made the national top 10. VE3OIL led the way for Rovers in a close victory over KØPG and K9ILT.

Midwest Region

KT8O led the way for SOLP and managed to make the National top 10 list as did KMØT and WØGHZ for SOHP. KFØQ had a fine effort in SO- Portable followed by WBØLJC. WØEEA led the multiops while Gene, NØDQS, did his usual great job to lead the rovers breaking the 100k mark, followed by WØAMT.

West Coast Region

VE7DXG's excellent 46k score topped the SOLP category followed by WA7JTM, K7MI, and KC6ZWT. AF6O led the SOHP category, while the AD6IJ and W6MMM crews topped LM and Multioperator, respectively. N7OEP, KAØTP and KQ6EE, all part of the national top 10, followed K6MI's winning SO-portable effort. The West Coast rovers really shined with five 100k plus efforts out of the region from N6NB, N6MU, W6TOI, N6TEB and N6DN.

Affiliated Club Competition

This year 21 clubs competed for the bragging rights in the Medium and Local categories. For several years the Potomac Valley Radio Club has finished first with the Northeast Weak Signal Group placing second. Without the big score usually provided by the K8GP Multioperator station (they sat it out this time) the NEWS Group was able to surpass the PVRC to take top honors. The Rochester VHF Group, Society of Midwest Contesters and The Northern Lights Society all finished tightly bunched in third-fifth for the Medium Category. The Delaware VHF Society took top honors in the Local category.

The name of the game in VHF contesting is to get on the bands and have fun. And getting on even more bands appears to add to the fun as noted earlier. So, as we head to spring and summer, figure out what band to add to your station and increase the fun in the 2004 September contest. And, keep your fingers crossed that perhaps enhanced conditions will land on the *right* weekend this year! But one thing is for certain, you gotta be in it to win it—and have fun! See you on the bands this summer. QST

STRAYS

QST congratulates. . .

◊ Ben Mackenzie, K8IRY, who has received the prestigious Pioneer Award from the Airline Avionics Institute. The avionics industry's highest award for individuals, it is awarded for outstanding personal achievement. It is presented on an as-deserved basis, and has been awarded only seven times since 1967. Ben was nominated for the award by several of the largest avionics equipment manufacturers, NASA and by major airlines.—*Michael A. Johnson, K7RZU*

By **David Sumner, K1ZZ**
Chief Executive Officer

The 2003 ARRL 10 GHz and Up Contest

The ARRL 10 GHz and Up Contest continues to grow! There were 141 entries for the 2003 running of this cutting-edge event, held on the weekends of August 16-17 and September 20-21. This is more than 5% above last year's record total.

Even more remarkable are the scoring trends. At the top of the heap is Gary Lauterbach, AD6FP, who made the long trek from Los Altos down to Baja California (XE2) on both weekends to take advantage of the coastal 10 GHz propagation. His single 24 GHz QSO with XE2/W6DTA puts him in the multiband category. Close behind, and first in the 10 GHz only category, is Mike Ramirez, XE2/W6YLZ, followed closely by XE2/W6DTA (multiband) and XE2/K6DYD (10 GHz only). Gary logged the best DX of this Baja quartet, reaching AA6IW, W6QI, WA6CGR, and a non-entrant over a 1040 km path from DL27rs to CM95xv. These were the longest QSOs of this year's competition and just 60 km short of last year's.

On the California end of the coastal path the highest score was turned in by Glenn Allen, KE6HPZ, followed by Larry Frakes, KG6EG, both in the single-band category. The advantage of the longer paths spanned by the Baja boys is shown by the fact that it took Glenn 330 QSOs with 54 stations to make just over half the score accumulated by XE2/AD6FP from 337 QSOs with 60 stations. Jack Henry, N6XQ, worked the most different call signs, 61, by splitting his time between Mexico and California.

It's a different contest in the rest of the country (not forgetting our loyal VE2s and VE3s).

The top score in Colorado was earned by Ron Hranac, NØIVN. Ron operated from the top of Mt Evans the first weekend and Pikes Peak the second while a loyal band of 15 other operators fed him 416 10-GHz QSOs over distances of up to 261 km. Ron noted that participation was down somewhat in his area because some of the regulars had schedule conflicts.

The most impressive group effort of the year was mounted by the Northern Lights Radio Society of Minneapolis-St Paul, Minnesota, who put 18 stations on the air around Lake Superior for the August weekend. Gary Danelius, WBØLJC, turned in their best multiband score with Bruce Richardson, W9FZ, close behind in the 10 GHz only category. There are 307 QSOs with 25 different call signs in the WBØLJC log—quite a testimony to the Twin Cities microwavers, who provided a nice boost in the number of entries from the 10th call area! With typical equipment of 1 W and an 18 inch dish on 10 GHz, they spanned paths up to 333 km.

In the Northeast the high score was submitted by Chip Taylor, W1AIM. Chip operated from six different locations, making 143 QSOs with 53 different call signs on 10 GHz. There's a reason for the lower ratio of QSOs to call signs than in the other regions: trees! The rules permit two stations to make a new QSO every time one of them moves 10 km, but clear shots to the horizon are few and far between in foliage-laden New England. Not far behind Chip in the single-band category was Dale Clement, AF1T (and yes, they're known as Chip 'n' Dale), who spent the first weekend on Block Island, Rhode Island, and the second on Martha's Vineyard, Massachusetts. Dale notes rain scatter QSOs with W2KV, K1RZ and KB8VAO, and an aircraft scatter QSO with K2AXX as highlights of the first weekend. The best DX in the Northeast was 610 km from the K1RZ home station in Maryland to AF1T and W1MKY (operating her first 10 GHz Contest with 750 mW and a 1 foot dish) on the Vineyard, but there were many close contenders. The top multiband score in the Northeast came from Mike Seguin, N1JEZ.

On the higher bands, the best DX was achieved on 24 GHz by NØUGY and KØRZ (164 km), and on 47 GHz by W4SW with a non-entrant (86 km). These distances are down a bit from the previous year. Four entrants reported QSOs above 300 GHz.

The 2004 running of the ARRL 10 GHz and Up Contest will take place on the weekends of August 21-22 and September 18-19. With all of the equipment improvements that were made over the winter and the new operators cropping up all over the country, it should be another record-setting year! QST

Best DX (km)—10 GHz Only

XE2/K6DYD	910
XE2/N6WKS	910
W6QIW	910
XE2/W6YLZ	910
WB6DNX	884

Best DX (km)—10 GHz and Up

10 GHz	
AA6IW	1040
WA6CGR	1040
W6QI	1040
XE2/AD6FP	1040
XE2/W6DTA	910

24 GHz	
KØRZ	164
NØUGY	164
KA1OJ	150
W1GHZ	150
W6HCC	140

47 GHz	
W4SW	86
KA1OJ	41
W1FKF	36
KB8VAO	34
N2EZS	34

300+ GHz	
K1DS	1
N6IZW	1
WA3GFZ	1
WB6IGP	1

Entries by Call Area

1	24	7	1
2	5	8	7
3	5	9	2
4	4	Ø	27
5	7	VE	8
6	44	XE	7

Top 10 Scores

Call Sign	*Score*	*Call Area*
10 GHz Only		
XE2/W6YLZ	196,859	DX
XE2/K6DYD	161,813	DX
KE6HPZ	105,127	6
XE2/N6XQ	89,158	DX
XE2/WB6TFC	82,886	DX
N6CA	77,093	6
N6EQ	68,966	6
N6RMJ	66,622	6
NØIVN	63,537	Ø
XE2/N6WKS	58,667	DX
10 GHz and Up		
XE2/AD6FP	210,124	DX
XE2/W6DTA	182,175	DX
AA6IW	76,640	6
W6QI	75,106	6
WA6CGR	70,544	6
WA6QYR	55,226	6
WBØLJC	55,101	8
WA6NIA	51,578	6
K6JEY	45,941	6
W6OYJ	33,230	6

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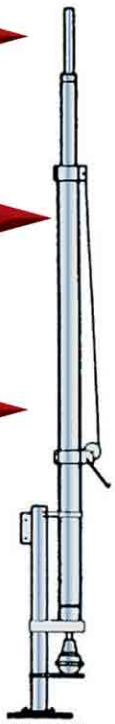

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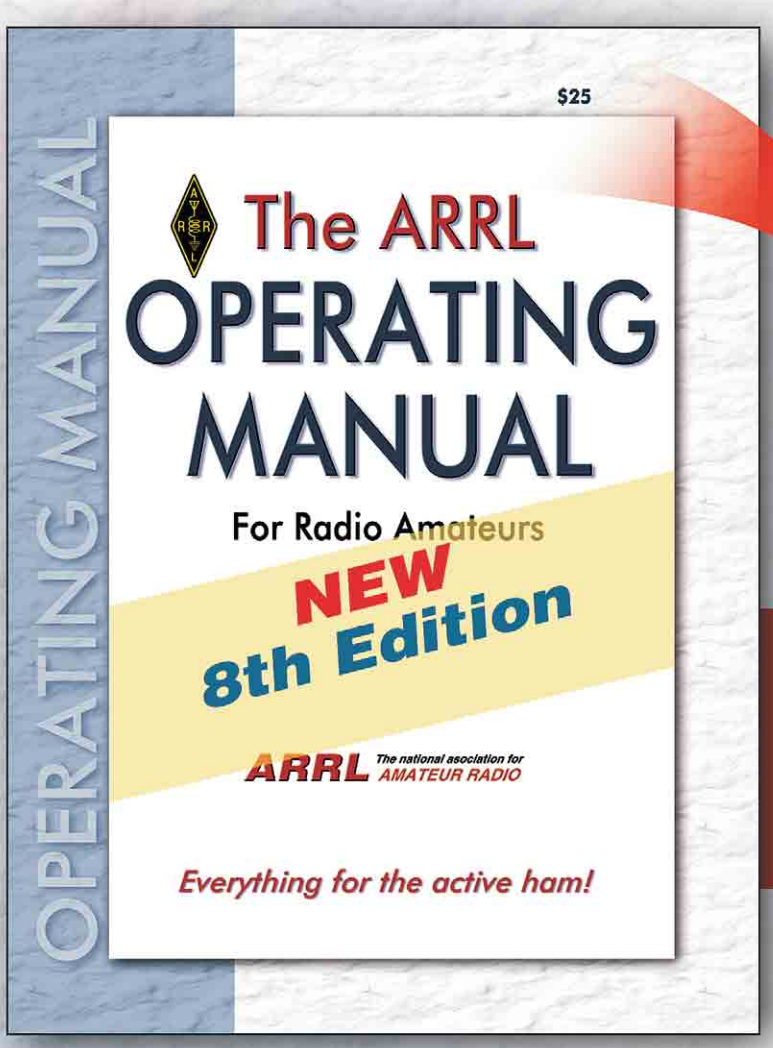

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TH-K2AT A triumph of advanced engineering and design. (middle) This 2M 5W HT is equipped with internal VOX, weather alert/RX, auto simplex checker, auto repeater offset and multiple scans. The K2AT also offers built-in CTCSS, DCS and 1750Hz tone burst. The K2AT charges up to 3X faster than others and meets MIL-STD-810 for resistance to rain, vibration, shock and humidity. 2.44"w x 4.38"h x 1.13"d, 12.5 oz..... **$159.99**

TH-F6A Head-scratching, unique features. The FM 144/220/440MHz F6A offers dual-channel RX capability, 16-key pad, multi-scroll key, 5W, and no fewer than 435 memories. Other attractive features include built-in ferrite bar antenna for AM, backlit LCD, lithium-ion battery, and a MIL-STD design. 2.3"w x 3.44"h x 1.18"d, 8.8 oz **$329.99**

TH-G71A The brighter side of handy communications. (right) This FM dualbander (144/440MHz) boasts an illuminated keypad and LCD, high-performance antenna, and a stylish yet ergonomic design. The 5W G71A also offers convenience with menu mode, PC compatible and 200 memories. 2.31"w x 4.44"h x 1.44"d, 11.6 oz.. **$229.99**

TM-271A All-terrain performance. On or off road, the 144MHz, 60W 271A delivers powerful mobile performance and other features such as multiple scan functions, 200 memories, NOAA weather rx, and CTCSS/DCS. Yet, this MIL-STD transceiver goes easy on you, providing high quality audio, illuminated keys and large LCD **$189.99**

TM-G707A The essence of ease. From the extra-large panel to Kenwood's Easy Operation mode, the G707A is extraordinarily user-friendly. In addition to its regular profile, it can store four others for instant recall. This 50W/35W, FM dualband (144/440MHz) offers 180 multi-function memories with name function to identify each. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs..... **$269.99**

TM-742AD Triple advantage in mobile communications. The 742AD 144/440MHz is a high performance FM multibander offering triple receive and display capabilities. With optional band units, it can even receive three bands simultaneously. The user can mount the controls and display separately (with optional kit) for unique 3-way convenience. The 50W (35W on 440) 742AD has built-in DTSS, 101 memories, flexible scan, tone alert, triple repeater functions and S meter squelch. 5.88"w x 1.94"h x 6.88"d, 3.3 lbs..... **$639.99**

TM-D700A Harnessing APRS®, GPS and SSTV. This FM 144/440MHz mobile features a built-in TNC offering options including simple packet. However, the brightest spot of the 50/35W D700A is its ability to enable APRS® without a computer. It also has 200 memories, dual receive, built-in CTCSS/DCS, and DX cluster monitoring. 5.5"w x 1.58"h x 7.68"d, 3 lbs **$519.99**

TS-480SAT New compact all-mode. This 100W HF/50MHz can operate on DC 13.8V and offers two power terminals. The 480SAT also features AF DSP, RX dynamic range, separate LCD control panel with speaker, auto tuner and 100 alphanumeric memories. Can be controlled from a PC and is PSK31 compatible .....FREE jacket* **$1369.99**
TS-480HX 200W version without tuner .FREE jacket* **$1499.99**

TS-2000 Distinctive, packed for performance. The all-mode, HF, 2M, 6M, 70cm 2000 is serious about DSP. Its advanced digital technology converts analog waveforms into digital data, enabling digital processing like IF filtering, slope tune, and auto notch. 10.63"w x 3.75"h x 12.5"d..... NOW! FREE Heil mic **$1699.99**

TS-570D(G) Affordable DSP without compromise. High-end technology doesn't mean a high-end budget. With 16-bit DSP, untouchable digital filtering, heavy-duty transmitter design, and central frequency control system, the 570D(G) provides powerful 160-10M operation. 10.63"w x 3.75"h x 11"d, 15 lbs..... **$989.99**

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VX-150 Designed to perform under the most difficult conditions. (left) This 2M 5W HT provides exceptional receiver performance with clean, clear transmit. Built to withstand outdoor use, the 150 is constructed to MIL-STD, with commercial-grade speaker and Omni-Glow™ keypad. 4.3"h x 2.3"w x 1"d, 11.5 oz..... **$119.99**

VX-2R Smallest HT dualband! (mid-left) This 1.5/1W dualband (144/440MHz) handheld offers VHF, UHF, shortwave, marine and aircraft bands, or WIRES™ linking. The 2R's wide band receive includes the AM broadcast band, continuous HF shortwave, VHF/UHF up to 729MHz, plus 800-960MHz (cell blocked). It also includes over one thousand memories (20 groups), CTCSS/DCS encode/decode and auto repeater shift. 1.9"w x 3.2"h x 0.9"d ..After *Rebate! **$129.99**

VX-5R/VX-5RS Setting water resistance standards. (mid-right) Offering 5W (4.5W on 430MHz), the 5R/5RS cover 50/144/430MHz while providing short to microwave reception. Great for outdoors with optional barometric pressure unit. Black or silver. 2.3"w x 3.4"h x 1.1"d, 8.9 oz.....After *Rebate! **$224.99**

VX-7R/VX-7RB The first submersible amateur HTs. (right) Water protected, the 50/144/430MHz, 5W 7R/7RB are rated for 3', 30-minute submersions. Magnesium bodies make them ideal for outdoors. Include dual/wide-band rx, status strobe, and WIRES™ key. Silver or black. 2.4"w x 3.5"h x 1.1"d, 9.2 oz.....After *Rebate! **$289.99**

FT-2800M Cool and quiet 65W operation. The most rugged 2M transceiver ever provides 65/25/10/5W with an extensive 221 memories, alphanumerics and CTCSS/DCS. The 2800M also features NOAA with weather alert, WIRES™ access, SmartSearch™, and excellent receive performance. With a bullet-proof front end and direct keypad entry, it's a dream come true. 6.3"w x 2"h x 7.3"d, 4 lbs... **$159.99**

FT-7800R Get "back to basics." This FM, 144/430MHz mobile boasts 50/40W output and 1000 memories. It also offers one-touch hyper memories, full-featured CTCSS/DCS, WIRES™ internet linking and wide receiver coverage. The 7800R has a large LCD and NOAA weather alert. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs..... **$279.99**

FT-8800R Easy operation, ultimate dualband. This 144/430MHz 50/35W mobile offers simultaneous monitoring of one band while operating the other. Besides extended receive, the 8800R provides 1000 memories, CTCSS/DCS, and versatile scan. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs.....After *Rebate! **$329.99**

FT-920 Dedicated to the enhancement of Signal-To-Noise ratio. The 160-6M 920 is optimized for noise reduction, wide dynamic range and audio tailored to the operator's voice. This 100W rig also features dual watch, extensive menu, keyboard frequency entry, 127 alphanumeric memories and versatile scanning. 15.2"w x 5.3"h x 12.5"d, 24 lbs. NOW! FREE FM1 included.....After *Rebate! **$999.99**

FT-897 All-in-one portable base. The all-mode, multi-band 897 features high output 100W (HF/6M), 50W (2M), 20W (70cm), rugged construction, 200 memories, and optional internal power supply and external antenna tuner. 7.87"w x 3.15"h x 10.3"d, 8.6 lbs.....After *Rebate! **$699.99**

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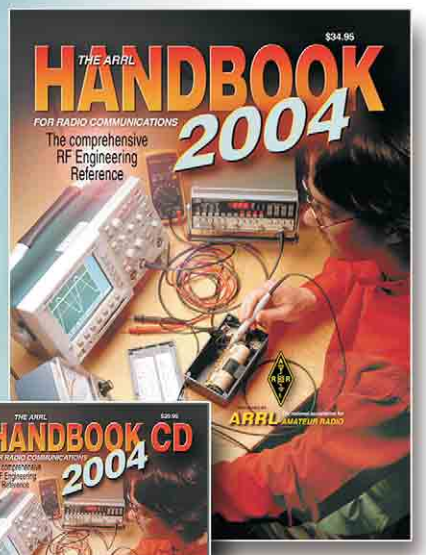

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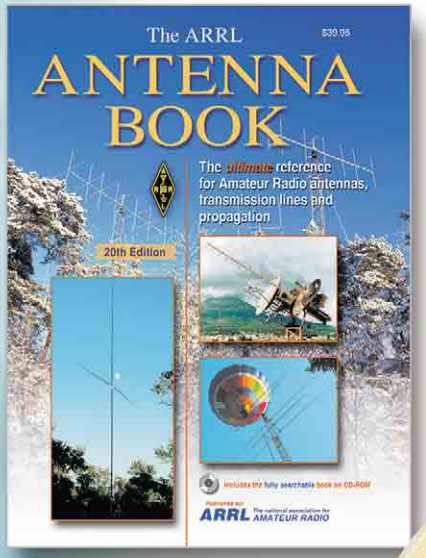

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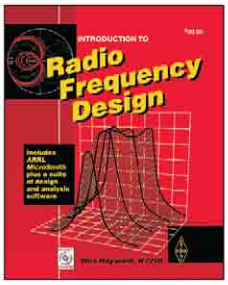

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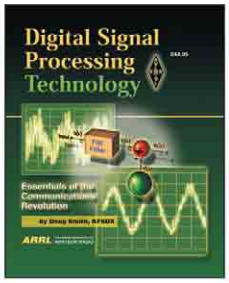

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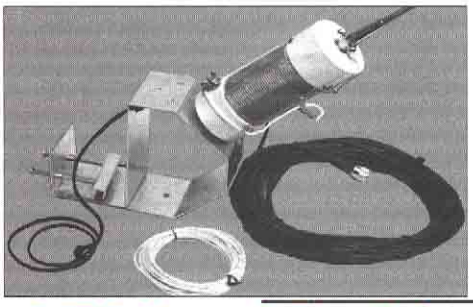

MFJ-1622 **$99.95** *New!*

New MFJ-1622 Apartment Antenna lets you operate 40 thru 10 Meters on HF and 6 and 2 Meters on VHF with a single antenna!

Its universal mount/clamp lets you easily attach it to window frames, balconies and railings. It also works great indoors mounted to a bookshelf, desk, or table. It's not a 5 element yagi, but you'll work your share of exciting DX!

Highly efficient air wound "bug catcher" loading coil and telescoping 5½ foot radiator lets you really get out! Radiator collapses to 2½ feet for easy storage and carrying.

It includes coax RF choke balun, coax feed line, counterpoise wire and safety rope. Handles 200 Watts PEP.

Operating frequency is adjusted by moving the "wander lead" on coil and adjusting counterpoise for best SWR.

MFJ Ground-Coupled Portable Antenna Base

Provides effective RF ground and stable mount for vertical antennas . . . Antennas radiate well with low SWR

MFJ-1904 **$99.95** *New!*

MFJ *Ground-Coupled Portable Antenna Base*™ provides an *effective* RF ground 160 through 2 Meters and a stable mount for vertical antennas.

Capacitive coupling to ground is a *time-proven* principle. It needs no tuning and antenna radiates well and gives good SWR on all bands. Performance is similar to mobile stations when using a mobile antenna but is far better with longer antennas.

The base can support a lightweight multiband vertical antenna -- like the all band Hy-Gain 18AVS and the bandswitching MFJ-1795 -- and provide a semi or permanent installation.

You can easily set up and take down vertical antennas for stealth operation and hide the base by covering it with dirt.

The MFJ-1904 is a 2x2 foot *stainless steel* square with reinforcing bends that greatly strengthens it. Folded and tapered six-inch *stainless steel* legs firmly anchor the MFJ-1904 into the ground.

Built-in antenna mount with SO-239 coax connector and two U-bolts lets you mount most standard and homebrew vertical antennas.

Standard 3/8-inch x 24 mobile mount is built-in for MFJ Mobile Whips, bug catchers, *Hustlers* and screwdriver antennas.

Two handles make carrying and removing the base fast and easy. You can also attach radials for improved performance.

33 Feet Telescoping fiberglass Mast . . .

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Super strong fiberglass mast has huge 1¼ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

MFJ-1910 **$79.95**

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Perfect for permanent or portable operation in antenna restricted areas. Hide behind trees, fences, buildings, *in* bushes -- only 7 to 10 feet tall (adjustable).

MFJ-1795 **$149.95** *New!*

Low angle of radiation for DXing, omni-directional, handles 1500 watts PEP, low SWR.

Highly efficient end-loading. Entire length radiates.

Ground mounts with suitable ground such as MFJ-1904 *Ground-Coupled Antenna Base*, radials or ground rods. Or roof mount with radials.

HF mini-Bugcatcher

Highly efficient 40 - 6 Meter base-loaded 5½ foot Bugcatcher mobile antenna . . . Use light duty mounts

Become an *"HF Mobileer"* almost instantly with this *new* MFJ high-efficiency *mini-bugcatcher* mobile antenna! Have tons of fun rag-chewing and DXing on the HF bands. Turn boring drives into fun-filled ham adventures.

MFJ-1624 **$79.95** *New!*

Attach a simple mount to your vehicle (*mounts*: trunk lip, MFJ-347, $39.95; mirror or luggage, MFJ-342, $9.95; tri-magnet, MFJ-338T, $19.95) . . . **Screw** in your MFJ *mini-bugcatcher* . . . **Throw** your rig into your car, plug into cigarette lighter and turn power down to 20 Watts (to avoid overloading your cigarette lighter; MFJ-1624 handles 300 Watts PEP). **Operate!**

Bugcatcher design uses large highly-efficient *air-wound* inductor -- far out performs other compact HF antennas. *Exclusive* built-in inductive matching network keeps SWR low. 5½ foot whip collapses to 2½ feet for easy storage and low garages. Base loaded for minimum wind load and light duty mounts. Change band by moving *wander lead*. 3/8x24 in. mount.

MFJ Portable Antenna

MFJ-1621 **$89.95**

Operate from apartments, homes, hotels, campsites, beaches or any antenna restricted area. Work all bands 40, 30, 20, 17, 15, 12 and 10 Meters.

DXCC, WAZ, WAC, WAS have been won with the MFJ-1621! Compact 6x3x6 inch cabinet has 4½ foot telescoping whip, built-in antenna tuner, field strength meter and 50 feet coax. Handles 200 Watts.

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MFJ's *tiny* 36 inch diameter *high-efficiency* loop antenna performs like a *full-size* dipole! Operate 10 thru 30 MHz *continuously* -- including WARC bands!

MFJ-1786 **$379.95**

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Mounts vertically or horizontally. Low angle radiation gives you excellent DX.

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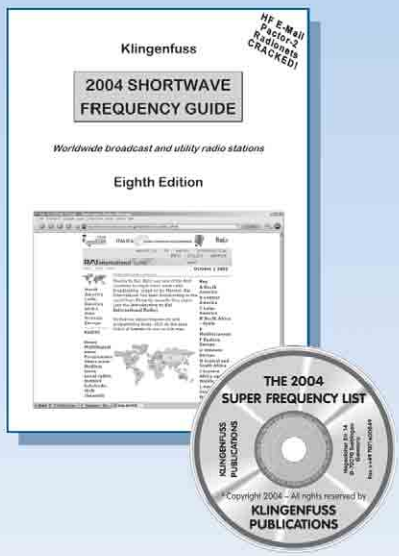

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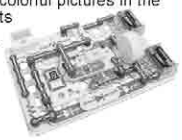
Electronic Snap Circuits

As Featured in a July 2003 *QST* "Short Takes" Review!

Assembling simple, and even fairly advanced, experimental circuits is as easy as snapping together toy building blocks. Follow the colorful pictures in the manual to build exciting projects such as AM and FM radios, digital voice recorders, burglar alarms, doorbells, and more! (Depending on the specific model) No tools required!



Snap Circuits, Jr, (SC-100)
$29.95
Contains over 30 parts. Build over 100 different circuits!

Snap Circuits, Standard (SC-300) $59.95
Contains over 60 parts. Build over 300 different circuits!

Snap Circuits, Standard (SC-300S) Includes Computer Interface $74.95
Contains over 60 parts. Build over 300 different circuits and **20 computer interfaced projects!**

Snap Circuits, Pro (SC-500) NEW! $89.95
Contains over 75 parts. Build over 500 circuits!

Advanced Test Equipment for the Serious Experimenter!

Elenco GF8046

3MHz Sweep Function Generator with built-in 60MHz frequency counter
$199.95
This sweep (linear/log) function generator with counter is an instrument capable of generating sine square, triangle ramp, plus pulse, minus pulse, TTL, and CMOS pulse over a frequency range from 0.5Hz to 3MHz.
GF8025 - without counter Special! $99.95

Elenco F2800 $99

Handheld Universal Counter 1MHz - 2.8GHz
Features 10 digit display, 16 segment and RF signal strength bargraph.
Includes antenna, NiCad battery, and AC adapter.
Resolution to 10Hz.
C2800 Case with Belt Clip $14.95

Elenco RF Generator Model SG9500 $239

100kHz-250MHz (to 450MHz on harmonics) with counter (100kHz - 150kHz)
Features internal AM mod. of 1kHz, RF output 100mV to 35MHz. Audio output 1kHz @ 1V RMS.
SG9000 (analog, without counter) $135

Elenco Oscilloscope Model S1325 30MHz Special $325

Free Dust Cover and x1, x2 Probes – 2 Year Warranty

S1330	30MHz	Delayed Sweep	$439
S1340	40MHz	Dual Trace	$475
S1345	40MHz	Delayed Sweep	$569
S1360	60MHz	Delayed Sweep	$725
S1390	100MHz	Delayed Sweep	$895

Digital Scope Super Specials

DS203	20MHz/10Ms/s Analog/Digital	$695
DS303	40MHz/20Ms/s Analog/Digital	$850
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- All Metal Case

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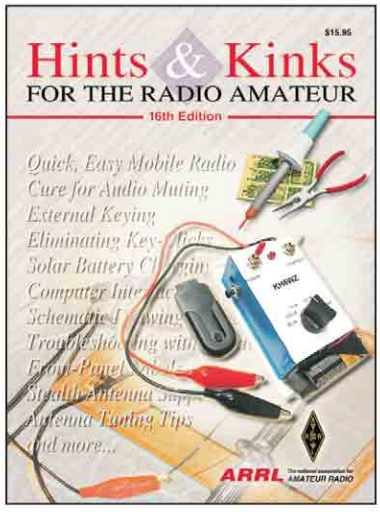

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Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

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Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ inches.

B-5018-G **$329**

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT or mobile/base amplifier. 160 Watts out for 10 Watts in. For 0.25-10 Watt rigs.

B-2518-G, $329. Same as B-5018-G but for 10 to 25 Watt mobile or base. 160 Watts out for 25 Watts in.

RC-2, $45. Remote Control. On/Off, preamp On/Off, selects SSB/FM. With 25 foot cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

35 Watts for 2 Meter HT

For handhelds up to 8 Watts. 35 Watts out for 3-8 Watts in (18 W out/1W in)! 18 dB *GaAsFET* preamp. All modes: FM, SSB, CW. RF sense T/R switch. Reverse polarity protection. Includes mobile bracket, 1 year warranty. 5¼Wx1¾Hx4¾D in.

B-34-G **$99.95**

35 Watts, $79.95, FM only

B-34, $79.95. 35 Watts out for 2 Watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛Wx1¾Hx4¼D in

MIRAGE Dual Band 144/440 MHz Amp

Boost your *dual band* 144/440 MHz handheld to a powerful mobile/base -- 45 Watts on 2 Meters/ 35 Watts on 440 MHz! Works with all FM handhelds to 7 Watts. In-cludes *full duplex* operation -- lets you talk on one band, listen on other at same time. Auto band selection, RF sense T/R switch, single connector, reverse polarity protection, 5Wx1¾Hx5D in. Mobile bracket. One year warranty.

BD 35 **$159.95**

100 Watts for 2M HT

100 Watts out for 2-8 Watts in! Great for HTs up to 8W. FM, SSB, CW. 15 dB *GaAsFET* preamp, RF sense T/R, high-SWR protected. B-310-G **$199.95**

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- ***High Current Roller Inductor***
- ***SSB*Analyzer Bargraph™***
- **Cross-Needle Meter**
- ***6 Position Antenna Switch***
- ***Built-in 4:1 Balun***
- ***Gear driven Turns Counter***

The VECTRONICS HFT-1500 is not just an antenna tuner . . . it's a beautifully crafted work of art, using the finest components available and the highest quality construction.

Every HFT-1500 aluminum cabinet is carefully crafted with a super durable paint that won't scratch or chip.

Attractive two-color Lexan front panel is scratch-proof. Take a quarter. Scratch the front panel. You won't leave a mark!

Arc-Free Operation

Two 4.5 kV transmitting capacitors and a massive roller inductor give you arc-free operation up to 2 kW PEP SSB.

Precision Resetability

A sturdy hand cranked roller inductor lets you quickly fly from band to band. A precision 5-digit gear driven turns counter lets you accurately retune.

HFT-1500 **$459.95**

Large comfortable knobs and smooth vernier drives make tuning precise and easy. Bright red pointers on logging scales make accurate resetability a breeze.

Absolute Minimum SWR

You can tune your SWR down to the absolute minimum! **Why?** Because all network components -- roller inductor and variable capacitors are *fully* adjustable.

Tune any Antenna

You can tune any *real* antenna from 1.8 to 30 MHz, including all MARS and WARC bands. You can tune verticals, dipoles, inverted vees, Yagis, quads, long-wires, whips, G5RVs, and more!

*SSB*Analyzer Bargraph™*

Exclusive 21 segment bargraph lets you visually follow your instantaneous voice peaks. Has level and delay controls.

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A shielded directional coupler and backlit Cross-Needle meter displays accurate SWR, forward and reflected power simultaneously. Reads both peak and average power on 300/3000 Watt scales.

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Select two coax fed antennas (tuned or bypassed), balanced line/wire or bypass.

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Automatically tunes any antenna balanced or unbalanced . . . Ultra fast . . . 2000 memories . . . Antenna Switch . . . Efficient L-network . . . Matches 6-1600 Ohms at 300 Watts . . . 1.8-30 MHz . . . 4:1 current balun . . . Cross-Needle and Digital SWR/Wattmeter . . . Aural SWR meter . . . Backlit LCD . . . Remote control port . . . Radio interface . . .

MFJ-993

$259.95 **New!**

The MFJ-993 *IntelliTuner*™ lets you tune any antenna *automatically* balanced or unbalanced -- *ultra fast*.

It's an automatic antenna tuning *console* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJs exclusive *IntelliTuner*™, *Adaptive Search*™ and *InstantRecall*™ algorithms give you *ultra fast* automatic tuning with over 2000 *non-volatile* revolving memories.

You get a highly efficient L-network, wide 6-1600 ohm matching at *full* 300 Watts SSB/150 Watts CW, 1.8-30 MHz coverage, Cross-Needle and *digital* meters, aural SWR meter, *backlit* LCD display, remote control port, radio interface, heavy-duty 16 amp/1000 volt relays and more.

It learns while you're having fun

As you're ragchewing, contesting or DXing, *your MFJ-993 is learning!*

When you transmit, the MFJ-993 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!*

Each of two antennas can learn and remember over a thousand frequencies and tuner settings. They are safely stored in *non-volatile* revolving memory.

Highly Intelligent ultra fast tuning

MFJ *InstantRecall*™ first checks its memory to see if you have operated this frequency before. If so, tuning is instantaneous and you're ready to operate.

If not, MFJ's *IntelliTuner*™ algorithm -- based on MFJ's famous SWR Analyzer technology -- kicks in. It *measures* the complex impedance of your antenna. Next, it *calculates* the components it needs and instantly *snaps* them in. Then, it fine tunes to minimize SWR -- you're ready to operate. It's all done in a *fraction* of a second.

When the impedance is within its measurement range, the MFJ-993 is the *fastest automatic antenna tuner in the world.*

If it can't accurately determine impedance, MFJ's *AdaptiveSearch*™ algorithm goes into action. Frequency is measured and relevant components values are determined. Only those values are searched for ultra-fast tuning.

For even faster searches, you can set the target SWR to 2 (settable 1.0 to 2.0).

You can manually tune when you can't transmit (for listening out of ham bands).

Cross Needle and Digital Meters

Lighted Cross-Needle and *digital* SWR/Wattmeters lets you accurately read SWR, forward and reflected power at a glance.

An *aural* SWR meter lets you *hear* the tuned SWR when you can't see or read the meters.

Turn on a highly visible, instant response SWR LCD bargraph when you need it.

Backlit LCD Display

An easy-to-read *backlit* LCD displays SWR, forward/reflected power, frequency, antenna 1 or 2, L and C tuner values, on/off indicators and other information.

Remote Control Port

Plug in the **MFJ-990RC, $39.95**, remote control and put your tuner at your antenna or elsewhere and control it remotely.

The MFJ-993 supports radio tuner interfaces such as the ICOM 706 series. *Interface cables are available.*

The MFJ-993 is a compact 10Wx2¾ Hx9D inches. Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $19.95**.

Tune any Antenna

You can tune any antenna -- dipoles, verticals, beams, phased arrays, inverted vees, quads, random wires, mobile antennas, limited space antennas -- any antenna.

A 4:1 true current balun lets you tune any *balanced* antenna -- horizontal loops, vertical loops, multi-band doublets, quads, folded dipoles, Zepps.

150 Watt Automatic Tuner

New!

MFJ-991, **$219.95**

MFJ-991, *150 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 150 Watts SSB/100 Watts CW, matches 6-3200 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines.

600 Watt MFJ Automatic Tuner

MFJ-994, **$359.95** **New!**

MFJ-994, *600 Watt IntelliTuner*™ automatic antenna tuner. Similar to MFJ-993 but handles 600 Watts SSB/300 Watts CW, matches 12-800 Ohms. Does not have digital SWR/Wattmeter/LCD display, aural SWR meter/audio feedback, antenna switch or 4:1 current balun for balanced lines. Tuning must be done at low transceiver power with the amplifier bypassed.

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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 in.

MFJ-902
$79.95 **New!**

Tiny Travel Tuner with 4:1 Balun

MFJ-902H
$99.95

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 inches.

Tiny Travel Tuner with Cross-Needle SWR/Wattmeter

MFJ-904
$109.95

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 in.

ALL-in-one *Tiny Travel Tuner* with 4:1 Balun *and* SWR/Wattmeter

MFJ-904H
$129.95

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
$19.95
10 Feet

MFJ-1956
$29.95
12 Feet

10 foot extended, 19 inches collapsed, MFJ-1954, $19.95. 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
$39.95

Holds 66 pounds of antenna steady. Black *steel* base forms strong braced equilateral triangle 40 inches on a side. Non-skid feet. One inch diameter steel mast extends height to six feet. Strong base and mast locks. Easily add antenna mount or mast extension for greater heights. Collapses to 38 inches by 4 inch diameter. 6¾ pounds.

40-10M G5RV Junior **MFJ-1778M, $34.95.** *Half-size* 52 foot *G5RV Jr* 40-10 Meters, 1500 Watts.

1500 Watt Lightning Surge Protector

MFJ-272
$39.95

Protect your expensive transceiver from static electricity and lightning induced surges with an ultra-fast gas discharge tube. Plug between rig and antenna, attach ground. DC to 1000 MHz. SO-239s.

All-Band G5RV Antenna

MFJ-1778
$39.95

Cover all bands, 160-10M with tuner. 102 ft. long, 1.5kW. Custom fiberglass insulator stress relieves 450 Ohm ladder line. Use horizontally, as inverted vee or sloper. Marconi on 160M.

Glazed Ceramic Antenna Insulator

MFJ-16C06
$3.95
Package of six. (69 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*® coax. 1.5kW, 1.8-30 MHz. Stainless steel hardware. *Direct* antenna connection. 5x1½ in.

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Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . the world leader in ham radio accessories!

MUST SELL, Silent Key: DX Paradise in Pompano Beach, Florida! 2 bedroom/2 bath furnished mobile home in adult park. A/C, carport, Florida room, Ham Shack, shed, tools and lots more! Monthly property rental fees paid through the end of 2004. 40-foot crank-over tower with 2-element 20-10 meter Lightning Bolt quad. Contact Doris Halpin, W2KXC, 954-655-5962

SUN CITY WEST AZ: Beautiful 2-bedroom luxury home with family room plus utility/hobby room. 2103 Sq. ft. on 77' x 125' property, suitable for antenna. Double garage, all appliances included. $174,900. Taxes $834. Active adult community, safe, quiet and affordable. N7RH@azqth.com. Don Steele, Ken Meade Realty, 623-521-5254

SUN FAMILY VACATION - Nature Island of Caribbean, Dominica. Great DX J73HPL cottage, tower, HF ready to operate or your own Blue Ridge, VA , mountain top QTH. KK4WW, 540-763-2321, www.va-mountainland.com

TO BUY A HOME for that antenna tower or any type of home in Palm Beach county, Florida, call me, **Mort Penn, K1MP, Realtor with Coldwell Banker**, 561-642-1900 or 561-308-6676 mortpenn@bellsouth.net

TURKS AND CAICOS "HAM-LET" VACATION: House with station, highspeed internet. **Providenciales** above ocean. VP5JM, 649-946-4436 or E-mail: jody@tciway.tc

TURKS AND CAICOS: 3 br/2 bath; pristine beach; XYL approved deluxe accommodations; rigs; amps; antennas. www.qth.com/vp5 270-259-4530; k4isv@k105.com **For rent or sale**

VY2TT www.peidxlodge.com

Antique/Vintage/Classic

ANTIQUE RADIO CLASSIFIED. Free sample copy! Antique radio's largest-circulation monthly magazine. Old radios, TVs, ham equip., 40s & 50s radios, telegraph, books & more. Ads & articles. Free 20-word ad monthly. Subscribe today. Six-month trial: $19.95. Yearly rates: $39.49 ($57.95 by 1st Class). Foreign: write. ARC, PO Box 802-B22A, Carlisle, MA 01741. Phone: 978-371-0512, Fax: 978-371-7129, Web: www.antiqueradio.com

ANTIQUE WIRELESS ASSOCIATION. The organization for all enthusiasts of antique and historical radio! Publishes OLD TIMER'S BULLETIN, covering vintage ham gear, keys, telegraphy, contests, broadcast receivers, vacuum tubes, historical, technical articles, restoration, and much more. AWA produces the famous annual Rochester, NY meet. Maintains world-famous historical radio-electronics communications museum. Membership only $20/year USA, $25 elsewhere. Antique Wireless Association, Box E, Dept. 1, Breesport, NY 14816. Check our Website: http://www.antiquewireless.org

APPLE 1 microcomputer for sale. Very rare. PO Box 179, Floyd, VA 24091. KK4WW, 1-540-763-2534 or Land@swva.net

CLASSIC RADIOS — www.radiofinder.com finder@radiofinder.com

MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974H is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

The MFJ-974H is its successor. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974H gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974H tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974H is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to unbalanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

MFJ-974H **$199.95**

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974 **$179.95**

MFJ-974, $179.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $49.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ *High Current* DC Multi-Outlet Strips

Choose super versatile 5-way binding posts AND/OR Anderson PowerPole® connectors

Anderson PowerPole® is a registered trademark of *Anderson Power Products.*

Provide multiple high current DC outlets for transceivers and accessories from your main 12 VDC power supply – keeps you neat, organized and safe. Prevents fire hazard. Keeps wires from tangling up and shorting. Outlets are fused and RF bypassed.

All MFJ DC power strips have *built-in* six foot, eight gauge, flexible color-coded cable with ring tongue terminals -- *no extra cost. RF-tight* aluminum cabinet has mounting ears and ground post with wing nut.

Choose MFJ's *super versatile* super heavy duty 5-way binding posts (spaced for standard dual banana plugs) and/or *Anderson PowerPole®* outlets.

Each *Anderson PowerPole®* is individually fused as needed. Standard color coded automobile fuses plug in externally. Extra *PowerPole®* connectors, contacts, fuses are included at *no extra cost.*

Versatile 5-Way Binding Posts

MFJ-1118 **$74.95**

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 with master fuse, ON/OFF switch, and "ON" LED provide 15 Amps for accessories. 12½x2¾x2½ in.

All PowerPoles®

MFJ-1128 **$99.95**

12 outlets, each fused, 40 Amps total. Three high-current outlets for transceivers. Nine *switched* outlets for accessories. Mix and match in-cluded fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). *Built-in 0-25 VDC Voltmeter.* Includes *extra* 12 pairs of *PowerPole®* contacts and *extra* 10 fuses (2 each: 1, 5, 10, 25, 40A) -- *no extra cost.* 12Wx1¼Hx2¾D in.

MFJ-1126 **$79.95**

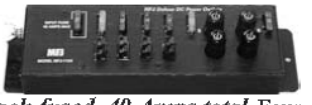
8 outlets. each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *Built-in 0-25 VDC Voltmeter.* Includes *extra* 6 pairs of *Anderson PowerPole®* contacts and *extra* 5 fuses (1, 5, 10, 25, 40A) -- *no extra cost.* 9Wx1¼Hx2¾ inches.

PowerPoles® AND 5-Way Binding Posts

MFJ-1129 **$109.95**

The best of both worlds! ***10 outlets, each fused, 40 Amps total.*** Three high-current outlets for rigs -- 2 *PowerPoles®* and 1 versatile high-current 5-way binding post. Seven *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 versatile binding posts. Mix and match included fuses as needed (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *Built-in 0-25 VDC Voltmeter.* Includes *extra* 7 pairs of *PowerPole®* contacts, and 10 fuses (2 each,1,5,10, 25, 40A) -- *no extra cost.*12½Wx1¼Hx2¾D in.

MFJ-1124 **$59.95**



6 outlets, each fused, 40 Amps total. Four *PowerPoles®* and two high-current 5-way binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes 4 pair *PowerPole®* contacts, and 5 fuses -- *no extra cost.*

•1 Year *No Matter What*™ warranty •30 day money back guarantee (less s/h) on orders direct from MFJ.

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MFJ . . . The World Leader in Ham Radio Accessories!

BROADCAST MICROPHONES and accessories (call letter plates, stands) wanted: early carbon, condenser, ribbon, dynamic models. Cash or trade. James Steele, Box 610, Kingland, GA 31548. 912-729-6106. jsteele@k-bay106.com; http://www.k-bay106.com/mics.htm

CODE PRACTICE OSCILLATOR MUSEUM: http://www.n4mw.com

COLLINS REPAIR - Specializing in S-Line and KWM2. Precision Collins Services, N6HK 661-822-6850. n6hk@csurfers.net

FOR SALE: Collins KWM2-30L1. One owner. K4CCQ, 478-955-3000

OUR Asheville, NC **Southern Appalachian Radio Museum** keeps history alive! - www.saradiomuseum.org

TELEGRAPH KEYS wanted by collector. Bugs and unusual or unique straight keys or sounders, and tube electronic keyers. Also pre-1950 callbooks. Vince Thompson, K5VT, 3410 N. 4th Ave., Phoenix, AZ 85013. 602-840-2653.

TELEGRAPH MUSEUM / COLLECTOR'S INFORMATION: http://w1tp.com

W4QCF MANUALS - buy/sell, www.w4qcfmanuals.com

WANTED: pre-1925 battery radios, crystal sets, and vacuum tubes. Also early telegraph keys and pre-1900 electrical apparatus. Jim Kreuzer, N2GHD, 1541 Bronson Road, Grand Island, NY 14072. 716-773-4999. wireless@pce.net

QSL Cards/Call Sign Novelties

250 QSL CARDS $20.00 postpaid. We also print color QSL cards, eyeball cards etc. Send stamp for sample. Vaso Nagl, KD4WVK, 832 Woodcraft Drive, Nashville, TN 37214

AFFORDABLE QSL CARDS available in small quantities with lots of options. Parma Graphics, K2BKA, 5 Rondout Harbor, Port Ewen, NY 12466. 845-339-1996.

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HAND MADE LEATHER BELTS with your call sign on them. Measure old belt from the fold in the buckle end to the hole now in use, and send the exact measurement. Specify black or brown. Send $35.00 ppd. To: Rohn Stearns Custom Leather, 3077 Camerons Rd., Homer City PA 15748. Call for brochure - toll free 866-749-2358

MFJ TUNERS

MFJ-989C *Legal Limit* Antenna Tuner

MFJ uses super heavy duty components to make the world's finest legal limit tuner

MFJ uses super heavy duty components -- roller inductor, variable capacitors, antenna switch and balun -- to build the world's most popular high power antenna tuner.

MFJ-989C
$359.95

The rugged world famous MFJ-989C handles 3 KW PEP SSB amplifier input power (1500 Watts PEP SSB output power). Covers 1.8 to 30 MHz, including MARS and WARC bands.

MFJ's *AirCore*™ roller inductor, new *gear-driven* turns counter and weighted spinner knob gives you exact inductance control for absolute minimum SWR.

You can match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave -- nearly any antenna. Use coax, random wire or balanced lines.

You get everything you've ever wanted in a high power, full featured antenna tuner -- widest matching range, lighted Cross-Needle SWR/Wattmeter, massive transmitting variable capacitors, ceramic antenna switch, built-in dummy load, *TrueCurrent*™ Balun, *scratch-proof* Lexan front panel -- all in a sleek compact cabinet (10¾Wx4½Hx15D in).

MFJ AirCore™ Roller Inductor gives high-Q, low loss, high efficiency and high power handling.

MFJ's exclusive *Self-Resonance Killer*™ keeps damaging self-resonances away from your operating frequency.

Large, self-cleaning wiping contact gives good low-resistance connection. Solid 1/4 inch brass shaft, self-align bearings give smooth non-binding rotation.

MFJ *No Matter What*™ Warranty

MFJ will repair or replace your MFJ-989C (at our option) *no matter what* for one year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

MFJ-986
$329.95

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. 10¾Wx4½Hx15 in.

MFJ-962D *compact* Tuner for Amps

MFJ-962D
$269.95

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. 10¾x4½x10⅞ in.

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969
$199.95

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. 3½Hx10½Wx9½D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E
$149.95

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. 3½Hx10⅝Wx7D inches. **MFJ-948, $129.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E
$119.95

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 10½Wx2½Hx7D in.

MFJ-945E HF+6 Meter *mobile* Tuner

MFJ-945E
$109.95

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, $4.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971
$99.95

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 6x6½x2½ inches.

MFJ-901B *smallest* Versa Tuner

MFJ-901B
$79.95

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-16010 *random* wire Tuner

MFJ-16010
$49.95

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
$79.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $49.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 or MFJ-924
$69.95

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 inches. Simple 2-knob tuning for mobile or base.

MFJ-922 144/440 MHz Tuner

MFJ-922
$79.95

Ultra tiny 4x2½x1¼ inch tuner covers VHF 136-175 MHz and UHF 420-460 MHz. SWR/Wattmeter reads 60/150 Watts.

MFJ-931 *artificial* RF Ground

MFJ-931
$89.95

Creates artificial RF ground. Also electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire. Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. **MFJ-934, $169.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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http://www.mfjenterprises.com

1 Year *No Matter What*™ warranty 30 day money back guarantee (less s/h) on orders from MFJ

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General

MFJ 1.8-170 MHz SWR Analyzer™

Reads complex impedance . . . Super easy-to-use

***New* MFJ-259B reads antenna SWR . . . Complex RF Impedance: Resistance(R) and Reactance(X) or Magnitude(Z) and Phase(degrees) . . . Coax cable loss(dB) . . . Coax cable length and Distance to fault . . . Return Loss . . . Reflection Coefficient . . . Inductance . . . Capacitance . . . Battery Voltage. LCD digital readout . . . covers 1.8-170 MHz . . . built-in frequency counter . . . side-by-side meters . . . Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . and much more!**

***The* world's most popular SWR analyzer just got incredibly better and gives you more value than ever!**

MFJ-259B gives you a complete picture of your antenna's performance. You can read antenna SWR and Complex Impedance from 1.8 to 170 MHz.

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

You can determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet.

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

You can also read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

It has built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Here's what you can do

Find your antenna's true resonant frequency. Trim dipoles and verticals.

Adjust your Yagi, quad, loop and other antennas, change antenna spacing and height and watch SWR, resistance and reactance change instantly. You'll know exactly what to do by simply watching the display.

Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance over the entire spectrum 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

Take the guesswork out of building and adjusting matching networks and baluns.

Accurately measure distance to a short or open in a failed coax. Measure length of a roll of coax, coax loss, velocity factor and impedance.

Measure inductance and capacitance. Troubleshoot and measure resonant frequency and approximate Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

Adjust your antenna tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance and Reactance Analyzer, Coax Analyzer, Capacitance and Inductance Meter and much more!

Call your favorite dealer for your best price!

MFJ-259B **$259.95**

Call or write for Free Manual

MFJ's comprehensive instruction manual is packed with useful applications -- all explained in simple language you can understand.

Take it anywhere

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. It uses 10 AA or Ni-Cad batteries (not included) or 110 VAC with MFJ-1312D, $14.95. Its rugged all metal cabinet is a compact 4x2x6¾ inches.

How good is the MFJ-259B?

MFJ *SWR Analyzers*™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Used worldwide by professionals everywhere.

More MFJ SWR Analyzers™

MFJ-249B, $229.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

MFJ-209, $139.95. Like MFJ-249B but reads SWR only on meter and has no LCD or frequency counter.

MFJ-219B, $99.95. UHF *SWR Analyzer*™ covers 420-450 MHz. Jack for external frequency counter. 7½x2½ x2¼ inches. Use two 9 volt batteries or 110 VAC with MFJ-1312D, $14.95. *Free* "N" to SO-239 adapter.

SWR Analyzer Accessories

Dip Meter Adapter

MFJ-66, $19.95. Plug a dip meter coupling coil into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate bandswitched dip meter. Save time and take the guesswork out of winding coils and determining resonant frequency of tuned circuits and Q of coils. Set of two coils cover 1.8-170 MHz depending on your *SWR Analyzer*™.

Genuine MFJ Carrying Case

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this *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-29C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

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

Has clear protective window for frequency display and cutouts for knobs and connectors so you can use your MFJ *SWR Analyzer*™ without taking it out of your case. *Look for the MFJ logo for genuine authenticity!*

MFJ-99, $54.85. Accessory Package for MFJ-259/B/249/B/209. Includes *genuine* MFJ-29C carrying case, MFJ-66 dip meter adapter, MFJ-1312D 110Vac adapter. ***Save $5!***

***New!* *Tunable Measurement Filter*™**

MFJ-731, $89.95. *Exclusive* MFJ tunable RF filter allows accurate SWR and impedance measurements 1.8 to 30 MHz in presence of strong RF fields. Has virtually no effect on measurements. Works with all SWR Analyzers.

MFJ *No Matter What*™ warranty

MFJ will repair or replace (at our option) your MFJ *SWR Analyzer*™ for one full year.

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http://www.mfjenterprises.com

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders from MFJ

MFJ-224 **$159.95**

MFJ 2 Meter *FM SignalAnalyzer*™

Measure signal strength over 60 dB range, check and set FM deviation, measure antenna gain, beamwidth, front-to-back ratio, sidelobes, feedline loss in dB. Plot field strength patterns, position antennas, measure preamp gain, detect feedline faults, track down hidden transmitters, tune transmitters and filters. Plug in scope to analyze modulation wave forms, measure audio distortion, noise and instantaneous peak deviation. Covers 143.5 to 148.5 MHz. Headphone jack, battery check function. Uses 9V battery. 4x2½x6¾ in.

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Box 494, Miss. State, MS 39762
(662) 323-5869; 8-4:30 CST, Mon.-Fri.
FAX: (662) 323-6551; **Add s/h**
Tech Help: (662) 323-0549

More hams use MFJ SWR Analyzers™ than any others in the world!

MFJ *Pocket size* Morse Code Reader™

Hold near your receiver -- it instantly displays CW in English!

Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . .

MFJ-461
$79.95

Is your CW rusty?

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

Automatic Speed Tracking

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW.

Four Display Modes

1. Bottom line scrolls and fills with text, then that entire line is displayed on top line until bottom line refills -- makes reading text extra easy! Automatically displays speed in WPM.

2. Same as **1**, without speed display -- gives you maximum text display.

3. Top line scrolls, bottom line displays speed in Words-Per-Minute.

4. Both top and bottom lines scroll.

Two-line LCD display has 32 large 1/4 inch high-contrast characters.

MFJ Instant Replay

The last 140 characters can be instantly replayed. This lets you re-read or check your copy if you're copying along side the MFJ-461.

High Performance Modem

Consistently get solid copy from MFJ's high performance *PLL* (*phase-lock loop*) modem. Digs out weak signals. Even tracks slightly drifting signals.

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

Computer Interface

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

More Features

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable.

Battery saving feature puts MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery (not included).

True Pocket Size

Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 2¼x3¼x1 in. 5½ ounces.

No Instruction Manual needed!

Super easy-to-use! Just turn it on -- it starts copying instantly!

Accessories

MFJ-26B, $4.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $14.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $5.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ *Pocket* Morse Tutor

MFJ-418
$79.95

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

MFJ Code Oscillator

MFJ-557
$29.95

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312, $14.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. 8½x2¼x3¾ in.

MFJ *Pocket* CW Keyer

MFJ-403P
$69.95

Built-in Iambic Paddle. Thumbwheel speed control. Adjustable weight. Adjustable sidetone with speaker. Iambic modes A or B. Fully automatic or semi-auto "bug" mode. Reversable paddle. Tune mode. RF-proof. Battery Saver. Tiny 2¼x3¼x1 in.

MFJ *miniature* Travel Iambic Paddle

MFJ-561, $19.95. 1¾Wx1¾Dx¾H in. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

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MFJ . . . the world leader in ham radio accessories!

MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$169.95

"What did you say?" Can you hear but . . . just can't always understand everything people are saying?

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $19.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $58.80. *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434
$179.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and play back five natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more *"Please repeat"*.

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434 is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

It's easy to use -- just plug in your 8 pin mic and plug the MFJ-434 cable into your transceiver. Internal jumpers let you set it to your rig. Use your mic or its built-in mic for recording.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $14.95. 6½Wx2½Hx6½D in.

MFJ-73, $29.95. MFJ-434 Remote Control with cable.

60 dB Null *wipes out* noise and interference

MFJ-1026
$179.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network*. You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $14.95. 6½x1½x6¼ in.

MFJ-1025, $159.95. Like

MFJ-1026 less built-in active antenna, use external noise antenna.

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MFJ-784B
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You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

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

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QT 3/2004

Index of Advertisers

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Issue	Reservation Date	Materials Due Date
April 2004 Issue	Wednesday, February 11, 2004	Monday, February 16, 2004
May 2004 Issue	Tuesday, March 16, 2004	Friday, March 19, 2004

Advanced Specialties: 153
Alinco: 11
All Electronics Corp: 155
Alpha Delta Communications: 135
Amateur Electronic Supply LLC: 119, 121, 123
ARRL: 22, 26, 27, 115, 118, 120, 122, 124, 126, 128, 129, 132, 133, 134, 135, 136, 138, 142, 144, 152, 153, 154, 156, 157
Ameritron: 18
Antique Radio Classified: 154
AOR: 8
Array Solutions: 154
Associated Radio Communications: 125
Atomic Time: 142
Austin Amateur Radio Supply: 125
Autek Research: 122
B & D Enterprises: 133
BetterRF Co, The: 132
Bilal/Isotron Co: 113
Bosun Supplies: 140
Buckmaster Publishing: 128, 146
Burghardt Amateur Center: 117
Buylegacy.com: 131
CABLE X-PERTS: 128
C.Crane Company: 131
C & S Sales: 136
Circuit Specialists: 134
Code Quick: 146
ComDaC: 125
Command Technologies: 113
Computer International: 153
Cubex Company: 153
Cutting Edge: 146, 154, 157
Davis Instruments: 134
Diamond Antenna: 3
Digital Communications, Inc.: 157
DX Engineering: 140
Elecraft: 129
Electric Radio Magazine: 146
Fluidmotion, Inc: 144
FX Rotor Works: 131
GAP Antenna Products: 148
Greater Baltimore Hamboree: 132
Ham PROs: 125
Ham Radio Outlet: 108, 109, 110, 111
High Sierra Antennas: 154
Hy-Gain: 2, 10
ICOM America: Cover II, 1, 153, 155, 157
IIX Equipment Ltd: 124
Intuitive Circuits, LLC: 131
Jun's Electronics: 134
K2AW's "Silicon Alley": 140
Kanga US: 124
Kenwood Communications: Cover IV, 19, 127
KK7TV Communications: 146
Lakeview Company, Inc.: 140
Larry's Antennas, LLC: 150
LDG Electronics: 116
Lentini Communications: 125
Log Window/SCO, Inc: 153
Logic: 146
Mayberry Sales & Service, Inc: 150
Metal & Cable Corp: 150
MFJ Enterprises: 112, 130, 139, 141, 143, 145, 147, 149, 151
Micro Computer Concepts: 131
Mike's 2-Way Radio Shop: 124
Mirage: 137
Mr NiCd: 158
N3FJP Software: 113
N4XM, XMatch Antenna Tuners: 124
NARTE: 152
National RF: 132
NCG Company: 6
New Communications Solutions: 150
Palomar Engineers: 113
PC Electronics: 148
Peet Bros Company: 124
Personal Database Applications: 146
Powerwerx: 129
Pulver: 142
QSLs By W4MPY: 131
R & L Electronics: 114
Radio Amateur Callbook: 134
Radio Bookstore: 140
Radio City: 125
Radio Club Of JHS 22 NYC: 116
Radio Daze: 113
Radio Era Archives: 153
Radio Works: 120
Rapidan Data Systems: 113
RF Parts Co: 3, 25, 113
Saratoga Amateur Radio Products: 138
SGC: 113, 115
SSB Electronic: 152
Star Quality QSLs: 146
SteppIR Antennas: 144
Surplus Sales of Nebraska: 131
Ten-Tec: 23
Teri Software: 148
Texas Towers: 17, 159, 160
TGM Communications: 124
The Mast Company: 133
Tigertronics: 122
Tower * Jack: 146
Universal Radio: 125
Vectronics: 137
Vibroplex: 124
Vintage Manuals, LLC: 122
W2IHY Technologies: 152
W3FF Antennas: 142
W5YI: 128, 146
W9INN Antennas: 146
Warren Gregoire & Associates: 113
WB0W Inc,: 133
West Mountain Radio: 131
Wheeler Applied Research: 146
Wireman Inc.: 140
Yaesu USA: Cover III, 7
YV-5 Communications, Inc.: 133
Yost & Co, EH: 158
Z Antenna Systems: 146

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Voyager Counterpoise	$49
Voyager Guy Kit	$45

Please Call for Delivery Information.

LAKEVIEW HAMSTICKS

9106	6m	9115	15m 9130 30m
9110	10m	9117	17m 9140 40m
9112	12m	9120	20m 9175 75m

All handle 600W, 7' approximate length, 2:1 typical VSWR...$24.95

HUSTLER ANTENNAS

4BTV/5BTV/6BTV	$129/169/199
G6-270R, 2m/70cm Vertical	$169
G6-144B/G7-144B	$109/179

Hustler Resonators in stock–call.

ANTENNA ROTATORS

M2 OR-2800P	$1249
Yaesu G-450A	$249
Yaesu G-800SA/DXA	$329/409
Yaesu G-1000DXA	$499
Yaesu G-2800SDX	$1089
Yaesu G-550/G-5500	$299/599

ROTATOR CABLE

R62 (#18)	$.32/ft.
R81/82	$.25/ft./.39/ft.
R84	$.85/ft

PHILLYSTRAN GUY CABLE

HPTG1200I	$.45/ft
HPTG2100I	$.59/ft
PLP2738 Big Grip (2100)	$6.00
HPTG4000I	$.89/ft
PLP2739 Big Grip (4000)	$8.50
HPTG6700I	$1.29/ft
PLP2755 Big Grip (6700)	$12.00
HPTG11200	$1.89/ft
PLP2758 Big Grip (11200)	$18.00

Please call for help selecting the Phillystran size for your application.

WEEKDAY HOURS:
9 AM–5 PM CST

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9 AM–12 NOON CST

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HUGE ICOM DEALS ★ HUGE YAESU DEALS

IC-756PROII..... Icom Special!
The Icom IC-756PROII is an all mode HF and 6m transceiver featuring 32-bit digital signal processing, auto antenna tuner, 100 watts RF output, digital twin PBT, 5" multifunction color TFT LCD display with band scope function, built-in CW and SSB memory keyers, and more. Supplied with hand mic and DC power cord.

PW-1..... In Stock!
The Icom PW-1 is a 1000 watt solid state linear amplifier for HF and 6m operation, featuring a high power automatic antenna tuner, built-in power supply, and a removable front control panel, and more.

IC-746PRO..... In Stock!
The Icom IC-746PRO is an all mode HF/6m/2m XCVR with 32-bit IF level DSP. The radio features a built-in auto tuner, built-in RTTY demodulator and decoder (reads out on the radio's LCD display), auto notch, digital twin PBT, and more. Supplied hand mic and DC power cord.

IC-910H ..... In Stock!
All-mode 2m/70cm dual band transceiver, featuring dual data inputs, CTCSS encode/decode, CW keyer, satellite mode, scan, sweep display function, optional 23cm module, optional DSP, and more. Supplied with hand mic and DC power cord.

FT-1000MP-V..... Yaesu Special!
Competition class HF DSP transceiver with auto tuner, 200 Watts RF output, and more!

FT-1000MP-V Field .....Special!
Low power (100W) version of the FT-1000MP-V, with built-in power supply.

FT-920 ..... Yaesu Special!
All mode HF/6m XCVR featuring DSP, auto tuner, and more. With up/down hand microphone and DC power cord.

Quadra System ..... In Stock!

FT-897..... In Stock!
"Backpack" all-mode HF/6m/2m/70cm XCVR offering 100 watts of output power! The radio can be run from optional internal batteries with reduced output of 20 watts, or an optional internal power supply can be installed instead. An optional bolt-on external auto tuner is also available. The FT-897 is a truly self-contained portable!

FT-847 ..... Yaesu Special!
Great all-mode XCVR covering HF/6m/2m/70cm! The radio is perfect for satellite operation, and features DSP, CTCSS tone encode/decode, and more. Supplied with microphone and DC power cord.

IC-703 ..... New, In Stock!
IC-703PLUS..... New, In Stock!
The Icom IC-703 is a compact HF XCVR, with built-in auto tuner, DSP, and more! The IC-703PLUS adds 6m coverage.

IC-706MK2G..... Icom Special!
The Icom IC-706MK2G is a compact HF/6m/2m/70cm all mode XCVR with DSP, CW keyer, built-in CTCSS encode/decode/scan, 107 memoriess and more. A detachable front panel offers convenient mounting, even in compact vehicles.

IC-718 ..... New Lower Price!

IC-2720H.....New!
Dual band 2m/70cm FM XCVR. Features remote control panel, CTCSS tone encode/decode/scan, cross band repeat, data jack, dual RX, extended RX, 212 memories, and more. Supplied with a DTMF hand mic, separation cable, mounting brackets, and a fused DC power cord.

IC-V8000..... In Stock!
Great 75W 2m mobile XCVR. Features CTCSS tone encode/decode/scan, 207 memories, front panel mounted speaker, and more. Supplied with a DTMF hand mic, mounting bracket, and DC cord.

FT-8900R..... In Stock!
Quad band mobile XCVR covers 10m/6m/2m/70cm, with cross-band repeat.

FT-8800R..... New, In Stock!
Great 2m/70cm dual band mobile, 45/35 Watts, removable front panel, and more!

FT-7800R..... New, Please Call!
New, 2m/70cm dual band mobile XCVR.

FT-2800M ..... In Stock!
Rugged, 50W 2m mobile transceiver.

FT-857.....Now In Stock!
Ultra-compact all mode XCVR for HF/6m/2m/70cm. Features CW memory keyer, CTCSS encode/decode, 200 memories, optional DSP, and more. Supplied with a hand microphone, a fused DC power cord and mounting bracket.

FT-817..... In Stock!
A truly tiny self-contained all mod e HF/6m/2m/70cm QRP XCVR featuring tone encode/decode, 200 memory channels, VOX, and more! With hand microphone.

IC-T2H Sport... Great Low Price!
IC-Q7A..... Great Low Price!
IC-T7H..... Icom Special!
IC-V8..... Great Low Price!
IC-W32A..... Now In Stock!
IC-T90A ..... New, In Stock!

IC-208H..... Great Low Price!
A great 2m/70cm dual band mobile XCVR, featuring CTCSS tone encode/decode, 500 memories, removable control panel, and more. With a back-lit DTMF hand mic, mounting bracket, and a DC power cord.

IC-2100H..... Great Low Price!
Rugged 2m mobile XCVR with CTCSS tone encode/decode/scan, DTMF paging/squelch, 113 memories, and more.

IC-PCR1000 ..... In Stock!
IC-R8500/R75..... In Stock!
IC-R3/R5/R10..... In Stock!

G-2800DXA.....$1089
Heavy duty antenna rotator handles 34 sq. ft. of antenna load, and features 450° rotation, preset and variable speed.

G-1000DXA.....$499
G-800SA/DXA.....$329/409
G-450A.....$249
G-5500 .....$599
G-550 .....$299

FT-50RD..... New Lower Price!
VR-120D ..... In Stock!
VR-500 ..... In Stock!
VX-2R..... New, In Stock!
VX-5R..... New Lower Price!
VX-7R ..... New Lower Price!
VX-150..... New Lower Price!

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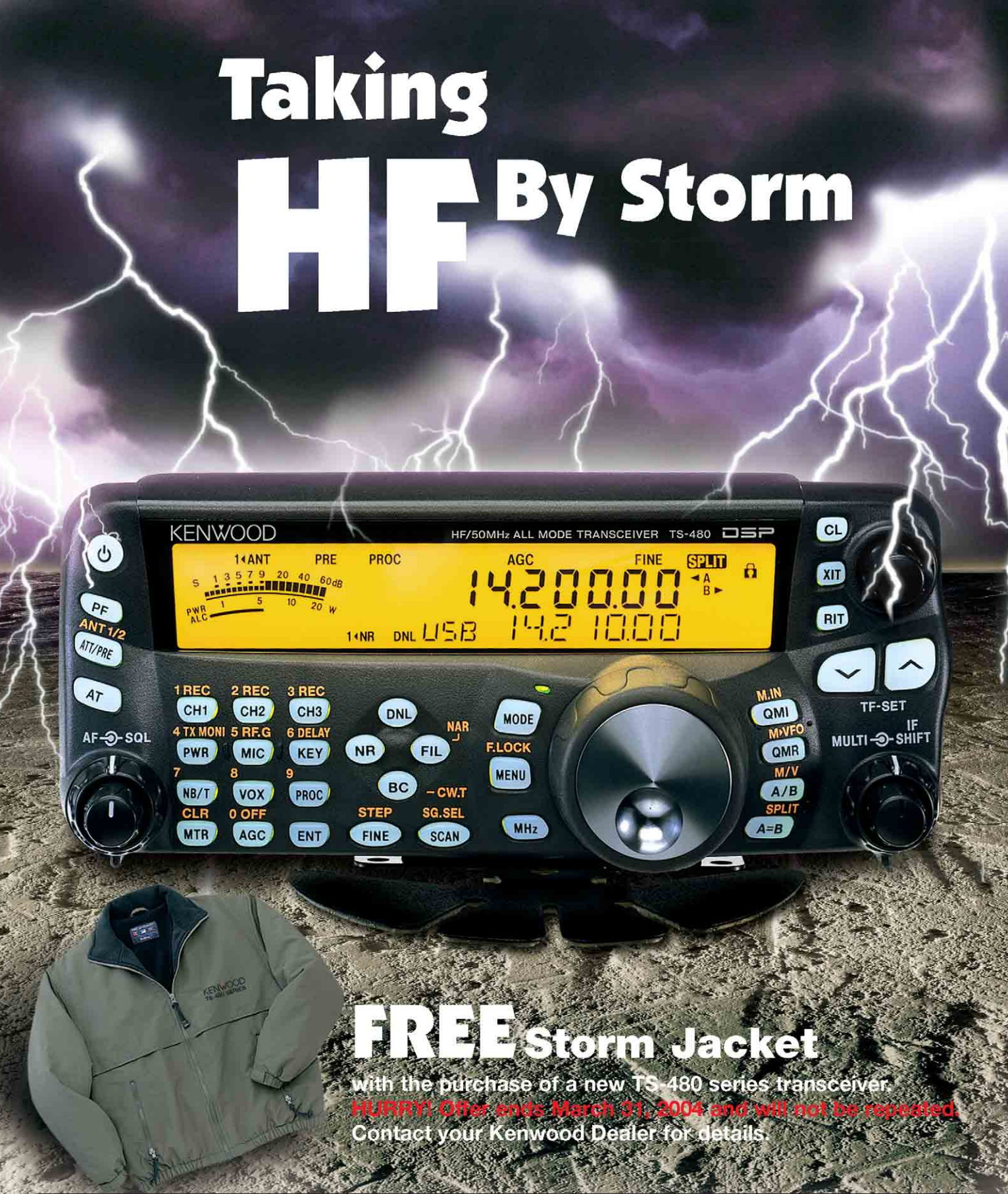

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