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QST

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AMATEUR RADIO

November 2004

QST reviews

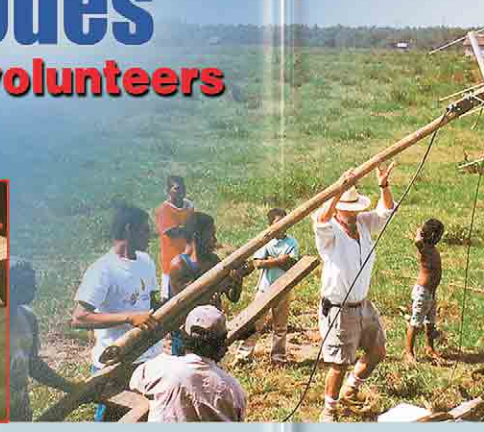
ICOM IC-2200H
2 meter FM transceiver

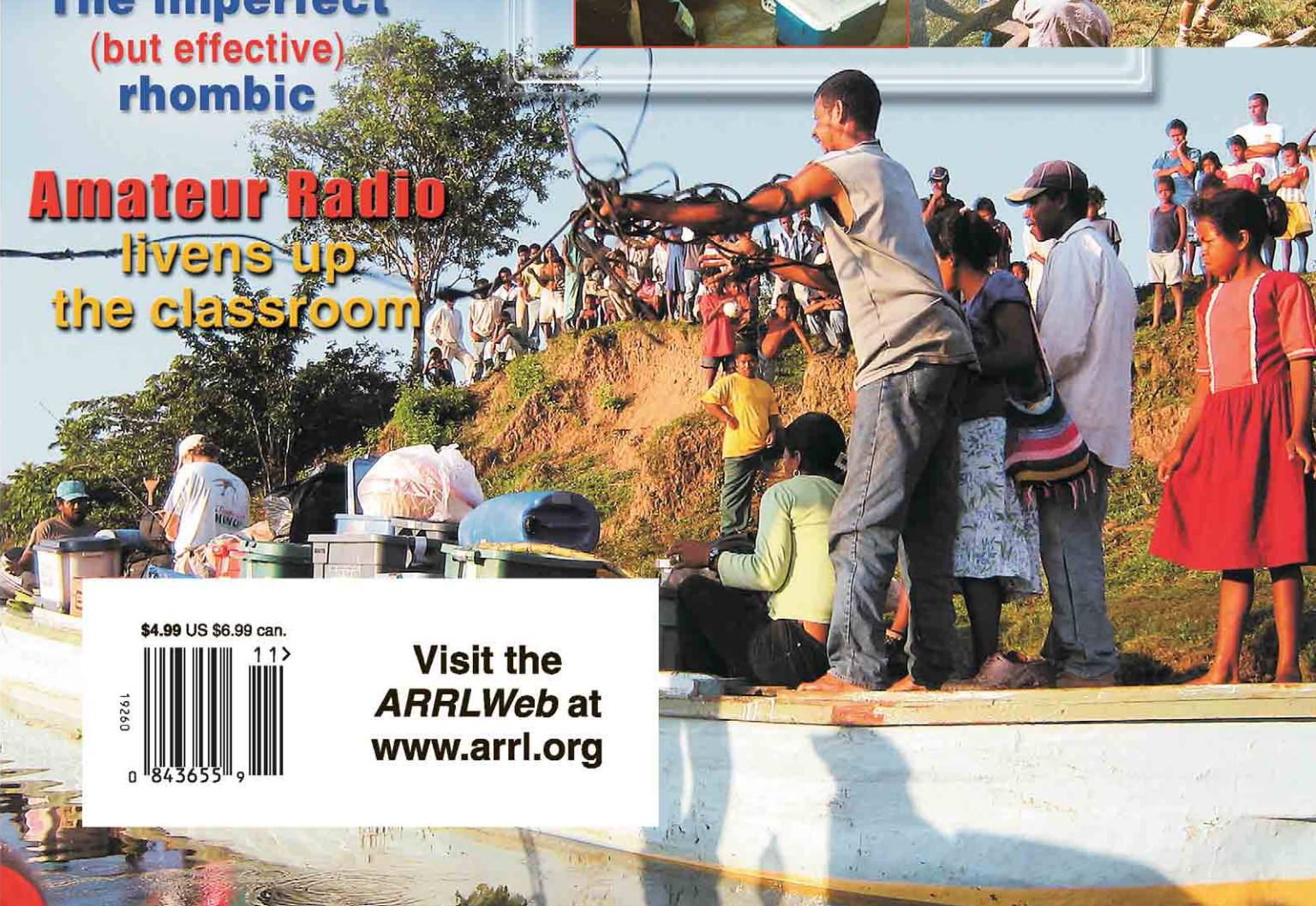
Yaesu FT-897D and FT-857D all-mode tranceivers

The imperfect (but effective) rhombic

Amateur Radio livens up the classroom

Digital Modes support health volunteers in Honduras





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HAM-IV
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The most popular rotator in the world!

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

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

T-2X
$649.95

T-2XD
$1029.95
with DCU-1

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

CD-45II

CD-45II
$389.95

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

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

HAM-V

HAM-V
$949.95
with DCU-1

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

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TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

AR-40

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

HDR-300A

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

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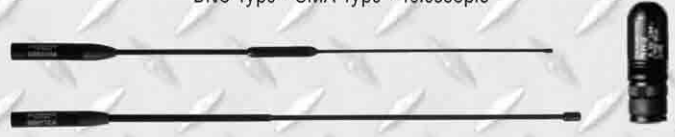

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DIAMOND ANTENNA

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News and Features

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Operating

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Our Cover
What better place for an international aid effort, enhanced by digital Amateur Radio, than the Central American nation of Honduras? The article begins on page 42. Photos (clockwise from top) by Louis Linden, KI5TD; Lola Johnson, and Loring Kutchins, W3QA.

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"IT SEEMS TO US..."

Radio Activity

Every few years the ARRL commissions a mail survey of licensed radio amateurs to get a snapshot of who we are, what we're doing in Amateur Radio, and what we think of the ARRL. The most recent survey was conducted in September and October 2003, and the results were reported to the ARRL Board at its January 2004 meeting. The minutes of the meeting reported the highlights:

> Compared to the results of a similar survey conducted in 1992, the new survey showed increasing age and declining activity in the amateur population, with inactive respondents most often citing competition for time and the use of other communications media as reasons for their inactivity. More frequently than long-time licensees, newer licensees cited emergency communications and personal safety as reasons for obtaining their license. ARRL members were far more likely to be active than non-members. Respondents identified the protection of Amateur Radio and defense of frequencies as the most valuable ARRL service.

If you spend time listening to the bands, probably you have come to a similar conclusion with regard to declining activity. The bands *are* quieter than they were a few years ago. Why is this? The survey summary cites time pressures and competing media (most likely cell phones and the Internet), but there are other factors as well.

Probably because of time pressures, more of us take Amateur Radio in concentrated "doses." For example, between 1992 and 2003 the percentage of active survey respondents who listed ARRL Field Day among the activities they most enjoyed leapt from 22% to 30%. We also combine Amateur Radio with other activities; mobile and portable operating remains popular at 54%, with a significant increase in the number of HF mobile stations. Also reflective of the societal shift toward multitasking is the fact that "listening to ham bands," probably while also doing something else, has become the most popular Amateur Radio activity.

Competing communications media certainly have had an impact. Autopatches are rare now that cell phones are practically ubiquitous. Electronic mail keeps people in touch who previously used HF, although e-mail also has a positive side: it makes it easier for groups with specific interests to share information and ideas and to keep one another motivated. Amateur Radio Voice over IP (VoIP) has shifted some routine long-distance contacts to VHF, sometimes off the air altogether. That's certainly understandable given the decline in sunspot activity and the resultant (albeit temporary) shrinking of the useful HF spectrum.

Yet when there's a reason to get on the air, amateurs come out of the woodwork. Your local repeater may not carry as much drive-time chatter as it used to, but plenty of amateurs—especially more recent licensees—will answer a call to provide public service communications. Ratings services don't record the number of listeners to the Hurricane Watch Net, but during this season's bevy of killer storms it probably ranked well compared to lot of broadcast stations—the difference being that *our* listeners were ready to jump in as needed. All it takes to generate a beehive of activity is for an interesting DX spot to appear.

Meaningful activity is not always a nose-counting exercise, and some is nearly invisible. For example, on September 19 W6QI and AD6FP completed a 47 GHz contact over a distance of 290 km to set a new world record for that band. Much as we may like to listen, there wasn't much opportunity to eavesdrop on their achievement! However, microwaving is not necessarily a solitary pursuit, nor is it necessarily invisible to the rest of hamdom. My wife Linda, KA1ZD, and I operate the ARRL 10 GHz and Up Contest as a team under her call sign. At one point during last year's contest we counted nine separate stations on top of Mount Wachusett in central Massachusetts! This year there was heavy rain on the Saturday of both weekends, but still a lot of fun and new experiences to be had. Coordination is done on 2-meter SSB, generating more activity on the low end of 2 meters here in New England than at any other time except during a band opening. My hope for next year's 10 GHz and Up Contest is that everyone who goes to a hilltop will bring along a friend to share the experience.

Which brings us to our main point this month: Activity begets activity. Bell's invention of the telephone would have passed unnoticed had Watson not been at the other end of the line. If all we ever do is listen, we'll never know what we're missing because we won't know who *else* is just listening.

Even worse is to ignore callers because we don't know them or are "too busy" to reply. They will conclude either that no one is hearing them or, worse still, that they're being heard but ignored. Either way, their enthusiasm will flag and we'll be left to wonder why the bands are so quiet.—*David Sumner, K1ZZ* QST

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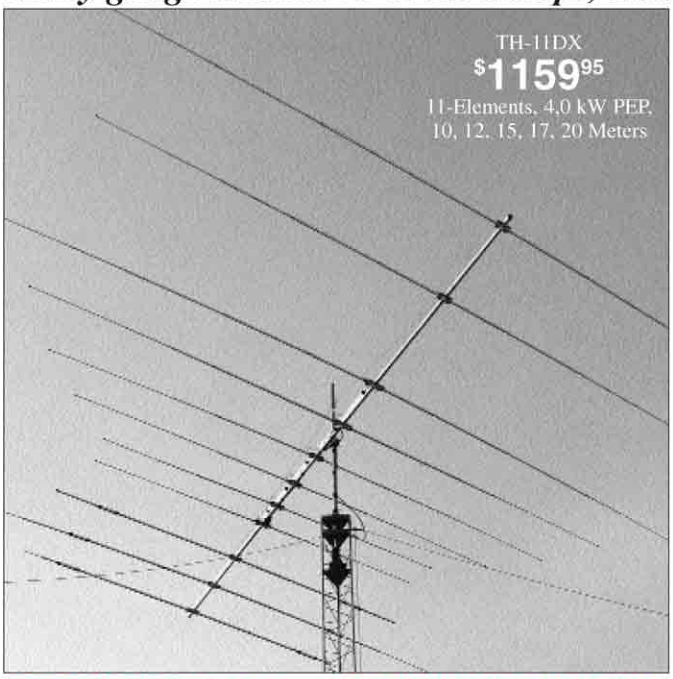

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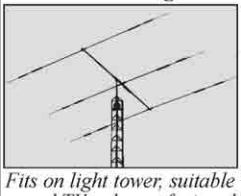
Compact 3-element 10, 15, 20 Meter Tri-Bander
For limited space . . . Installs anywhere . . . 14.75 ft turning radius . . . weighs 21 lbs . . . Rotate with CD-45II, HAM-IV



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

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

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

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

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

Tooled Manufacturing . . . Highest Quality Materials

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

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

3. Thick-wall *swaged* aluminum tubing

Tooled *manufacturing* is the difference between Hy-Gain antennas and the others -- they just don't have it (it's expensive!).

Die-cast aluminum boom-to-mast bracket and element-to-boom compression clamps are made with specially *tooled* machinery.

Hy-Gain antennas feature *tooled* swaged tubing that is easily and securedly clamped in place. All tubing is deburred and cleaned for smooth and easy assembly.

Durable precision injection molded parts.

Hy-Gain *antennas are stronger, lighter, have less wind surface area, better wind survival, need no adjustments, look professional and last years longer.*

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and Nearest Dealer . . . 800-973-6572
Call your dealer for your best price!

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http://www.hy-gain.com

Small, but ready for Xtra operating fun.

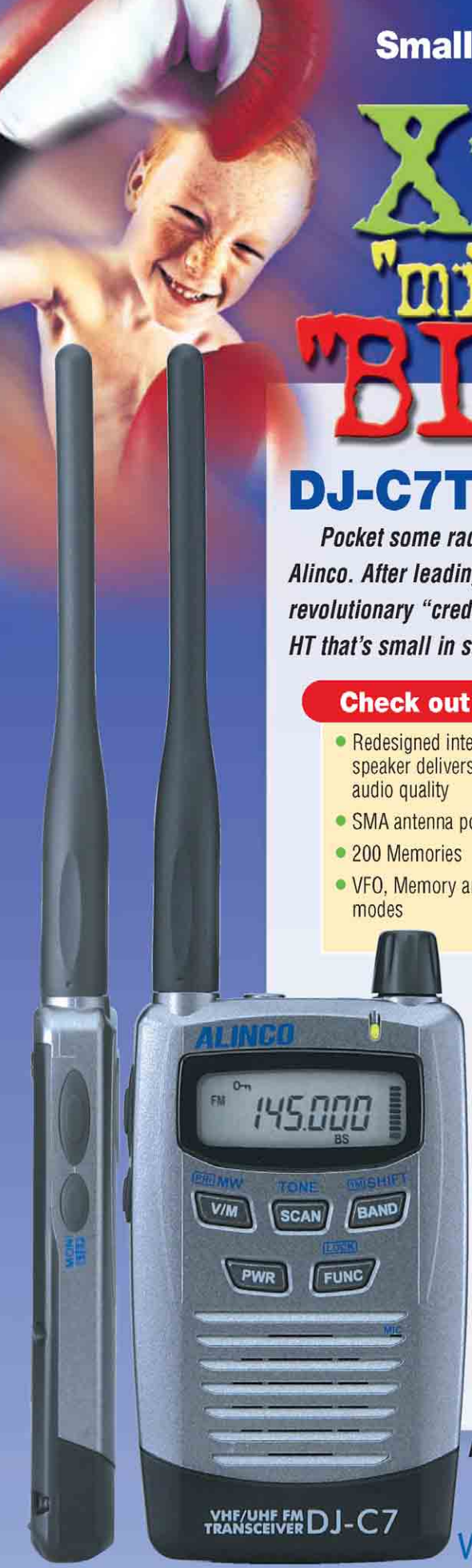
Xtremely "mini" HT delivers "BIG" performance!

DJ-C7T 2m+440 "Pocket-size" HT

Pocket some radio power with the DJ-C7T, the Xciting new dual band mini HT from Alinco. After leading the way in breakthrough miniature electronics technology with its revolutionary "credit card" size transceivers, Alinco creates a new kind of "pocket size" HT that's small in size but BIG in added memories and modes. BIG radio audio quality, too!

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

- Redesigned internal speaker delivers AMAZING audio quality
- SMA antenna port
- 200 Memories
- VFO, Memory and Scan modes
- 39 CTCSS tone squelch (encode+decode) settings
- Tone burst function (1,000, 1450, 1750 and 2100Hz)
- Split function
- Cloning feature
- Lithium-ion battery
- TX range 144 ~ 147.995, 420 ~ 449.995
- Wide-band receive 88.1 ~ 107.995, 108 ~ 173.995, 380 ~ 511.995 includes FM broadcast and AM aircraft bands
- Auto repeater setting



The DJ-C7T is so small, it can fit in a pocket, yet it's a versatile dual-band HT with an enhanced receiver. So, you can enjoy twice the operating fun in half the size. Thanks to Alinco, now you can take a transceiver almost anywhere.

Xciting Xccessories for the DJ-C7T

Included with your HT, you'll find:

- Lithium ion battery pack EBP-58N (3.7V 600mAh)
- AC battery charger (6.0V 0.5A)
- Helical Antenna
- Antenna Cap

Add to the fun with these Xcessories:

EMS-60 Speaker microphone
EME-24 Earphone microphone
EME-18 Earphone
EDH-32 Cigarette lighter cable
ESC-38 Soft case

Actual Size

www.ALINCO.com

Distributed in North America by Ham Distribution, Inc., 15 South Trade Center Pkwy, #B5, Conroe, Texas, 77385. Phone: 936-271-3366. Fax: 936-271-3398. email: USRep@Alinco.com.

ARRL in ACTION

***YOUR* membership at work**

By Steve Ford, WB8IMY, sford@arrl.org

ARRL Goes to Buffalo for WNY Convention

The League was highly visible at the 2004 Greater Buffalo Hamfest and ARRL Western New York Section Convention. The event, which was sponsored by the Lancaster ARC, was a two-day affair that included an outdoor flea market and events such as a radio direction finding "fox hunt," CW proficiency competition and an "Ugly Mobile" contest. Trophies were awarded to winners in all the events.

Norm Fusaro, W3IZ, ARRL Affiliated Club/Mentor Program Manager, talked to the group about mentoring new hams and welcoming them to the hobby. Also attending the convention were ARRL Atlantic Division Director Bernie Fuller, N3EFN, and Vice Director Bill Edgar, N3LLR. Western New York Section Affiliated Club Coordinator Luke Calianno, N2GDU, was the convention chairman.

The "Ugly Mobile Contest" winner at the Greater Buffalo Hamfest and ARRL Western New York Section Convention was Joe Ogozaly, KC2IQT.

New Mobile *PowerPoint* Presentation Available

There is a new *PowerPoint* presentation available for downloading, free of charge, from the ARRLWeb at **www.arrl.org/FandES/ead/materials/videos.html**. Created by Norm Fusaro, W3IZ, ARRL Affiliated Club/Mentor Program Manager, "HF Mobile Installation and Operation" is a general discussion designed to appeal to hams who've yet to try this fascinating aspect of Amateur Radio. You can view the presentation on any *Windows* computer that is equipped with Microsoft *PowerPoint* software.

If you don't have *PowerPoint*, you can download a free *PowerPoint* viewer at **www.microsoft.com/office/ork/xp/appndx/appa13.htm**. "HF Installation and Operation" is ideal for solo viewing, or for use at club meetings.

RICK LINDQUIST, N1RL

"No BPL" stickers were popular items at the ARRL booth. A limited supply is still available free of charge from Tom Frenaye, K1KI, New England Division Director, PO Box J, West Suffield, CT 06093-0090. Include a self-addressed stamped return envelope with your request.

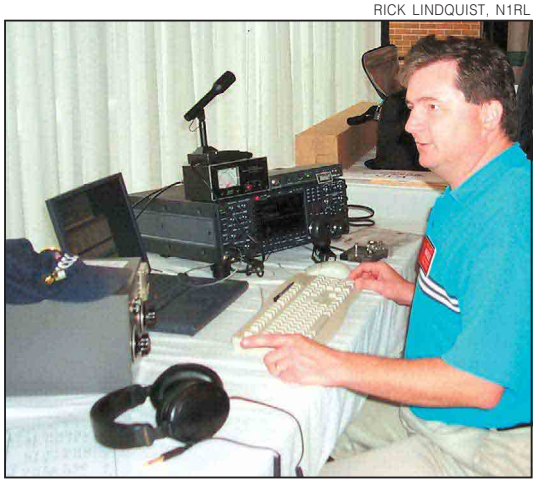
BPL a Hot Topic at ARRL New England Division Convention

Broadband over Power Line (BPL) was on the minds of many of the more than 2000 who attended the ARRL New England Division Convention August 14-15 in Boxboro, Massachusetts. During two standing-room-only ARRL forums, New England Division Director Tom Frenaye, K1KI, fielded questions and comments on BPL, Amateur Radio license restructuring and other current topics.

Frenaye informed the groups about an impending BPL field trial by Northeast Utilities in Agawam, Massachusetts, and there was considerable give and take regarding possible strategies to deal with the interference potential from the technology.

Among the most popular items at the ARRL booth was the *free* "No BPL" sticker, which many conventioneers soon applied to their shirts, caps and vehicles—and on a few spots in the convention hotel itself.—*Rick Lindquist, N1RL*

RICK LINDQUIST, N1RL



ARRL Vermont Section Manager Paul Gayet, AA1SU, operated K1A, the special event station at the 2004 New England Division Convention.

League Represents Hams at Citizen Corps Conference

The 2004 National Citizen Corps Conference was held in Denver, Colorado last July. Two hundred representatives from across the country and from national, state and local Citizen Corps groups, along with affiliated programs and organizations, attended the three-day meeting. Steve Ewald, WV1X, of the Headquarters' Field Organization and Public Service Team, represented the ARRL, which has been affiliated with Citizen Corps since June 2003. Steve was able to network with fellow conference attendees and learn how Amateur Radio can play an increasing role in their homeland security/community safety missions.

Citizen Corps and its 19 affiliated programs and organizations offer resources to communities nationwide for public education, outreach and training. It represents volunteers interested in helping to make their community safer, or to offer volunteer service opportunities to support first responders, disaster relief activities and community safety efforts. For additional information, log onto **www.citizencorps.gov**.

The ARRL's Steve Ewald, WV1X, and Karen Marsh, Program Director with the Department of Homeland Security, Office for Domestic Preparedness, Citizen Corps.

ARRL Makes Presentations at APCO Conference

Montreal was the venue for the 70th annual Association of Public Safety Communications Officials (APCO) Conference and Exposition, August 8 through 12. As the largest gathering of public safety communications officials from around the globe, APCO's conference offers a forum unparalleled in professional, technological and educational opportunity.

Dan Miller, K3UFG, from the ARRL Headquarters Field and Educational Services Department, was a key presenter, along with Gene McGahey, AL7GQ, Deputy Manager of Communications Technology, National Law Enforcement and Corrections Technology Center, Rocky Mountain Region, NPSTC Support. Their well-attended presentation was titled, "Not a Last Resort—Amateur Radio in Support of Homeland Security."


Gene McGahey, AL7GQ, speaks at the APCO conference.

Both Miller and McGahey participated in several workshops and mingled among the attendees who visited the many exhibits. According to Miller, he spoke with more than 100 participants who were interested in obtaining more information about how Amateur Radio could enhance emergency operations.

ARRL Technical Specialist to the Rescue

Norm Hamel, KD1WD, contacted ARRL Rhode Island Section Manager Bob Beaudet, W1YRC, and expressed concern about his request for a 50-foot tower permit in the town of Exeter. Norm had strong reason to believe that the permit would be denied.

Bob suggested that Norm telephone the ARRL Rhode Island Technical Specialist, Tom Olsson, W1TKO. Olsson quickly investigated the situation, then went to the Exeter Town Hall to meet with the town engineer. The engineer had a number of questions about how Hamel's request would fit their existing town ordinances, which Tom was able to answer to the engineer's satisfaction. After some further discussion and negotiation, the town issued a building permit for the tower.

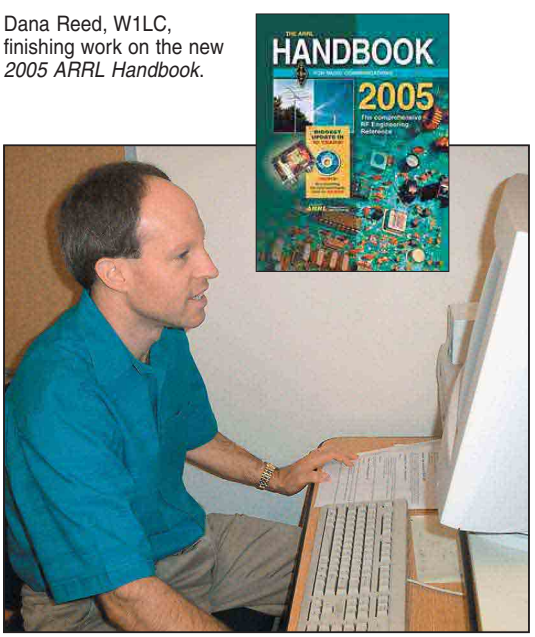
According to W1TKO, the experience with the town engineer will help ease the way for the next tower permit application. In the spirit of ham diplomacy, Hamel has also asked the engineer to see the finished work. The engineer happily agreed and said that he expected to find no problems.

2005 ARRL Handbook is "Monumental Effort"

The ARRL Handbook underwent a major revision for the 2005 edition, according to editor Dana Reed, W1LC.

"*The Handbook* is revised to a certain degree every year, but for 2005 we practically ripped the book apart and put it back together. It was a monumental effort," Reed said. "Every chapter was updated and we added a bunch of new projects that have never appeared in the US ham media, including *QST*. We haven't revised *The Handbook* on this scale since 1995."

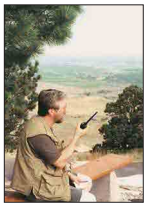
Another new feature that appears in the 2005 edition is a bound-in CD-ROM containing the entire *Handbook* in PDF format. "We tried this with the most recent edition of *The Antenna Book* and it was a big success," Reed explained. "So, we thought, 'Let's do it for *The Handbook*.' The CD will be a huge help to *Handbook* owners. If they are looking for something specific, they can search the CD and print the pages directly for easier reading. It beats lugging a 1200-page book around with you!"



Dana Reed, W1LC, finishing work on the new *2005 ARRL Handbook*.

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.

ARRL E-mail Forwarding

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.

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.

Books, Software and Operating Resources

You can rely on ARRL for the very best publications and products: license manuals, circuit design and project resources, antenna construction ideas, and more. Shop online or locate a dealer near you at **www.arrl.org/shop**. What's the secret for making great publications even better?**—We listen to you!** E-mail your publications feedback, suggestions and product ideas to **pubsfdbk@arrl.org**.

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.

FCC License Renewal/Modifications Service

At just over 90 days before license expiration, ARRL sends FCC-license renewal notices to ARRL members reminding them to renew. ARRL will also handle duplicate license requests, as well as address or other license changes (upon receipt of a completed and signed Form 605) as a free members-only service.

Educational Materials

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

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 860-594-0397.

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 . . .

	Contact	*Telephone*	*Electronic Mail*
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Hamfests	Gail Iannone	860-594-0262	**hamfests@arrl.org**
Write for QST	Joel Kleinman	860-594-0273	**qst@arrl.org**

Can't find the department you're looking for? Call 860-594-0200 or e-mail **hq@arrl.org**. Sending e-mail to any ARRL Headquarters staff member is a snap. Just put his or her call sign (or first initial and last name) in front of **@arrl.org**. For example, to send mail to Martin Cook, QSL Service Manager, use **n1foc@arrl.org** or **mcook@arrl.org**. If all else fails, send a message to **hq@arrl.org** and it will get routed to the right person or department.

ARRL Division Directors

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

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(956-425-3128); **k5rav@arrl.org**

*Executive Committee member

ARRL Section Managers

The 15 divisions of ARRL are arranged into 71 administrative *sections*, each headed by an elected *section manager* (SM). Your section manager is the person to contact when you have news about your activities, or those of your club. If you need assistance with a local problem, your section manager is your first point of contact. He or she can put you in touch with various ARRL volunteers who can help (such as technical specialists).Your section manager is also the person to see if you'd like to become a section volunteer. Whatever your license class, your SM has an appointment available. Visit your section page on the Web at **www.arrl.org/sections/**.

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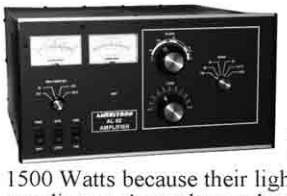

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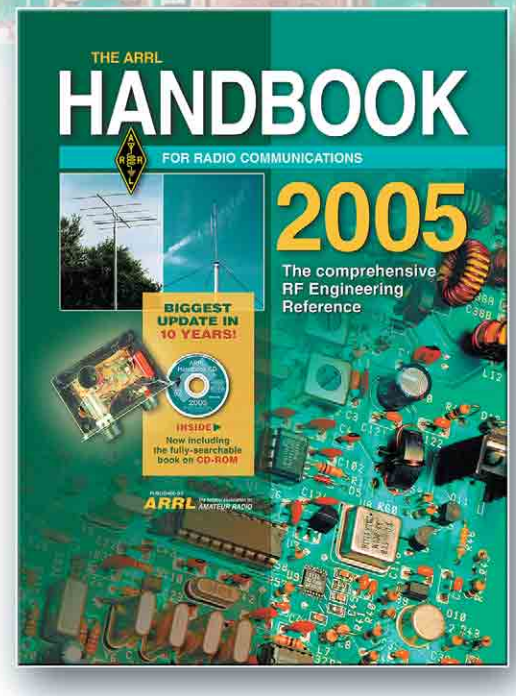

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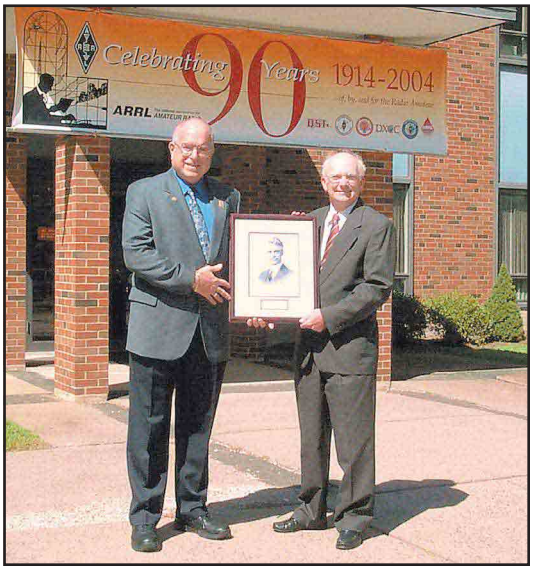
N1XG Joins the ARRL Maxim Society

Bruce Marcus, N1XG, of Glastonbury, Connecticut, became a member of the ARRL Maxim Society in 2004 when he renewed his support at the Director Level of the ARRL Diamond Club. One of the first donors to the ARRL Diamond Club when it was launched in the fall of 2002, his continuing support at the highest level contributes vital support for ARRL programs not funded by member dues. Marcus is the founder of Marcus Communications and is one of the founders of the statewide Pioneer Valley Repeater Association, which he now serves as Vice President of Operations. The ARRL Maxim Society recognizes lifetime contributions totaling $10,000 or more.



Bruce Marcus, N1XG, is presented with his Maxim Society plaque by ARRL Chief Executive Officer David Sumner, K1ZZ, at ARRL Headquarters.

JEFF WIENER, N6VCS

On French Soil? You Bet!

I enjoyed reading "K2KN Among Those Honored at D-Day Commemoration" [Aug 2004, p 20]. One of the 100 French Legion of Honor medals was actually presented in the USA. Admiral Tom Patterson, chairman-CEO, National Liberty Ship Memorial Inc, received the honor on June 6 while standing on a container of Normandy sand brought from France by a delegation aboard the WW II Liberty Ship *Jeremiah O'Brien.* The ship's radio operators maintained continuous amateur operation during the voyage of more than two months. The ship is maintained in operating condition by more than 200 volunteers, including several hams: WD6EAE, ex-K6BWT, W1HL, K6RJI, KE6FGL, K6RDK, N6VCS and K6BI.—*Captain Mark L. Shafer, USNR (Ret)*

KXCH lives!: **In the radio room of the Liberty Ship *Jeremiah O'Brien*: Norman Williams, K6BI; James Fisk, W1HL, and John Chow, ex-K6BWT.**

Mobile, in Style

Bruce Phegley, W4OV, of Coconut Creek, Florida, writes: A good mobile installation can be a lot of work, but this one really paid off. My primary goal was to get the antenna up high enough so it would really work, not just look good. Removal of the left rear speaker provided access for mounting the Little Tarheel antenna with a threaded steel plate behind the door jamb. No external holes were necessary, and it will be easy to cover up when I want to dispose of the vehicle. The IC-706 transceiver is located under the driver's seat on a rubber skidpad. The remote head is mounted on a homemade aluminum bracket mounted on existing screws inside the glove box door. A piece of shelf bracket is used with starboard to hold the paddle. A few indentations in the starboard for the paddle feet provide a stable platform for the key. *A safety note:* Always be sure that no part of your mobile installation will interfere with the operation of your vehicle's airbags.

Inside view of W4OV's creative mobile installation, showing the transceiver control head at the top, and the paddle and speaker on the center console.

MARK MANSOUR

The Chrysler PT Cruiser, ready for cruisin'.

Clubs Decipher Washington-Area Cryptologic Museum

By Murray Green, K3BEQ

Two DC-area Amateur Radio clubs, The Green Mountain Repeater Association and the DC Metropolitan ARC, decided to combine forces and tour a communications-oriented area museum. The final selection? The National Cryptologic Museum, located near the Headquarters of the National Security Agency, Fort George G. Meade, Maryland, about 20 miles north of Washington, DC. Some 50 club members took part, including some who work at or have retired from the Agency. The author wishes to thank the National Cryptologic Museum for the photographs and descriptions.

The Museum collection includes thousands of artifacts that serve to sustain the history of the cryptologic profession. Originally designed to house artifacts from the Agency and to give employees a place to reflect on past successes and failures, the Museum quickly developed into a priceless collection of the nation's cryptologic history. The Museum opened to the public in December 1993, and now hosts about 50,000 visitors annually. The accompanying photos (photos and captions courtesy National Cryptologic Museum) provide a glimpse into the secret world of codemaking and codebreaking. Admission is free. You can find more information at **www.nsa.gov/museum/**.

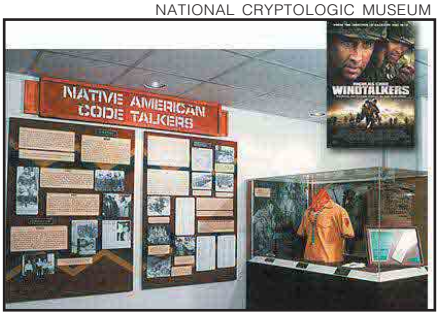
NATIONAL CRYPTOLOGIC MUSEUM

Radio intercept shack: **Army cryptologists first went to the field during World War I. The photo shows a mock-up of the World War I Verdun intercept site in France. It was built by NSA craftsmen based on the two extant pictures of the original shack.**

NATIONAL CRYPTOLOGIC MUSEUM

Mobile US DF truck (circa 1918): **Before the more familiar efforts by the FCC (in fact, before there *was* an FCC), the Army operated direction finding equipment from mobile as well as fixed installations. The truck had a DF antenna that was turned by hand from the inside. By measuring the angle of entry of a signal coming in and bouncing off the ionosphere, an operator could pinpoint the distance the radio wave had traveled—rather advanced for 1918.**

NATIONAL CRYPTOLOGIC MUSEUM



The exhibit on code talkers is a monument to the most complex machine of all—the human mind. Lacking secure battlefield voice communications during the Great War, the Army employed Choctaws to encrypt voice communications, using their native language, itself encoded. The Army studied the program even before war was declared in 1941, and during World War II employed Comanches, Choctaws, Kiowas, Winnebagos, Seminoles, Navajos, Hopis, Cherokees and others. The Marine Corps took the Army work and codified, expanded, refined and perfected it into a true security discipline, using Navajos exclusively.

WW II bomber over 1-land: **In her time away from the office, ARRL Contest Assistant Kathy Allison, KA1RWY, really knows how to enjoy herself. Here, she's seated in the Bombadier's seat aboard a B-17 Flying Fortress, the *Nine-O-Nine*, as it flew over Windham, Connecticut, recently. "Incredible view!" she reports. "The bullets and machine gun are vivid reminders of the plane's history. I was pleased that I spent some time in the 'radio room.' The 'inter-phone' for the BC-348 was working as one of the crew plugged in. It was great to see the ARC-5s as well."**

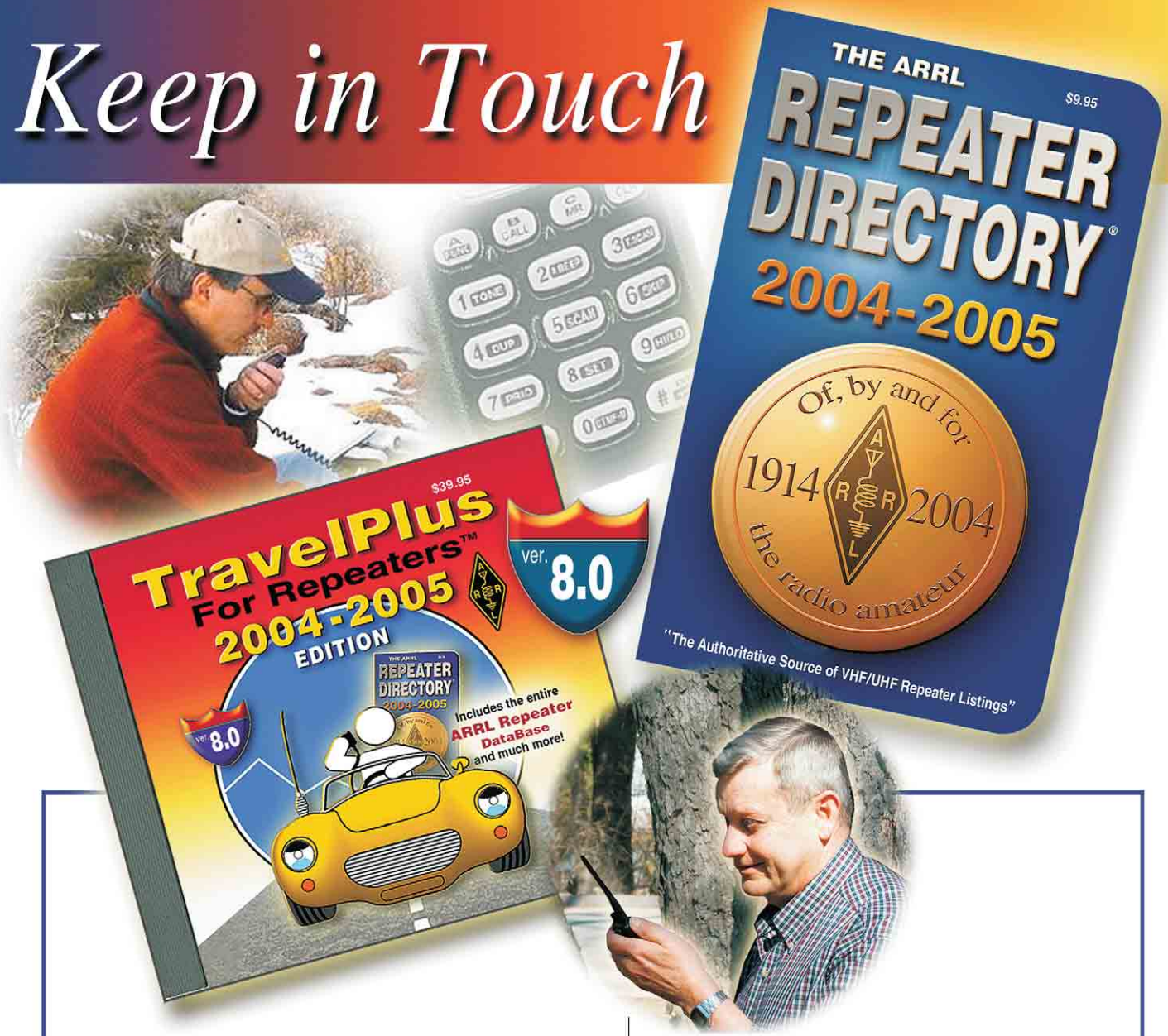
COURTESY FRANK OPRZEDEK, K9JDV

Thanks, anyway, **but aside from Patty Lovelace, Joe Walsh, Lance Bass, Ronnie Milsap and a select few others, most of us would prefer *not* to hear hams in concert. Makes you wonder how many people actually show up at this venue… As it turns out, the Artemus W. Ham Concert Hall is located on the campus of the University of Nevada, Las Vegas.**
—tnx K9JDV and NØPQV

GARRY HAMMOND, VE3XN

Garry Hammond, VE3XN, of Listowel, Ontario, spotted this "all band" license plate recently in Kitchener. Although not a ham, the driver "seemed as friendly as any fellow radio amateur, anyway," Garry says.

Keep in Touch



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KEEPING ISS SIMPLE

♦ I very much enjoyed K5WX's article ["Using Simple Antennas for ISS Contacts," Sep 2004, pages 34-36]. It was a great analysis of what I have been observing the last few months. Using my IC-706 and a 2 meter Ringo that I bought back in 1973, I have been able to digipeat APRS via the ISS on several occasions. I am still trying for the "holy grail" of a voice contact with the crew.—*Frank Stone, AC3P, Middle River, Maryland*

ON SNARING WAS/90

♦ After reading the article in September *QST* ["The Road to Worked All States—90th Anniversary Style," page 44], I was again inspired to get the WAS/90 completed.

I am pleased to have finally finished my WAS/90. This was a pretty challenging event and looked pretty doable in the beginning. All WAS events are fast moving in the beginning, and pretty frustrating as one nears completion. I was re-excited when I read the article, then again frustrated as I saw the majority of the people who had completed it were located in mid America. I was looking for some tips from someone who was located on one extreme coastal area or the other, as I am, but no such luck.

I trudged along in my usual manner and finally succeeded. I am very proud to have achieved this award and know it was not easily accomplished. Band conditions now that the solar cycle is in a downward direction were and are not conducive to doing the best, creating a more competitive environment.

My helping hands were threefold. The first was the 14.336 MHz county hunters daily net; this was a treasure trove of states. One must hold in there and will eventually hear most states represented. This does not mean your propagation will allow you to make contact. One must be diligent and willing to spend many hours listening and be instantly prepared with the protocol and procedures to make wanted contacts.

Secondly, the early September HPM/135 event worked in my favor as a two-fold event, filling in my needed states and accomplishing the 100 maximum /135 contacts for the HPM award itself. This event was much fun for all involved and those sentiments were conveyed to me by others, over and over again.

Thirdly is the proven tried and true means of calling CQ and searching the bands over and over again for those elusive last few states. Having done all this I am pleased to send in my (finally) completed application for this great event. Thanks for all the articles and topics of interest in *QST*.—*Roger Odorizzi, AB7PG, Manson, Washington*

HE WAS THERE!

♦ I enjoyed the article about the AM station being put together ["W1AW Vintage/AM Station Ready for Visitors," Sep 2004, pages 41-43]. I was the first one to see the Johnson Valiant transmitter come off the production line at the factory and test it. It operated perfectly from the very first unit I tested. If my memory is good yet, it was designed by a tech in the lab, not an engineer as was usual in those days. I don't remember how many units I tested, but I left the E. F. Johnson Co shortly after it made its appearance.—*Jerry Nelson, WØQPX, Richfield, Minnesota*

FROM SNIDE COMMENTS TO RENEWED FAITH

♦ On August 12, the day before Hurricane Charley struck very near my home in North Port, Florida, I was mobiling in Ohio. I was tuning 20 meters looking for information on the hurricane's track when I copied a group. One member was in Florida and had commented that he had just seen an update about Charley on TV. I waited for a pause and broke in with my call sign, asking if I could please contact the Florida station to get an update regarding the projected path.

I was immediately set upon by various members of this "group" because my speech processor was on and they didn't want to hear that sort of audio. When I said that I was mobile and couldn't really divert my attention to navigate the menus to turn it off, and could I just please get an update, I was again chastised and everybody in the group had to make some sort of snide comment. It became apparent that they were more interested in trying to humiliate me than just providing the one piece of information I thought I had kindly asked for. I then said 73 and continued my trip. It is interesting to note that I did make a few more QSOs that day, and not a single station had anything bad to say about my transmit audio.

Later that day I did get an update on Hurricane Charley and on Friday I watched on TV from 1200 miles away as the eye passed within 10 miles of my home…it was very unsettling to say the least. The good news is that my home and antennas survived with only minimal damage. Many thousands of others were not so lucky.

Since my return home, I have reflected back on this experience and I must say that it saddens me. In nearly 35 years of operating as an amateur, I have always been proud of what it stands for, and the hundreds of thousands of fellow amateurs I have worked and met in those years have almost universally made me feel good about Amateur Radio and the people it attracts—except for a few who choose to try and make themselves feel important by excluding anyone who doesn't think or act or sound exactly like they do.

On a more positive note, upon my return home to SW Florida, the ARES, RACES and various government and private aid agencies were already up and running, and our local repeater W4DUX on 147.255 was providing yeoman service as the central communications point for the Charlotte County EOC operation. I provided what assistance I could by helping establish communications links to shelters and whatever else was needed.

I saw incredible acts of generosity and selflessness that helped offset my earlier experience…it renewed my faith in this marvelous activity of ours (I refuse to just call it a hobby), and should keep me going for the next 35 years or so.—*Don Baughman, K7MX, North Port, Florida*

PUT OLD COPIES OF *QST* TO GOOD USE

♦ We all have old *QST*s around the house. You don't want to throw them out,

but what can you do with them? There has to be a good use for such a great source of Amateur Radio information. Here is what you do: The next time you go to your doctor's office, or anyplace that has magazines out on a table, use a marker or label and write on an old *QST* or two, "For more information about local Amateur Radio contact..." Use your ham club's Web site or mailing address. Write it in a couple of different places in the magazine. Leave it on the table and see what grows from this seed you planted.

How can we expect to increase our ranks and gain respect when Amateur Radio is such a big secret? Get that word out and your old *QST*s will serve a noble purpose.—*Robert Bastone, WC3O, President 2004 Skyview Radio Society, Tarentum, Pennsylvania*

FRIENDLY FIELD DAY

♦ Field Day hospitality *is* alive and well! I read the letter by Jeff Fritz, WB1AAL, in September *QST* ["What Fraternity?" page 25], and hope his case was an isolated one. FD 2004 found me away from home, for training, in Petoskey, Michigan. I used the ARRLWeb to locate local clubs in advance, checked the Straits Area ARC Web site for repeater info, programmed my handheld with the repeaters in advance, was answered on the repeaters, invited to their Monday night local net and Tuesday night IRLP net, and e-mailed the site to find the map to their FD location.

At the FD site, I met the folks I'd heard on the net, plus family members, and happily participated in the potluck supper. I helped get the tower tilted up, and really enjoyed the camaraderie! I wish I'd kept a diary instead of a log, but the folks I worked and met included KO8P, KG8JK, KK5KZ, KC8NTE, KC8TBU, KC8NVI, KC8ZSO and N8DNX.

I also did what I could to recruit for the club. One of the trainers in my class mentioned that GeoCaching was his hobby, and he was wondering about integrating it with radio. Did I have a deal for him—APRS! Eugene met me at the FD site, which was near a GeoCache, and as we left the FD site as a rainstorm came through, we detoured to a GeoCache, he handed me the Garmin GPS unit, and waited patiently until I found the container under a little pine tree. I told him about the study guides the first day I met him, and the next day he'd already obtained *Now You're Talking!* and the *General Class License Manual* from the local library. He's getting his scout troop involved, and I expect to hear some positive results before the year is out.

Back home, my compatriots had a whiz-bang FD experience, which was already described on the ARRLWeb. I got there in time to help tear down. Next year I hope to be home for, and be on, the night CW team. Hospitality lives—and some personal preparation, at home or on the road, can help a lot.—*Fred Wagner, KQ6Q, Cypress, California*

NO COMPLAINTS!

♦ The Labor Day weekend was my first chance to start collecting /135 contacts. I expected it to be fun but found it gratifying as well. More often than not, the response to my exchange as "Bureau Worker" was met with such positive comments as "Good work," "Appreciate the job you're doing" and the like. Now that's what I like to hear...and not one complained about not getting their cards! —*Bud Weisberg, K2YOF, Bergenfield, New Jersey*

A LITTLE HUMOR, PLEASE

♦ *QST*'s pages used to be filled with simple pen and ink doodles that were pleasantly whimsical. Some had simple but effervescent comedy, like Jeeves's adventures in "How's DX?" Others simply graced the masthead of columns. In addition to all the usual topics, there were articles whose sole purpose was to be humorous. Take "The Repenter" from January 1947. It poked fun at "expert operators" but showed us in a humorous way how easy it is to become the operators we loathe. Some were just so inane in their humor. "The Spumoni Incident" from June 1964 was for pure laughter.

The best part is that these articles and doodles were not four color affairs with fancy drafting done on a pitzogonculator. They were just simple words and plain pen and ink sketches. Today's *QST* is a journal with integrity and appeals to a broad range of interests within our community. Of all the periodicals I subscribe to, yours is the one I look forward to the most. It is well written and well edited. It keeps me current and informed, but alas it does not make me laugh. Our world today is troubled, and so is our hobby. A little humor with tact and wit could return your great periodical to a fantastic one.—*Sean Sanderson, KD6MPY, Brattleboro, Vermont* QST

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By Joel R. Hallas, W1ZR

Achieving Near Perfection with the Imperfect Rhombic

The classic rhombic antenna is still a contender to provide serious performance at low cost—if you have just a little bit of room.

I don't know about you, but I have had a fantasy for some years about having a big chunk of flat land, getting the power company to sink some tall poles and stringing a serious rhombic around them. Perhaps it had to do with my soldiering days at Fort Monmouth, New Jersey when I walked past, and even occasionally operated K2USA, which had exactly that antenna setup (at least in 1962).

Well, it's been quite a few years and somehow I don't think the ideal situation will present itself anytime soon. For the last 20-some years I have been living on a suburban lot of a bit more than an acre with a number of impediments to my dream—a house in the middle, lots of tall trees and not too level ground. The fact that I'm up a bit of a hill is not an accident either, but hasn't helped facilitate the rhombic fantasy.

The Current Farm

My mini HF antenna farm of a G5RV broadside to Europe and a perpendicular biconical lazy-H have done well for themselves, but I wanted to refocus my efforts a bit lower in frequency in response to our current point in the sunspot cycle. I think 30 meters will gain in importance as we move forward and the G5RV just doesn't do it on 30. I spent some time going over options and decided that if I could get good directivity toward Europe on 30 meters and up, I could replace the G5RV with a "mini cage dipole" with a fundamental response on 80/75. This would give me better performance than the G5RV on the fundamental and less feed-line loss, and provide good coverage off boresite on 30 meters and up.

I would then need that coverage to Europe to complete the plan. Of course, a good multiband rotary array would do the trick. If I had an extra few kilobucks for hardware, plus legal fees to get through zoning and deal with the divorce, it would be perfect. What I ended up with was an imperfect rhombic hung from trees of opportunity and providing about 7 dBd or more gain toward Europe on 20 meters and up with significant gain on 30 meters. In addition, I can get 15 dB or more front to back ratio and easy switching toward the US and New Zealand when I want. This performance is better than a three element Yagi for each band, covers the whole range and even can be an NVIS (Near Vertical Incidence Skywave) cloudwarmer on 80 and 40 when the dipole is down. To top it off, it is relatively inexpensive and hasn't incurred any legal fees to date.

How to Make a Rhombic

The ultimate terminated rhombic is made in the shape of a diamond. For a frame of reference, I started with the compromise multiband rhombic shown in *The ARRL Antenna* Book.[1] That design used 3 λ per leg, but my yard would more readily support 2 λ, so I adjusted both the length and the tilt angle to obtain the appropriate pattern across the range; the result is shown in Figure 1.

I used *EZNEC*[2] to estimate the horizontal and vertical patterns at 20 and 10 meters for such an antenna and they are shown below (Table 1 and Figures 2 and 3) along with a summary of operation on all HF bands and a detailed examination of the performance as a function of height on 20 meters in Table 2. Note in Table 2 that for any height, *EZNEC* predicts that the rhombic has a 7 to 8 dB edge over the dipole, both in terms of peak gain and gain at 10° elevation, a measure of long-haul capability.

[1]Notes appear on page 32.

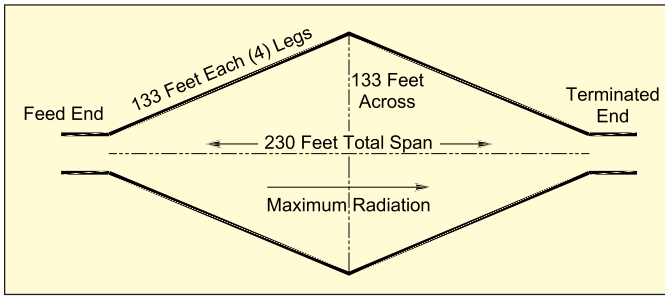


Figure 1—Compromise 2 λ per leg rhombic for 20 through 10 meters.

Table 1
Gain, Peak Takeoff Angle and 3 dB Beamwidth of Rhombic at 50 Feet

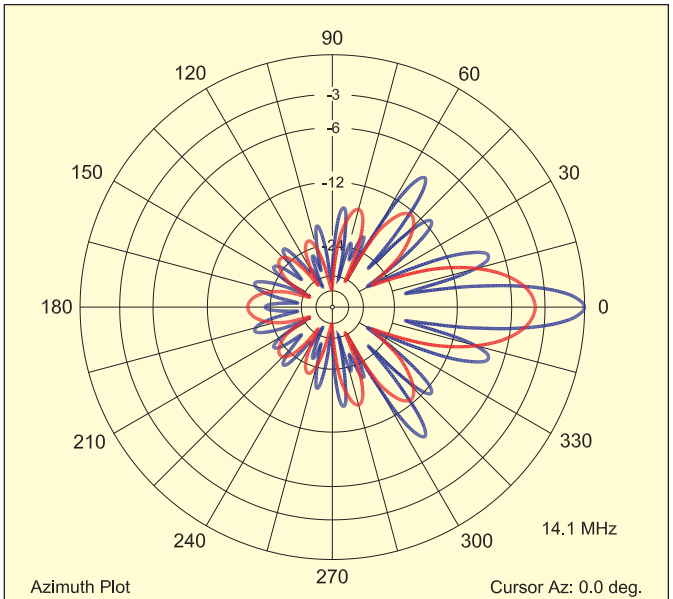
Band (Meters)	*Peak Gain (dBi)*	*Elevation*	*Gain at 10° (dBi)*	*3 dB Beamwidth*
30	12.5	30°	5.2	35.4°
20	15.6	20°	12.1	23.8°
17	17.7	15°	16.4	18.4°
15	18.7	13°	18.3	15.6°
12	19.4	10°	19.4	12.8°
10	19.5	9°	19.3	10.6°

As the snow cleared, I went tromping about my yard with my trusty hand-bearing compass[3] pacing off distances between trees in about the right spot. What I found was that I could get a non-ideal rhombic pointing right down the Mediterranean, giving good coverage across most of Europe, the Middle East and into the Indian Ocean. A few days with an EZHang slingshot[4] got my halyards up, but none on the first try! Many thanks to Rich Roznoy, K1OF, for his one shot success on the far corner following days of frustration. This article came very close to being about a V beam!

The resulting configuration is as shown in Figure 4, with corresponding *EZNEC* patterns shown in Figures 5 and

Table 2
Gain and Peak Takeoff Angle of Rhombic and Dipole as a Function of Height (14.15 MHz)

	Rhombic			*Dipole*		
Height (ft)	*Peak Gain (dBi)*	*Elevation*	*Gain at 10° (dBi)*	*Peak Gain (dBi)*	*Elevation*	*Gain at 10° (dBi)*
70	15.3	15°	14.3	7.7	14°	7.0
60	15.6	17°	13.5	6.9	16°	5.4
50	15.6	20°	12.3	7.6	19°	5.0
40	15.4	24°	10.6	8.2	24°	4.2
30	14.6	27°	8.3	6.3	32°	0.4



Azimuth Plot
Elevation Angle: 20.0 deg.
Outer Ring: 17.06 dBi
Slice Max Gain: 13.29 dBi @ Az Angle = 0.0 deg.
Front/Back: 15.07 dB
Beamwidth: 24.0 deg.; −3 dB @ 348.0, 12.0 deg.
Sidelobe Gain: 4.56 dBi @ Az Angle = 50.0 deg.
Front/Sidelobe: 8.73 dB

Cursor Az: 0.0 deg.
Gain 13.29 dBi
0.0 dB max

Figure 2—Horizontal pattern of 2 λ compromise rhombic on 20 meters (red) and 10 meters (blue) at 50 foot height.

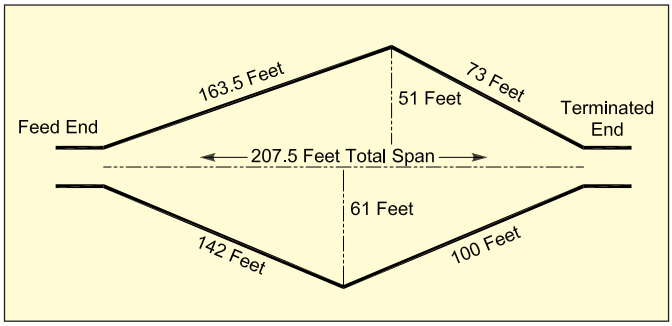
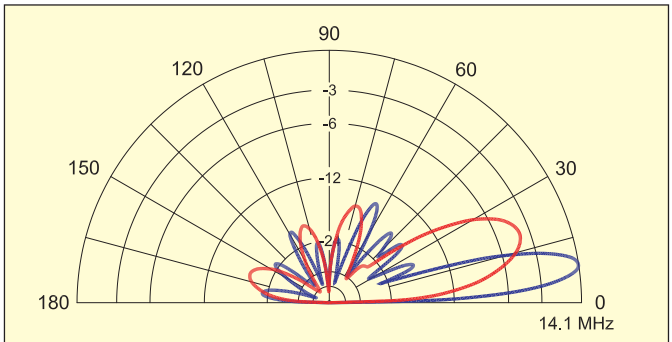


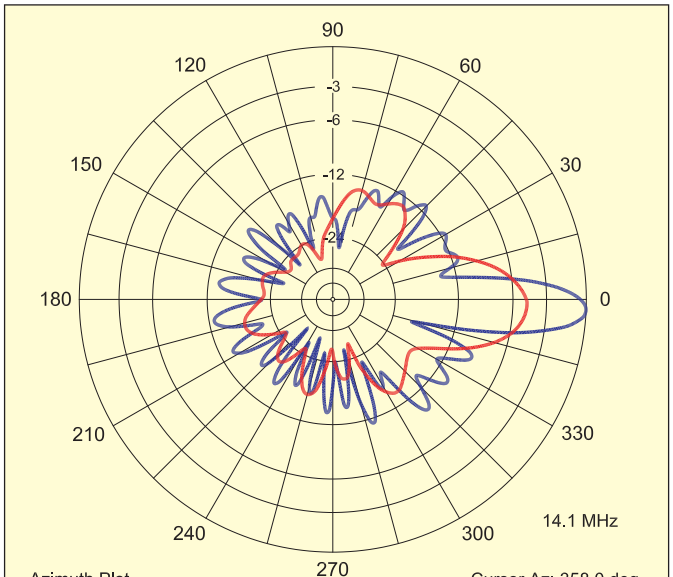
Figure 4—W1ZR achievable single-wire terminated rhombic for 30 through 10 meters.



Elevation Plot
Azimuth Angle: 0.0 deg.
Outer Ring: 17.06 dBi
Slice Max Gain: 13.29 dBi @ Elev Angle = 20.0 deg.
Beamwidth: 19.1 deg.; −3 dB @ 10.5, 29.6 deg.
Sidelobe Gain: 1.27 dBi @ Elev Angle = 74.0 deg.
Front/Sidelobe: 12.03 dB

Cursor Elev: 20.0 deg.
Gain 13.29 dBi
0.0 dB max

Figure 3—Vertical pattern of 2 λ compromise rhombic on 20 meters (red) and 10 meters (blue).



Azimuth Plot
Elevation Angle: 25.0 deg.
Outer Ring: 16.56 dBi
Slice Max Gain: 11.94 dBi @ Az Angle = 358.0 deg.
Front/Back: 17.96 dB
Beamwidth: 28.2 deg.; −3 dB @ 343.8, 12.0 deg.
Sidelobe Gain: 3.2 dBi @ Az Angle = 54.0 deg.
Front/Sidelobe: 8.74 dB

Cursor Az: 358.0 deg.
Gain 11.94 dBi
0.0 dB max

Figure 5—Horizontal pattern of W1ZR rhombic on 20 meters (red) and 10 meters (blue), fed from left end.

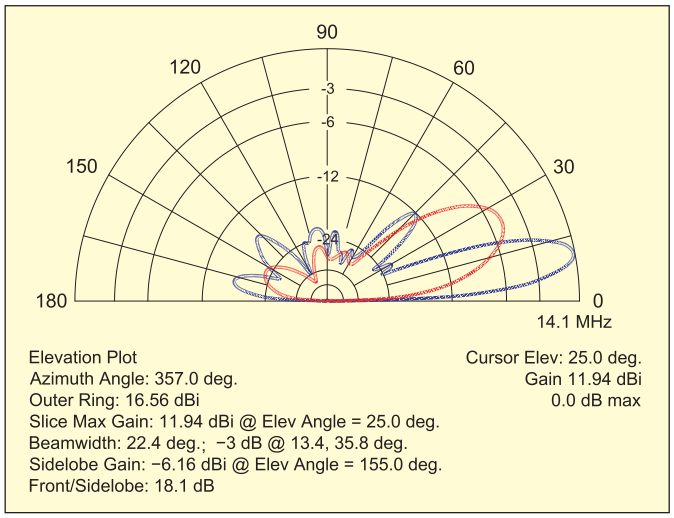


Figure 6—Vertical pattern of W1ZR rhombic on 20 meters (red) and 10 meters (blue).

Figure 8—View of the feed line from the New Zealand feed point in the back yard. The "messenger rope" also holds up the feed from the Lazy H.

Figure 7—If you look *very* closely with a magnifying glass, you can just about see the catenary leading to the Europe feed in the front yard.

6 for comparison with the textbook model. Although some of the trees looked like 50 feet high or higher, we ended up at about 40 feet, raising the main lobes a bit. Also note that we were not able to line trees up with as much symmetry as I would have hoped. This turned out to be a mixed blessing, since the main lobes are a bit broader, although the peak gain is reduced slightly. The pattern shown is while fed from the left end (toward Europe). Fed from the other end, the pattern is similar except by 28 MHz, the major lobe breaks into multiple lobes.

We looked at a number of different configurations to get an idea of the sensitivity to dimensional changes for other locations. If the antenna is made wider, changing the tilt angle from our 60° target toward say 55°, the result is about a dB increase in forward gain and about a degree lower main beam on 20 meters, but the 10 meter pattern starts to break up into multiple lobes. If you make it narrower, say to 65°, it favors 10 meters with about a dB more gain, but the 20 meter gain drops almost two dB and the pattern shifts up about a degree. As you change the length to width ratio, you shift the operating frequency up and down a bit, but it still works well over most of the range.

Note that there is nothing magical about the leg length either. A terminated rhombic is a wideband antenna and does not need to be an integral number of wavelengths on each leg to function well. Below about 1 wavelength per leg, it may not be the best use of the available wire and supports, but whatever can be fit can be easily modeled to see if the performance is what you want. A 1 wavelength per leg rhombic may be a viable solution for a smaller or squarer lot shape.

My installation is hardly noticeable, unless you are looking for evidence of antennas. The prime feed is in our front yard and, as shown in Figure 7, the feed line is barely visible. Part of the rear run is shown in Figure 8, and is visible in the backyard, but no one has complained. Note that if you *just* were interested in high performance in one direction, a 9:1 balun and dummy load could be made waterproof and placed near the base of the terminating end. This would avoid one transmission line run, saving money and making the antenna even less visible.

Feeding a Rhombic

A nice feature of a terminated rhombic is that it has relatively constant impedance over frequency, if well constructed and terminated. The traditional rhombic is viewed as a 600 Ω system, probably closer to the truth if made with multiple wires in each leg separated more widely in mid span. There was no way I was going to pull that through my small forest!

This rhombic is closer to an 800 Ω system, with an SWR that varies within about 2:1 of 450 Ω ladder line. The *EZNEC* SWR plot is shown in Figure 9. Note that the antenna works continuously across the range, making it suitable not only for all the ham bands, but also as a great SWL receiving antenna.

The relatively constant impedance makes feeding and terminating this antenna relatively easy. Nine-to-one balun transformers[4] can be used for the feed line or the terminating line, or both. If used on both ends, a pair of coax switches or relays[5] can be used to switch directions easily and the resulting 2:1 VSWR is usable with many transmitters directly, and is certainly within range of any internal tuners. A single 9:1 balun can be used with a 50 Ω dummy load as a termination and a tuner can be used directly on the feed line to the driven end.

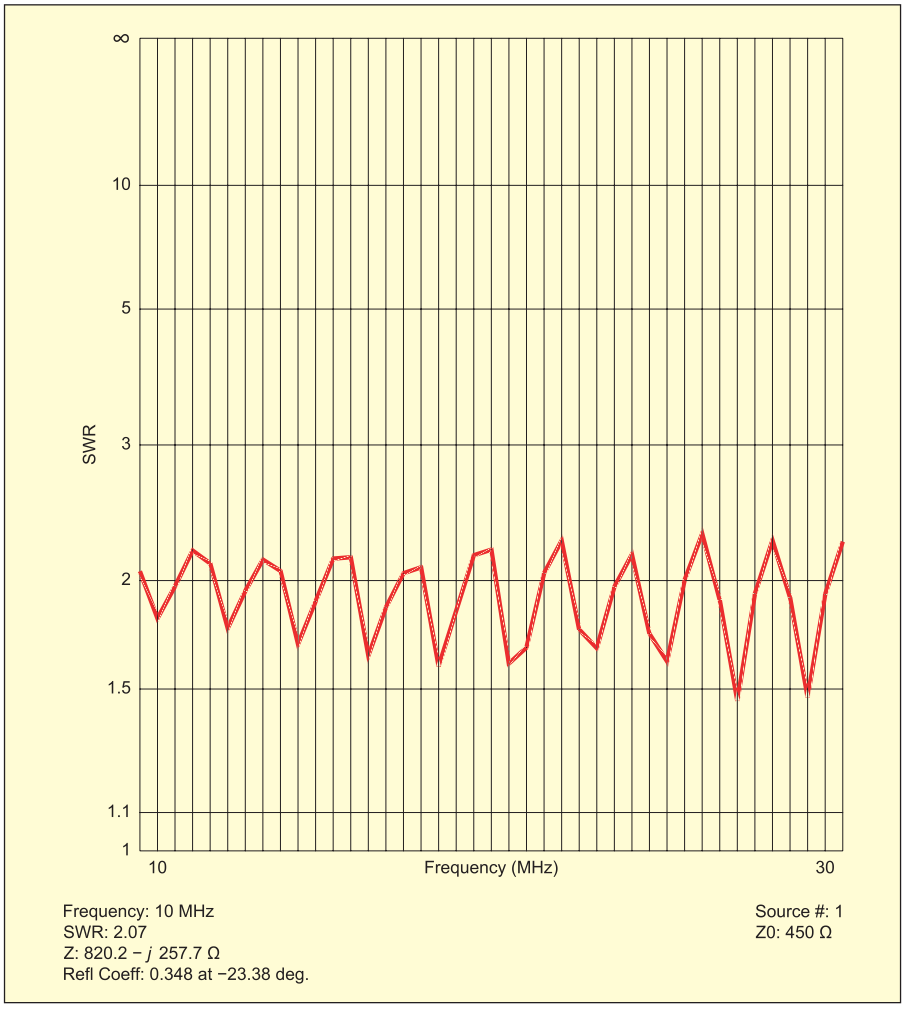


Figure 9—*EZNEC* plot of 450 Ω SWR of as-built rhombic, far-end terminated in 800 Ω.

Note that the SWR is within the range that is generally satisfactory for use with a balun on the antenna side of the tuner. This arrangement requires switching directions with the 450 Ω line, which can be done with relays, switches or even double banana plugs. Figure 10 shows the switching arrangements. Note that double the set of contacts are needed if switching the ladder line rather than coax.

This is all fine for feeding the driven end with any of the arrangements described above. Unfortunately, the terminated end will not always be well matched. The consequence of this will be a reduction in front-to-back ratio due to reflection from the termination mismatch and additional radiation in the rear direction. The result is a front-to-back ratio I found to be typically around 10 dB. While this isn't terrible, a simple way to get close to optimum results is shown in Figure 11. Any old tuner (losses don't matter in this application) should do, as long as it can match over the range required. Adjustment can be made as in either of two ways as follows:

1. Get in range by terminating the desired *transmit* side, apply power to your "terminating tuner" and adjust the tuner for a match to 50 Ω.

2. Switch ends, put the load back on the terminating tuner and tune to null a station in the back direction (so long Tex!).

Alternately, if you have a power meter, you can put it into the line going to the terminating load and adjust the tuner for maximum power delivered to the load.

Note that in either case, you will need to recheck the transmitter (or transmitter side tuner) settings since the drive impedance will change with an adjustment to the termination.

This is kind of handy and can be applied whenever needed. If your termina-

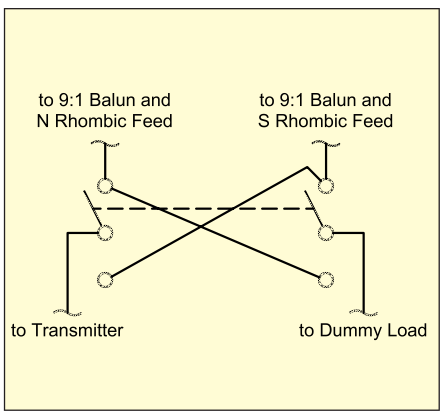


Figure 10—Diagram of coaxial switching arrangement. All shields are in common at the switch. For ladder line switching, twice the connections and switch points are required.

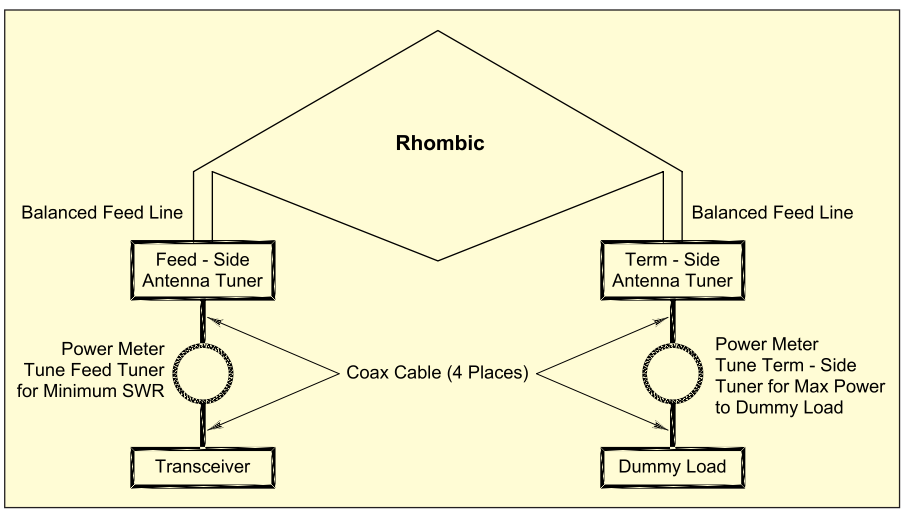


Figure 11—Terminating the non-ideal rhombic with an antenna tuner and dummy load.

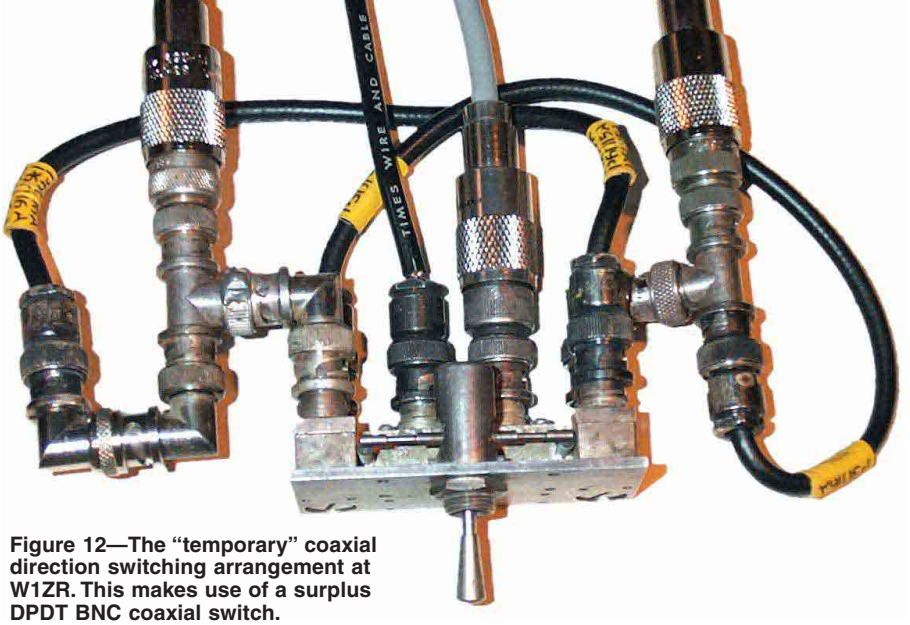


Figure 12—The "temporary" coaxial direction switching arrangement at W1ZR. This makes use of a surplus DPDT BNC coaxial switch.

tion tuner has calibration markings on its controls, you may want to record the approximate settings for each band so you can skip step 1 above. Note that the tuner can be adjusted to meet other objectives. If you tune to maximize signals from the back, you may not need to switch directions. Although the performance will be down, it may be just fine for stateside contacts. You also may be able to reflect a short up to the termination and make the antenna work like a "loop skywire." You can also do that by making the terminating line a half wavelength (or multiple) on 80 meters and shorting it at the bottom. It will reflect a short on 80 and all harmonics back to the terminating end. It won't work quite as well as a square loop, but there's no extra charge.

For my operation, I grew tired of fooling with the tuners and put a 9:1 balun on both ends where the ladder line entered the house and switched the coax (see Figure 12 for my "temporary" switching setup made out of a "junk box" DPDT BNC coaxial toggle switch) to change directions. This allows the use of standard coaxial lightning arrestors, which should be applied at both ends and grounded at the house entry point.

So, How Does it Play?

I have been very happy with the results. I observe both the predicted forward gain (in A/B tests with my G5RV and using my ARRL Lab calibrated S-meter) and front-to-back ratio. On the air results in the European direction have validated the data with many reports such as "booming in," even when the bands are not great. Unfortunately, I have not encountered conditions to Asia/Pacific that allowed a good test to that region, although WWV provided a good measurement source on 10 and 15 MHz in that direction, at a higher angle than optimum for this antenna. The difference on 30 meters is particularly dramatic, since the G5RV has a high mismatch on that band and significant loss in the coax. I didn't know what I was missing!

And What Does it Cost?

The needed parts are available from many sources. I obtained almost all the pieces of the antenna itself at Radio Works (**www.radioworks.com**). Although there are other sources and flavors, I have learned a few things in my 50 years of antenna work:

1. Don't use cheap halyards. I have found Dacron braid or double braid the least subject to abrasion from tree movement.

2. Use stranded, not solid wire, ladder line for unsupported runs.

3. Order the antenna wire in two pieces so you don't have to stretch out the whole length to find the center.

For my installation, I ordered the following:

Halyard rope, 5/16 inch black Dacron braid, 500 feet	$45
Antenna wire, 520 feet #14 hard-drawn copper	$47
Ladder line, #14 stranded copper clad, 300 feet	$69
Ladder lock insulators, 2	$27
Standard insulators, 2	$3
Total	**$191**

In addition, I purchased two of the optional CWS-Bytemark W2FMI 9:1 baluns at $90 each. I think this is an excellent price to performance ratio and I'm very happy that I pulled this together after all these years.

Notes

[1] *The ARRL Antenna Book*, 20th edition, Chapter 13, pp 9-15. Available from your local dealer or the ARRL Bookstore, order no. 9043. Tel toll-free in the US 888-277-5289, or 860-594-0355; **www.arrl.org/shop**; **pubsales@arrl.org**.

[2] *EZNEC* is available from Roy Lewallen, W7EL, at **www.eznec.com**.

[3] Make sure you compensate for the difference between True and Magnetic North if using a compass (magnetic) to line up antennas against the typical polar projections in true coordinates. This varies by area. (In my part of Connecticut, one needs to add almost 14° to true bearings to get the magnetic equivalent. This makes a big difference if you are working with narrow beam antennas.)

[4] EZHang slingshots are available from **www.ezhang.com**.

[5] J. Sevick, *Understanding, Building and Using Baluns and Ununs*, CQ Communications, Inc. Available from the ARRL Bookstore, order no. 8982. Tel toll-free in the US 888-277-5289, or 860-594-0355; **www.arrl.org/shop**; **pubsales@arrl.org**. I purchased my W2FMI 9:1 baluns preassembled from CWS Bytemark (**www.cwsbytemark.com/prices/baluns.php**). An alternate source is DX Engineering (**www.dxengineering.com**).

[6] Note that typical antenna relays (such as the popular "Dow Key" type) short the "receiver" terminal on transmit and thus will not work in this application unless that feature is disabled.

Photos by the author.

Joel Hallas, W1ZR, is an ARRL Assistant Technical Editor. He can be reached at **jhallas@arrl.org**.

NEW PRODUCTS

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◊ The New Communications Solutions Model NCS-C250 Mobile Multi-Switcher is designed to reduce multi-radio vehicle clutter by allowing a mobile user to control up to four radios with a single mic (or headset) and two speakers. It provides dual 4 W receive audio channels, one from the *selected* radio and the other for a mixed combination of the *unselected* radios. Both audio channels have independent volume controls and mute functions. The unit is designed to work with electret or dynamic mics.

Other features include a 16 W PA speaker output, crossband repeater capability, automatic external equipment muting, selected radio, mute and busy indicator LEDs and DTMF mic control of switch functions. Price: $499. For more information, contact New Communications Solutions, 5364 Valley Mist Trace, Ste 101, Norcross, GA 30092; tel 888-883-5788; **www.ncsradio.com**.

By Rick Rogers, K5RCR

An Economical Satellite Station

Operating amateur satellites doesn't have to be expensive. With a little homebrewing and frugal hardware shopping, the sky is no longer the limit.

My time spent as a ham is probably typical of most. I have been licensed off and on for 36 years and passed the Amateur Extra exam a few years ago. I am active, but not rabid. The station at K5RCR was (and is still) modest—a Kenwood TS-830 HF transceiver driving an ancient Hallicrafters HT-41 amplifier to a vertical antenna. Until relatively recently, my VHF/UHF experience centered on a very modest 2 meter handheld transceiver that I used infrequently. I would occasionally read the satellite articles in *QST*, but without much active interest. However, when I was studying for the Extra, there was a fair amount of material included on the amateur satellite service which, for reasons of enlightened self interest and a desire not to have to take the test again, I became familiar with.

At about the same time, I read an article in *QST*[1] about ham satellites on Field Day. I noted from the article that the Russian RS-12/13 satellite had a strong downlink in the 10 meter band and one day I tuned to the frequency. By sheer luck, the bird was making a pass at that time and I could hear the downlink beacon transmitting CW telemetry. I could also hear a few CW and SSB QSOs going on in the adjacent 40 kHz band of frequencies, interspersed with strings of "dits" which varied slightly in frequency ("dits" are sent to help locate one's own transmitter frequency in the downlink). I also noticed that the signals gradually drifted down in frequency due to the Doppler effect of the satellite moving at high speed (18,000 MPH) over my location. Doppler imparts a ghostly quality to the signals and this experience had a galvanizing effect.

[1]Notes appear on page 36.

Unfortunately, RS12/13 is now history. It was blasted by intense solar-flare activity on or around August 20, 2002 and hasn't been heard from since. But that first satellite contact set the hook pretty deeply. The excitement of operating the hamsats for the first few times must be like hunting big game out the open door of a box car on a train going a hundred miles an hour!

I've since embarked on a project to build up a station that could "reliably" work the low-Earth orbit (LEO) voice/CW birds: AMSAT-OSCAR 7, AMRAD-OSCAR 27, Fuji-OSCAR 29 and the new AMSAT-OSCAR 51. As with any venture that might end up costing money, especially my money, some research was in order. The two sources I used most often are the FAQ sections of the AMSAT Web site (**www.amsat.org**) and the *Amateur Satellite Handbook*.[2]

My definition of "reliably" was the ability to make a QSO on the bird on about 50% of passes. I know that it is possible, with a little luck, to work AO-51 and AO-27 with a 2 meter/70 cm FM handheld transceiver and a handheld directional antenna. However, the other satellites (AO-7 and FO-29) require narrower-bandwidth SSB or CW uplinks. Further, given the usual density of traffic on AO-51 and 27 (think, "DX pileup where everyone is the DX"!) hitting it with a few watts and a handheld antenna is a fine challenge for a more experienced operator, but potentially frustrating for a rookie like me.

The Transmit (Uplink) Side

On the transmit side, since I wanted to operate more than just the FM repeater satellites like AO-51 and AO-27, a rig capable of FM, CW and SSB was required. Since the uplink frequencies of all of the LEO satellites I was interested in used 2 meters, a used 2 meter multimode transceiver would work fine. I located a 25 year old Kenwood TS-700A transceiver on eBay (**www.ebay.com**) for less than $200. If you want to pay more for a more modern radio, you have other models to choose from as well. In fact, to use the AO-51 satellite, you'll need a transceiver with CTCSS subaudible tone capability. The good news is that most modern rigs offer this feature as standard equipment.

Although the 5 W output from the TS-700 is adequate for many satellites (especially with the antenna system I'll describe later), it is a little light for the others. To remedy this problem, I added a Mirage B23A 30 W "brick" amplifier for about $50. The amp includes a receive preamp and ability to operate on CW, SSB as well as FM. Resist the temptation to buy a high-power amplifier. With a directional antenna to focus your uplink power, anything more than 30 to 50 W is overkill—especially for the FM birds.

Certainly, one could obtain one of the magnificent new, and very expensive complete multiband, multimode transceivers to accomplish this goal. Likewise, one could go the homebrew transmitter or up-converter route. However, remember that this goal was set by a cash-strapped rookie, so simplicity of operation as well as low cost were the principal, and admittedly competing, considerations.

The Receive (Downlink) Side

On the receive side, inexpensive, yet easy to operate options are more limited, since the downlink frequencies, with one exception, are in the 435 to 438 MHz range. The exception is AO-7 with an occasional 10-meter downlink.

After reading a *QST* review[3] of the ICOM PCR-1000 receiver, I decided to try this rig. The PCR-1000 is a PC-

controlled receiver with a frequency range of between 0.01 to 1300 MHz on FM, CW, SSB and AM. There are several reasons for trying this rig. Most hams already have a PC in the station for logging, running PSK31, etc. You will also need a PC for predicting the pass times of the satellites you want to work. The PCR-1000 now costs less than $300. The included operating software works well on *Windows* machines and is intuitive in function. A number of other third-party software sources are also available to drive this receiver.

The computing requirements to run this machine are modest and it will easily run simultaneously with complex satellite tracking programs on older 486 computers like the one I have in the shack. One of the included features, a spectrum analyzer, is handy for tuning in the FM downlink on AO-51 and AO-27. Of course, this radio makes a good general-purpose receiver and a nice platform for receiving downlinks from other commercial and government satellites, especially NOAA weather satellites on 136 MHz. It also offers numerous intermediate frequencies for the down-converters one might use to receive microwave signals such as the 2.4 GHz downlink that AO-51 uses from time to time.

Of course, an inexpensive broadband receiver like the PCR-1000 has problems with both sensitivity and selectivity. However, many other UHF receivers for terrestrial ham service have the same problem. That is, they all need help in the form of an antenna-mounted preamplifier that has some degree of band-pass filtering. These preamps can cost between about $20 for kits to about $200 for high quality, complete units. The preamps generate between 10 and 18 dB of gain with low noise. Most also provide some preselectivity and some of the more expensive units are equipped for automatic switching, if you want to also use the 435 MHz antennas for transmitting. I chose a Hamtronics LNK model at a cost of about $60. These can be powered with 12 V dc through the coax, or with a separate 12 V supply line.

Antennas

A gob of money and frustration can be saved at this juncture. First, the money.

There are several manufacturers of excellent high-gain antennas optimized for satellite service that cost between about $250 and $500 to cover both up and down links. Some of the high-end antennas are almost too good. Their gain is so high, and beamwidths so narrow, that rotators in both the azimuth and altitude direction are needed to direct the beam to the bird. This approach requires more sophisticated antenna controllers, coupled with the satellite tracking software, not to mention at least 500 more dollars. This will happen at K5RCR eventually, but something a little less heroic (and costly) will do in the meantime.

Let's address frustration. A number of articles describe how it is possible to work these LEO satellites with small, simple omnidirectional antennas. Indeed, I have heard experienced operators, some using mobile rigs, who accomplish this feat. I have also talked with other entry-level ops who complain about how these antennas only work well on nearly overhead passes.

I decided on an antenna design not often associated with satellite ops: multi-element quads. Quads can be built for almost nothing, they are easy to tune and have relatively broad bandwidths and beamwidths. They are also relatively compact, especially compared with some of the commercial monsters that have booms 17 feet long!

EZNEC models of the quad antennas I will describe suggest that they will have a gain of 10 dBi for the 2 meter and 14 dBi for the twin 70 cm quads. Furthermore, the half-power beamwidth is quite wide—approximately 60° for the 2 meter quad and 45° for the twin 70 cm setup. This broad beamwidth, reasonable gain and compact size means that the antennas can be set at a fixed elevation of about 30° and rotated in azimuth by an inexpensive TV style rotator. Although these antennas are literally built from sticks and wire, they are pretty tough. Mine survived two tropical storms, each packing 70 MPH winds and 10 inches of rain. One of the nice features of satellite operations is that the antenna only needs to be far enough off the ground to allow a rider mounted on a lawn tractor to pass underneath. At K5RCR, a 10 foot, 2 inch diameter steel pipe serves well as a mast for the rotator and the antenna array.

Antenna Construction: 6 Element, 2-Meter Quad

Buy or cut out a piece of clear, knot-free pine 1 × 1$^1/_2$ inches and 7 feet long to serve as the boom. Also, acquire 12 1-inch (approximate) pine spreaders 30 inches long. Starting one inch from one end, attach the spreaders to the boom as shown in the accompanying photos. Spreaders should be mounted 13 inches apart along the boom. The reflector loop (85 inches) is made by first drilling holes through the spreader 14$^1/_2$ inches from the boom. The wire is then threaded through the holes and soldered together. Almost any wire will do; I used stiff #16 stranded hard copper because I have a lot of it around. The first-through-fourth directors are all 75 inches long and are assembled to the spreaders in the same manner as the reflector. Drill wire pass-through holes in the spreaders 13$^1/_4$ inches from the boom.

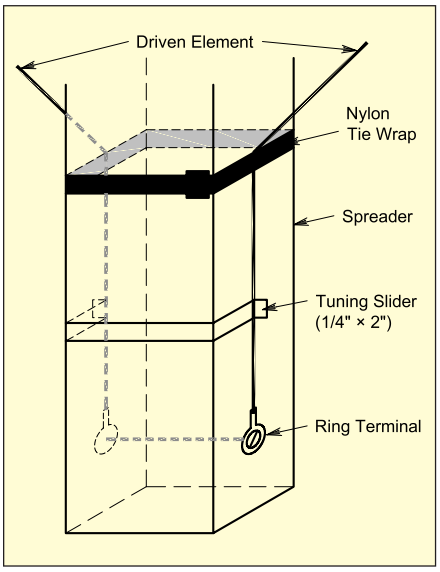


Figure 1— Outline drawing of the tuning slider for the 2 meter quad driven element. The slider is fashioned from a flat copper or brass strip $^1/_4$ inch wide and 2 inches long. The strip is bent into the shape of a "U" and slipped between the loop wires and the spreader.

The driven element starts as a length of wire 84 inches long. Like the directors and reflectors, it is passed through holes in the spreaders made 14 inches from the boom. Solder a ring terminal to each free end and screw the terminals to the spreader. Solder the coax (RG-8) feed line directly to the loop wires leading from the terminals. Use nylon tie wraps to secure the coax to the spreader and boom. Coat the feed point area liberally with silicone-plastic caulk for waterproofing. On the corner adjacent to the feed point, tighten the loop by tightening a tie-wrap around the loop wires and the spreader (Figure 1). Bend a piece of flat copper or brass strip $^1/_4$ inch wide and 2 inches long into the shape of a "U" and slip it between the loop wires and the spreader. This acts as a tuning slider and will be soldered in place later.

Once assembled, the antenna can be laid on a table and tuned. Use a signal from a 2 meter rig and adjust the slider for minimum SWR. Solder the slider in place when finished. Spray paint the antenna with a couple of coats of enamel to help preserve the wood against the weather (Figure 2).

Antenna Construction: 8 Element, 70 cm Quad

This antenna is also built on a wood boom. Since the loops for 70 cm are so

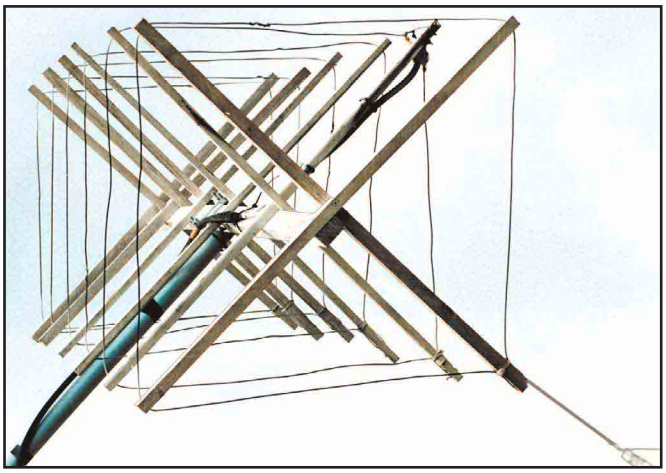


Figure 2—The wood-and-wire 2 meter quad pointed skyward.

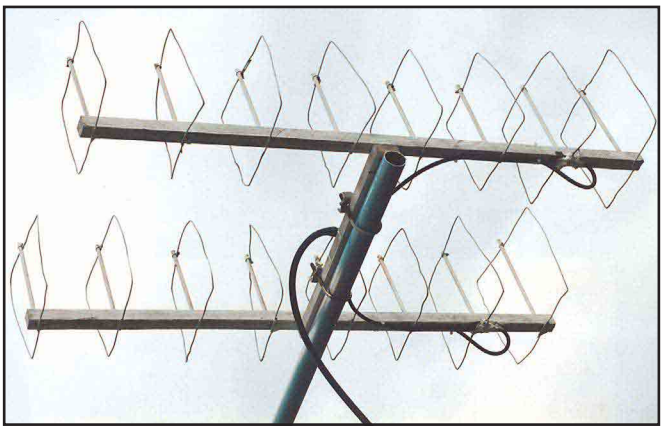


Figure 3—Two 70 cm, eight element quads fed in phase.

much smaller than for 2 meters, single 9 inch long, 1/4 inch diameter dowel rods rather than spreaders, are used to support the loops. Booms are made from 1 inch square pine stock 48 inches long.

Drill eight, 1/4 diameter holes five inches apart for the dowel supports. Put a drop of wood glue on the end of each dowel support and put the dowels in the holes. Make the reflector from a square loop from stiff copper wire 30 inches long. The loop can be tie-wrapped to the dowel and boom. Likewise, make six director loops with a total length of 26 inches and attach to the dowel and boom.

The driven element is made from a length of wire 28 inches long. Ring terminals are soldered on the free ends and screwed to the boom. Coax feed line is then soldered directly to the loop wires next to the terminals. Coat the entire feed point area liberally with silicone-plastic sealant to protect from the weather.

According to *EZNEC*, the antenna should produce about 11 dBi forward gain with a half-power beamwidth of 50°. Since these antennas are so cheap and easy to build, I made two and fed them in phase with 1 3/4 wavelength (32 inches, taking the velocity factor into account) of RG-59 coax connected at a "T" to the RG-8 feed line.

The quad booms can be attached with screws to a horizontal 1 × 2. Mount the quads about 20 inches apart. Each quad stacked together with another quad should yield another 3 dB of gain over the single antenna alone. This "double-barreled quad" arrangement is very effective, easy to point, could be built from scratch in an afternoon and cost nothing. Who could ask for more (Figure 3)?

Mast, Rotator and Mount

A 10 foot piece of 2 inch steel pipe set in a hole filled with four sacks of concrete is more than adequate to hold up this array. A TV-type rotator (about $80) was selected to turn the array. At some point in the future, a much more ambitious system of alt-azimuth rotators with direct communications with the satellite pass-prediction software will be installed. For now, manual azimuth control is sufficient. The whole antenna array weighs less than 20 pounds and can be easily turned with TV hardware.

The 2 meter and 70 cm antennas are attached to a 1 1/2 inch piece of aluminum tubing six feet long using "U" bolts. This, in turn, is mounted to the rotator with the standard plate-and-U-bolt technique. The antennas are pointed about 30° above the horizon. This is adequate, since the majority of satellite passes are 30° or less above the horizon, and the half-power beamwidth of the antennas should cover from just above the horizon up to an elevation of 60°. I have found this system to work well, even with passes that are directly overhead (Figure 4).

I ran RG-8 coax from the 2 meter quad directly to the shack and connected to the power amplifier-preamplifier unit. A short length of RG-8 connects the 70 cm quads to a mast-mounted preamp that, in turn, connected to the 70 cm receiver. The

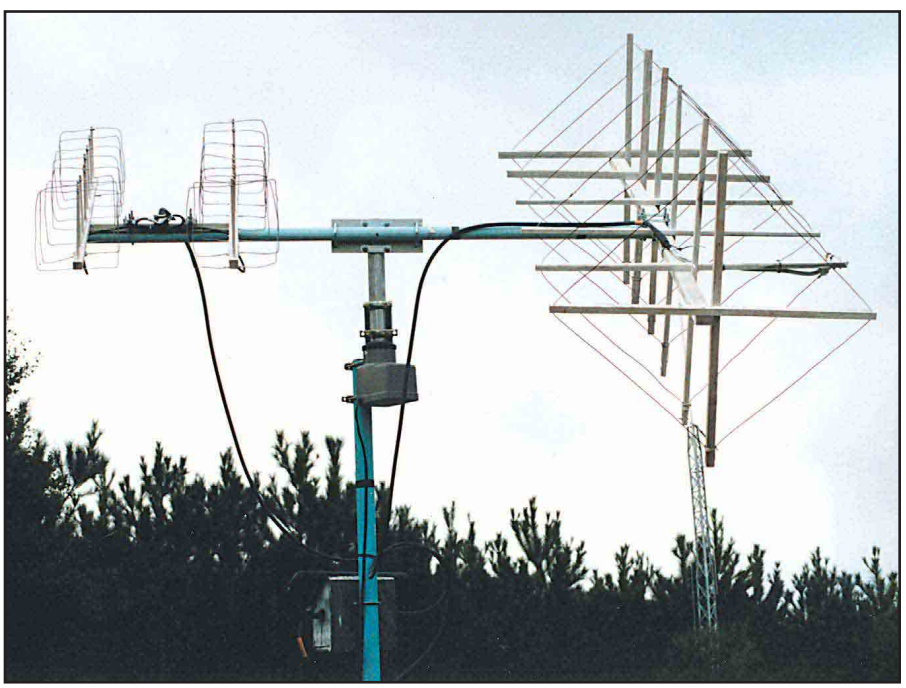


Figure 4—My inexpensive satellite 70 cm and 2 meter antenna array tilted at a fixed 30° angle and turned in azimuth with a TV-type rotator.

preamp is what makes this setup possible. No mast mounted preamp, no signals at the receiver.

Pass Prediction, Or "I Wonder Where The Birdie Went?"

There are several software packages that allow modest PCs to predict the orbits of satellites in real time and then graphically display their "footprint," the area under which ground stations can access the bird. These programs also display a running list of the present azimuth and elevation of the satellite with respect to the location of the ground station. Some of the more sophisticated programs use this information to control the antenna rotators. I simply turn the rotator knob in the indicated direction a few times during the pass. Given the broad beamwidth of the antennas I have, this works just fine.

I use *Nova for Windows* from Northern Lights Software Associates. It is available over the Web for about $90 or $80 through AMSAT. There is even a free program for *Windows* known as *Winorbit* and you can download it at **www.satnet.com/winorbit/**.

All such programs need to be updated once every month or so with new Keplerian Elements. The "Keps" are the parameters the computer plugs into the orbital equations to predict where the bird is. The update is necessary, since all the orbits change gradually over time. You can download new Keps from the AMSAT Web site. Most pass-prediction programs will read the Keps file and update automatically.

Starting with the FM Birds

AMSAT-OSCAR 51 is an FM repeater that listens on 145.920 MHz and retransmits on 435.300 MHz. You must transmit a 67 Hz subaudible CTCSS ("PL") tone on the uplink to access AO-51.

A minute or so before the pass, point the antenna toward the AOS or acquisition of signal azimuth. Set the receiver about 10 kHz higher (435.310 MHz) tune slowly and listen. Once the satellite is 5-10° above the horizon, the action begins. What you typically hear are rapid exchanges. Part of the reason for this frenzied manner of operation is the fact that, like other FM communications systems, the most powerful signal appearing at the receiver is captured and retransmitted in the downlink. So, to allow maximal use of the satellite, exchanges are made quickly, with brief gaps between. There is no better way to earn the enmity of other satellite ops than to dominate this particular bird with a high-powered, long-winded ragchew.

As the satellite frequency drifts lower, adjust the receiver to compensate. From beginning to end of a typical pass, the frequency may drift 18-20 kHz. Modern radios, coupled with some of the more advanced satellite pass prediction software can automatically compensate for the Doppler effect. For now, manual adjustments are good enough.

Speaking of manual adjustments, don't forget to keep up with the antenna rotator. I know, it sounds like an operator has to be busier than a three-legged cat in the sandbox, but it is actually not so hard to keep up. (Rudi, our three-legged cat, manages just fine.)

AO-27 is similar to AO-51 in that it is an FM repeater-type satellite. This satellite also has a lower transmitter power and operates on a schedule designed to maximize the life of the on-board storage batteries. For example, while I'm writing this, the satellite is "open" during only 10 minutes of every daylight pass. The downlink frequency is 436.795 MHz. Uplink is 145.850 MHz.

Fuji-OSCAR 29

Fuji-OSCAR 29 is a technical and operational step up from AO-27 and AO-51, but it is well worth it. This bird uses an analog transponder that accepts an uplink passband of between 145.9 and 146.0 MHz and repeats the downlink passband inverted from 435.8 to 435.9 MHz. The inverting transponder can cause some confusion, even while staring at a conversion table such as the one AMSAT provides to its members. This probably explains why the great majority of activity on this satellite is focused on the center frequency: 145.950 MHz up and 435.850 MHz down. At least the last two numbers are the same. CW and SSB are the only modes used on these satellites, and for SSB the rule is to use LSB on the uplink and listen for USB in the downlink. Unlike AO-51 and AO-27, these birds are wide open. Although the center few kHz can be busy, the rest of the passband could easily accommodate schedules, ragchews, etc.

The setup described in this article has worked FO-29 using both CW and SSB, although CW will be more reliable. To begin, set the receiver to a frequency away from other QSOs (say, 435.860 MHz) and set the transmitter to 145.940 MHz (the complementary uplink frequency). Slowly tune while sending a series of slow CW "dits." When you hear your Doppler-shifting signal in the receiver, you have "found yourself" and can now move the transmit frequency closer to the action. Although this setup will not produce a commanding signal in the downlink, it can be copied to within 10° above the horizon without much trouble.

OSCAR 7

AO-7 belongs in the category of the miraculous. This bird was launched in 1974 and served the hamsat community until 1981. This is when the onboard battery supply failed and knocked the bird off the air. On June 21, 2002, Pat Gowen, G3IOR, identified the warbly CW telemetry signal from AO-7. Apparently, 21 years after being declared dead, the battery unshorted, allowing the solar panels to power up the bird.

She still plays well, although only in daylight. Additionally, AO-7 switches at random between a resting state (no activity), Mode A (2 meters up and 10 meters down) and Mode B (70 cm up and 2 meters down) whenever it comes out of darkness into the light. It is easy to tell which mode it is in, since AO-7 activates a beacon for the appropriate downlink: 29.502 MHz for Mode A or 145.975 MHz for Mode B.

Working this bird is similar to, and maybe easier than, Fuji-OSCAR 29. This satellite uses a CW/SSB transponder like FO-29, but it is non-inverting. As with FO-29, the center of the 100 kHz passband (145.9 MHz uplink; 29.450 MHz downlink) is where most of the action is, but the edges are wide open. Since this bird is running entirely off of the solar panels without a battery to "buffer" the effects of changes in illumination, transponder demand, heating and cooling, etc, the downlink signal can have a distinct warble. This can have an interesting effect on the quality of the signals, but it is easy to get used to. I have found that my modest 25 year old HF rig and vertical antenna have no problem with the 10 meter downlink from AO-7.

Overall, setting up a ground satellite communication system that works well "on the cheap" has been, without a doubt, the most challenging and rewarding experience I have had yet in Amateur Radio. With this platform, I can now move into digital and "deep space" operations as I gain experience.

Notes

[1]"Amateur Satellites and Field Day 2001," *QST*, Jun 2001.

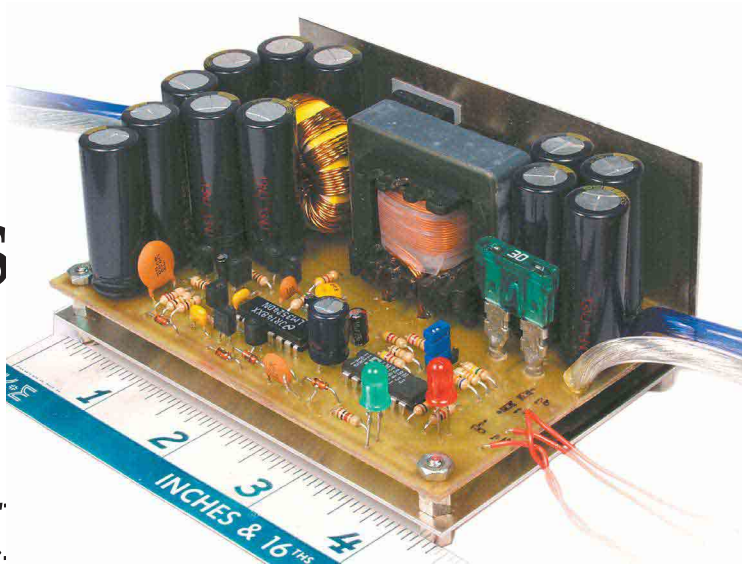
[2]*The Radio Amateur's Satellite Handbook*, ARRL, 2001.

[3]Ford, Steve, "ICOM IC-PCR1000 Computer-Controlled Communication Receiver," *QST*, July 1998.

Rick Rogers, K5RCR, ex-KN6HGY, ex-KA6EZT, ex-N9COO, ex-N7GEF, ex-KI8GX is a Professor of Neuroscience at the Louisiana State University in Baton Rouge. He can be reached at 9831 Bank St, Clinton, LA 70722; **rogersrc@pbrc.edu**. *He is halfway to the not-so-coveted "licensed in all call areas" award.*

By Daniel R. Kemppainen, N8XJK

A 12 V dc Boos Regulator for Battery Operat



A dc-dc boost switching converter is the answer to low voltage battery problems for mobile, portable or emergency-power operation.

Battery low charge state conditions, combined with voltage drops in wiring, can cause reduction in output power, transmit signal distortion or even total shutdown in many radios. One solution to this problem is to build a switch-mode power supply (SMPS) to maintain the dc input voltage. An SMPS can offer boosted power levels and allow longer operating times from a given battery. This article describes how to build and test one from both new and recycled parts for about $50.

Overview

This SMPS is a simple boost supply, designed to make up the difference between battery voltage and a preferred output voltage level at the cost of some additional current draw from the battery. It was designed for an output current of about 25 A. When turned off, the battery voltage (less one diode voltage drop) is present at the output terminals of the supply. No power transfer relays or switches are required. The supply can be set up to operate on demand or continuously, depending on user requirements. A switch or relay contact is used to switch the power supply control power off when not in use. This reduces power consumption during periods of inactivity or when voltage is sufficient to power the radio.

Two "on demand" inputs are provided to enable the voltage boost function. One of the inputs is a simple remote enable input, and requires only a battery voltage signal. This can be used in conjunction with a control signal from a radio to key the supply or it can be enabled by a toggle switch for manual operation. The other input is an RF detector. The RF detector can be used to monitor the RF output of the attached radio and allow the voltage boost to take place when the radio is transmitting. The RF detector attaches directly to the antenna lead of most radios using a coax T fitting or a coupling transformer. This design has been tested with radios transmitting from several watts to 100 W. Operation at higher power levels may require some circuit modifications. The completed supply is shown in Figure 1.

Circuit Description

The SMPS uses a push-pull design topology. Its schematic appears in Figure 2. The positive battery terminal is connected to the center tap of the primary of the switching transformer T1. The secondary of T1 is also a center tapped winding, with its center tap also attached to the battery voltage. The voltages seen on the secondary legs of T1 are the battery voltage plus the voltage of the transformer windings. This configuration allows the transformer to supply only the difference between the output and battery voltages. In addition, the power requirements of the transformer and switching transistors are reduced. This also allows battery voltage to be present at the output of the supply when it is switched off.

Figure 1 (above)— The completed boost regulating switching supply. It is shown with an aluminum sheet that acts both as a mounting base and a heat sink.

MOSFET transistors Q5 and Q6[1] alternately switch the legs of the primary winding of T1 to ground, creating an ac flux waveform in the transformer. The secondary legs of transformer T1 are rectified by the dual Schottky diode D7. Inductor L1 and eight 3300 µF capacitors form a low pass filter to smooth the rectified waveform.

A switch-mode power supply controller, U1, handles the voltage regulation. The controller used in this supply is an LM3524D.[2] The LM3524D uses pulse width modulation to control the time that switching transistors Q5 and Q6 are turned on. By varying the pulse width, the ac voltage of the transformer is varied and the output voltage is maintained.

A simple battery voltage monitor circuit is used to monitor low battery conditions. The low voltage protection circuit shuts down the LM3524D in the event that battery voltage falls below a minimum level. The protection voltage is jumper selectable to 9, 10 or 11 V. The circuit uses an LM339[3] quad comparator in conjunction with a +5 V dc reference voltage provided by the LM3524D controller IC. When the protection circuit is tripped, the supply boost function is disabled and battery voltage is present at the output of the supply. A reset of the battery protection circuit is accomplished by cycling the power switch.

Collecting the Parts

The inductor and transformer are custom parts that will need to be made for

[1]Notes appear on page 41.

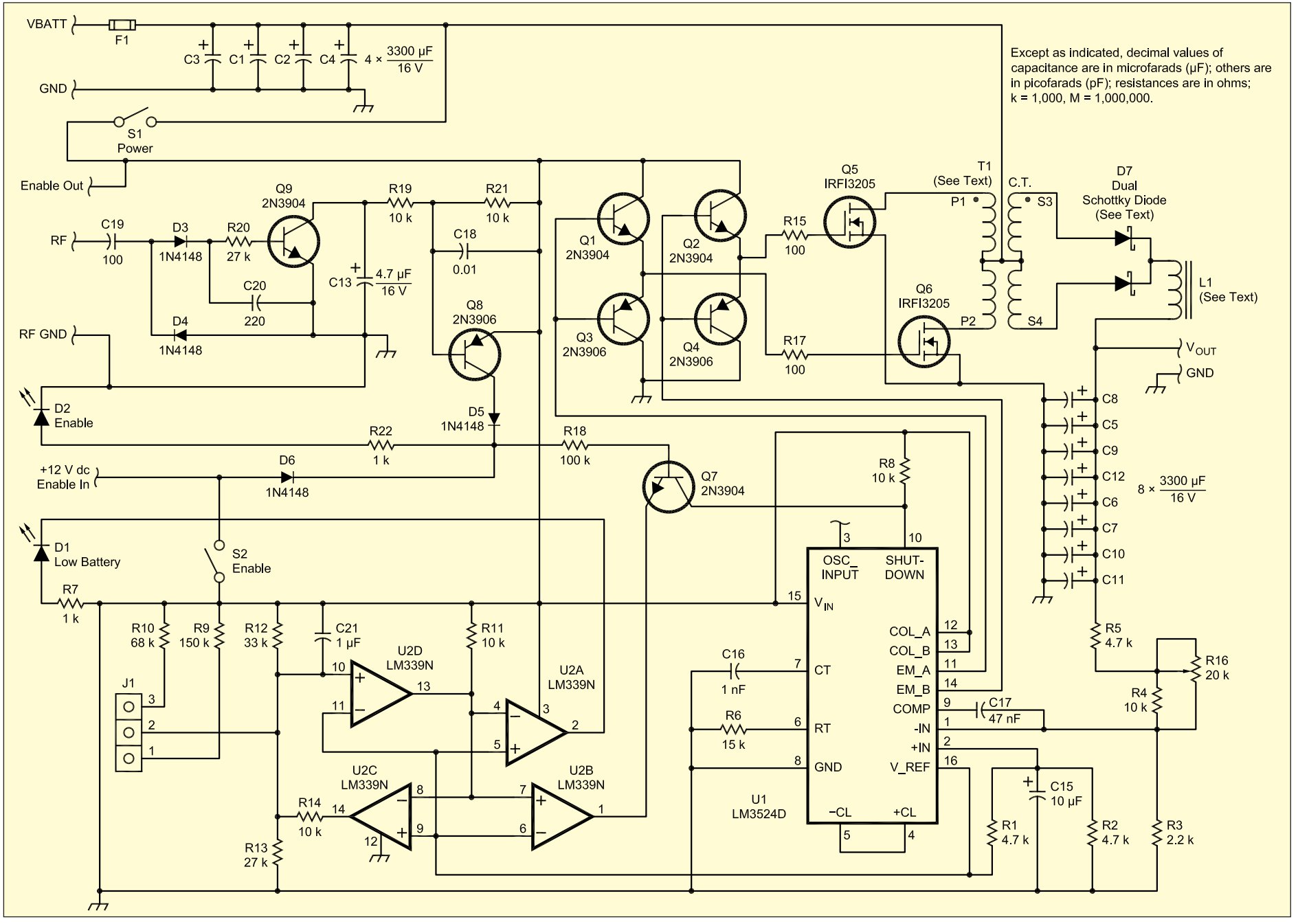


Figure 2—Schematic diagram of the boost regulator. A detailed parts list is available at www.arrl.org/files/qst-binaries/boost_reg.zip.

the supply. A good source of these components is an old PC power supply. For this SMPS, an AT-style computer power supply was chosen. The inductor and transformer will need to be disassembled and rewound before building this supply. Details can be found on the ARRLWeb.[4] The dual Schottky diode (D7) can also be salvaged from the same surplus power supply. Capacitors C1 through C12 are specific, and will need to be ordered new. The rest of the parts are common and can be replaced, provided that close matches can be found.

Detailed directions for disassembly of the transformer core, transformer winding calculations, directions for winding the transformer and inductor, the PC-board layout, a complete parts list, and construction preparation and assembly instructions can also be found on the ARRL Web site (see Note 4).

A good reference for ferrite core applications and design is the *Ferrite Core Design Manual*, available from Magnetics, PO Box 11422, Pittsburgh, PA 15238; **www.mag-inc.com/ferrites/fc601.asp**.

The Filter Inductor, L1

The only inductor used in the circuit is L1. The inductor is used in conjunction with eight 3300 µF high frequency electrolytic capacitors to make the output low pass filter section of the power supply. The approximate value of L1 is 9 µH and it must be capable of handling currents of up to 25 A. Nine turns of wire on the salvaged toroid core will produce the 9 µH inductance. Ten paralleled 24 gauge copper wires work well for the winding. Each strand needs to be about 18 inches long. Plan on a total length of about 15 feet of wire for the winding. Strip, twist and tin the leads before inserting the inductor into the circuit board.

Supply Boost Enable Circuit

The supply enable circuit is designed to allow the supply to boost voltage when required. Two inputs allow the circuit to function. The first is a simple 12 V input and the second is an RF detection input. The ENABLE input feeds current into D6, supplying current to the base of Q7 through R18 and to the ENABLE LED through R22. The ENABLE function can also be manually forced by closing S2, the ENABLE switch. Feeding current into the base of Q7 allows comparator U2B to pull the shutdown pin low, thus enabling the LM3524D.

The RF INPUT enables the supply when RF is present. The RF INPUT feeds current into the base of Q9 through D3, causing C13 to be discharged and half of the supply voltage to appear at the base

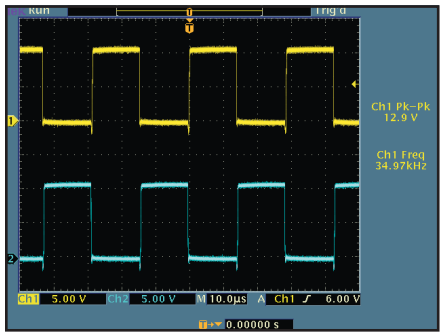


Figure 3—MOSFET gate driver waveforms shown with no MOSFET devices attached. Note the 180° phase shift between phases.

of Q8. Transistor Q8 then feeds current into D5, enabling the supply just as the ENABLE input would. The charge time of the 4.7 µF capacitor, C13, sets up a small delay that keeps the supply enabled after the RF signal is removed.

To test the ENABLE circuit, apply power to the supply and close the power switch. Supply a 12 V signal to the ENABLE input or close the ENABLE switch. The ENABLE LED should come on. Remove the 12 V feeding the ENABLE input, and the ENABLE LED should go off.

To test the RF INPUT, apply an RF signal to the RF INPUT. It is important to note that a 2 V peak-to-peak signal will be the minimum needed at the RF INPUT to enable the supply. The supply ENABLE LED should light up in the presence of RF, and go off about a quarter of a second after removing the RF signal. The turn-off time may vary slightly, depending on the strength of the RF source.

Battery Low Voltage Protection Test

The battery low voltage protection circuit was designed to protect the battery from being discharged too far. The circuit works by comparing a sample of the battery voltage to a reference voltage. The LM339 comparator is used to compare the battery voltage to the reference provided by the LM3524D. The controller circuit is shut down when a low voltage condition has been detected. R12 and R13 form the voltage divider used to sample battery voltage. R9 and R10 and the jumper J1 act in parallel with R12 to vary the voltage divider ratio. U2D compares the sample battery voltage to a reference voltage. When the voltage falls below the reference, U2D pulls its output pin to ground. U2C then seals the circuit by pulling the voltage going to U2D down even further. U2A acts as a simple switch turning on the low voltage LED. U2B allows Q7's emitter to go high, allowing R8 to pull up the shutdown pin on the LM3924 and thereby disabling the supply.

To test the low voltage protection circuit, simply apply power and a ground to the supply and close the power switch. With the power switch closed, remove the 12 V input from the supply. After a few seconds, the LOW BATTERY voltage LED should light up and stay on. Before depleting the voltage stored in the input capacitors C1 through C4, reconnect power to the supply. The LOW BATTERY voltage LED should still be on. Turn the power switch off for a few seconds, and then back on again. This should reset the battery protection circuit and the LOW BATTERY LED should be off.

Next, test the threshold voltage for the low battery protection circuit. Start by connecting a voltmeter or oscilloscope across the battery input to the supply. Set the battery protection voltage to 11 V by removing the voltage select jumper J1. Connect power to the supply, and cycle the POWER switch OFF and then ON. Remove the input voltage to the supply, and watch for the LOW BATTERY LED to come on. Take note of the voltage at which the LED turns on. This voltage should be very close to 11 V. Reconnect power and cycle the power switch. Repeat this test for the 10 V (jumper toward fuse) and the 9 V (jumper away from fuse) threshold settings.

Switching Regulator IC

The switching regulator is the heart of the circuit. The regulator uses pulse width modulation to vary how long the switching transistors Q5 and Q6 stay on for each switching cycle. By adjusting the pulse width of the switching transistors, the output voltage can be kept at a constant level. The switching regulator monitors the output through a voltage divider as a 2.5 V dc signal. Resistors R3, R4, R5 and R16 form the voltage divider that provides the feedback voltage. R16 is variable, allowing for adjustment of the output voltage. The reference signal comes from the LM3524D's internal 5 V reference and is divided down by the voltage divider formed by R1 and R2.

The next test will verify that the switching frequency is correct, the feedback network is working, and the gate driver transistors are operating correctly. After D7, Q5 and Q6 are removed from the supply, tie the supply positive input to the supply positive output. Turn variable resistor R16 fully clockwise. This will help to ensure that the output voltage setting is above the input voltage. Attach a voltage source to the supply, and close the power switch. Check that the input voltage to the supply is around 12-13 V dc.

Using an oscilloscope or a frequency

counter, check the frequency at the nodes between R15 and Q5 and R17 and Q6. This should be about 35 kHz, with a 50% duty cycle for each transistor. If the frequency is not within a few kilohertz of 35 kHz, the timing capacitor or resistor (C16 or R6) will need to be adjusted. The waveform should have fast rising and falling edges. Figure 3 shows a sample of the gate driver waveforms without Q5 and Q6 attached.

With the oscilloscope or frequency counter still attached to the nodes between R15 and Q5 or R17 and Q6, turn the voltage adjust resistor all the way to the left. This will set the minimum output voltage to around 9 V dc, well below the input voltage. The switching drive signals should be a steady 0 V signal, indicating that the output voltage is above the current voltage setting. When the test is complete, center the output voltage potentiometer. This should set the supply to around 13.3 V dc.

Putting It All Together

After operation of the switching regulator IC, RF detect and enable inputs and the battery voltage protection circuit have all been verified, mount the switching transistors (Q5 and Q6) and rectifier diode (D7). It is important that a heat sink is attached to the switching transistors and rectifier diode. The transistors come in an electrically isolated package and need only heat sink grease between them and the sink. The diode is not an electrically isolated package and it requires electrical isolation between its package and the heat sink. The insulating pad originally used to isolate the diode from the heat sink in the PC should also be used.

The first test with the switching transistors and rectifier diodes should be done with a low current fuse (5 A) or a pair of 100 W, 12 V light bulbs in series with the battery. If light bulbs are used, set the battery protection circuit to 9 V. Hook a voltmeter and a small 12 V automotive tail lamp or similar small load to the output of the supply. Hook the supply to the 12 V battery. With the power switch off, the 12 V load should be energized, and the meter should read the battery voltage minus one diode voltage drop (0.5-0.6 V).

Close the power switch. No LEDs should be on. If the battery protection LED is on, check the input voltage to the supply and cycle the power switch. Enable the supply with the RF DETECT input or ENABLE input and watch the output voltage. The voltage should jump up slightly when the ENABLE LED comes on. If no change in voltage is detected, turn R16 clockwise until an increase is detected. As long as the battery protection LED is off, the ENABLE LED is on, and the output voltage setting is higher than the input voltage, the supply should be running. Set the output voltage to a desired level by adjusting R16. The supply is now running, and will regulate the minimum output voltage.

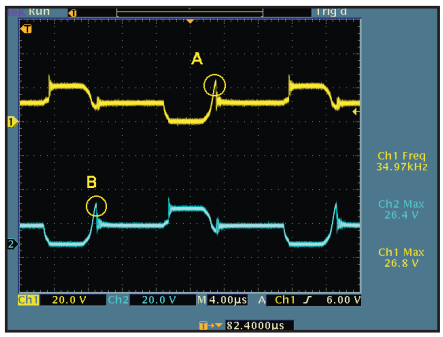


Figure 4—The drain to source voltages of Q5 and Q6 while operating the supply at a load of 300 W. The input voltage was between 10 and 11 V dc. The output voltage was set to 14 V dc. Note points A and B showing the transients generated during MOSFET turn-off.

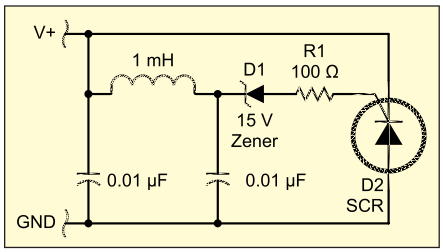


Figure 5—A sample crowbar circuit. Values shown are recommended starting points. Determine the exact values experimentally, depending on the SCR and Zener diode used and the clamp voltage desired.

A final check of the supply should now be made. The transient voltages on the switching transistors now need to be checked. This check is important and should not be skipped. This test will be run several times, with an increase in the load on the supply each time. The minimum peak voltage that will normally be seen is double the supply voltage. This is because the switching transformer acts as an autotransformer when each transistor is ON. This voltage should not be of any concern, but the voltage that is of concern is the transient voltage generated when the switching transistors turn OFF. This occurs when the voltage across the transistor starts to rise from the 0 V level (see Figure 4). The changing current in the transformer, combined with any leakage inductance, cause these transients to be generated. The peak voltages need to be below the rated 55 V of the switching transistors.

Attach an oscilloscope or peak detecting voltmeter from the drain lead (center lead) of Q5 and Q6 to ground, and attach a 1 A load to the supply. Enable the supply and check the peak voltage across each of the transistors. If peak voltages are close to the transistor breakdown voltage (55 V) under light loading, stop the testing immediately. The switching transformer will need to be rewound with tighter spacing between all of the windings.

Repeat the previous test with a large load on the supply. Remove the current limiting from the battery, and place a 30 A fuse in the fuse holder. Attach a load of around 100 W to the supply. A 100 W automotive light bulb works well for this. You may have trouble with the battery protection circuit when trying to enable the supply with the 100 W light bulb attached. If so, leave the voltage on the ENABLE input to the supply, then cycle the power switch. The supply has a built-in soft-start circuit that will bring the output voltage up slowly when the ENABLE input is powered before closing the power switch. It may be necessary to use this feature when testing the supply with large light bulb loads. With the 100 W load attached, check the transient voltages to make sure they are below the 55 V rating of the transistors. If the transients are low, repeat the test with 200-300 W of load. If any of the tests reveal transients close to the 55 V maximum, the transformer will need to be rewound with tighter spacing between the windings.

Final Notes

The power supply can be mounted in an enclosure, provided that enough cooling is available for the switching transistors. The level of power drawn and the state of charge of the battery will determine the heat sink requirements. Basically, if the heat sink or cases of the transistors are too hot to touch, a bigger heat sink or more air flow is required.

A set of optional high frequency "snubbers" can be added to the switching transformer and the switching transistors. The snubbers are basically a series RC network used to reduce the high frequency ringing that can occur during switching transitions. Place the snubbers from each leg of the transformer to the center tap of the transformer, and from the drain lead (center) of the switching transistors to ground. A 220 pF ceramic capacitor in series with a 220 Ω resistor is a good starting point for each snubber. It is best to determine the exact values experimentally. Find values that reduce the ringing without dissipating excessive heat in the resistors.

It is highly recommended that a crowbar circuit be included on the output of the

supply. If a malfunction were to occur in the supply feedback circuit, the output voltage could rise enough to cause damage to any attached equipment. The crowbar circuit watches the output voltage of the supply and shorts the output—blowing fuse F1—if the voltage gets too high. The simple circuit shown in Figure 5 uses a Zener diode in series with the gate of an SCR. A small current limiting resistor and an RF filter are included. The current limiting resistor prevents damage to the gate of the SCR, and the filter prevents RF on the 12 V line from tripping the crowbar circuit. Values for the capacitors, inductors, resistors and the Zener diode will depend on the particular SCR used and the crowbar voltage desired. Although the values shown in the circuit are a good starting point, it is best to determine the exact values experimentally. When testing the crowbar circuit, use a large 12 V light bulb in series with the battery or voltage source. This can save the cost of several fuses.

It may be desirable to add additional filtering and shielding to the supply. No testing of the electromagnetic interference (EMI) generated by this supply has been done. The generated EMI should not be very great, but it may be strong enough to be received by an attached radio. This, of course, will depend on your antenna and mode of operation. For this reason, it is recommended that you use the RF enable circuit, whenever possible. Many radios have problems with low input voltage only when transmitting and not when receiving. The RF detect circuit has been designed to supply full power to the radio when transmitting, and it allows pass-through battery voltage to be supplied while receiving. This reduces the EMI generated by the supply and received by the radio.

Figure 6 shows oscilloscope voltage traces of the supply in operation. The supply was powering a radio that was being used to transmit SSB voice. In this case, the RF input was used to enable the supply and boost the rig voltage only when transmitting. Trace 1 shows the output voltage of the supply. The corresponding RF envelope is shown in trace 2. The terminal voltage of the battery was approximately 11 V dc, while the boosted output voltage was set at 13.8 V dc. The supply regulation action can be clearly seen as the higher levels of voltage shown in trace 1 after RF excitation turned the supply on. In this case, the supply was being tested from a weak battery, similar to that of typical operating conditions.

This simple supply can be built by anyone—no background in switch-mode power conversion is required. To simplify the parts list, the sometimes hard-to-find magnetic components are recycled from a common power supply. The rest of the components are available from a single distributor, to make ordering easy. Even the most difficult task (winding the switching transformer) should take no more than an hour. Anyone who has had some experience with soldering and coil winding can build and test this power supply.[5] A little extra money, a few spare parts and some free time are all that are required.

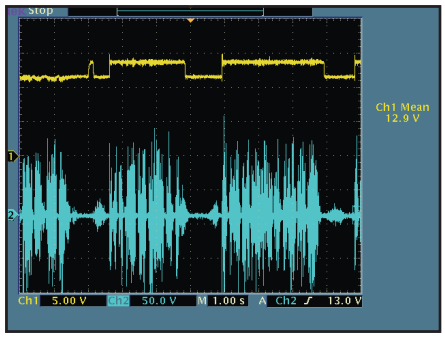


Figure 6—The supply in operation. Trace 1 shows supply output voltage. Trace 2 shows the RF voltage at the input of the RF detector. The time base is set to 1 s/cm. The zero reference baseline for trace 1 is at arrow 1. The battery voltage is about 11 V dc (a weak battery) and the boost voltage is set to 13.8 V dc. The first two seconds the supply is OFF. It comes on with RF excitation, as shown by the lower trace. It can also be enabled with 12 V dc to the ENABLE input or by operation of the ENABLE switch.

A special thank you to John Kemppainen, N8BFL, and Jim Carstens, W8LTL, for their article help, testing and photography.

Notes

[1]IRFI3205 power MOSFET; International Rectifier (**www.irf.com/product-info/datasheets/data/IRFI3205.pdf**).

[2]LM3524D regulating pulse width modulator; National Semiconductor (**www.national.com/pf/LM/LM3524D.html**).

[3]LM339 low voltage quad comparator; National Semiconductor (**www.national.com/pf/LM/LM339.html**).

[4]**www.arrl.org/files/qst-binaries/boost_reg.zip**.

[5]The author may be able to supply a professionally built PC board. If interested in procuring a board, write or e-mail the author at the address shown at the end of the article. If enough requests are received, details as to cost and availability will be supplied.

With a lifelong love for science and electronics, Daniel Kemppainen, N8XJK, has been a ham for more than 10 years. As is obvious from this article, his area of interest includes switching power conversion, but he's also interested in high power audio amplifier design. Daniel is a design engineer dealing with analog and digital electronics, data acquisition systems and programming for the Windows *operating system. He has both Associate's and Bachelor's degrees in Electrical Engineering Technology. You can reach him at 25403 E Acorn St, Calumet, MI 49913 or at* **drk@pasty.com**.

NEW PRODUCTS

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The DJ-C7T provides 200 memories, a two way antenna system, wide-band receive including FM broadcast and AM aircraft bands, auto repeater setting, VFO, memory and scan modes. There are 39 CTCSS encode and decode settings and four tone bursts designed to make the unit usable for repeater operations in many parts of the world. Price: $199. For more information, see **www.alinco.com** or your amateur dealer.

By Louis F. Linden, KI5TD

Winlink 2000 in the Jungle

Digital modes come of age in support of volunteers providing health services in a place where few exist.

The Cessna 206 banked steeply left. I surveyed 15 or 20 huts arrayed 500 feet below us next to a meandering river, wondering which one of them would be the new home of HR3/KI5TD, one of 12 International Health Services Amateur Radio stations temporarily in Honduras. What concerned me even more was that I saw no landing strip.

I turned to Lola Johnson, our team pharmacist and yelled in her ear, "I don't see no landing strip!"

"I think it's that foot path leading into the village," she shouted, barely audible over the engine noise as we circled. I shook my head to indicate I thought she was crazy. She held up five fingers indicating the amount of the bet and I nodded in assent. At least if we augured it in, finally making me one with all my radio equipment, I would confront St Peter with an extra five bucks in my jeans! By the time our pact was sealed George Goff, our pilot, had plopped us down on the ground. We were indeed heading right up that foot path toward the village at 50 miles per hour sending chickens and pigs scrambling for safety until the plane stopped 20 yards short of a clump of wooden huts on stilts, turned 180° and George shut the engine down. In the dust and silence Lola simply held out her hand, palm up. It was just another day in the ongoing adventure that is Amateur Radio.

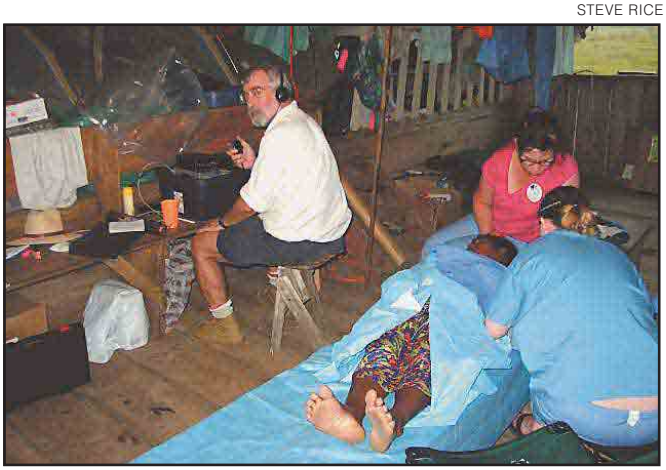
LOLA JOHNSON

The author erects antenna mast for experimental 2 meter beam and HF Delta loop.

International Health Service,[1] an all-volunteer, non-governmental organization based in Minnesota, provides medical care to underserved populations in Honduras, Central America. For most of IHS's 23 year history the organization has used Amateur Radio as its primary means of communication in this rural country. IHS's multi-year experiment using the digital mode PACTOR has proven that all-digital communications networks over ham radio, when interfaced with the Internet using the Winlink system, are powerful and sophisticated tools for use in public service.

[1]Notes appear on page 45.

STEVE RICE



The author meets the afternoon net in the middle of a thunderstorm while a patient is prepped for minor surgery.

LOUIS LINDEN, KI5TD

A member of the author's team prepares an e-mail for him to send to her family in the US.

Servicios de Salud Internacional—International Health Service

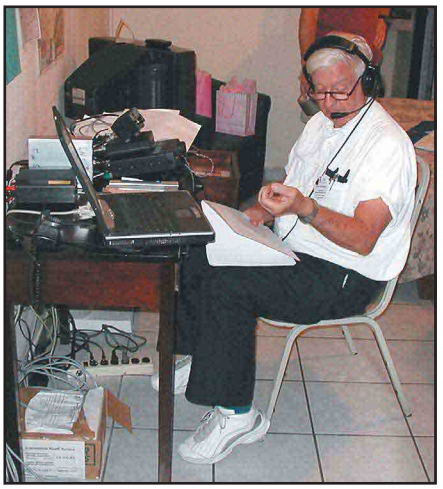
International Health Service was founded in 1982 by a pair of dentists and a pharmacist who saw the need for a completely apolitical and areligious organization to provide medical services to the poor of Honduras. The next year they returned with some donated supplies and medicines and started fixing teeth. Subsequently they persuaded other healthcare professionals to join them in their annual winter forays to Honduras. The effort has grown steadily over the years until 2004 when a record 122 people and tons of supplies, drugs and gear moved to Honduras during the second week of February.

The typical IHS mission starts in mid-March, when the all-volunteer Board of Directors and staff start planning and fundraising for an expedition that will take place the following February. In October several IHS volunteers make a scouting trip to Honduras, meet with officials of the Honduran Health Service and IHS supporters in-country to decide where IHS teams will operate for two weeks the following February. By late summer IHS starts taking applications from volunteers who are ready and willing to pay about $1200 to cover their expenses and roundtrip airfare to Honduras. IHS selects a radio operator for each team from the applicants. Communications Director John Kirckof, KBØUUP, watches over selection and training of the ops.

Donated and purchased supplies and equipment are collected and stored in donated spaces until December when they are loaded into a 40 foot shipping container, driven to New Orleans and loaded on a Standard Fruit Co ship for a donated voyage to La Ceiba, Honduras. As you can imagine, the logistics of moving an organization this size 2000 miles to a foreign country, setting up health clinics and surgical teams in some of the most remote places in the Americas, then returning them and their gear to the United States is awesome. That this is done entirely by volunteers and that they have never lost a person in over two decades is mind-boggling.

IHS divides itself into 10 to 12 teams for operations in Honduras. Based on the October reconnaissance and the available personnel it locates teams throughout the countryside. Most teams provide basic medical and dental care. Surgical teams are usually located in larger towns so that patients can be moved from the remote medical teams to surgical sites, often by small single engine airplanes, in less than half an hour. Two administrative teams oversee and coordinate the effort, one team at the group's temporary headquarters in the Gran Hotel Paris in La Ceiba and one in Puerto Lempira on the fabled Miskito Coast of Eastern Honduras.

The teams are comprised of 8 to 12 people. Usually there will be a physician and a dentist, a couple of nurses, a pharmacist, sometimes a paramedic or EMT, at least one, often two English-Spanish translators, a general helper or two (often the Team Leader) and, of course, a radio operator/engineer. The engineer is responsible for purifying drinking water, generating electricity as needed, sanitation, security for people and equipment, and any other infrastructure-related tasks. The radio operator (always a ham, reciprocally licensed by Honduras) is responsible for all communications between the team and the administrative headquarters and with other teams. He or she also often provides communications links with family and professional associates in the United States via e-mail or phone patches. The two functions are usually but not always performed by one person.



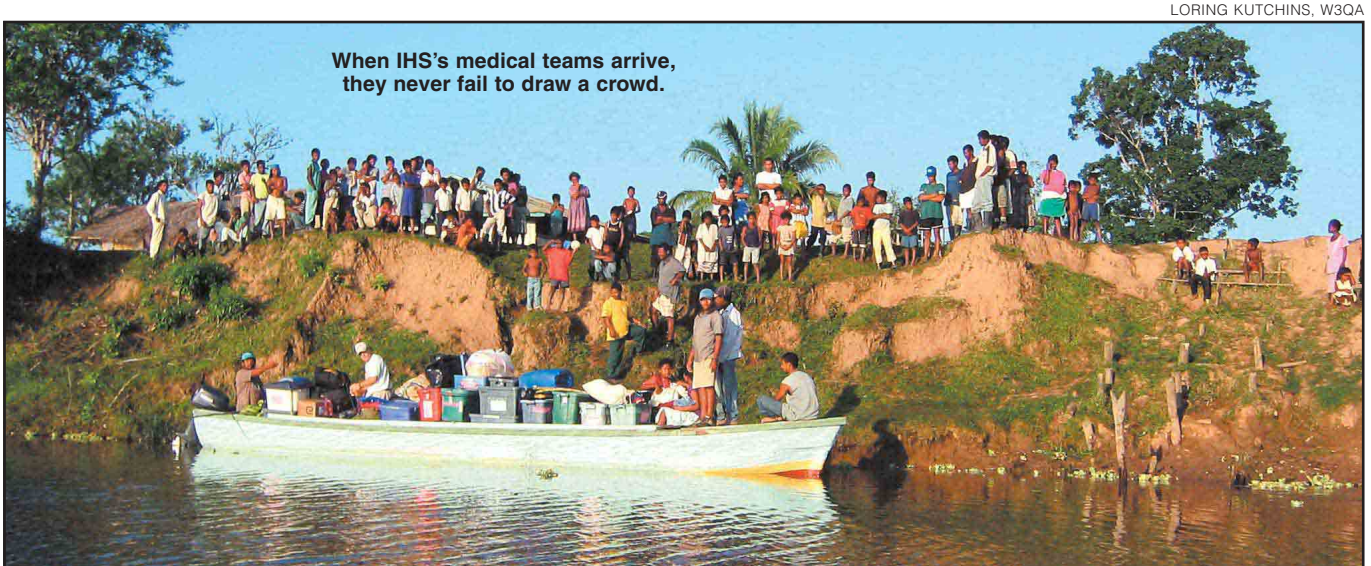
Bob Johnsen, K7TR, IHS net controller, counts down to the noon net in the IHS office, a cramped motel room in La Ceiba.

The Poor Man of Central America

Honduras is about two-thirds the area of Minnesota and bordered by Guatemala, El Salvador and the Pacific Ocean on the West, Nicaragua on the South and the Caribbean Sea on the North and East. It is home to 6.7 million people, 60% of whom live in rural areas. 28% of Hondurans are unemployed, 60% are illiterate and the population is growing at 2.3% per year. It is reputed to be the poorest country in the Americas after Haiti. In 1998 Hurricane Mitch killed over 5000 people and wiped out most of the bridges and roads in the country.

The northeastern plain of Honduras, La Mosquitia is the most sparsely populated part of the country. About the size of Massachusetts, it is the home of about 70,000 Miskito Indians and Miskito is the dominant language. For a visual, think Jurassic Park: rolling savanna dotted with swamps, old-growth hardwood forests, conifers and palm trees. Also think hot, humid, scorpions, mosquitoes and chiggers in abundance. The area is dotted with grass or gravel airstrips, many built during the Contra War, that enable single-engine aircraft to move people and cargo (read medical teams) into and around the area. People in La Mosquitia often walk an entire day for a chance to see an IHS

LORING KUTCHINS, W3QA



When IHS's medical teams arrive, they never fail to draw a crowd.

doctor. Usually an IHS surgical team, an administrative team and four mobile medical/dental teams deploy to La Mosquitia. One La Mosquitia team travels to its operations area by local dugout canoes. My team was sent to Warunta and Wauplaya, two Miskito villages so remote and obscure that medical teams had never been there before.

The half of the teams that aren't in La Mosquitia are spread around the mountainous western half of the country. The population there speaks Spanish, and roads, such as they are, service the villages. Commercial power is generally available if not reliable and many of the teams sleep in beds, an unimaginable luxury in La Mosquitia. For all that, the poverty is only slightly less onerous and the lack of medical care is substantial. At the same time La Mosquitia is sweltering, this area can be cold and damp.

LORING KUTCHINS, W3QA

IHS's Kruta River team including radio op W3QA prepare to move their clinic farther up river.

E-Mail Comes to the Jungle

John Kirckof, KBØUUP, the IHS Communications Director decided in 2002 that the time and technology was right to test the usefulness of data communications in IHS's 2003 mission. In 2001 an IHS ham brought a PACTOR² modem with him and used it successfully. The next year four volunteer ops brought PACTOR modems in addition to their HF Voice gear. They all managed to send e-mail over the Winlink 2000[3] (WL2K) system. In August 2002 Kirckof placed a posting on QRZ.com inviting hams interested in operating from remote, primitive locations for two weeks at their own expense to apply. Over 100 radio amateurs expressed interest.

A new selection criterion was added that year: the ability and willingness to operate PACTOR. All of IHS's hams supply their own transceivers and tuners, so this also meant that hams would also have to provide a TNC. The selected ops gladly complied and by December 2002 Loring Kutchins, W3QA, Assistant Communications Director for IHS, instituted a training program for those of us new to digital operations and helped everyone master PACTOR and *AirMail*.[4] The only digital mode I had ever operated before was CW!

The organizing principle of the operation was simply to send e-mail to one another via existing Winlink mailboxes located in the US and the Caribbean. We simulated our in-country net while at home in the States then took our show on the road. Most of the teams were using PACTOR I mode. In spite of the low throughput rate of PACTOR I, the 2003 experiment was a qualified success. Everyone was able to send e-mail to other teams, headquarters and various addresses in the US. The downside was that very few people actually used the system internally as it might take 24 hours to get an e-mail message across the country depending on propagation and the availability of power. The three-times-a-day SSB net on 40 meters passed almost all the important traffic. Most of the e-mail I sent last year was health and welfare traffic to the US and Europe for other team members and myself. Although H&W traffic was secondary, it proved the feasibility of creating relatively reliable intercontinental links.

Kirckof mulled over the results and decided more speed was necessary. During the summer an anonymous donor provided the organization with five SCS PTC-IIe modems equipped to operate in the PACTOR III mode. PACTOR III has a maximum rate of 3600 bps while PACTOR I maxes out at 200 bps, a huge difference when important documentation needs to be moved quickly to multiple recipients. Barely a week before leaving for Honduras Dave Houser, WA9OTP, suggested to Loring Kutchins that what we really needed was a PMBO (Participating Mail Box Organization in Winlinkspeak) of our own to interface with the Internet at our headquarters in La Ceiba. That would give all teams all-day access to the same mailbox. It was a great idea but too late for 2004. Loring also thought it too late but decided to inquire of Steve Waterman, K4CJX, anyway. K4CJX is a member of the Winlink Development Team, and its network administrator,

Waterman responded within two hours by e-mail, "Give me *PCAnywhere 10.5*, a decent computer with XP and some memory, permanent access to the Internet, a decent radio, an SCS modem and cables for the radio, and I'll have it up for you in less than an hour. Deal?" Frantic negotiations immediately began with the Honduran Internet Service provider. Six days later, Loring and Jim Scott, KG6EFT, arrived in La Ceiba with three complete radio stations between them, one for each of their field teams and one to serve as our new Winlink 2000 PMBO! Along with Bob Johnsen, K7TR, who would be Communications Manager conducting the Net from La Ceiba, and Hector Godoy Bueso, HR3HGB, they spent the entire weekend dodging power failures and parts shortages to get the PMBO up and running. Its new home was a broom closet in the lobby of the Gran Hotel Paris with coax to a G5RV antenna stretched 30 foot above the hotel's swimming pool. They made the PMBO Internet connection with an 802-11b wireless broadband link sharing the hotel's cable modem. It was a technological and organizational triumph that would have been impossible without the continuing support and involvement of the Winlink Development Team and the management of Gran Hotel Paris.

E-mail Comes of Age in the Jungle

IHS Teams fanned out over the country on February 16 and the entire radio network was up and running the following day. Field teams use NVIS antennas,[5] for both voice and data on 40 meters, mostly G5RV dipoles and coax furnished by IHS. These also serve well for making stateside contacts on higher bands. (Ever out of step, I opted for a 40 meter delta loop fed with coax set horizontally at about 10 feet. It worked great as an NVIS antenna on 40 meters and I worked Japan on 15 one afternoon!) ICOM IC-706MKIIG transceivers put the fire to the wire in most cases. Laptop computers, some new and fast and some ancient and donated, all running *AirMail*, worked into the SCS modems.

Within 24 hours it was apparent that having our own PMBO, HR3/K7TR, was the key to a successful digital network. NVIS 40 meter propagation enabled field teams throughout the country to send mail or check their mailboxes anytime throughout the workday as we had hoped. Between 6 PM and 7 AM field team stations could usually hit WL2K PMBO stations in the southern US or ZF1GC in the Cayman Islands. Messages sent through them arrived at HR3/K7TR in a matter of minutes via the Internet ready to be picked up. Usually the messages were available from other PMBOs as well. Initially e-mail was used to track down a (surprisingly small) number of missing and misdirected boxes and containers. Soon teams were requesting supplies from other teams and getting answers in hours if not minutes. The amount of e-mail traffic soared as traffic over the voice net dwindled and the nature of that net changed, probably forever.

Winlink e-mail enabled consultations not only among IHS medicos but also with stateside medical professionals. Pharmacists inquiring about a particular drug were able to get information from the US in less than an hour. Doctors put general inquiries out on the e-mail net and got the benefit of their colleagues' knowledge. This not only improved efficiency but also improved the quality of care rendered to our patients. Aside from logistics and consultation the system's real forte was making arrangements, especially travel arrangements. This might seem mundane, but in a country with few roads or telephones it is crucial. If a patient needs surgery we must arrange with a surgical team to perform the procedure and arrange transportation for the patient, and often a family member, who have no money to the surgical site and back home when the patient is able. Very often we will need to arrange food and shelter for them at the surgical site as well. As most surgical teams are within 2 meter range of the remote teams we used a local 2 meter simplex net to track the patients until they got back home.

More complex referrals to medical facilities in the capital city, Tegucigalpa, called for more complex arrangements. These cases can involve traveling in canoes, trucks, small airplanes, Honduran military aircraft and city buses. Being able to put all of this in writing not only expedites the process but minimizes opportunities for errors during communication. Mistakes could be catastrophic for a sick patient who could find herself hundreds of miles from home with no money, no food, no support system and not even able to speak the language. E-mail also supports tracking of patients in a systematic way so no one gets lost.

The hams of International Health Services will continue to refine the organization's radio network both data and voice. The results of this year's experience can be applied directly to any emergency or public service situation. Given the ease with which a PMBO can be created and operated under less than optimal conditions, and the great benefit of increased accurate information throughput, Emergency Coordinators should be looking into how this mode can be integrated into their communications plans. It's just too good to ignore. The only thing it doesn't do well is ward off chigger bites.

Notes

[1]For more detailed information about IHS and to see photos of IHS in action in Honduras go to **www.ihsofmn.org**. The organization's mailing address is International Health Service, PO Box 16149, St Louis Park, MN 55416; 612-920-0433 (voice or fax).

[2]The de facto standard digital ARQ (linked) mode on high frequency Amateur Radio is called PACTOR. Invented in Germany, it transfers text, files and graphics relatively quickly and without error. See **www.airmail2000.com/pprimer.htm** for a broad overview. See also *ARRL's HF Digital Handbook*, available from your local dealer or from the ARRL Bookstore, order no. 9159, and **www.scs-ptc.com/pactor.html**.

[3]For more information about the Winlink 2000 system, see V. Poor, "Introduction to Winlink 2000," Jun 2002 *QST*, p 31, and *ARRL's HF Digital Handbook*. A good Web resource can be found at **www.winlink.org**.

[4]*AirMail* is the client software used to send e-mail with the Winlink system. It can be downloaded free of charge from **www.airmail2000.com**.

[5]For more on Near Vertical Incident Skywave propagation, see A. Pion, "The NVIS—A Low Antenna for Regional Communications," Jun 2002 *QST*, p 28; **www.qsl.net/k5eph/nvis.htm**.

Louis F. Linden, KI5TD, was first licensed in 1965 as WNØPWQ. After a 20 year hiatus that involved becoming a lawyer, racing motorcycles and running away to sea for several years (not necessarily in that order), he returned to Amateur Radio as N5NJU. You can reach the author at **loulinden@toad.net**. *The following hams participated in the research and/or made suggestions for this article: John Kirkoff, KBØUUP; Loring Kutchins, W3QA; David Houser, WA9OTP; Jim Scott, KG6EFT; Jerry Reimer, KK5CA; Mike Ward, NW5M, and Bill Roussel, K5TAS. The blame rests entirely on KI5TD.*

STRAYS

ORANGE COUNTY RACES EMERGENCY COMMUNICATIONS VEHICLE PROJECT

By Ray Grimes, N8RG, Chief Radio Officer, Orange County (CA) RACES

◊ The Orange County Sheriff's Department in Southern California administers the County of Orange Radio Amateur Civil Emergency Service program. RACES volunteers are available for callout 24 hours a day and provide communications support to public safety departments countywide.

Over a 14 month period, 10 very talented and committed RACES volunteers assumed additional responsibilities by serving on the Emergency Communications Vehicle Committee. The following committee members have dedicated more than 3600 hours to the project: Jack Barth, AB6VC; Ken Bourne, W6HK; Scott Byington, KC6MMF; Jim Carter, WB6HAG; Ray Grimes, N8RG; Martin LaRocque, N6NTH; Harvey Packard, KM6BV; John Roberts, W6JOR; Joe Selikov, KB6EID, and Tom Stroud, N6FDZ.

This group of volunteers transformed a County surplus truck with an empty shell into a high-tech emergency communications response vehicle. Their efforts involved the design, fabrication and installation of workstations and communications equipment. The vehicle has a telephone switch, computer network with printer, and an onboard generator for emergency power. Three workstations are available, each with radio and telephone equipment.

The emergency communications vehicle will be used for on-site special events and for emergency and disaster incidents. It provides the ability to coordinate communications using Amateur Radio, public safety radio, and ground to air systems. It is capable of sending and receiving amateur fast scan and slow scan television, projecting video onto a large exterior flat screen display.

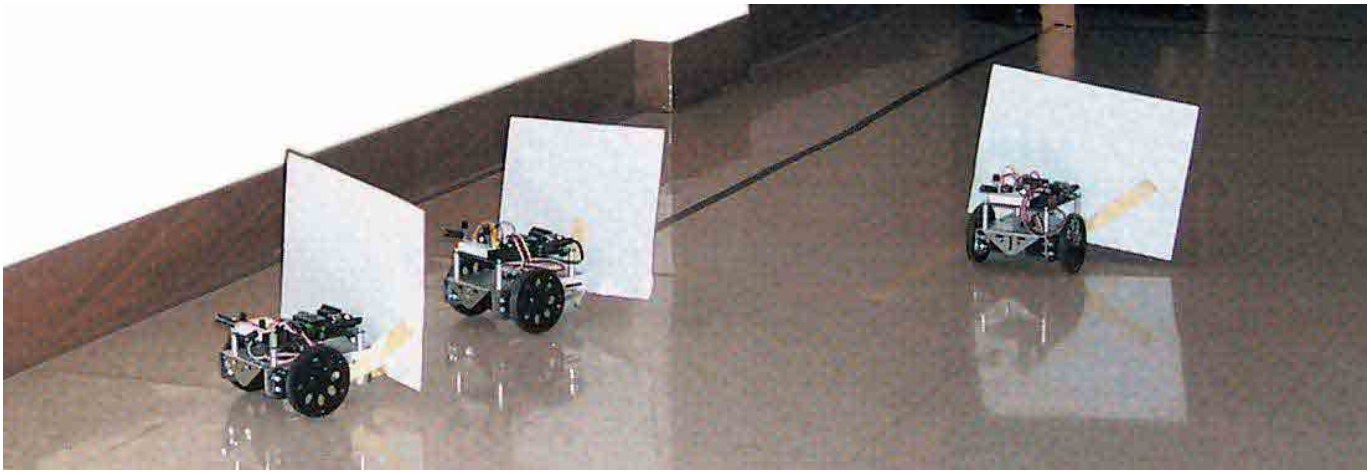
Thanks to the ingenuity and resourcefulness of the Emergency Vehicle Committee, the County of Orange now has a first-class emergency communications response vehicle at a cost to the taxpayers of around 10 cents on the dollar.

COURTESY RAY GRIMES, N8RG

The new emergency communications van for Orange County (CA) RACES. At the right is a cake with a design appropriate for the occasion.

By Rick Lindquist, N1RL

First ARRL Education and Technology Program Teachers Institute Revs Up Educators



A group of nine enthusiastic educators from across the US comprised the inaugural class of the ARRL Education and Technology Program (ETP) Teachers Institute August 6-13 at ARRL Headquarters. Depending on continued donations, the seminar will become an annual event. Its aim is to acquaint participants with effective approaches to teach wireless technology and electronics. After-class comments and suggestions from attendees—most of whom are associated with ETP schools—indicated they wished the Teachers Institute could have been longer.

"We would like to see an additional two days and maybe some evening seminars too," were among recommendations attendees expressed. Those definitely are *not* the kinds of sentiments you'd expect to hear from students going to "summer school."

The Teachers Institute freshman class included teacher-hams, non-teacher hams, non-ham teachers and community volunteers from high, middle and elementary school programs. One ARRL staff member, Debra Johnson, KB1LMT, audited the sessions. ARRL Education and Technology Program Coordinator Mark Spencer, WA8SME, served as the institute's lead instructor.

"I could not have asked for a better demographic mix of participants than those who attended," he said. Spencer says the inspiration for the Teachers Institute grew out of an observation that many teachers hesitate to include wireless technology instruction in their classrooms.

"Teachers teach the way they were taught, and teachers teach what they are most familiar with," he explained. "Even though they may be experienced ham radio operators, sometimes they don't feel comfortable enough to *teach* wireless technology."

Funded primarily through donations, the ETP (also known as "The Big Project") provides a turnkey amateur station to participating schools and promotes Amateur Radio as a pathway to understanding radio and electronics as well as other subjects such as language arts and geography. But the program's overarching focus is to incorporate wireless technology into today's classrooms. Amateur Radio offers an exciting means to demonstrate and illustrate that topic. While wireless technology is present in virtually every aspect of our lives, we, as a society, by and large are ignorant of how it works. The ETP's mission is to address that issue by raising wireless technology literacy.

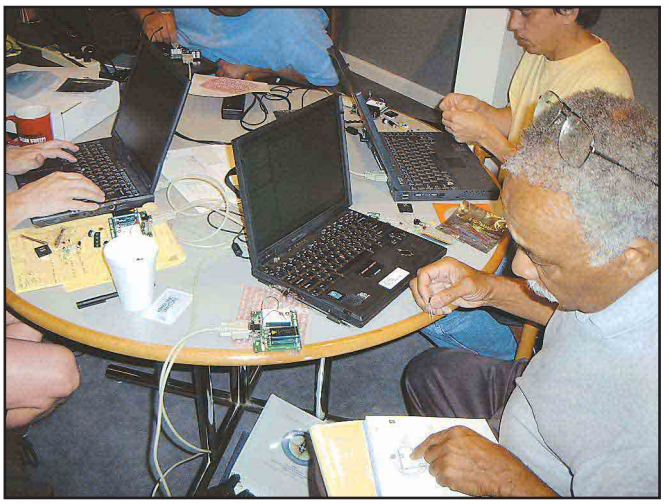
"So far we have done a very good job of providing an Amateur Radio station to schools and teachers plus resources in the form of grants of equipment and activity board kits and free curriculum materials," Spencer said. "However, the initial focus of the program was predicated on an assumption that participating teachers were prepared to teach the subject, and that's not always the case." The Teachers Institute has been a big step toward that goal.

Teaching Teachers Technology

This year's pilot Teachers Institute included three days of instruction on how to teach wireless technology, one day on how to teach microcontroller basics and one day on how to teach basic robotics. Class materials were a mixture of a refresher in basic theory coupled with pedagogical strategies participants could use in their classrooms.

Each teacher received a resource library of ARRL materials for their classrooms, TV remote decoder and activity board kits, an OptaScope digital oscilloscope, a "What is a MicroController" instructional kit and a "BOE-BOT Robotics" instructional kit. Participants also got a chance to preview future ETP kit offerings—including the L/C/Resonance and DSP Fundamentals

From the left: Don Wilson, K1IN, and Brian Brethauer, KC8NPH, work their way through an activity board project.



At the round table: Wilson joins other class participants in wiring up a microcontroller experiment. To his right is Mike Pagoria.

board and the receiver kit. All told, they took home a package worth approximately $2000, but priceless in terms of reaching their students.

Better than Harvard?

While offering some suggestions for future institutes, the educators who attended the premier session by and large judged it a positive experience. One even said it was the best seminar he'd ever attended, "Harvard included."

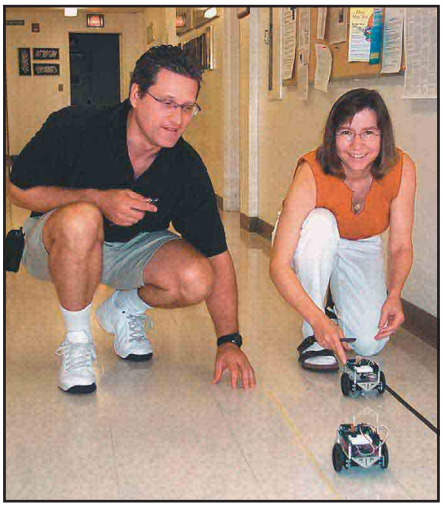
Others said they enjoyed the many hands-on activities throughout the week. Spencer is a big proponent of learning by doing.

"The use of the computer oscilloscope software is outstanding," another participant said. "The ability to build a sound

ARRL ETP Coordinator and Teachers Institute Lead Instructor Mark Spencer, WA8SME (right), guides Ronny Risinger, KC5EES, through a robot chip programming exercise.

Spencer (left), explains a live satellite transmission as part of the seminar's "Space in the Classroom at Little or No Cost" unit, while Ronny Risinger, KC5EES, and Don Wilson, K1IN, look on.

Frank Giannini, KA1NIO (right), builds his BOE-BOT kit from the chassis up, while husband and wife Joe and Jill Mohr, KC7ZZX and KC7ZZY, team up on their robotics projects.



The race is on! **Carl Dombrowik, N1PXL, and Jill Mohr, KC7ZZY, set their BOE-BOT programmable robot vehicles loose on the obstacle course test set up in the ARRL Headquarters hallway. "Those robots rock!" one ARRL staffer remarked.**

tone generator and RC stuff with the microcontroller board and then show it on the oscilloscope is *great*!"

Others said the Institute provided an excellent foundation and opened up a world of exciting projects. "I learned a lot," another attendee summed up. "It was fun and educational. I need to now use this data and information in my classroom."

"This past week has been hard work, but at the same time rewarding work," said Spencer as the first Teachers Institute drew to a close. For their part, participants went home full of enthusiasm, re-energized and ready to get to the real work—applying what they had learned at the ARRL Teachers Institute in their *own* classrooms.

"I look forward to a better Institute next year," Spencer added. "For the participants, their own hard work has just now begun!" Spencer said plans already are in the works for next year's Teachers Institute. Drawing upon lessons learned this year—and pending sufficient funding—the strategy calls for holding two Institutes in 2005, one in late June and the second in late July. A call for applications to attend the Institutes will go out in March.

A Word for the Sponsors

Substantial funding for the pilot Teachers Institute came from a generous member in the ARRL West Gulf Division as well as through the donations of others. The League is appealing for donations to support the Teachers Institute as an ongoing ETP activity. Donations will also make it possible to continue making project activity boards and hands-on projects available to schools.

For more information or to become a Teachers Institute sponsor, contact Mark Spencer, WA8SME, at 860-594-0396; **mspencer@arrl.org**.

Rick Lindquist, N1RL, is ARRL Senior News Editor. He can be contacted at **rlindquist@arrl.org**.

The Inaugural Class of the 2004 Teachers Institute

Brian Brethauer, KC8NPH, Allendale (Michigan) High School
Carl Dombrowick, N1PXL, A. I. Prince Tech Regional Vocational School, Hartford, Connecticut
Jim Foutz, AA4JF, Northside High School, Warner Robins, Georgia
Frank Giannini, KA1NIO, Hartford, Connecticut, Public Schools
Debra Johnson, KB1LMT, ARRL Headquarters
Jill Mohr, KC7ZZY, The Linkup Program, Oregon City, Oregon, School District
Joe Mohr, KC7ZZX, The Linkup Program, Oregon City, Oregon, School District
Mike Pagoria, St Joseph Catholic School, Palm Bay, Florida
Ronny Risinger, KC5EES, LBJ High School, Austin, Texas
Don Wilson, K1IN, community volunteer, Talcott Mountain Science Center, Avon, Connecticut

The inaugural Teachers Institute class poses with lead instructor Mark Spencer, WA8SME (left), in front of W1AW.

New L/C/R Activity Board Opens Door to a Myriad of Teaching Possibilities

The ETP offered a new activity board to schools this fall. The "L/C/R" activity board allows students to explore capacitive and inductive reactance, verify reactance formulas using actual data taken from the activity board, measure the resonant frequency of either series or parallel L/C circuits and then put it all together to explore the relationship between capacitive and inductive reactance and resonance.

Because the board uses a microcontroller and a digital-to-analog converter (DAC) to generate the ac waveform used to explore L/C circuits, there is an additional learning opportunity: digital signal processing (DSP) fundamentals. This facet of the board leads to exploration of root mean square (rms) voltage and current and the mathematical derivation of rms.

"In other words, there is a whole lot of activity packed into this little board," said ARRL ETP Coordinator Mark Spencer, WA8SME. Given the level of mathematics required, he said, the activity board is intended for high school physics or second-year algebra students. But Spencer says anyone studying for the General or Amateur Extra examination could also benefit from the learning opportunities the activity board affords.

Students use mathematical, graphing, graphing calculator, spreadsheet and critical-thinking skills to demystify the data collected during the various board activities. For example, students use graphing calculator curve-fitting techniques to verify reactance formulas. Spreadsheet software helps them to make sense out of the raw voltage and current data measurements. During the DSP activities, students use the OptaScope to see the stair-step waveform generated by the computer and the DAC on one channel, and the smoothed waveform exiting a simple filter on the other.

"Visualizing a waveform in discrete slices helps students understand what happens during DSP," Spencer explains. "Then, students explore the mathematical concepts that are the foundation of root mean square by using the amplitude of each slice to computer-average and rms voltages. This really helps to clarify these important ac concepts."

Another new activity board kit available in January 2005 is a simple and inexpensive direct-conversion receiver kit, produced by the American QRP Club, which includes a two-level instructional curriculum. The first level describes the operation and function of each major receiver circuit, from antenna to headphones. The second describes the function of individual components within a circuit block.

For more information about these boards and the Education and Technology Program, contact Mark Spencer at 860-594-0396; **mspencer@arrl.org**.

By Dennis Silage, K3DS

Amateur Radio—A Perfect Fit for Engineering/Computer Students

Opportunities abound for undergrads to use ham radio in their courses and projects.

Figure 1—The completed TUARC Earth-bound Mars Rover. The ATV camera is mounted under the lid on the right side. The 2 m and 70 cm rubber whip antennas are mounted on a ground plane that is under the lid. The toggle switches and jacks are for control and monitoring of the battery subsystems.

Most of today's undergraduate Electrical and Computer Engineering (ECE) students take courses with hands-on laboratories and computer aided design exercises. Most also take a project course before graduation in which they apply their knowledge as a team to solve a design problem. This capstone design course is an important component of their engineering education and provides some relevant experience before they begin applying what they've learned in professional practice.

In times past, many of these engineering students (it was called Electrical Engineering then) were Amateur Radio operators and their projects were in RF electronics, microwaves, antennas, and the misty beginnings of analog and digital data as well as amateur satellite communication. They went on to their careers with an ongoing interest in Amateur Radio.

Where Are the Good Old Days?

Nowadays, many undergrads have never heard of Amateur Radio and most ECE educators are not aware of the many benefits of bringing Amateur Radio and ECE together again. Their capstone design projects now use embedded microcomputers and often low power, low range and unlicensed wireless devices for simple process control and robotic vehicles.

Why is this so? I can only think that they are not aware that Amateur Radio has so much to offer ECE education and with such an easy impedance match. Most seem to believe that the requirements for an Amateur Radio license are a stumbling block, and are unaware of the available resources and opportunities for capstone design projects that include Amateur Radio.

There are many examples of how Amateur Radio can once again find a role in undergrad ECE education. Along with a few others, I have been supervising such projects in Amateur Radio for a while and have been spreading the word to ECE educators. At this year's national meeting of the American Association for Engineering Education, Mike Batchelder, KBØZND, from the South Dakota School of Mines and Technology and their club station, KØVVY, presented projects such as using the NorCal 40A CW transceiver kit in an electronics course and an AX.25 packet radio data telemetry in a Formula SAE Mini-Indy race. At the same meeting I presented the Earth-bound Mars Rover project using an Amateur Radio digital data telemetry system with error correction and ATV.[1]

It's Not Just for Morse Code Anymore

Of course its not—but that has to be transmitted to the ECE faculty and the students! The questions on the Amateur Radio license exam can provide a technical review and a capstone design experience in regulatory issues and licensing. They should also know that the Morse code requirement has been removed entirely for the Technician class of license, which is more than adequate for experimentation and design of digital data communication projects. Successful capstone design projects in Amateur Radio mean that ECE undergrads can even have the unique chance to present their results in a technical forum, such as the ARRL/

[1]Notes appear on page 51.

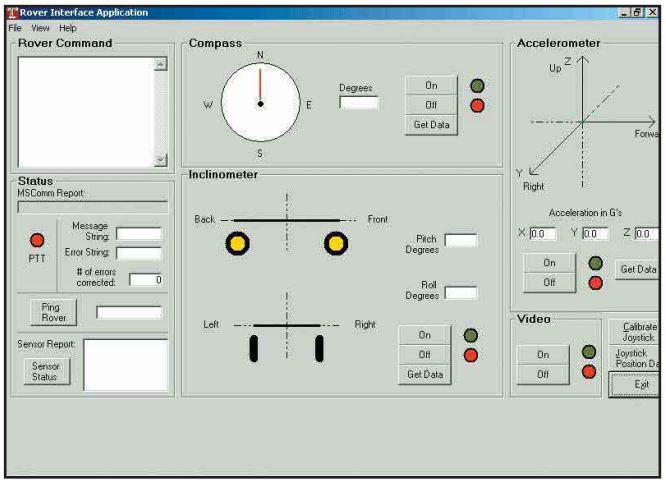


Figure 2— The Rover Interface Application, written in *Visual Basic*, shows sensor readings and communication between the Base Station and the Rover.

TAPR Digital Communications Conference (DCC) or in *QEX*.

I also think that ARRL means All Resources for Real-life Learning and that ECE educators should be made aware of what is available from the League. *The ARRL Handbook* outlines fundamental electronic theory from dc to DSP, certainly suitable for ECE undergraduates, and projects in electronics, microwaves, antennas, and analog and digital communication. The long list of ARRL reference books, such as the *Spread Spectrum Sourcebook*, the *Image Communications Handbook* and *Digital Signal Processing Technology*, are prime points for ECE undergraduates to find capstone design projects.

I've found that the interest and involvement of an ECE educator, though, is crucial. They are around a lot longer than the undergraduates! Educators should be licensed, of course. For those who aren't, licensed ECE undergrads can show them how easily this can be done. Educators can more effectively lobby for institutional resources to set up an Amateur Radio station. The Temple University ARC, K3TU, (TUARC, **www.temple.edu/k3tu**) has become not only a student organization, but also a recognized lab of the ECE undergrad curriculum in analog and digital communications, electromagnetic waves and capstone design.

Projects that Resonate with Industry

The wide variety of ECE capstone design projects using Amateur Radio in digital wireless, microwave and satellite communication and DSP serves the undergraduate well by the resonance that occurs with industry. Over the years I have supervised many capstone design projects, such as frequency hopping spread spectrum, patch antennas, 10 GHz microwave digital data transceivers and Amateur Radio satellite communication. These projects included a microcomputer-based azimuth-elevation antenna tracking system and Doppler shift correction scheme that were presented with the IEEE Region 2 Bendix Award for the most outstanding capstone design project in 1988 and 1989.

Last year's project was a redesign of an Advanced Multiband Excitation (AMBE) voice encoder-decoder, or vocoder,[2] for Amateur Radio digital voice experimentation. To show you that the times really have changed, this team consisted of three female ECE undergraduates and their results were presented at the 2003 DCC.[3] The AMBE vocoder technical report and our progress on the digital voice project is on the TUARC Web site.

Earth-Bound Mars Rover

This year's project captured the excitement of the NASA Mars Rover mission. Using an old 27 MHz radio control car as a base, the 2004 capstone design team stripped away everything except the DC drive and steering motors and the chassis. A large plastic enclosure is the new body. Figure 1 shows the completed Rover.

The embedded computer is a LogicFlex 25 MHz, 32-bit i386EX microcomputer (JK Microsystems, **www.jkmicro.com**), which has 46 digital input/output (I/O) lines, two RS232C serial ports, eight 12-bit analog-to-digital (ADC) and four 12-bit digital-to-analog converter (DAC) channels, and eight optoisolated driver ports. The LogicFlex uses DOS and is programmed in *C*, *C++* and assembly language using the Borland V4.52 development environment.

A variety of real-world sensors are integrated into the Rover. A biaxial tilt sensor (model 0729, Fredericks, **www.fredickscom.com**) provides analog pitch and roll signals. A tilt compensated electronic compass (model TCM2, PNI, **www.pnicorp.com**) with a triaxial magnetometer is used to measure the true magnetic vector as an analog signal. A triaxial, solid-state transducer (model CXL04LP3-R, Crossbow, **www.xbow.com**) outputs analog signals proportional to acceleration. The remaining two ADC channels are used to provide feedback on the position of the steering axle of the Rover with a potentiometer and to monitor the main battery voltage. Finally, a GPS receiver (model 25, Garmin, **www.garmin.com**), that outputs an RS232C serial ASCII data string reporting satellite acquisition and a valid position, is interfaced to the LogicFlex.

Let's Communicate

Both the Rover and the Base Station require a data modem. Two 1200 bps AFSK half duplex modems are built using the MX-COM MX614 IC.[4] The data terminal ready (DTR) line of the RS232C serial interface controls the transmit or receive mode of the modem and transceiver.

The Rover 144 MHz handheld data transceiver is a Kenwood TH-25AT. Operating the handheld on 12 V dc produces an output of either 0.4 W on low or 4.2 W on high power. The high/low switch was interfaced to an optoisolated driver port of the LogicFlex for RF power control. A 2 meter simplex frequency, typically 146.58 MHz, is used for data communication. A shortened 2 meter antenna (rubber flex) is mounted at one end of the lid of the plastic body. An aluminum plate under the lid provides a reasonable ground plane for the Rover antennas.

Since you have to see where you are driving the Rover, a 1 W 426.25 MHz ATV transmitter with a 4.5 MHz audio subcarrier modulator and solid-state color camera with microphone are on the Rover and an ATV downconverter is at the Base Station (models TXA5-RCb, FMA5, LB1000, and TVC-4G, P C Electronics, **www.hamtv.com**). A shortened 70 cm antenna is mounted at the other end of the Rover lid.

Data Protocols

Although AX.25 could have been used for the Rover, a custom client-server protocol is developed as part of the capstone design experience. The client protocol, the Rover Interface Application (RIA), is written in *Visual Basic* and executes on a PC at the Base Station. The RIA, shown in Figure 2, displays sensor data in both numerical and graphical form. The server protocol, the Rover Operation Application (ROA), is written in *C* and assembly language and executes on the LogicFlex on the Rover.

RIA commands consist of a single

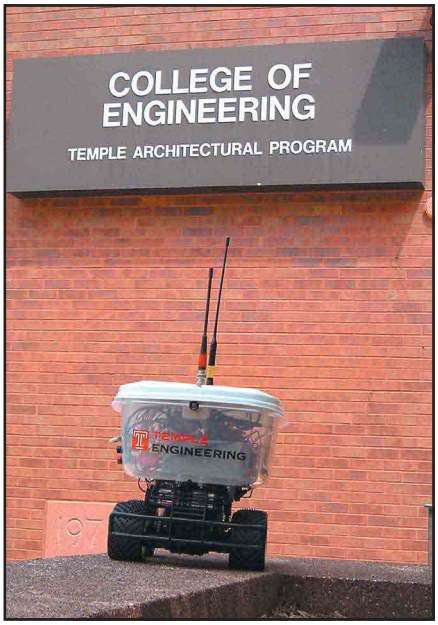


Figure 3—The TUARC Earth-bound Mars Rover outside and underway. The Rover has been controlled and the surroundings seen and heard over 5 miles away using the K3TU club station antennas.

7-bit ASCII character and allow the Rover sensors and the ATV subsystem to be turned on and off to conserve battery power and to control the forward and reverse speed of the drive and the position of the steering motor in discrete increments. Each 7-bit ASCII character is encoded as an 11-bit message using an error correction code (11,7 Hamming block code). In what might seem like magic, this code can sense and correct a single bit transmitted in error.

Let's Get Moving

The Rover DC drive and steering motors are controlled by pulse-width modulation (PWM), with the on-off timing of PWM set by a software interrupt routine and a real-time clock on the LogicFlex. The Rover is a semi-autonomous vehicle and will shut down if data communication with the Base Station is corrupted or lost. The pitch and roll transducers can abort the Rover's movement if trouble is sensed.

The Base Station RIA initiates all communication with the Rover. A joystick on the PC is used to send drive and steering commands, but can be overridden in a panic with the keyboard. Using the K3TU club station antennas on 146.58 and 426.25 MHz, Yagi antennas at 150 feet, the Rover has been controlled and the surroundings seen and heard at a distance of over 5 miles.

Figure 3 shows the Rover outside and underway. If you want to see the Rover in operation and listen to the sound of the AFSK digital data communication, the TUARC Web site has a short MPEG video. The complete Rover capstone design technical report is also there, authored by the team of ECE undergraduates Steve Herman, John Dessino and John Falcone, KB3KDM.

What Will the Future Bring?

Hopefully, more ECE educators and undergraduate students turned on to Amateur Radio! Many ECE institutions have club stations on campus, but only a few have been using Amateur Radio in the curriculum and the capstone design course. In some places the clubs are run by dedicated undergraduates, many of them not even ECE students, who leave only all too soon. Unfortunately, in some places Amateur Radio is not there at all.

ECE capstone design projects using Amateur Radio are exciting and go well beyond the areas usually embraced by undergraduate students. With Amateur Radio an interested ECE educator and a supportive institution can easily provide design opportunities in the emerging technologies of the wireless world. The technical rewards for the institution, the educator and the undergraduate ECE students are certainly wide band!

Notes

[1]D. Silage, "Reintroducing Amateur Radio into ECE Capstone Design Projects," *Proceedings ASEE*, Jun 2004, pp 1481-1490.
[2]Vocoder originally stood for Voice Operated reCorDER and was devolved by Homer Dudley at Bell Laboratories in 1939.
[3]D. Silage, "Vocoder Redux: the AMBE-2020," *22nd ARRL/TAPR Digital Communication Conference*, 2003, pp 208-214.
[4]J. Mitrenga, "An MX614 Packet Modem," *QST*, Jan 2000, pp 44-46.

Dennis Silage, K3DS, was first licensed in 1963 and has held the calls WB2LGJ, WB3AYR and G5EMU. Dennis is a Professor of ECE at Temple University, teaches digital signal processing, digital data communication, and microprocessor and programmable gate array systems. He is the trustee of TUARC, K3TU, and has had appointments as Technical Coordinator of the EPA Section and Assistant Director of the Atlantic Division. Dennis has held an Amateur Extra class license since 1980 and is a Life Member of the ARRL. He received the Atlantic Division 2001 Technical Achievement Award for his work in using Amateur Radio in ECE capstone design projects. The author can be reached at 3312 Saw Mill Rd, Newtown Square, PA 19073; **silage@temple.edu**.

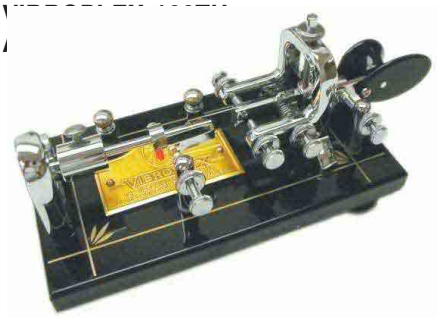
NEW PRODUCTS

FIELD PACK FOR ICOM-703 OR '706 USERS

◊ The PowerPort WorldPack-706 is a combined belt case and backpack designed for ICOM users. This pack comes with a remote-head belt case for the IC-706 or IC-703 control head to provide access to the radio controls for QRP operations while mobile. The rest of the radio is in the padded backpack, with enough additional room for accessories and auxiliary power. The remote-head case is zippered for access and padded for protection of the radio head. It can be attached to a belt or to the shoulder strap of the backpack with either a spring clip or a belt loop.

The pack itself is constructed of a laminate of nylon, 1/4 inch closed-cell foam padding, semi-rigid polyethylene board and a nylon interior. The upper compartment holds the radio while the lower one can hold the 12 V, 8 Ah WorldPack Power Kit offered as an option by PowerPort. All power and antenna connections are accommodated.

In addition to these features, there are tie-down points to attach other gear and two antenna pockets on the sides to hold and support mobile antennas. The shoulder straps are ventilated mesh with webbing cross straps to fasten handheld transceivers, GPS units or other compact devices. Price: HMP-706, $69.95. For more information, contact Cutting Edge Enterprises, 1717 Seventh St, Los Osos, CA 93402; tel 800-206-0115; **www.powerportstore.com**.



◊ The patent for the Vibroplex Original bug (semi-automatic telegraph key) was registered on August 9, 1904. In recognition, Vibroplex is offering a 100th Anniversary Special Edition Bug. The black powder coated base is said to duplicate the smooth but weathered look of the early cast bases. This model features gold pinstriping and gold leaf designs in each corner. Bright chrome standard upper parts are used with black finger pieces. The Vibroplex serial plate is engraved with "100th Anniversary, 1904-2004" and special run serial numbers. Price: $199.95. Also available is a new display case with a hardwood base, Plexiglas cover, holes to match the feet of most keys and a Vibroplex serial plate. Matching serial number plates are available for the display cases. Price: $129.95. For information call 800-840-8873 or e-mail **catalog@vibroplex.com**.

By H. Ward Silver, NØAX

The FMT Strikes a New Tone

This year's Frequency Measuring Test, to be held November 18 UTC, has a new twist.

Growing in popularity with each running since its return to the airwaves in 2002, the Frequency Measuring Test will offer a new challenge to ham radio metrologists this year. Instead of measuring a carrier frequency, the test asks for the measurement of an audio tone modulating the carrier.

Why measure a tone? First, it reinforces the understanding of the relationship between carrier frequency and the actual components of a transmitted signal. The carrier is suppressed for SSB signals, leaving only the sideband components. The frequency of components of the modulating audio signal is preserved as the difference between the carrier frequency and the transmitted component. A single modulating tone results in a single transmitted component.

Figure 1 shows a typical USB 'phone signal, with the transmitted sideband *above* the carrier frequency. For example, if you're on USB with the frequency display showing 14.349 MHz, the actual transmitted signal is mostly out of the band! The transmitter's frequency display for this signal shows f_C, leaving it up to the operator to remember that what is actually coming out of the transmitter is *above* f_C. For LSB signals, the transmitted signal is *below* the displayed frequency.

Another reason to practice measuring a tone's frequency is that digital modes use tones to encode the transmitted data. The equipment or program that translates the tones back into data depends on the tones having the proper audio frequencies. If the data is transmitted via SSB, that means you have to know the relationship of the carrier to the transmitted tones in order to receive them with the proper frequency. Demodulation can be severely compromised by a carrier frequency error of only a few tens of Hz.

In past FMTs, W1AW transmitted on a "mystery frequency" near a published frequency. This year, the exact carrier frequencies will be published and the frequency of the modulating tone will be unknown. The job of the test participants is to report the audio tone's frequency as accurately as possible.

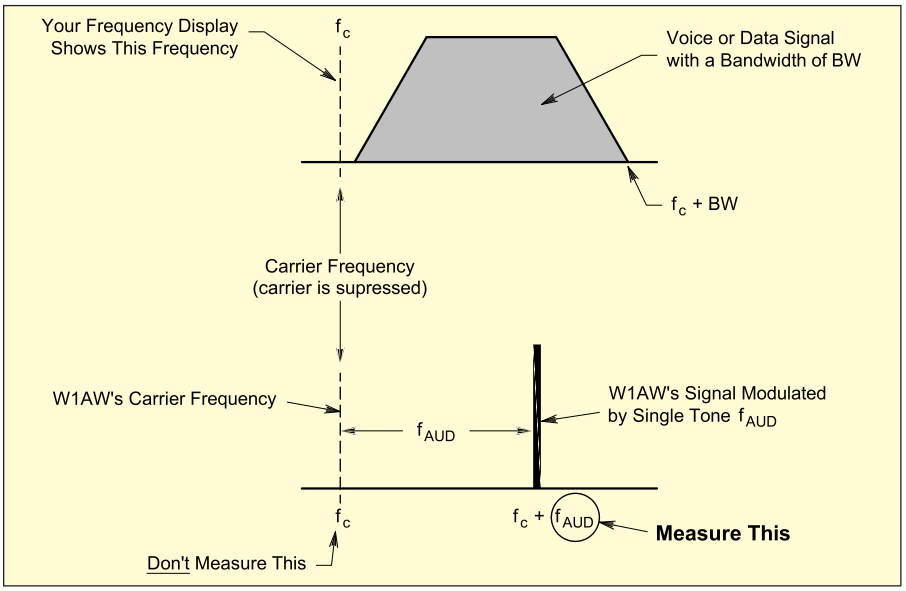


Figure 1—The components of SSB signal form a sideband above or below the carrier frequency. An SSB signal modulated by a single audio tone appears as a single transmitted signal offset from the carrier by the audio tone's frequency.

Measurement Techniques

There are two basic ways to measure the tone's frequency: *indirect* and *direct*. In the indirect method, the frequency of the transmitted signal, which consists of a single component as shown in Figure 1, is measured as if it were an unmodulated carrier. The *difference* between the published frequency and measured frequency is the tone frequency. It's important to remember that the tone will be *above* the published frequency for USB and *below* it for LSB. In this method, the primary source of error is the receiver's master oscillator. A number of techniques for making this measurement are presented in the November 2002 *QST* article on the Frequency Measuring Test.[1]

In the direct method, the measuring receiver is set to the published carrier frequency and the audio tone frequency is measured with a frequency counter. This is the way a digital mode signal would normally be received. However, the stability of the frequency counter is an extra source of error. Noise in the received signal will also affect the counter's measurement. The more successful participants will have to account for error and noise in both their receivers and counters.

Direct Measurement Example

The ARRL published carrier frequency is 7.153 MHz. You set your receiver to 7.153 MHz, LSB, and receive a tone that is connected to your counter. The counter's displayed frequency is that of the audio tone which also includes receiver carrier frequency errors and errors from noise and ionospheric Doppler shifts.

Indirect Measurement Example

The ARRL published carrier frequency is 14.165 MHz. You measure the transmitted signal's frequency as 14.166231 MHz, which is the carrier's frequency plus that

[1]H. W. Silver, "The ARRL Frequency Measuring Tests," *QST*, Oct 2002, p 51.

of the audio tone. The audio tone's frequency is 14.166231 – 14.165 = 1231 Hz, including any errors in the receiver's displayed carrier frequency.

For measurements on 80-meters, LSB will be used. If the published carrier frequency is 3.785 MHz and you measure the transmitted signal as 3.782476 MHz, the audio tone's frequency is 3.785 – 3.782476 = 2524 Hz.

2004 ARRL Frequency Measuring Test Schedule

The W1AW FMT will run on November 18, 2004 at 0245Z (or November 17, 2004, at 9:45 PM EST). It will replace the W1AW Phone Bulletin normally scheduled at that time. It is recommended that participants evaluate conditions by listening to W1AW's CW/digital transmissions prior to the event to see which band (or bands) will be best for measurement purposes.

Format

The FMT will begin with a general W1AW (QST) call-up beginning at 0245Z sent simultaneously on three of W1AW's phone transmission frequencies. The test will consist of three 60 second tone transmissions (for each band) followed by station identification. The test will last for a period of approximately 15 minutes total. The test will end by station identification. The tone frequency will be *the same* on all three bands.

During the course of the FMT, W1AW will indicate the band participants should measure. For example, after the initial call-up, we will begin by saying "Now 80 meters." During the 80 meter measuring time frame, we will continue to indicate the band by first IDing, and then indicating the band; that is, "This is W1AW—80 meters."

With the exception of the tone transmission, all other transmissions will be voice.

The phone frequencies are as follows:

80 meters—3990 kHz—(LSB)*
40 meters—7290 kHz—(LSB)*
20 meters—14,290 kHz—(USB)*

*All frequencies will be accurate to at least 0.1 ppm (that is, 3990 ±0.4 Hz).

Reporting and Results

The submitted report should include the time of reception and the *tone* frequency. If you used the indirect method of measurement, show your calculation of the tone frequency. Include your name, call and station location. Participants may submit a separate report for each band.

A *Certificate of Participation* will be available to all entrants. Those entrants coming closest to the measured frequency as measured by the ARRL Laboratory will be listed in the test report and will also receive special recognition on their certificate.

Entries should be postmarked by December 17, 2004 to be eligible. Send entries to W1AW/FMT, 225 Main St, Newington, CT 06111.

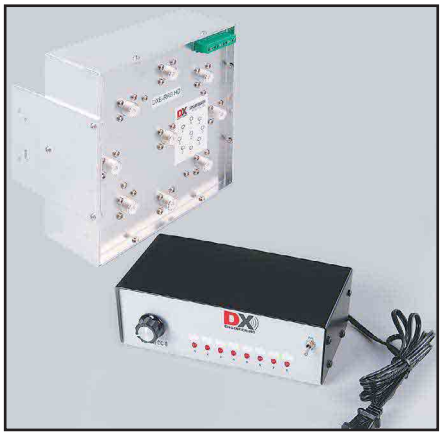
H. Ward Silver, NØAX, is an engineer, author and teacher who enjoys contesting and DXing. Ward is the author of the recently published Ham Radio for Dummies, *as well as the current* QST *series, "Hands-On Radio." He can be reached at 22916 107th Ave SW, Vashon, WA 98070 or at* **n0ax@arrl.org**.

NEW PRODUCTS

REMOTE ANTENNA SWITCH

◊ DX Engineering has announced a remote antenna switching system, the RR8-HD. Users can select a single port, or multiple ports for antenna stacking and phasing applications. They can also designate unused ports to be open or grounded. The RR8-HD offers built-in lightning protection and is said to offer unterminated port-to-port isolation of more than 70 dB at 30 MHz.

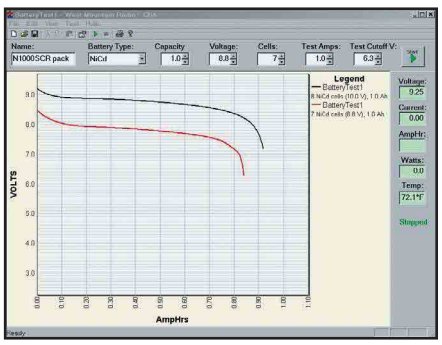
The unit uses sealed 20 A relays in an aluminum enclosure with stainless steel hardware and silver and Teflon UHF connectors. It is specified to operate at over 2 kW CCS RTTY. The RR8-HD allows the use of CAT 5 style control cable with a plug-in control line connector, eliminating the need to disassemble the unit on the tower. A 12 V control console, the CC-8 is included. The control console has automatically resetting fuses, LEDs adjustable for brightness and a solderless connector on the back panel. The CC-8 can be powered by 120 or 240 V ac. Price: $249.95. For more information, see **www.dxengineering.com**, or contact DX Engineering at PO Box 1491, Akron, OH 44309; tel 800-777-0703, fax 330-572-3279.



COMPUTERIZED BATTERY ANALYZER

◊ The West Mountain Radio computerized battery analyzer (CBA) is designed to determine if batteries will perform up to specification, or if they might fail prematurely during operation.

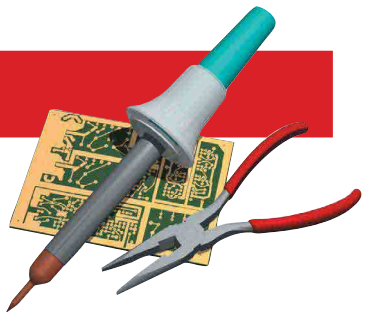
The CBA is designed to test any battery, up to 48 V. The CBA is said to be capable of test rates up to 40 A or 150 W, whichever is reached first. In addition to testing the total amount of energy stored in a battery in Ah, it graphically displays these tests on a standard *Windows* computer with a USB interface. An optional external temperature probe



can be used to measure the temperature of a battery during a test. The CBA uses a constant current load rather than a resistor.

Battery test graphs may be displayed, saved and printed. Multiple graphs of the same battery, or multiple batteries, may be overlaid. The CBA will also print test labels that may be placed directly on batteries to keep track of the last time they were tested and how they performed.

The CBA uses an 8051-based microcontroller to measure voltage, current and temperature with 10 bit resolution in three auto-switched voltage ranges. It is supplied with wire and Powerpole connectors, a cooling system with fan and LED indicators that display communication and test status visible from across a room. Price: CBA, $89.95; temperature probe, $9.95. For more information, or to place an order, see **www.westmountainradio.com** or contact West Mountain Radio, 18 Sheehan Ave, Norwalk, CT 06854; tel 203-853-8080.



The Doctor is IN

Q Jorge, K4KB, asks: I live on the second floor of a house and the closest earth ground is about 13 feet down. Most of the pipes are PVC and I'm trying to find a viable solution to bring a ground into this room. My only alternatives would be to run a heavy wire or ground strap down the 13 feet and attach it to a ground rod. The other one is to use the ground of an electrical outlet. What would you advise in my case?

A The Doctor has covered this topic before (Mar 2004, p 57), but some of it bears repeating as the topic comes up repeatedly. A good dc ground is achievable (with some effort) but it's difficult, if not impossible in some situations, to ensure an effective RF ground. The good news is that it may not be necessary. If you design your station to minimize the need for a good RF ground you may be able to solve the problem easily. Use balanced antennas, such as dipoles, instead of verticals, which are hard to decouple from their transmission line. Feed them with a balanced feed line (like ladder line). You can also decouple with RF chokes, so that RF is prevented from flowing on wires and shields. Approximately 16 turns on an FT-240-43 ferrite core works well from 1.8 through 54 MHz.

A reasonably effective RF ground from a second story ham shack can be a pair of copper wires, one 13 feet long, the other 26 feet in length; each terminated at 8-10 foot ground rods. The junction at the two wires will provide an effective RF ground. This system may, however, cause problems with lightning protection, as it doesn't provide a good dc ground. For lightning protection, wiring should be grounded at a single point, and that should be fed outside the house with heavy wire (at least 10 gauge). A good article about installing a single point ground can be found at this ARRL site: **www.arrl.org/tis/info/lightning.html**.

While it may be difficult to find a good dc ground inside second story ham shack, try to make an effort to provide an easy path to ground for lightning *outside* the house. Lastly, don't depend on the ac ground at an electrical outlet for RF use. The ground path is typically long, generally more than a quarter wavelength from the outlet, and the ground tends to be noisy. It's okay for ac equipment grounding but not for RF, and definitely not for lightning protection.

A good place to look for grounding tips is the following ARRLWeb page: **www.arrl.org/tis/info/grounding.html**. In particular, in "Lab Notes: Different Grounds for Different Shacks," the reasons for grounding, the considerations for different types of grounds and the solutions to try for an above-first-floor installation are discussed.

Q Carl, K4VVX, writes: I need an opinion/explanation on building parasitic suppressors for HF amplifiers (tube type). Carbon composition resistors are getting difficult to find. I understand the need for low inductive resistance. I am restoring an old amplifier that I built about 25 years ago and need to replace the old overheated and broken parasitic suppressors. Are carbon film and carbon composition resistors interchangeable for this application?

A Whether or not they are interchangeable depends on the style and manufacture of the particular resistor and its characteristics. While the low frequency measurement is a good sign, the real question is the impedance at the frequency in which parasitics are likely to occur—60 to 120 MHz. I'd suggest repeating the measurement with an RF instrument, such as an RF impedance bridge.

The resistor's time constant (t), parasitic inductance (L_p) and resistance (R) determines the HF limit of the resistor and $\tau = L_p/R$. For a parasitic inductance of 100 nH (100×10^{-9} H) and a resistance of 47 Ω, the upper break frequency, $f = 1/(2\pi\tau)$, is about 75 MHz.

Another issue is the ability to handle overloads—something that carbon composition does much better than carbon film. Metal oxide resistors seem to have reasonably low inductance, excellent overload capabilities, and they do make good VHF dummy loads, but I'm not aware of anyone who has used them for parasitic suppressors. Good luck!

Q Bill, N5DEE, asks: I'd like to clear up a question I've had for years and still don't know the answer to. When a commercially made W2AU balun is used on a 75 Ω, 40 meter dipole antenna, should the aluminum strap connecting the top to the bottom be left intact or not?

A Leave the strap in place. It's only a ground strap that connects the top mounting hook to the SO-239 coaxial socket shield. Its purpose is to act as a lightning discharge path from the top anchor to ground. In any case, it is balanced to either leg of the dipole and it won't hurt anything. The top anchor isn't connected to anything except that strap.

Q Charles, N2KR, writes: I'm having problems with "motor-boating" in my electronic keyers. After completing a character, the keyer continues to send a continuous string of dots or dashes—more common with some characters than others—using a non-iambic paddle. I originally thought is may be due to RF getting into the cables, but it also occurs with the keyer and paddle standing alone; away from, and not wired to, the radio equipment. I have four different keyers and paddles and it happens with all of them. Since I primarily operate CW, this is very frustrating—I don't want to go back to using a straight key, and I don't like "bugs" very much, but I may be forced to go to a mechanical bug. Any suggestions?

A Most keyers are designed to operate with very low power, in order to minimize battery drain. What this means is that the paddle sensing circuit is usually designed to operate at high impedance and there is very little current passing through the paddle contacts. In fact, water across the paddle contacts will short out most designs. This low current design sometimes results in "contact bluing," in which a microscopic oxide layer builds up on the contacts and requires more current than is available to "punch through" that layer. Try cleaning the contacts of the paddle with bond paper and set the contact spacing slightly farther apart. Also, a covering to enclose the paddle may help. Figure 1 shows a typi-

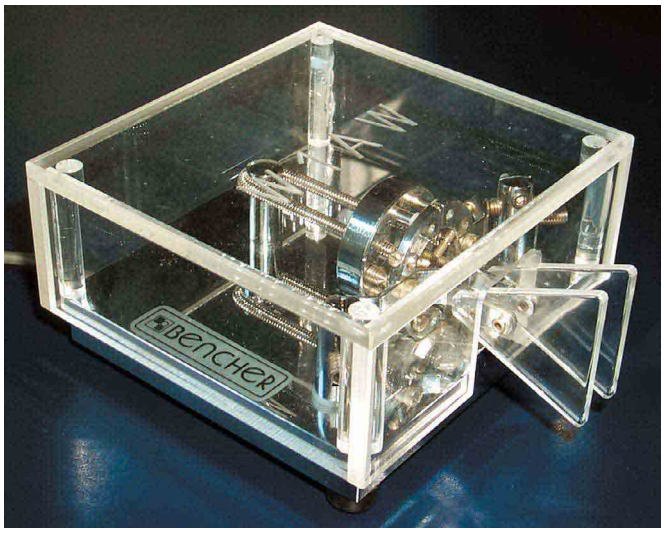


Figure 1—A plastic cover over the paddle will help keep those contacts clean. It takes only a microscopic layer of dirt to insulate a high impedance paddle circuit.

cal example of a paddle cover. This will help prevent dirt buildup on the contacts, but it won't do much for the effect of environmental air conditions on the contacts. Periodic cleaning and slightly wider spacing is the answer here. By the way, it's one of the reasons that sensitive relays are often hermetically sealed.

Q Alan, KB2HEI, asks: I would like to build the power supply shown in the Beginner and Novice column of the April 1961 issue of *QST*. The transformer shown in that article has a 365 V ac secondary on either side of the center tap. The one I have available is 600-0-600 V ac. Also, the filter choke in the article has an inductance of 2 H while mine is 4.5 H at 200 mA and rated at 3000 V. My question has to do with the other components of the supply. What, if any, modifications are needed to build a dc power supply using the components I have on hand?

A Your filter choke should be fine, but you would most certainly need to reduce the secondary voltage coming from the transformer by about 40%. There are several ways to do this. You might be tempted to put a series resistor in the transformer primary to lower the input voltage. It's not a good idea. That would seriously affect the input voltage regulation and it isn't recommended. Similarly, a resistor at the secondary would seriously degrade the output voltage regulation. Rewinding the transformer is also not a good idea at these power levels, as the effort is very time consuming and difficult.

I would try to locate a small 220/120 V ac isolation transformer and apply the 120 V ac to the 220 V winding—use the 120 V winding to feed your transformer primary. This will give you about the right voltage at the secondary of your transformer. Conversely, you could also try to find a small Variac or Powerstat auto-transformer. These are sometimes available on the surplus market. Use that to feed the transformer primary and you'll have a variable voltage power supply. Another technique is to connect a transformer out of phase with the input primary, so its voltage effectively "bucks" the input voltage. In this case, you'd need about a 50 V ac transformer. Connect its winding in series with the input, while monitoring the output voltage. If the output voltage increases, reverse the series connection windings—the output voltage should now drop. Figure 2 shows some approaches to lowering (or, for that matter, boosting) the primary voltage.

Be aware that all of these techniques will affect *all* the secondary voltages coming from the transformer. That includes any 6.3 V filament windings and the rectifier tube filament voltage

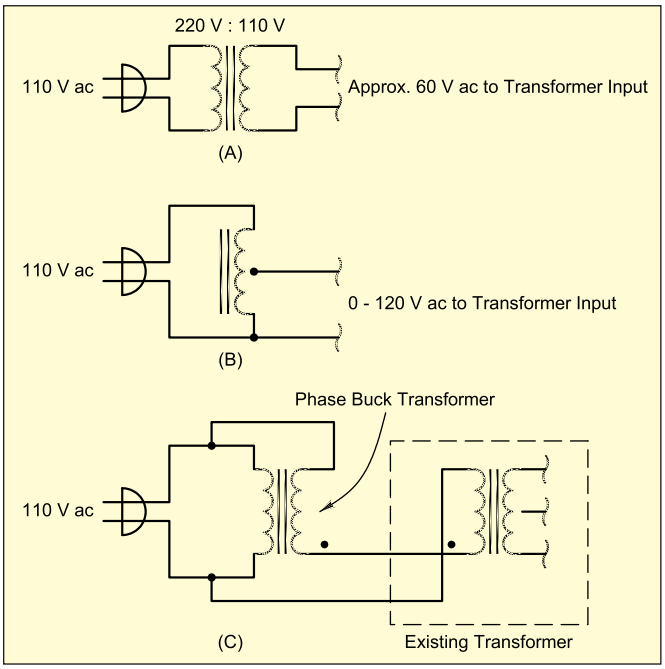


Figure 2—(A) A simple 220:110 V ac isolation transformer lowers the primary voltage if 110 V ac is fed to the 220 V winding. (B) A variable autotransformer configured to supply primary voltage. (C) An out of phase transformer winding can also be used to lower the primary voltage.

(usually 5 V). You would then need a separate transformer to supply these voltages. Or, in the case of the vacuum tube rectifier that is used in this supply, replace the tube rectifier with solid-state diodes, making sure that the PIV and current ratings of the diodes are sufficient for your application and the surge current drawn by the filter capacitors. In this case I'd recommend a full-wave bridge rated at 800 V PIV at 3 A, or, if you go with discrete diodes, use a type 1N5408 diode. Have fun, good luck and, as always, be careful around those high voltages!

Q Don, WA1ELA, writes: I've a question relating to dipole antennas. If I feed a dipole with 450 Ω balanced transmission line and use a balanced antenna tuner, is there an optimum length to operate, let's say, 160-10 meters, 75-10 meters or 40-10 meters?

A Yes, there is. The difficulty, however, is that typical amateur dipoles are installed too close to nearby objects to make them no-tune like, for example, a large Yagi that might be mounted on a tower free and clear of surrounding terrain. Even the tower-mounted Yagi often needs tuning if it has to share space with other antennas. Thus, while you can do the optimization with modeling programs like *EZNEC*[1]—even modeling the effect of ground and wire insulation—the reality is often considerably different that what you think you are modeling.

Perhaps the best strategy is to put up your antenna and measure its impedance on all the bands you intend to operate. You can then simultaneously optimize the feed line length and choose the best compromise for your operating needs. The *TLW* program that comes with *The ARRL Antenna Book*[2] will model the feed line and matching network losses, given the load impedance.

[1]**www.eznec.com**.

[2]Available from your local dealer or the ARRL Bookstore. 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**.

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/.

By Pete Norloff, KG4OJT, and Tom Azlin, N4ZPT

Antenna Mounts for all Occasions

Have you ever needed to attach an antenna to a bus? Neither had the authors...

In preparation for the May 8, 2004 disaster drill at Dulles International Airport, those of us in the Fairfax (Virginia) ARES started struggling with the idea of how to mount an antenna on a bus. Why a bus? We were using them to transport the majority of the volunteer "victims" from the mock crash site to area medical facilities.

At first, we hadn't even known if we'd be operating from school buses, small limo buses or large charter buses. One problem with buses is that in order to save weight, the upper parts are often made of fiberglass, aluminum or other lightweight alloys. Mag mounts have nothing to stick to, and there's a good chance that there's not even a good ground plane on the top.

On the way to a planning meeting, the authors derived some inspiration for an antenna mount from a suction cup mount for holding a personal digital assistant device (PDA) to the car windshield. We discussed ways of finding sources of heavy-duty suction cups to build an antenna mount. Later, we each searched the Internet for suppliers of suction cups and came up with similar devices from a variety of sources.

We were lucky enough to find a local supplier of a small variety of heavy-duty suction cups at Harbor Freight in Woodbridge, Virginia (**www.harborfreight.com**). They had a number of items that looked like they might work, but one in particular stood out—a device for lifting raised flooring tiles or carrying sheets of glass. This device has two large (4 inch) suction cups with attach/release levers connected by a handle. We drove to the nearby store and purchased enough to make antenna mounts for all seven buses in the drill, plus a few extra for experimentation.

In what turned out to be an all-day affair, the authors, along with Maria Norton, KG4JBJ, created suction cup mounts for NMO antennas from both simple L bracket mounts (Figures 1 and 6) and from luggage rack mounts (Figure 2). We also created a mast mount for a quarter-wave ground plane antenna (Figure 3) and a support for mag mount antennas (Figures 4 and 5). All of the mounts with the exception of the quarter-wave ground plane also received a short "rat tail" radial (green wire in the photos) to help provide the ground side of the antenna. The various mounts for NMO antennas were configured so that they could be used either on a horizontal plane like a roof or on a vertical plane like a window.

The L-bracket NMO mounts were bolted through the handles on the suction cup. We drilled two holes for the horizontal mount orientation and two holes for the vertical mount orientation. Changing the antenna orientation would require simply moving those two bolts. The luggage rack mount was attached to the suction cup handle with a strap, so the orientation could be changed by loosening the strap and rotating the mount. The mag mounts were built for mounting on a vertical surface. We purchased some 5 inch steel plates for electrical junction boxes and mounted them to the suction cup handles with two bolts.

We also discovered that our double suc-

Figure 1—Using a suction cup assembly designed to lift floor tiles and hold glass for transport, the authors, along with KG4JBJ, devised this simple L bracket mount for an NMO antenna.

Figure 2—A luggage-rack mount attached to PVC pipe and supported by split suction cups.

Figure 3—A 1/4 wave ground plane attached to PVC pipe. Again, it is supported by split suction cups.

Figure 4—With metallic surfaces hard to come by on the bus, this mag mount assembly did the trick.

tion cup floor tile lifters could not be attached to compound curved surfaces, such as many automobile front and rear windows. They could usually be attached to a side window, however, as long as the mount went side to side and not top to bottom. The curve of the glass kept the suction cup from sealing.

We measured the SWR on most of the antenna configurations (direct NMO mount, mag mount and luggage rack mount) to be between 1.3 and 1.5:1. The quarter-wave ground plane was close to 1:1. Adding the rat tail lowered the SWR from 1.6 or 1.7:1 to the figures above.

On disaster drill day, everything went according to plan. We inspected the large charter buses immediately upon arrival and found that they had only three openings to the outside for feed line: The entry door at the right front corner of the bus, a single roof vent/escape hatch toward the rear and a small sliding window next to the driver. We also inspected the roof—all of our buses had flat fiberglass/plastic roofs. Our antenna mounts could be mounted on the roof or a window but we decided to use the position immediately behind the driver and run our feed lines out his window to the antennas mounted on one of the forward side windows. Six of the seven buses used these suction cup mounts.

Did They Work?

All of the mounts held up throughout the drill. In the case of

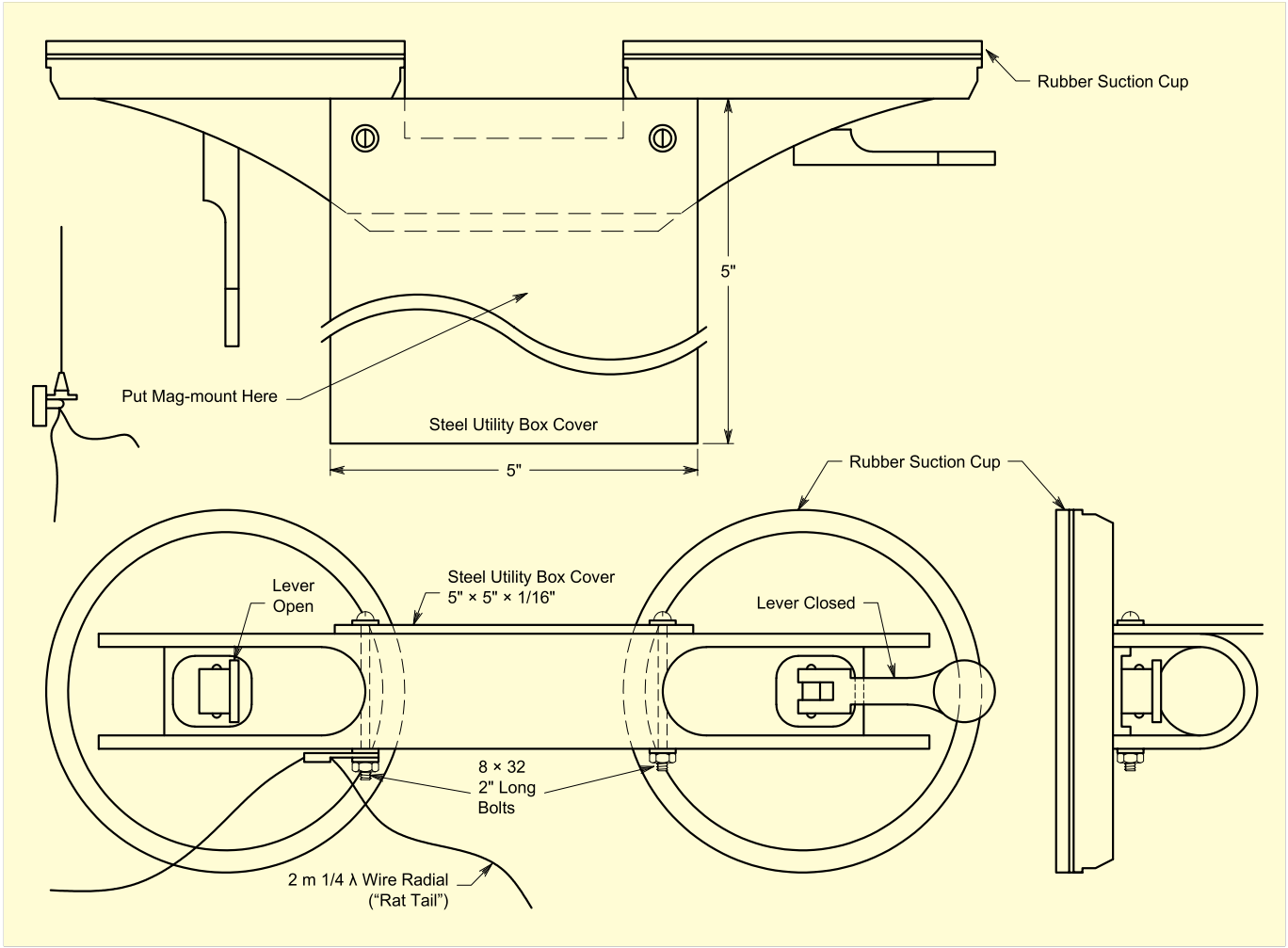


Figure 5—Detailed diagram of the mag mount assembly.

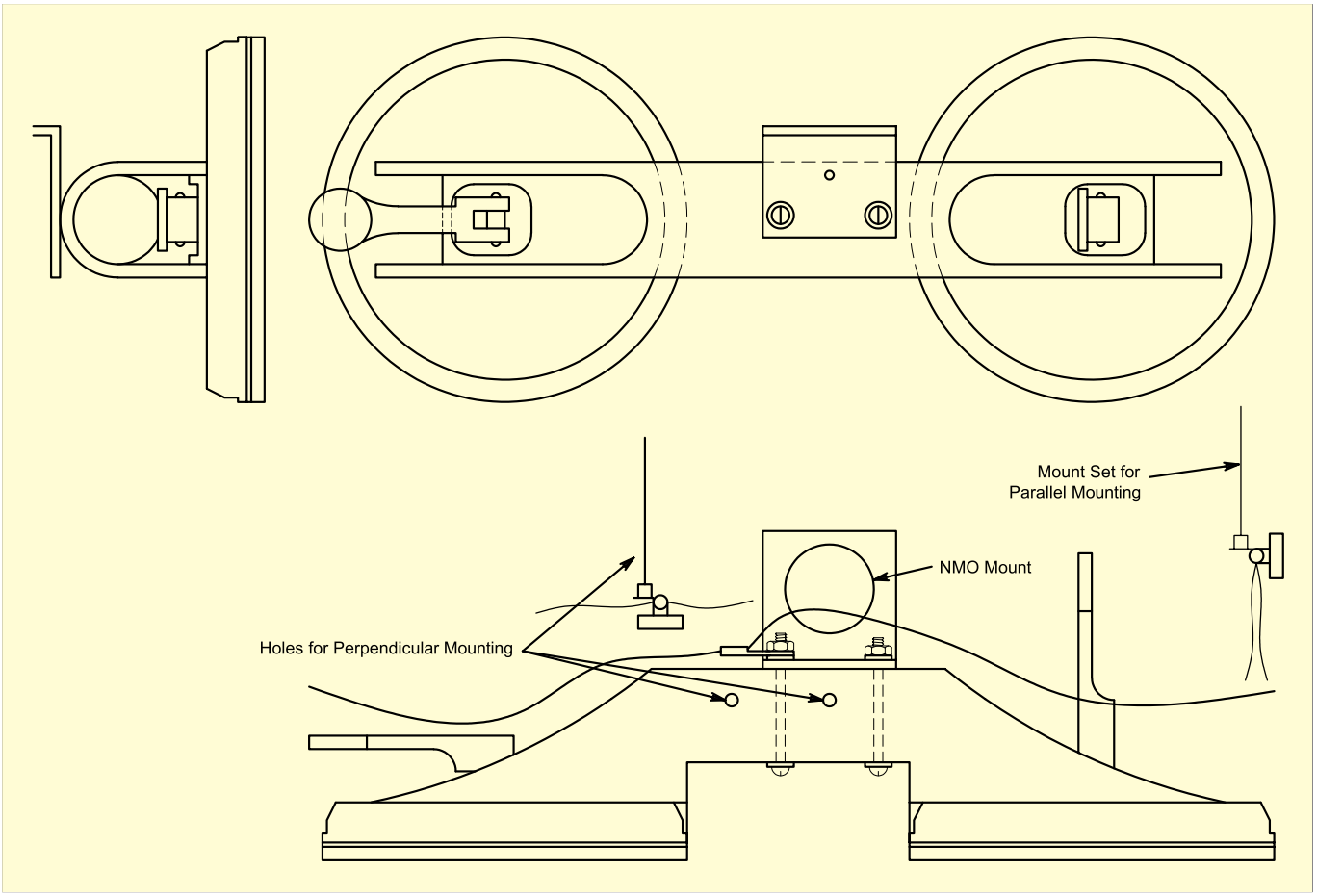


Figure 6—Detailed diagram of the NMO mount assembly. The design allows for either horizontal or vertical mounting.

one bus, the antenna was driven through some trees, knocking the mag mount antenna from its suction cup mount. Fortunately, the mount survived. Since the radio operators on that bus did not have a ladder to reach the mount to reinstall the antenna, they retrieved the antenna and duct-taped it to the dashboard.

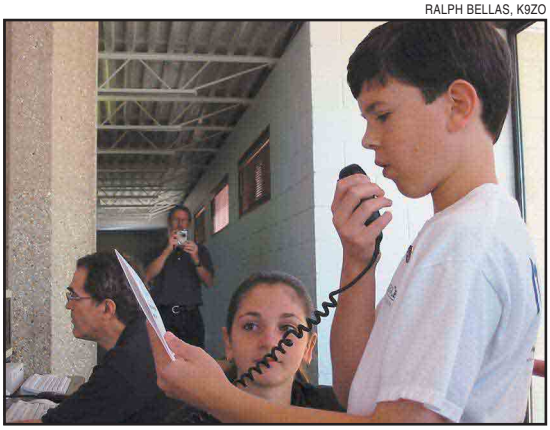
All in all, it was a successful venture, one that solved the problem of temporarily attaching antennas to unknown vehicles. We have a good assortment of these mounts now, and based on the amount of interest among local ARES groups, we're likely to need quite a few more for our next activation or exercise.

Photos by the authors.

Pete Norloff, KG4OJT, was licensed in 2001 and works as a software engineer in Oakton, Virginia, developing an eye-controlled computer system and supporting varied network operations. He is active with the Vienna Wireless Society and Fairfax County ARES, and can be reached at **kg4ojt@arrl.net**. *Tom Azlin is a communications engineer who has been employed in Northern Virginia since about 1977. First licensed as WN7SUA in college during 1971-72, since 1990 he has been licensed as N4ZPT. He is active in the Vienna Wireless Society in Northern Virginia. He is also most active in HF digital communications as well as Fairfax County ARES. You can reach Tom at* **n4zpt@arrl.net**.

STRAYS

RALPH BELLAS, K9ZO



Amateur Radio received some excellent publicity from local TV and radio stations and newspapers following the successful August 16 contact between the International Space Station and the Challenger Learning Center in Bloomington, Illinois. The scheduled contact between astronaut Mike Fincke, KE5AIT, operating NA1SS aboard the Space Station, and the Central Illinois Radio Club, W9AML, went like clockwork. Shown (from the left) are Grant Zehr, AA9LC; John Chubick, KB9LNS; 14 year old Roxie Able, KC9CSV, and one of the students on hand who were attending a nearby summer space camp.

NEW PRODUCTS

AM RADIO LOG—25TH EDITION

◊ A listing of MF AM broadcast stations is provided by the National Radio Club, a group that enjoys listening to long distance standard broadcast stations. The 2004 edition consists of 294 3-hole punched 8½×11 inch loose-leaf pages. Covered are over 5200 radio stations in the US and Canada. Each listing includes location, frequency, call sign, transmit power, network affiliation and other information. The data is cross referenced by location and call sign.

The volume is available from the NRC for $25.95 for non-members. For more information or to order see **www.nrcdxas.org** or write their Publications Center at PO Box 164, Mannsville, NY 13661-0164.

SGC SG-211 Automatic Antenna Tuner

The SG-211 has finally solved one of the annoying issues with remote automatic antenna tuners: *dc power*. With most automatic antenna tuners you have to string a dc power cable to wherever the tuner is located. Not so with the SG-211, because this little tuner is *battery powered*.

The SG-211 ships with a AA alkaline battery pack already installed in the case. SGC claims that the batteries will last for years of normal use. Obviously, I wasn't able to put this claim to the test!

Another interesting feature of the SG-211 is that it is designed to accommodate balanced feedlines (such as 450-Ω ladder line) and long-wire antennas. The SG-211 will also work with unbalanced feed lines (coaxial cable) if you wire up an SO-239 connector as an adaptor.

Installation and Use

Since you don't have to worry about supplying power to the SG-211, installing the tuner is as simple as it gets. Should you ever need to refresh your memory, you'll find clear instructions printed on the case itself. There are no buttons or adjustments of any kind. Attach the coax, attach the antenna, apply RF and the SG-211 tunes.

The SG-211 has a frequency range of 1-60 MHz, so it is compatible with popular MF/HF/6-meter rigs. It is important to point out, however, that the SG-211 is designed to handle only 60 W PEP or 20 W continuous duty. This means that you have to be careful when using the SG-211 with 100-W transceivers.

My first on-air test was with radioteletype (a 100% duty cycle mode) using a 70-foot ladder-line fed dipole antenna. Taking care to keep my transceiver output below 20 W, I keyed the rig on 160 meters and listened as the '211's relays chattered away. The LED on the front of the '211 flashed several times, then the tuner fell silent and the LED held steady—the SG-211 had found an acceptable match resulting in a 1.5:1 SWR.

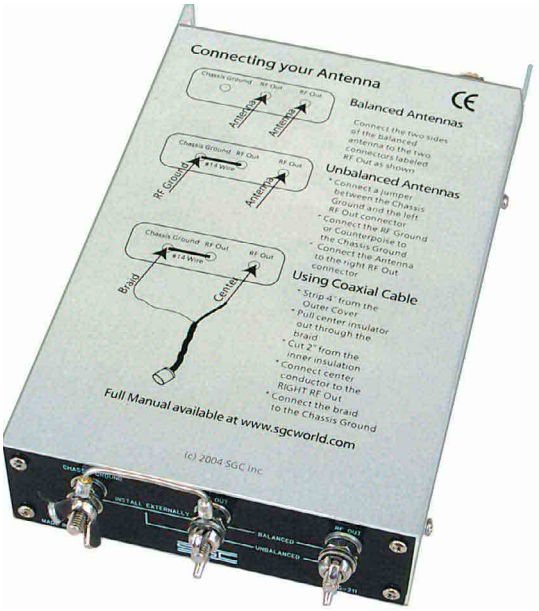
The SG-211 found a match on every band, 160-6 meters, although some complex impedances seemed to be more challenging for the little tuner than others. In this initial test, I was able to trigger the SG-211 into its tuning mode with my RF output reduced all the way down to 1 W.

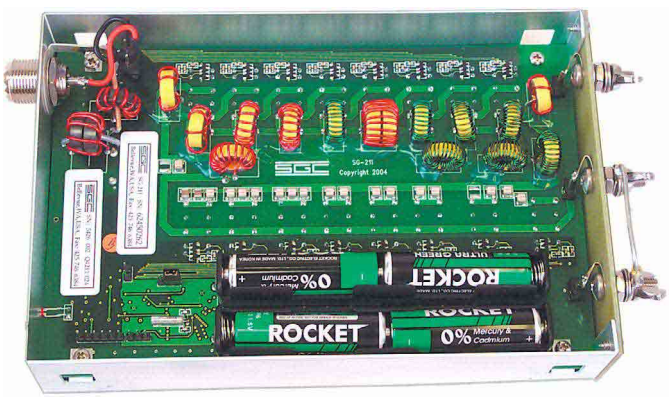
In subsequent tests on SSB and CW, I found that it was best to tune the SG-211 using the mode I intended to operate. For instance, I once tuned the SG-211 using RTTY, then switched to SSB. To my dismay, the SG-211 entered the tune mode again as soon as I began talking. On the other hand, if I used SSB to trigger the tuner from the beginning (by saying "hellooooooo," etc), the SG-211 was less prone to jump to the tune mode when I was transmitting normal speech.

ARRL Lab Testing

With a 50-Ω load on the bench, the RF loss in the SG-211 averaged 15% on 160-6 meters. Using a 3-Ω load, the Lab measured loss of about 30% on 40 and 20 meters, and about 20% on 10 and 6 meters.

Finally, with an 800-Ω load, the loss was measured at 30% on 160, 80 and 20 meters, and about 20% for 40 meters. The loss caused by this severe mismatch on 6 and 10 meters was 65%.





Interior view of the SG-211 antenna tuner.

Conclusion

The SG-211 is an important innovation in automatic antenna tuners. The tuner is bound to appeal to portable operating enthusiasts, but I think it also has excellent potential for hams who must enjoy their avocation from apartments, condos and other antenna-restricted settings. You can toss the SG-211 into a small attic, or outside a window, with a wire antenna and get on the air right away. Just remember that the SG-211 is not weatherproof, so you'll need to provide a waterproof enclosure if the tuner is going to be outdoors around the clock.

And what about the RF power limitation? In my tests, I was making just as many contacts with 60-W PEP SSB as I was at 100 W. Using 20 W for RTTY and PSK31 certainly was a serious step down from 100 W, but I only noticed the difference when propagation was marginal, or when the band was crowded.

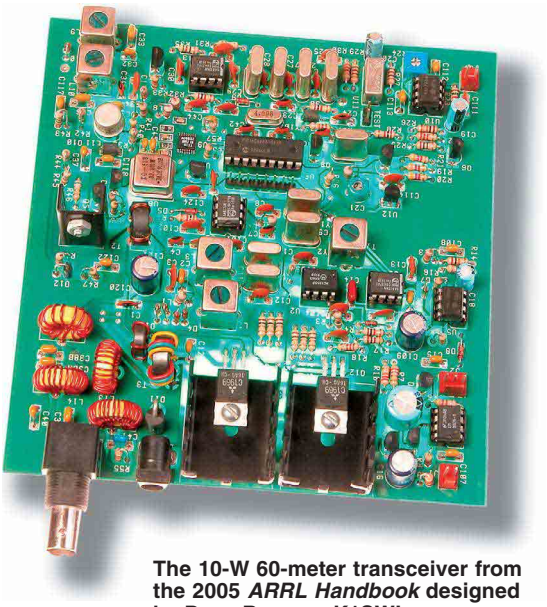
Manufacturer: SGC, 13737 SE 26th St, Bellevue, WA 98005; tel 425-746-6310; **www.sgcworld.com**. *$179.95.*

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

By Steve Ford, WB8IMY

Head on Down to 60

As we begin to plumb the depths of the solar cycle, our newest band looks better than ever.



The 10-W 60-meter transceiver from the 2005 *ARRL Handbook* designed by Dave Benson, K1SWL.

Seasoned hams know what to do when the solar cycle takes a plunge. As the upper HF bands lose their luster, these amateurs take their cues from submarine commanders: Dive! Dive! Take 'er down deep, down to where ionosphere still offers consistent long-range opportunities. For many hams that means 160 and 80 meters, but don't forget that we have a new band that's also likely to provide some excitement during the solar doldrums: 60 meters. If you have a General, Advanced or Amateur Extra ticket, this is fresh territory for you to explore.

Sixty meters isn't a globally allocated band, which means that you're not going to be hearing a lot of DX. But thanks to the regulations that govern our behavior on 60 meters, the band is ideal for low-profile hamming with modest equipment. More about this in a moment.

Our allocations on 60 meters are limited to specific frequencies, or "channels," if you will.

Channel Center	*Amateur Tuning Frequency*
5332 kHz	5330.5 kHz
5348 kHz	5346.5 kHz
5368 kHz	5366.5 kHz
5373 kHz	5371.5 kHz
5405 kHz	5403.5 kHz

Not only that, you must transmit upper sideband (USB) voice *only*—not lower sideband, not AM, not CW, not modulated CW, not PSK31, not any other mode except USB voice. *Period.*

So, when you have your radio in the USB mode, you need to tweak your VFO until you see the correct "Amateur Tuning Frequency" on your display (see above). With a properly modulated signal, you should be right on the channel-center bull's-eye. This isn't as difficult as it sounds. If you have a radio with programmable memories, the easiest thing to do is simply program five memories for the individual 60-meter tuning frequencies.

Equipment for 60

Obviously, the most important thing you need is a radio that will work on 60 meters. Fortunately, the major Amateur Radio manufacturers are now releasing transceivers with 60-meter capability. Others are offering upgrades (especially for rigs that are upgradable with software). If you have an older radio, check the Web and search for 60-meter modifications. The ARRL has a collection of 60-meter modifications on the Web at **www.arrl.org/tis/info/60-meter-mods.html**.

If you'd like to take a crack at building your own 60-meter transceiver, check out the nifty 10-W rig described in the new 2005 *ARRL Handbook*.

"Ten watts? I want to run serious power, at least 100 W!"

Slow down, cowboy. FCC Rules limit hams to *50 W* effective radiated power. In fact, to quote the Feds, "For the purpose of computing ERP, the transmitter PEP (peak envelope power) will be multiplied by the antenna gain relative to a dipole or the equivalent calculation in decibels. A half-wave dipole antenna will be presumed to have a gain of 0 dBd."

The translation is that if you use a half-wave dipole (about 87 feet 3 inches for the "middle" channel according to the formula), set your transmitter's power output power for 50 W PEP (many transceivers' meters can be set to indicate peaks), and you should be in compliance.

The Climate on 60

Since you'll be sharing only five frequencies with your fellow amateurs, resist the temptation to be a frequency hog. Enjoy your conversation, but remember that others may also be waiting. Courtesy demands that you keep your chats relatively short. I'd suggest 10 to 15 minutes maximum.

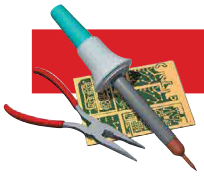
Keep the conversations particularly short on 5405 kHz. American and British amateurs share this frequency and it has become a de facto 60-meter "DX window." Everyone wants their shot at a 60-meter transatlantic contact, so don't tie up the frequency longer than necessary.

Bear in mind that we are *secondary* users on this band. Government stations are primary and you must yield the frequencies to them. If you hear a non-amateur signal on the channel you've chosen, choose another.

Sixty meters will surprise you when you least expect it. The band shares the propagation characteristics of both 40 and 80 meters. It is a good band for regional work during the daylight hours, out to about 300 miles or so. When the sun goes down, however, 60 meters becomes a long-distance band.

Check Out the New Turf

If you're looking for a refreshing experience, consider 60 meters. It is a fun band for the average ham. If you don't have a kilowatt amplifier that you can use on 60 meters, don't sweat it—neither does anyone else! That's the point, really. There are no "big guns" on 60; this band is a level playing field for everyone. QST



Experiment #22—Stubs

Most hams know about transmission line matching and VSWR, but the mechanics of stubs and using them for filtering is often considered mysterious. Like most mysteries, stubs are not hard to design and use if you know the secret. This month, not only will you learn the secret, but you'll build a useful gadget in the bargain.

Terms to Learn

- *Electrical length*—the length of a transmission line in terms of the wavelength (λ) of the energy traveling through it.
- *Termination*—a load attached to a transmission line.

Background

So what is a stub and how does it work? A stub is just a length of transmission line terminated in a fixed impedance, usually a short or open-circuit, in parallel with another transmission line to create a tuning or canceling effect. The tuning and canceling are the result of interference between the RF energy in the two transmission lines. That was simple, wasn't it? Take a deep breath and read on.

Before proceeding, we'll need to review some fundamentals of transmission lines.

Because energy in a transmission line travels slower than in free space, the *physical* length of the transmission line is always *shorter* than its *electrical* length. For example, if a piece of RG-58 is 1 λ long to energy traveling through it, the physical length of the cable will be about two-thirds as long as the wavelength of the same energy traveling in free space.

Impedances in a transmission line repeat every $^1/_2$ λ along the line. (If terminated in its characteristic impedance, Z_0, however, impedance is the same everywhere along the line.) If I terminate any transmission line with a load whose impedance is 100 Ω at some frequency, f, then every $^1/_2$ electrical wavelength away from that load, the transmission line will again present a 100 Ω impedance. If the line is perfectly lossless, I can't tell how many half wavelengths I am from the load.

Open and short circuits reflect 100% of the energy in a transmission line. For an open-circuit, the incoming (or *incident*) and reflected voltages are in phase and add together. The incident and reflected currents are out-of-phase and cancel so that there is zero current at the open-circuit. For a short circuit, voltages cancel and currents add.

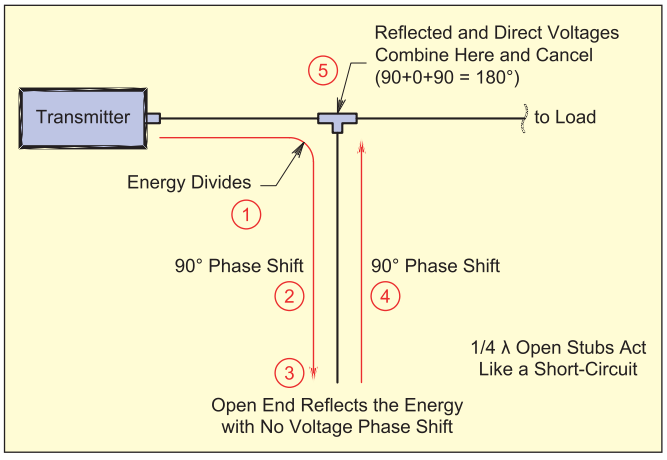


Figure 1—A $^1/_4$ λ stub uses reflections to cancel energy at its free end.

Stub design is based on these three key elements.

Figure 1 illustrates how a $^1/_4$ λ open stub (stubs are referred to by their electrical length and terminating impedance) creates an apparent short circuit. Imagine a single packet of RF energy just a few cycles long—a very short CW dit. The energy travels in the line from the transmitter, encountering the junction of the stub and the rest of the line. The energy divides between the line and stub. The wave traveling down the stub is phase shifted by 90° because the stub is an electrical $^1/_4$ λ long. At the open-circuit, all of the energy is reflected with the voltages in phase (no additional phase shift). The reflected wave gets another 90° of phase shift going back along the stub for a total phase shift of 180°. At the junction, the out-of-phase voltages cancel or *null*, creating an apparent short circuit. The quarter-wave open stub presents a short circuit at its free end!

Complete reverse only occurs if the stub is completely lossless and exactly $^1/_4$ λ long. Loss reduces the returning voltage, preventing a complete cancellation. Being off-frequency means that the net phase shift won't be precisely 180°. Nevertheless, the range of frequencies over which most of the voltages cancel is sufficient to be useful across a ham band.

What happens if the stub is shorted, instead of open? At the termination, the wave is reflected with voltage phase shifted 180° instead of zero, making the total phase shift 360° in the stub. The voltages now add back together, as if no stub was connected at all. The quarter-wave shorted stub acts like an open-circuit at its free end.

Longer stubs take advantage of the $^1/_2$ λ repetition of impedance. If the quarter-wave stub is doubled in physical length, to become $^1/_2$ λ long, its terminating impedance repeats at the free end. Leaving the physical length alone and doubling the frequency (halving the wavelength) has exactly the same effect so that the terminating impedance appears again at the free end. A stub any number of $^1/_2$ wavelengths long acts as if it were just $^1/_2$ λ long, although with a little more loss.

Harmonic Filtering

By far the most common application of stub is to act as a filter for transmitter harmonics. The free end of a $^1/_4$ λ shorted stub presents an open-circuit at its *fundamental frequency*, but a short circuit at the second harmonic where it is $^1/_2$ λ long. The free end also presents a short circuit at the fourth, sixth, eighth, and so on, harmonics where it is an integral number of $^1/_2$ wavelengths long. While passing energy at the fundamental frequency untouched, all even harmonics are canceled!

Half-wavelength stubs also filter harmonics, but in a slightly different manner. The free end of a shorted $^1/_2$ λ stub presents an open-circuit at one-half its fundamental frequency because there it is a $^1/_4$ λ stub. The stub acts like a short circuit at the fundamental and all harmonics.

Table 1 lists the filtering effect of $^1/_4$ and $^1/_2$ λ stubs cut for

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

Table 1
Useful 1/4 and 1/2 λ Stubs for Filtering

Stub Type	*Passes*	*Nulls*
1/4-λ 160-m shorted	160	80,40,20,15,10
1/4-λ 80-m shorted	80	40,20,15,10
1/4-λ 80-m open	40,20	80
1/4-λ 40-m shorted	40,15	20,10
1/4-λ 40-m open	20,10	40,15
1/4-λ 20-m shorted	20	10
1/4-λ 20-m open	10	20

different ham bands.[1] The possibilities are endless!

The 60, 30, 17 and 12 meter bands are absent from the table because stubs cut to pass or null these bands don't have a similar response in any of the other HF bands. These bands are not *harmonically-related* to other bands.

Design and Build a Multi-Band, Switchable Stub

Taking a look at rows four and five of Table 1, you can see that if a 1/4-λ 40-meter stub could be changed from short to open, it would pass or null signals from any of the four highest harmonically related HF bands, 40 through 10 meters. By attaching a switch to the end of an appropriate length of cable, you can do just that, as shown in Figure 2.

Cut 24 feet of coax with a solid polyethylene center insulator, such as RG-58 or RG-213. (You can use foam-insulated coax if you adjust for the different velocity of propagation.) Install a coax connector on one end.

Trim about a half inch of jacket and center insulator from the cable. Twist the shield and center conductor together and attach the stub to your SWR analyzer as shown in Figure 3. Any type analyzer that displays reactance can be used.

Tune for the *lowest* frequency at which the reactance "X" goes to a minimum. Don't watch the SWR value—it will remain high—or the R value. At this frequency the stub is acting like a 1/2 λ shorted stub, so the frequency should be *twice* the 40 meter design frequency. Measure stubs at a short-circuit frequency because the SWR analyzers give a much sharper and clearer response than for high impedances.

Since you're starting with the stub too long, trim 1 inch at a time and repeat the measurement until the short occurs at twice the desired 40 meter frequency, that is, 14.200 MHz for a 7.100 MHz stub.

When you've reached the desired frequency, replace the short with a toggle switch as shown in Figure 2, cover it with the plastic container and attach the stub to your radio's output with a T connector.

Attach an antenna and listen to signals as you switch the stub from open to shorted on the different bands. You should hear a difference of around 3 S units as you change the stub between "pass" and "null."

Tips on Stubs

I hope you'll try your hand at other types and uses of stubs. If you do, here are some helpful hints:

- Keep the shorting leads *short*!
- Trim open stub shields back from the end of the center insulator by 1/8 inch to prevent arcing from the extra voltage.
- Insulate and waterproof stub ends with shrink wrap or tape to prevent arcing or degrading the cable.
- Use low-loss cable to get the deepest null. RG-213 is good; surplus hardline is even better!

[1]G. Cutsogeorge, *Managing Interstation Interference*, Table 11, International Radio (**www.qth.com/inrad**), 2003.

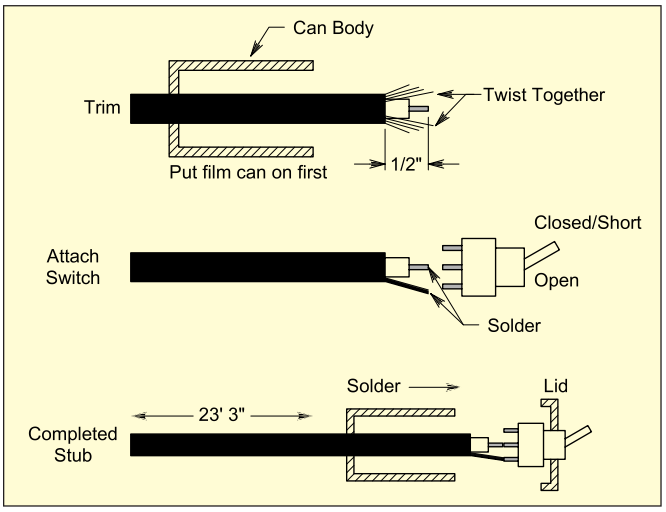


Figure 2—The switched-stub can pass or null energy on 40, 20, 15 and 10 meters.

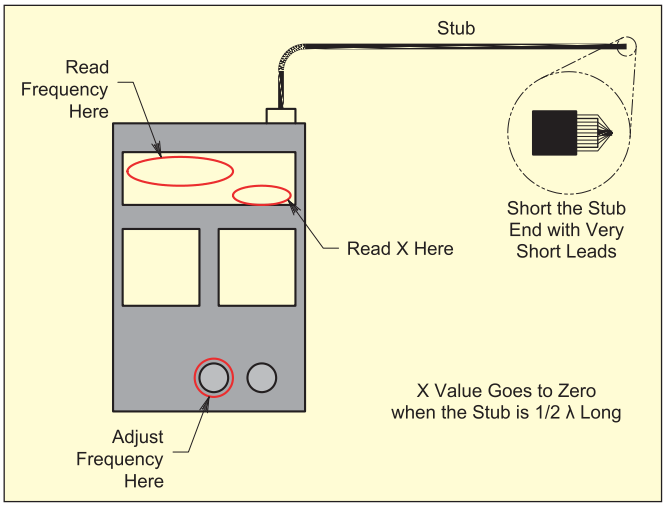


Figure 3—Use an SWR analyzer to measure the frequency at which the stub is 1/2 λ long.

- Remember that the stub's electrical length must include all adapters, connectors and switches. If possible, trim to length with all such extra items attached.

Suggested Reading

The best book available today on the subject of stubs is W2VJN's *Managing Interstation Interference*[2] with lots of information about all kinds of interesting stubs and applications. The May 2001 *QST* article, "Making a Stub," by Dean Straw, N6BV, may also be helpful.

Shopping List

- Plastic film can or pill bottle
- SPST or SPDT toggle switch
- 25 feet of RG-58 coaxial cable (any solid polyethylene 50 Ω cable will do)

Next Month

It's time for a holiday open house at NØAX's workbench and ham shack! I'll show off my tool box and gadgets to encourage all the Hands-On Radio homebrewers and experimenters. I'd better get started on the clean-up right away!

[2]See Note 1.

PowerPort 73 Portable Power Supply

With the increasing interest in emergency communication, and portable operating in general, batteries are popular topics of conversation. And why not? He who has the biggest battery operates longest, depending on how much current the equipment demands. Of course, with expanding battery capacity comes expanding size and weight. Still, it is possible to squeeze a lot of power into a relatively small space.

Cutting Edge Enterprises offers a varied lineup of batteries and charging systems. Among the products that attracted my attention was the PowerPort 73, a compact dc power supply specifically designed for long-term portable operating and overall ease of use.

Summertime was just around the corner when this review was written. The hardy among us operate portable throughout the year, but wimp that I am, I prefer Amateur Radio *al fresco* when the temperatures aren't so *freddo*. So, with warm weather beckoning, I decided to give portable hamming a try with the PowerPort 73.

Simple, But Handy

At its heart, the PowerPort 73 is a rechargeable 8 amp-hour 12-V gel cell. The gel cell in the PowerPort 73 is a dense, featureless block with a significant amount of heft. Nothing out of the ordinary.

What makes the product so interesting is what Cutting Edge has built around the battery. The PowerPort 73 sports three cigarette-lighter-jack outputs within a plastic "head" attached to the battery. This greatly simplifies the task of hooking up transceivers and other devices.

There is no ON/OFF switch as such. Instead, there is a cigarette lighter plug and socket that, when joined, complete the circuit path to the output head. (A green LED lights to indicate that the ports are "hot.") The reason for this unusual arrangement is to allow the PowerPort 73 to be easily recharged from a cigarette lighter jack in a vehicle, or from any other similarly equipped power source. You only need to separate the PowerPort 73 plug and jack assembly, then insert the plug into any convenient cigarette-lighter jack. (The PowerPort 73 package includes a "wall wart" charger with a cigarette-lighter jack.) The PowerPort recharges in 8 to 10 hours.

Everything except the wall charger fits into a nylon carrying case with a strap handle and foam padding. The entire battery weighs 6 pounds and is only $7 \times 4 \times 3$ inches. When you're ready to use the PowerPort, you simply remove the top cover and connect the cigarette light plug/jack. This maneuver requires all of about 30 seconds.

On the Air with the PowerPort

For this review, I used the PowerPort in two portable on-the-air applications.

During Field Day 2004, the PowerPort 73 powered my little 20-meter MFJ Cub transceiver. With the low current demand of the Cub, the PowerPort had no problem keeping me on the air throughout the entire event. I connected a voltmeter to the PowerPort to observe the performance and the needle barely budged.

A more demanding application involved powering my Yaesu FT-897 transceiver during a recent vacation outing. I operated CW and PSK31 with the '897 output reduced to 20 W. The PowerPort was able to keep me on the air continuously for about 4 hours before I had to resort to a recharge.

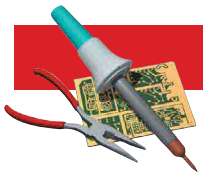
I really enjoyed the compact design and durability of the PowerPort 73. When it was time to move, I just closed the cover and grabbed the strap. I did manage to bump it off a table once. Fortunately, the PowerPort landed on its base without injury—other than to my eardrums due to a resounding *thud*—rather than on the top of the case where the power head would have taken the brunt of the impact.

Power to Go

If my experience is typical, I think the PowerPort 73 would be a highly capable portable power source. It can power anything that requires 12 V, and do it for quite a while. We tend to think of power sources in terms of radios, but I also used the PowerPort 73 and a voltage converter to run a laptop PC. The PowerPort kept the computer running for about 6 hours. If only my laptop's internal battery could do that!

Manufacturer: Cutting Edge Enterprises, 1717 Seventh St, Los Osos, CA 93402; tel 800-206-0115; **www.powerportstore.com**. $76.95.

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



HINTS & KINKS

SURFACE-MOUNT TEST TWEEZERS

◊ Here's a simple tool that you can easily build to quickly sort and test unmarked SMD components.

Passive surface-mount devices (SMDs) are frequently unmarked and can be difficult to test. If you use test probes and a multimeter they may flip or spin out of the probe tips when you apply pressure, which can be very frustrating.

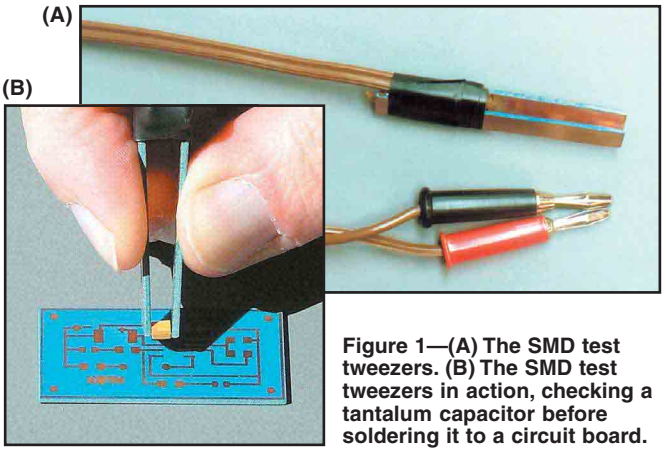


Figure 1—(A) The SMD test tweezers. (B) The SMD test tweezers in action, checking a tantalum capacitor before soldering it to a circuit board.

To solve that problem, build the SMD test tweezers shown in Figure 1. They grip SMD capacitors and resistors squarely, allowing for quick and easy measurements. I use these and an autoranging multimeter, such as the Craftsman model 82040 (Figure 2, about $20) to quickly double-check the value of each component before mounting it to the circuit board.

Figure 2—A typical autoranging DVM (Craftsman #82040) used with the SMD tweezers.

Construction

This is an easy one-evening project. All of the parts are listed in Table 1. Cut out the parts shown in Figures 3 and 4. Then use a plastic abrasive pad to polish the copper side of the PC board until it is shiny. Glue the assembly (Figure 5) together with "five-minute" epoxy, making sure the foil sides face inward. After the epoxy has cured, squeeze the tweezers together and carefully sand the tips so that they are flush with each other and square. Remove any sanding burrs from the ends with a small file. Next, carefully solder (don't overheat the epoxy) the test leads to the foil. Finish the tweezers with heat-shrink tubing or electrical tape arranged to dress the wires out of the way. Keep the multimeter leads short to minimize stray capacitance.

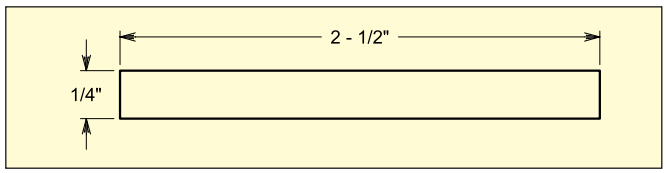


Figure 3— Fingers for the SMD test tweezers are made from two pieces of FR4 PC-board material.

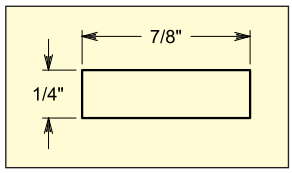


Figure 4—The spacer block is made from any hardwood.

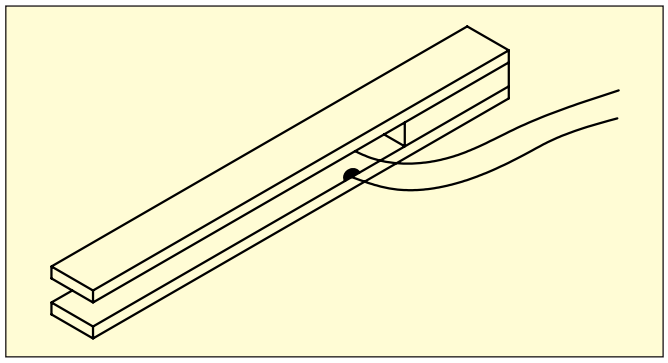


Figure 5—Assembly of the SMD test tweezers.

Table 1
SMD Tweezers Parts List

Qty	*Description*
2	2 1/2 × 1/4 inch FR4 circuit board
1	1/4-inch-square by 7/8-inch-long hardwood block
2	Test leads, about 12 inches long
2	Plugs to fit your multimeter

To use the tweezers, simply connect them to an autoranging meter and grip the SMD. Very rapid measurements are possible using this simple tool.—*Dean F. Poeth II, K8TM, 218 Gower Rd, Schenectady, NY 12302;* **www.Poeth.com; dpoeth@worldnet.att.net**

USB, EIA-232 AND AMATEUR RADIO

◊ This is just a quick answer to the question in the June 2004 Hints and Kinks column. I recommend products from **www.ionetworks.com,** specifically, **www.ionetworks.com/products/usbtoserialconverters/**. These converters work every time, all the time.

The key to their success is software that keeps the specific physical COM port on the device pointed at the operating system (OS) COM-port assignment. The problem with many

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

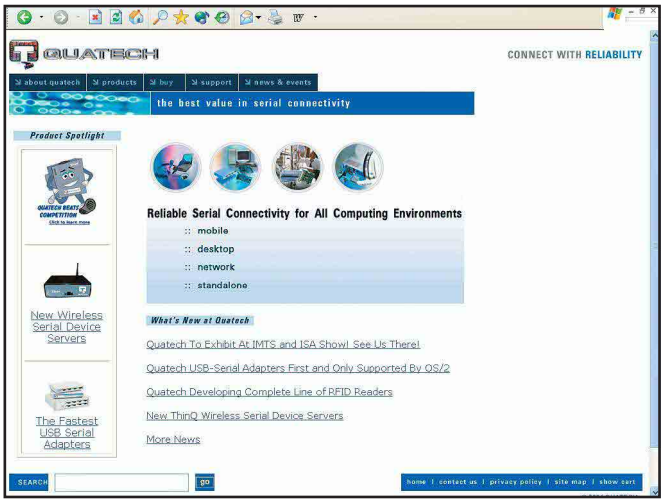


Figure 6—Quatech's home page (www.quatech.com). They supply USB/EIA-232 converters recommended by K1EHW.

adapters is that the COM-port number changes when starting the OS. *Windows XP* is particularly bad about it.

I do "a bit" of this stuff in the marine field, and this product is the only one that works for folks who have no technical knowledge. Once it is set up and running for them, it keeps working.

On my boat, I connect to a "four-porter": I run PACTOR on one, an NMEA autopilot on another and a GPS NMEA on another. They are always in the correct "place." The unit seems to be "RF proof," as it runs near marine radios and never flinches. —*Craig Owings, HP2XBA*; **craigo@pancall.com**

Another USB Story

◊ I saw your request for help with USB/EIA-232 devices. I can share my experience with such a device. I first needed a multiport board to implement a small RAS modem pool for our e-mail server. I found a company called Quatech that sells such a board (Quatech, 662 Wolf Ledgers Pkwy, Akron, OH 44311; tel 800-553-1170; **www.quatech.com**; **sales@quatech.com**). Their PCI multiport 232/485 board supports all modem lines. It has been in place now for four years.

I later had a need for a true EIA-232 port to expand a test set. I had written many *Visual Basic* programs that read torque data via a 19.2-kB standard COM port. As you stated, The old boxes (computers) had two standard COM ports COM1 and COM2. I purchased a new Compaq/HP box that had only USB ports. I went to Quatech again, and found they make USB/232 adapters, too. My program/hardware uses all the control lines for handshaking: RTS, CTS, CD, DSR and DTR. The adapter works flawlessly. The operating system in this case is *Windows 2000 Pro*. They (Quatech) supplied a CD that installed the drivers. (That was a bit confusing at the start because it kept reporting new hardware. That happened because it was installing a new device driver for each port.) I bought the four-port model: QSU 100. They make one-port, two-port, four-port and 16-port versions, in my case, COM3 through COM6. I set my source code to test each one, and again all lines are supported. I don't operate digital modes, but I'm sure the device will work with any rig requiring the hardware handshaking and a "STANDARD" EIA-232 interface. I hope this helps someone. Figure 6 is a screen capture of Quatech's home page.—*George Peters, K1EHW, 41 Barbara Dr, Norwalk, CT 06851-5306;* **k1ehw@arrl.net**

TUNING A WIRE J-POLE ANTENNA

◊ There have been many good 2-meter, or 2-meter/70-cm J-pole construction articles published in Amateur Radio magazines and numerous club newsletters. Unfortunately, they all fall short by not telling readers how to tune the new antenna.

I built two J-poles shortly after becoming an Amateur Radio operator. One tuned up just as advertised, the other was a lost cause. This antenna was constructed the same as the first, and I used the same batch of 300-Ω ladder line for both. I put this antenna aside for about three months, until one summer day I decided to discover just how to tune a J-pole antenna, first time *every* time.

Minimize SWR

I found that the distance between the feed point and the shorting bar determines the minimum SWR. If the antenna is too long or too short, the lowest SWR may be nowhere near 1:1. If you've followed the instructions and your dimensions are correct, however, that should not be the case.

I find it best to keep some extra wire at the bottom of the antenna matching section (about 2 inches). That lets me move the shorting bar up and down to find the minimum SWR. Do *not* use the stripped wire at the end of the matching section to form the shorting bar. Leave it straight and tack on a moveable shorting bar.

Resonant Frequency

Once you have the shorting bar set, do *not* cut off the extra wire at the bottom of the antenna. Move the shorting bar and the feed point *together*. Move them upward (shorter single wire) if the tuned frequency is too low, downward (longer single wire) if the tuned frequency is too high. Either way, maintain the distance between the feed point and the shorting bar. This insures that the SWR does not change.

The overall length of the antenna, the length of the matching stub, and the distance between the feed point and the shorting bar are not independent of one another. Since the construction-article authors have spent the time to optimize the antenna dimensions, however, you can treat these lengths as independent for the small changes needed to tune a J-pole.

A Bit More Information

I once constructed a J-pole antenna that was 3 inches too long, but with a matching stub of the correct length. The minimum SWR was about 3:1, and it would not resonate on 146 MHz, as expected. When I removed the extra length, it could achieve resonance on 146 MHz with a 1:1 SWR. Therefore, if an antenna cannot achieve a 1:1 SWR after you perform the steps above, check the overall length of the antenna again. The resonant (minimum SWR) frequency tells you if the antenna is too short (the frequency is too high) or too long (the frequency is too low).

I've built—or helped build—over 100 wire J-pole antennas, and I've yet to find one that couldn't be tuned using this method. If you have a problem wire J-pole in the closet, get it out and see if these instructions help.—*Phil Karras, KE3FL (OES, ORS, VE, and AEC), Carroll County, Maryland;* **ke3fl@juno.com**

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

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

ICOM IC-2200H 2 Meter FM Transceiver

Reviewed by Joe Carcia, NJ1Q
W1AW Station Manager

ICOM has introduced a new single band mobile transceiver with many functions and features. While some amateurs may not necessarily need all these "bells and whistles," they will find that the IC-2200H will meet the requirements for nearly every 2 meter application.

"Wow, all heat sink!" was my first impression when I pulled the radio out of the box. To answer that first question—no, there's no cooling fan! The IC-2200H does come with a remote control microphone; 3 meter long, fused dc cable; mobile mounting bracket with hardware, and microphone hanger.

This is a compact, no-nonsense, 2 meter FM mobile transceiver, weighing in at about 3 pounds. It includes all the features one would desire in an FM transceiver—CTCSS encoding and decoding (referred to as *Tone Scan*), DTCS or digital tone coded squelch, which performs a similar function to CTCSS using short sequences of sub-audible tones and is currently in favor with some emergency agencies, auto repeater offset, DTMF operation (DTMF decoding can be provided with the optional UT-108 Decoder Unit), programmable memory scan and band scan. The price is just above other single band radios, perhaps justified by the plug-in digital capability to be discussed later.

The radio includes expanded receive frequency coverage from 118 to 174 MHz, for both FM and AM modes. You can set the FM receive passband width from wide to narrow to match that of other services you may wish to monitor. The transmitter provides four power output settings: HIGH (65 W), MIDDLE (25 W), MIDDLE LOW (10 W) and LOW (5 W). I found the 5 W setting, appropriate for repeater operation in my area and used higher power just for some simplex operation.

The '2200H provides a total of 217 memory channels. This includes 6 scan edge memory channels (for scanning) and 1 call channel. There are 207 regular memory channels and 10 easily accessed memory *banks* (listed as A to J). Each memory can have up to a 6 character alphanumeric label including some symbols, such as *slash* or *star*.

It's Not a *Busy* Radio!

The front panel includes nine non-backlit buttons. With the exception of the POWER, S.MW(MW) and BANK (OFF) buttons, the functions of the remaining six buttons are labeled on the display. The POWER button is located to the left of the VOLUME control, with the S.MW(MW) below it. The RJ-45 modular style microphone jack is located beneath these two buttons. The BANK (OPT) button is located just below the MAIN dial. The letters in parentheses indicate those functions that are obtained through a menu procedure.

Reading from left to right on the display are the LOCK/SET, ANM/MONI, DUP/LOW, T-SCAN/TONE, PRIO/M/CALL and SCAN/V/MHZ functions. (The second listed functions are obtained by depressing the buttons for about a second.)

The LOCK/SET button toggles between locking the display or entering the SET mode. In the SET mode, the user may change various options, such as the color of the display (amber or green) or the CTCSS tone. The ANM/MONI button lets a user turn the monitor function or the channel names on or off (when using alphanumeric names for memories). The DUP/LOW changes the power settings as well the repeater offset, overriding the auto shift as needed. The T-SCAN/TONE button allows a user to select a tone function, whether it be the tone encoder (CTCSS), pocket beep, tone scan or even some of the functions related to digital mode operations (not available at press time). The PRIO/M/CALL button enables priority watch on a selected watch channel or a change to weather channel mode. The SCAN/V/MHZ button enables scanning or toggles between the VFO and memory channels.

The S.MW(MW) button is used for memory channel programming including incrementing the channel number. The BANK (OFF) button is used to select among the 10 memory bank channels.

Three solid plastic knobs are used to control VOLUME, SQUELCH and MAIN DIAL functions. The knobs are indented and have a smooth feel. I found it easy to fly by a desired setting with the MAIN DIAL until I got the feel for it.

The multi-function LCD display (measuring about 1 × 3 inches) has clear, easy to read alphanumeric characters. The display's brightness (DIM) level can be adjusted via a menu setting.

The display allows viewing from different angles. Even with it sitting atop my desk, I can look down and still read the display. When operating the radio from my truck, I found I was still able to see the display, although to me it appeared a bit easier if the display were amber—nice to have the choice. Speaking of the display, the front panel is not detachable.

On the rear of the radio, looking left to right you'll find the two-pin standard locking power plug pigtail. Above that are jacks for the external speaker and for DATA IN. Next is the large heat sink. A standard SO-239 chassis-mounted antenna connector rounds it out. Since the antenna connector is somewhat recessed between some long cooling fins and a smaller one on the opposite side of the connector, screwing on the PL-259 takes nimble fingers.

As noted, this radio is like one big heat

Bottom Line

With the IC-2200H ICOM has a solid 2 meter mobile radio ready to be upgraded to digital voice and data as soon as the optional module becomes available.

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

Table 1
ICOM IC-2200H, serial number 0501183

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 118-174 MHz; transmit, 144-148 MHz.	Receive and transmit, as specified.
Power requirement: Receive, 1.0 A (max audio); transmit, 15 A (high power).	Receive, 0.6 A; transmit, 13 A. Tested at 13.8 V.
Modes of operation: FM, AM (receive only).	As specified.
Receiver	**Receiver Dynamic Testing**
FM sensitivity, 12 dB SINAD: 0.14 μV typical.	For 12 dB SINAD, 0.13 μV.
AM sensitivity: Not specified.	For 10 dB S+N/N: 120 MHz, 0.57 μV.
FM adjacent channel rejection: Not specified.	73 dB.*
FM two-tone, third-order IMD dynamic range: Not specified.	73 dB. 10 MHz channel spacing: 91 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	90 dB.
S-meter sensitivity: Not specified.	S9 indication: 5.9 μV.
Squelch sensitivity: 0.1 μV typical.	At threshold: 0.09 μV.
Receiver audio output: 2.4 W at 10% THD.	2.5 W at 10% THD into 8 Ω.
Spurious and image rejection: Not specified.	First IF rejection, 110 dB; image rejection, 86 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output (H/M/ML/L): 65/25/10/5 W (approx).	69 / 26 / 9 / 4 W.
Spurious and harmonic suppression: ≥60 dB.	70 dB. Meets FCC requirements for spectral purity.
Transmit-receive turnaround time: Not specified.	PTT release to S9 signal, 164 ms, 50% audio output
Receive-transmit turnaround time (tx delay): Not specified.	112 ms.

Size (height, width, depth): 1.6×5.5×5.8 inches; weight, 2.8 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise-limited at the value indicators.

sink. With a maximum power output of 65 W and no cooling fan, you'll need this kind of sinking for proper heat dissipation. What's good about this is that you don't have a noisy cooling fan. The flip side is that since the radio's cabinet is used to dissipate heat, extra consideration must be given to where and how the radio is installed in either a mobile or base situation. The manual provides some basic installation tips with this in mind.

This quickly leads me to operating the radio. I tried running it on high power for quite some time (on simplex). The radio got quite warm, but never uncomfortably hot to the touch. It took some time for it to cool down afterwards, perhaps because there was little airflow in my shack at the time.

I reviewed this radio in late summer with popcorn thunderstorms, rain and humidity—welcome to summer in New England! With tropical storm Bonnie and Hurricane Charley knocking on our back door, it should come as no surprise that I listened with interest to the NOAA weather broadcasts. The '2200H provides coverage of 10 NOAA weather channels with a *weather alert* function (selectable via a menu setting). By depressing the PRIO/M/CALL button several times, you can select the weather group. You can activate the weather alert function by using the SET mode.

This weather alert function is one that many SKYWARN folk may find useful. In the event of an extreme weather situation, NOAA sends out a weather alert that is accompanied by a 1050 Hz tone, and then the weather report. You can set the '2200H to monitor (or scan) the 10 weather channels for this alert tone. If this tone is received, the '2200H will beep, and the display will indicate ALT (for *alert*) and the particular weather channel number.

You also do not need to be listening to a weather channel to receive this alert. You can be in casual QSO, but have the alert system running. However, be advised the '2200H will toggle back and forth about every 5 seconds between the weather channels and your listening frequency.

Another feature I like is the *Auto Repeater* function. When it is activated (the default is *On*), all you do is set the desired frequency and the radio sets the corresponding shift. (The shift is preset to conform to the accepted band plan of the country in which the radio is sold.) If a repeater has a nonstandard shift, you can disable this function and set the shift manually.

The *Channel Stepping* (tuning rate) is selectable from 5 (default) to 50 kHz in 8 steps via the SET system.

The '2200H provides for direct keypad frequency entry via the mic keypad. You depress the ENT/T-OFF (C) button first, and then you can key in the frequency. This occurs while in VFO mode. If you're in memory mode, you may enter a memory channel number instead of a frequency.

If a selected repeater supports phone patching or remote control of other functions, the 16 number DTMF MEMORY ENCODER can be quite handy. To memorize a DTMF sequence takes a few steps. It took me a couple of tries to get the process just right. The manual does a good job of explaining how to perform the programming and once you perform the actions a couple of times, it'll become second nature to set up.

Frequency Scanning is simple to set up. There are three scan types—full scan, programmed scan and memory bank scan. There are four scan resume options. The two I found most useful were timer scan; with pauses of 5, 10 or 15 seconds until scan resumed, or busy resume in which the scan will hold the frequency until the signal disappears.

To start scanning, you select the scan type and then press and hold the SCAN/V/MHZ button for at least 2 seconds. To stop the scan, you can either quickly depress the mic PTT button, or just depress any of the mic or display buttons. You can also control either scanning direction with the MAIN DIAL.

The IC-2200H has the standard fare of a priority watch function, pocket beep "common pager" function, time-out-timer, auto mute, auto power off. In terms of settings, there are 30 SET menus from which to choose.

A Mic of Many Functions

The DTMF 25-key backlit microphone (model HM-133V) performed as expected. Some microphone buttons can be programmed to operate some of the front panel control functions. I did have to get used to the UP and DOWN buttons being on the front of the microphone. But since they're located next to the PTT button, I can control the frequency (or any other

setting) with just a twitch of the thumb—very handy while driving. Audio reports from this microphone were all good.

So How Did It Perform?

Although it's one thing to receive good signal reports, it's another to actually hear "yourself" and how you sound on a radio. I always swap the radio with another ham so I can hear how well the audio sounds. As I expected, I found the transmit audio to be clean. (Reports from QSOs both on simplex and repeaters told me about the same.)

I used this radio both in my truck and at home. In both cases, I found the receive audio levels to be acceptable. The speaker is mounted underneath the radio, so when it was on my bench I had to prop it up. If this radio were to be mobile-mounted, however, I would see no need for an external speaker—unless the vehicle itself were really noisy.

I tried the old "operating the radio when W1AW came on frequency" while I was in the ARRL HQ parking lot under the antenna. I heard no intermod from W1AW. Yes, the signal appeared a bit wider than normal, but that is to be expected given the power of the ARRL code practice and my location. When I drove around town, I did not experience any other interference.

I could not find any mention of operating packet radio with the basic IC-2200H, although it should be capable of 1200 bps analog packet. Yes, you have the pin out for the microphone, and there is a pin for *Data In*. But I found no discussion about packet radio. With the UT-115 digital module (when available), the radio promises to handle data to 9600 bps and digital voice.

Programming

In general, there are two ways to program a memory channel—by using the display buttons or by the microphone keys. As with most radios, you select your frequency and settings (tones, offset, etc) first and then you go through the process of assigning that information to a memory channel. It's quite simple, actually. In VFO mode, set the frequency and settings. Depress the S.MW(MW) button momentarily. Then rotate the MAIN DIAL to the desired memory channel, and depress S.MW(MW) again to write the information.

When you're pushing a button to perform a function, there is certainly a difference between the terms "momentary" and "second." So don't be too surprised if you find that a function is missed simply because the "momentary" was a tad longer than it needed to be. But once you get used to it, it's a snap.

Send in the Clones

The IC-2200H can clone configuration data to and from another IC-2200H, or from a PC using the optional CS-2200H software and the optional OPC-478 serial cable. (The OPC-478U is a USB cable.) There is little information in the manual on exactly how to clone. The manual indicates that one should consult the cloning software help file for details.

A Manual, and a Half

The 94 page manual is laid out in a straightforward manner. You begin with *Foreword*, *Precautions*, *Supplied Accessories*, *Index* and then a *Quick Reference Guide* on installation and operation. The operation section starts with the general operation of the radio, including how to set up various functions. The rear of the section is devoted to menu functions and programming.

With the radio package, you also receive a book of *Ham Radio Terms*. This makes a nice little addition to help understand ICOM's terminology, or you may wish to give it to a family member.

What's *New* but Not Yet Available?

The IC-2200H is the first member of a family of ICOM VHF and UHF radios equipped for the yet to be released UT-115 digital voice and data module. We were hoping to have the module available for this review, but since it wasn't available we will provide an evaluation later. This module promises direct digital data transmission and digital voice operation simultaneously when used with another UT-115 equipped radio. When that is installed, the DATA JACK on the rear of the radio will be activated and allow connection to either a PC or a GPS receiver with an RS-232C serial port.

In order to install the UT-115, you will need to remove the front panel. It's as simple as removing two screws and the MAIN DIAL knob.

The following are the features expected to be supported when the digital option is installed: digital voice, digital call received retention, digital break-in (allows breaking into digital communications between two other digital mode stations), digital code/call sign squelch, 4800 and 9600 bps data communications (using a PC) and GPS operation.

A Closing Thought

Aside from not being able to play with packet, or with the digital option, I was quite pleased with the performance of this radio. I found I was able to handle many of the settings/menus without difficulty. Of course, not having it so chock-full of the "extra" features of a multiband radio didn't hurt. (Sometimes, too many is *too much*!) I believe that most hams would find that this radio would work fine for just about every application, especially if they wanted to be positioned for digital voice when the option becomes available. Although there are a few functions that some hams may never use, having them available is a selling feature.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 425-454-8155; **www.icomamerica.com**. Price: IC-2200H, $229.99; OPC-478 serial programming cable, $45.99; OPC-478U USB programming cable, $60.99; UT-108 DTMF decoder, $35.99.

Yaesu FT-897D and FT-857D MF/HF/VHF/UHF All-Mode Transceivers

Reviewed by Bob Schetgen, KU7G
Senior Assistant Technical Editor

It's Been Fun . . .

I reviewed the FT-897 in the spring of 2003.[1] My review experience and the results of our Lab tests sold me. I bought one, and I've not regretted it.

I had not yet completed a mobile installation, while on vacation in Maryland, so I operated on the Yaesu's internal battery from the back of my wagon with the hatch open and an old Hustler whip clamped to the hatch. A contact in Michigan from under a water tower was a good start.

While CW QRP with a reasonable antenna is great fun, operating ARRL Field Day from my father-in-law's yard taught me that 20 W fed to a mobile whip greatly limits SSB contacts. The flexibility of being able to operate the '897 either as a self-contained low power transceiver using the (optional) internal batteries or as a full 100 W transceiver from an auto battery or ac supply (optional internal FP-30 supply that fits in

[1]R. Schetgen, "Product Review: Yaesu FT-897 MF/HF/VHF/UHF All-Mode Transceiver," *QST*, May 2003, pp 63-67.

Bottom Line

The "D" models offer useful enhancements to make us consider an upgrade or make it a desirable choice for a first-time buyer—at the same prices as the original models without accessories.

the battery compartment or external supply) has contributed to its popularity.

My desire for a mobile station came from my wife's business. I support her, but the trips take me far from home with a lot of time on my hands. My old Hustler now resides on the wagon with a coax line that reaches the front seat or the hood. I can operate from inside or outside the vehicle comfortably with only a moment's notice.

One such trip found me in the rain outside a restaurant near Boston. The result was a wonderful contact with Argentina. We had landline quality, and the OM on the other end asked what I was running. The circuit ran from his amplifier and four-element Yagi to my FT-897 and the whip!

Okay, you know I'm happy with the old rig. The question for me, and many other users, is "why do I need a D?"

What's a "D" Model?

When the initial demand for the FT-100 began to diminish, Yaesu introduced a "D" model with some of the most popular accessories as standard equipment. The result was an enduring product that remains in their catalog.

Continuing that strategy, they have introduced the FT-857D and FT897D. Both operate *conveniently* on the five new 60 meter channels authorized for US hams. Also included is the temperature-controlled crystal oscillator stage that was optional on the previous models. In addition, the '857D includes the DSP circuit that was formerly an extra-cost option. The rest of the features and performance of the D models are comparable with the previous models. See the earlier reviews for the basic features, which remain unchanged in the new versions. Table 2 is the lab data taken to verify that the performance is similar to the original units. We installed the optional 500 Hz CW filters in one of the two open filter slots of each radio for testing. As noted there were some changes in receiver performance. Yaesu has made an attempt to improve dynamic performance through a change in roofing filter design, resulting in a significant improvement in in wide-spaced dynamic range. Other data is similar to the earlier version.

Figure 1—Front view of FT-897D with MH-59 Remote Control Microphone.

Figure 2—Front view of FT-857D with standard mic.

Figure 3—View of FT-857D with panel removed. The YSK-857 Separation Kit can be used to allow the front panel to be remotely mounted.

60 Meter Operation

The conditions for use of the 60 meter channels are unusual for amateur operation and are spelled out at **www.arrl.org/FandES/field/regulations/faq-60.html**. The five channels are specified by their center frequencies, bandwidth, mode and radiated power. The D models come factory programmed with five memories set indicating the channel center frequencies and in USB mode. Manually entered memory locations show the suppressed carrier frequency rather than the center of the channel and there has been some confusion resulting from this. The ARRL Lab confirmed that the

60 meter channels are indeed on the allocated frequencies when the factory provided channels are selected.

This makes 60 meter operation as simple as switching from VFO mode to memory mode and selecting the desired channel. Note that the FCC regulations limit output power to 50 W effective radiated power (ERP) compared to a dipole. If you have a dipole with no transmission line loss, you need to set your output power to 50 W to be compliant. With any other type of antenna you will need to compute and record the allowable power to be compliant.

Table 2
Yaesu FT-857D, serial number 4H0260120

Manufacturer's Specifications	*Measured in the ARRL Lab*
Receiver	***Receiver Dynamic Testing***
SSB/CW sensitivity, bandwidth not specified, 10 dB S/N: 1.8-30 MHz, <0.2 μV; 50-54 MHz, <0.13 μV; 144-148, 430-450 MHz, <0.13 μV.	Noise floor (mds), 500 Hz filter: *Preamp off* *Preamp on* 3.5 MHz –126 dBm –135 dBm 14 MHz –128 dBm –137 dBm Noise floor (mds), 2.4 kHz filter: *Preamp off* *Preamp on* 5.3 MHz –121 dBm –129 dBm
Blocking dynamic range: Not specified.	Blocking dynamic range, 500 Hz filter: Spacing 20 kHz 5 kHz *Preamp off/on* *Preamp off/on* 3.5 MHz 125*/123* dB 96/95 dB **orig** **111/109** **99/102** 14 MHz 122*/120* dB 96/95 dB **orig** **109/106** **96*/89*** Blocking dynamic range, 2.4 kHz filter: Spacing 20 kHz 5 kHz Preamp off/on Preamp off/on 5.3 MHz 116*/116* dB 91/91 dB
Two-tone, third-order IMD dynamic range: Not specified.	IMD dynamic range, 500 Hz filter: Spacing 20 kHz 5 kHz *Preamp off/on* *Preamp off/on* 3.5 MHz 84/83 dB 68/67 dB **orig** **91/90** **68/67** 14 MHz 88/88 dB 68/67 dB **orig** **86/89** **67/65** IMD dynamic range, 2.4 kHz filter: Spacing 20 kHz 5 kHz *Preamp off/on* *Preamp off/on* 5.3 MHz 81/80 dB 64/63 dB
Third-order intercept: Not specified.	Spacing 20 kHz 5 kHz *Preamp off/on* *Preamp off/on* 3.5 MHz +2.3/–6.8 dBm –18/–26 dBm **orig** **+5.6/–1.9** **–21/–29** 14 MHz +4.1/–4.9 dBm –20/–29 dBm **orig** **+1.3/–6.7** **–24/–32** 5.3 MHz +3.5/–5.6 dBm –19/–27 dBm
Second-order intercept: Not specified.	Preamp off, +78 dBm; on, +77 dBm.
Transmitter	***Transmitter Dynamic Testing***
Power output: HF and 50 MHz: SSB, CW, FM, 100 W, AM, 25 W (carrier); 144 MHz, SSB, CW, FM, 50 W, AM, 12.5 W (carrier); 430 MHz, SSB, CW, FM, 20 W, AM, 5 W (carrier).	CW, SSB, FM, typically 107 W high. 144 MHz: CW, typically 49 W high; 432 MHz: CW, typically 19 W high.
Spurious-signal and harmonic suppression: ≥50 dB on HF; ≥60 dB on VHF and UHF.	HF, 53 dB; 50/144 MHz, 61/63 dB. Meets FCC requirements.
SSB carrier suppression: >40 dB.	>70 dB.
Undesired sideband suppression: >50 dB.	56 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	3.5 MHz, third order, –21 dB PEP, fifth order, –32 dB PEP. (5.3 MHz data, –23 and –37 dB PEP).
Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.	

Bold type indicates data from the original FT-857 review.

*Measurement was noise-limited at the value indicated.

Why TCXO?

The TCXO option is popular because many operators want a temperature-compensated crystal oscillator reference to ensure that their operating frequency stays constant over a wide range of ambient temperatures. It is also a good idea considering the close frequency tolerances for 60 meter operation and V/UHF on CW and SSB. The option is also useful when the radio is used as a microwave IF. Finally, it's a necessity for narrow-bandwidth work such as the JT modes for EME at VHF and higher.

To Buy or Not to Buy?

Before purchasing the FT-897, I considered the FT-857, but I was looking for more than a mobile radio. Since then, the '897 has become my radio of choice and inspired a renewed interest in operating. I've put up a 525-foot-perimeter horizontal loop in the trees around the house, and now operate from home when I get the chance. Hence, I need to disconnect, carry and reconnect the rig for every trip. What a drag! How about a dedicated mobile rig for the car? Shortly after the FT-897, Yaesu introduced its mobile-dedicated counterpart, the FT-857.[2]

FT-857

Electronically, the two are nearly identical. The '857 gives up the compartment for internal batteries or power supply to achieve a *much* smaller package designed especially for mobile, rather than portable operation. The DSP board became an extra-cost accessory (now standard in the D model). The '857 also takes an accessory remote control microphone (MH-59A8J) that puts most of the radio's features in the operator's hand. (The microphone works with '897s, as well.[3])

The '857 has a removable front panel

[2]R. Arland, "Product Review: Yaesu FT-857 MF/HF/VHF/UHF Transceiver," *QST*, Aug 2003, pp 63-67.

[3]To work with the microphone, early (before about June 2003) FT-897s require a Yaesu firmware update. For the update, you must send the radio to a Yaesu repair facility. If the radio's warranty has expired, there is a small charge for the service.

You can determine whether a particular radio needs the update by repeatedly pressing the DSP button on the front panel. If the action simply brings up the DSP multifunction menu and leaves you there, the radio needs the upgrade. If repeated presses toggle between the current multifunction menu and the DSP menu, the radio should work with the microphone.

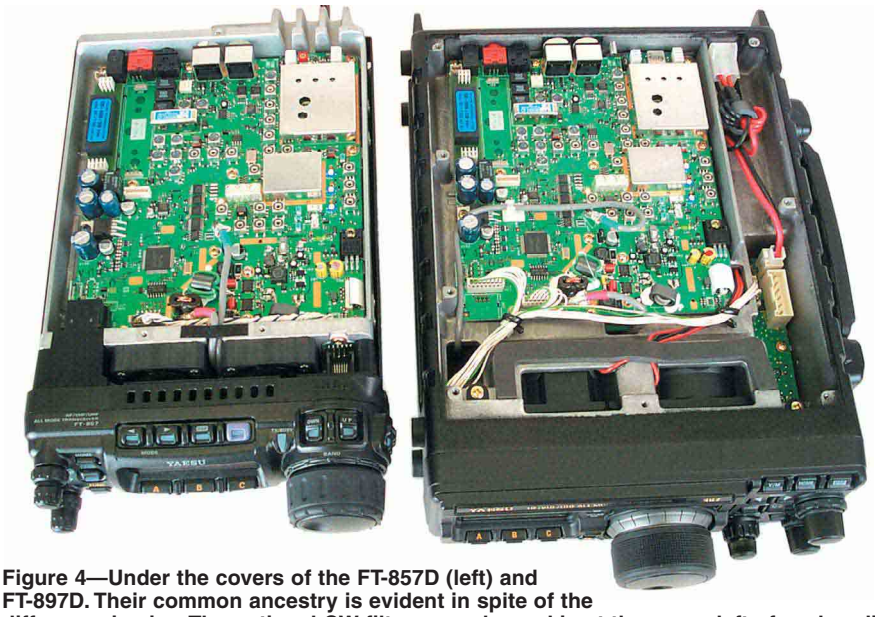


Figure 4—Under the covers of the FT-857D (left) and FT-897D. Their common ancestry is evident in spite of the difference in size. The optional CW filters are plugged in at the upper left of each radio.

Figure 5—Details of the MH-59 Remote Control Microphone front panel.

Figure 6—Tuning wheel on the side of the MH-59 Remote Control Microphone.

that can be remotely mounted, as is common with many mobile transceivers, but with a couple of twists. Many mobile radios forgo a front-panel headphone jack to save panel space, but there is a front-panel 1/8 inch headphone jack on the '857, as well as a speaker jack on the rear panel. By spacing several control buttons around the perimeter of the front panel—including the circular area behind the tuning knob—Yaesu has made them easier to locate by touch.

With FT-857D street prices below $800, I'll be looking when the payments on that new wagon are finished.

The MH-59 Microphone—Now That's Control

Figure 5 shows front and Figure 6 the side views of the mic. Anyone familiar with an '897 will recognize that many of the button labels match those on the '897 front panel. Some buttons serve three functions—as a tone pad in the DTMF mode, as a number keypad in frequency entry mode and specific functions when commanding the transceiver.

A small thumbwheel at the upper right of the mike also performs several functions controlled by the nearby AF/SEL/DIAL button. After a short press of the button, the wheel adjusts frequency as if it were the main dial on the front panel. Fast and slow tuning rates apply according to the action of the power buttons on the mic and front panel. A long press of the mic D/F button puts the radio in menu mode, and the thumbwheel acts as the SEL dial to select the various menus. After a long press of the AF/SEL/DIAL button, the wheel sets the AF gain.

Frequencies may be entered directly by pressing the ENT button followed by numbers from the keypad (D serves as the decimal point), with ENT pressed again to complete the entry. (The microphone essentially functions as a small CAT control pad, and it works with '897s, as well.[3]

Manufacturer: Vertex Standard, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; **www.vxstdusa.com**. Price: FT-857D, $769.99; YF-122C 500 Hz CW filter, $159.99; MH-59A8J Remote Control Microphone, $64.99; YSK-857 Separation Kit, $54.99; FT-897D, $879.99; FP-30 internal power supply, $209.99, FNB-78 Ni-MH battery pack (one or two can be used) $99.97; CD-24 charge adapter $119.99.

Going Once, Going Twice . . .

In order to present the most objective reviews, ARRL purchases equipment off the shelf from dealers. ARRL receives no remuneration from anyone involved with the sale or manufacture of items presented in the Product Review, Short Takes or New Products columns.—*Ed.*

The ARRL-purchased equipment listed below is for sale to the highest bidder. Prices quoted are the minimum acceptable bids, and are discounted from the purchase prices. All equipment is sold without warranty.

Details of equipment offered and bidding instructions can be found on the ARRL members' Web page at **www.arrl.org/prauction**. The following items are available for bid in the November auction:

- Ten-Tec Orion HF transceiver with built-in antenna tuner,
- Kenwood TS-480 HX 200 W mobile or fixed HF and 6 meter transceiver,
- MFJ-991 Automatic Antenna Tuner, SGC MAC-200 Automatic Antenna Tuner and control console,
- LDG Z-100 Automatic Antenna Tuner,
- LDG RT-11 Automatic Antenna Tuner with remote control head,
- Sounds Sweet Communications Speaker.

NEW PRODUCTS

STAINLESS STEEL MOBILE WHIP ANTENNAS

◊ MFJ has announced the availability of solid 72 inch and 108 inch stainless steel mobile whip antennas. Both sizes have standard 3/8 inch×24 threaded studs for use with standard mobile mounts. Prices: MFJ-1964, 72 inch antenna, $19.95; MFJ-1966, 108 inch antenna $24.95. For more information, contact MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759; tel 800-647-1800; fax 662-323-6551; **www.mfjenterprises.com**.

TECHNICAL CORRESPONDENCE

A MULTIBAND VFO USING THE AD-9830 EVALUATION BOARD

By Dan Cross-cole, N4ENM, 208 N Abingdon St, Arlington, VA 22203-2641; **n4enm@arrl.net**

◊ Having spent the better part of four years on the development of QRP transmitters and receivers, I reached a point where the primary point of dissatisfaction was the quest for the perfect oscillator. Yes, I had diligently worked to develop an oscillator with less than 100 Hz of drift per hour, using Varactor diodes, but the real frustration came when I wanted to develop a multi-band VFO that had a reasonable tuning rate. The prototype receiver had three tuning knobs and a band switch. This, because Varactor-diode tuning rates vary depending on the frequency range.

So it was that I sought a different approach. I looked to Analog Devices, mainly because I had found their digital signal-processing products to be satisfactory in a previous project, and I discovered on their Web site (**www.analog.com**) a device known as the AD-9830 direct-digital-synthesis chip. This chip is a complete digital synthesis oscillator. Input a number from the computer (via the parallel port) and get an output frequency up to 25 MHz. I ordered the chip (two, as usual) and downloaded the data sheets.

After reading the data sheets I realized that there exists an Evaluation Board with the chip and circuitry to interface it directly to the bi-directional parallel port available on many modern computers. I evaluated the cost/benefits of building my own board and purchased the ready-to-go unit. Interestingly, the chips were shipped from Taiwan but the board came from Ireland. Fortunately, the board arrived first.

When the board arrived, I saw that the chip is about 1/2-inch square, and each of the four sides has 12 leads. This means that the pins are *extremely* close together. I heartily recommend buying the Evaluation Board.

The board comes with software that runs under *Windows*. I tested it on *Windows 95* and *98*. The software has some limitations, however. The most serious is that the scanning mode, while useful as a sweep generator, has the annoying characteristic of not reporting the frequency when stopped during a sweep. This made it useless for a receiver, since we usually want to know the frequency of the signal on which we stop. Therefore, I had to develop my own control software. My first effort used that most ancient of languages, *QuickBasic*. Because it is text based, it allowed a very quick development of a test program. On the other hand, a text-based program does not take advantage of *Windows'* graphics capabilities. Therefore, I also developed a *Windows* program using *Visual C++* (Version 6.0). For comparison, it took me about two weeks to write the *QuickBasic* program and about six weeks to write the *C++* program. That would have been *even* longer had I not already solved some of the hardware/interface problems while writing the *QuickBasic* program. The source code for both programs is available on the ARRL Web site.[1] Those who want to use the source code in a commercial product should contact me before doing so.

Those who delight in checking software/hardware interfaces can check the output of the parallel port for given software inputs. Observation will show that a digital zero is required in bit D5 of the output control port (address 37A hex) for the output data to appear on the cable pins. In addition, bits D0, D1 and D3 are inverted. The bits for the output port (address 37A hex) are not inverted. The pin numbers for the various signals on the parallel interface are given in the instruction manuals that come with the evaluation board. The source code contains many comments to show how data is transferred to the parallel port.

Figure 1 shows a typical application for the AD-9830 Evaluation Board. Here, I used a buffer amplifier to keep the transmitter RF from getting back to the board and the receiver. The control program calculates the oscillator frequency needed to receive the desired frequency with a given IF. For example, if the IF is 4 MHz, the oscillator frequency must be 10 MHz to receive 14 MHz.

[1]You can download this package from the ARRL Web **www.arrl.org/files/qst-binaries/**. Look for 04TC11.ZIP.

My receiver was based on an article by Dave Benson, NN1G, in the November 1994 *QST*, except that I use 4.194304 MHz IF-filter crystals. I naturally assumed that this would also be the IF. When I compared it to my commercial digital radio, however, I realized there was a discrepancy of about 2 kHz. By tuning the oscillator around the IF, however, I was able to map the IF response and verify the actual IF. It was, indeed, about 2 kHz lower. I corrected the software, and clever code readers can discern the actual value in the code. In fact, you must change this number to suit your own system IF. The oscillator connects to the receiver via the SA-602 mixer chip, in place of what would be the local oscillator.

Another good feature of the evaluation board is that a pin (FSELECT) on the board that switches between two frequencies. I use the feature to go from the receiving frequency to the transmitting frequency. I derive the +5 V signal from the trans-

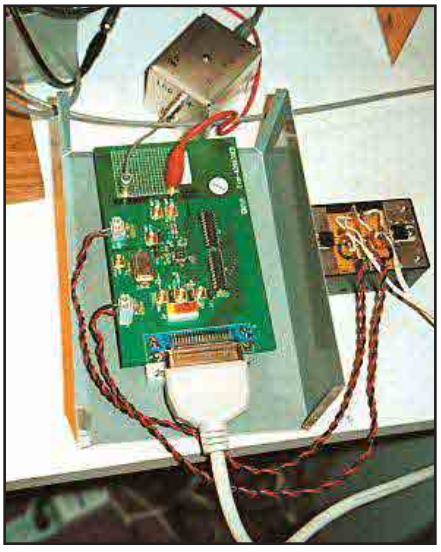


Figure 2—The AD-9830 Evaluation Board. The dual +5 V supplies are fed by two +12 V RadioShack ac adapters.

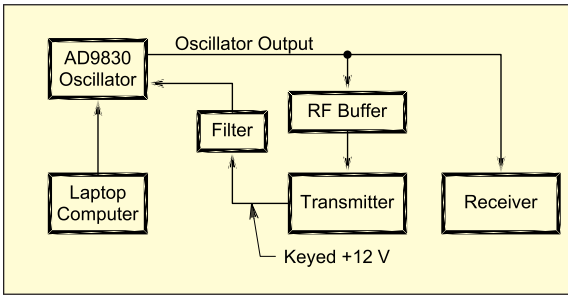


Figure 1—A block diagram of a station based on a AD09830 evaluation board. See text for details.

mitter keying voltage (+12 V). Be sure to filter this to get a steady dc signal.

Figure 2—The AD-9830 Evaluation Board, the dual +5 V power supplies and the bidirectional-parallel printer cable. The board contains an area for custom electronics. Notice the two RCA jacks. One is for the frequency output and the other is for the logic signal that switches between transmit and receive frequencies. The board comes with input and output connectors, but they are subminiature BNC connectors that are very difficult to find. I simply connected the RCA jacks to the original connectors. The small aluminum box houses an RF filter that converts the +12 V signal from the transmitter keying circuit to a +5 V signal and filters that signal to make a steady voltage. When the key is closed, the keyed voltage from the transmitter goes through the filter and puts +5 V on the FSELECT pin, thus changing the oscillator frequency from the receive oscillator frequency to the transmit frequency.

Figure 3 shows the display of the *Windows* program that controls the transmitter and receiver. The program is preloaded with the default receiving frequencies for the four bands that I use. The transmitting frequencies are loaded separately by the user. Neither transmitter operation nor temperature affects the frequency of the oscillator board within the limits of my digital frequency counter.

The display has four buttons for selecting the desired ham band and two boxes for transmit and receive frequencies. For the 40-meter (7 MHz) band, the oscillator is near 11 MHz. For each of the other three bands, it's about 4 MHz below the receiving frequency. When you select button, a default frequency is loaded into the receiving-frequency box. If you enter a frequency in the receiving box before selecting the band, the receiving frequency may not be what you wanted. The transmitting frequency, however, is exactly what you enter in the transmitting box. In both cases, enter all digits,. For example, for 7.040 MHz, enter 7040000. To enter a frequency, click (with the mouse) on the appropriate transmitter or receiver frequency box and type in the frequency (down to 1 Hz), then click on the ENTER button for that box.

The UP and DOWN buttons raise or lower the frequency in 100 Hz steps. This is adequate for CW work and compatible with the 500 Hz bandwidth of my IF amplifier. A left mouse click operates the UP and DOWN buttons, but holding down the click gives one change step. The keyboard "enter" key will continuously step when held down. I recommend using the mouse to select the appropriate UP or DOWN button, then use the keyboard "enter" key to move around the band.

Tests with my other radios indicate that the transmitter frequency does not change when the transmitter is keyed. The range of frequencies (1 to 25 MHz) means I can add other bands when I find room for more antennas. In addition, the ability to generate a test signal equal on the center frequency of the IF amplifier is very handy to test the receiver and its beat frequency oscillator response. Of course, the step size, and so on, can be changed if you have the *Visual C++* compiler, available at most software stores. The source code gives you a template for modification. With these tools, you can develop other uses for this handy little board.

Information on the Analog Devices AD-9830 Evaluation Board can be obtained from **www.analog.com**. *Visual C++* is available from Microsoft, Inc.

SOME COMMENTS ON "RS-232"

By Michelle Thompson, W5NYV, 5379 Carmel Knolls Dr, San Diego, CA 92130-3207; **w5nyv@arrl.net**

◊ "RS232" is a very interesting standard to look at from the perspective of an electronics hobbyist. The letters "RS" in "RS232" stand for "recommended standard." Ralph Gable discovered in the process of interfacing a PIC programmer to a laptop that a particular manufacturer might implement their RS-232 protocol differently from others (*QST*, August 2003, p 61). This occasionally causes some difficulty in attaching peripheral equipment and in designing interfaces.

Since the 1960s, when the very first RS232 standard was written, there have been several iterations of the standard. The most recent is RS232E. The most commonly used version is RS232C.

Ralph writes in the August 2003 Hints & Kinks column, "The specifications for RS-232 communication ports includes 12-V minimum levels." While 12 V may be the most commonly assumed minimum voltage level for communicating logic "0" by those using the RS232 protocol, 12 V is not the minimum according to the standard, by quite a large margin.

The voltage levels of RS232C are: A logic level of "0" on the RTS, CTS, DSR, DCD and DTR lines is represented by a voltage range from +5 to +15 V at the source or output device. At the receiving end of the cable, these signals must be above +3 V to comply with the standard. In other words, a loss of 2 V in the cable is allowed. A logic level of "1" must be between –5 and –15 V at the source device, and cannot be above –3 V at the receiving end of the cable.

This means that circuits designed to receive RS232 signals must respond to voltages of –3 V to –15 V with respect to ground as a logic 1, and voltages of +3 V to +15 V as a logic 0. Voltages between –3 V and +3 V at the receiving end are considered to be of an indeterminate or transitional logic state. They are assigned neither a 0 nor a 1.

Designers and experimenters, including many Amateur Radio operators, have come to assume that the oft-encountered personal-computer RS232-port voltage levels of +12 and –12 V are standard. This is not the case. Voltage levels of ±12 V are common, however, and are considered the "traditional" voltage levels of the RS232 interface. Many circuit applications assume these voltage levels as part of the design, and while many of these circuits will work at lower levels, some will not.

With the increasing number of laptops and other mobile devices that use RS232 ports, the downward pressure on voltage levels began as an inevitable result of the demand to optimize current consumption, which extends battery life. For example, my Dell laptop exhibits RS232 signal voltage levels of ±6.6 V, while my desktop PC comes in at ±14.1 V. Both of these measurements were made at the applicable output pins of the RS232 port. Many laptop voltage levels are low enough that digital interface circuits (such as for PSK31 and other PC-to-radio links) can fail if the circuit was designed around the traditionally higher RS232 voltage levels found in desktop PCs.

It should immediately come to mind

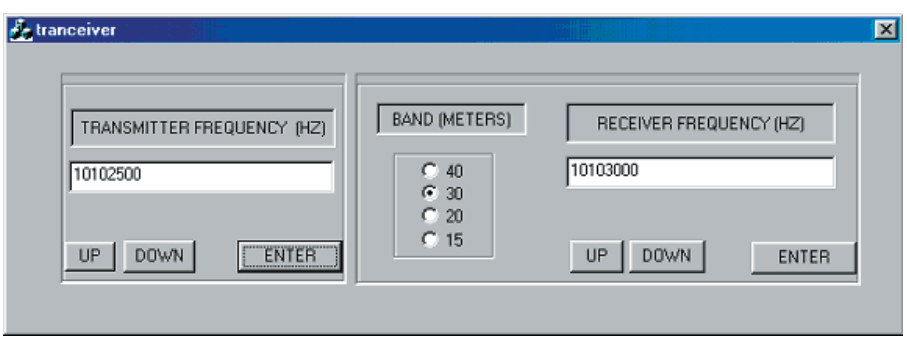


Figure 3—The transceiver screen as it appears in *Windows*.

that with the increasingly common use of laptop computers in all aspects of Amateur Radio, digital interface links need to be able to handle the entire range of RS232 voltage levels. Amateur Radio digital interface circuits, especially those that might be used for emergency communications, must be truly RS232 compliant and not just compliant for a narrow range of traditional voltage levels.

It is an important aspect of good design to understand the definition of a standard (such as RS232) and prepare designs that work for the *entire* standard, as, opposed to particular voltage level or narrow range of voltage levels. All circuit designs start with a set of basic assumptions. Yet in many cases it never occurs to the designer that assumptions, such as commonly used voltage levels for an interface, may change. Nonetheless, the one thing that an experimenter can count on is that things do change. Therefore, the best engineering practice when encountering an interface standard is to assume that *any* voltage level in the range given may be seen by the circuit in the field, and design accordingly.

COMMENTS ON THE POCKET APRS TRANSMITTER

By Lynn Barton, NX6B, 1336 J Lee Circle, Glendale, CA 91208-1730; **NX6B@arrl.net**

◊ The October 2004 article "A Pocket APRS Transmitter" was of special interest to me, as I built one of these kits earlier this year. When I had trouble getting the unit to work properly, Tony Barrett, N7MTZ, went beyond all reasonable expectations and repaired it, at no charge! The repaired unit certainly meets all of the claimed features (see the article).

Nonetheless, the article says that less than 1/4 W of RF output is "sufficient for most urban areas with well developed APRS repeater infrastructure." I guess that doesn't include the Los Angeles suburbs of Burbank, Glendale (my hometown) and Pasadena. On several test drives through those and neighboring cities, my signal was rarely received and displayed on **www.findu.com**.

There must be many fun applications for a pocketsize APRS transmitter, but before buying this one any interested ham should determine whether this low power unit is going to do the job at his or her location.

The authors reply

The Pocket APRS Transmitter is a low-powered device and because of that has definite range limitations under some conditions. However, we routinely use Pocket Trackers with mobile antennas to directly contact digipeaters over 50 miles away. Our digipeaters are very sensitive (partially due to Forest Service regulations), perhaps better than typical ham gear. We operate "line-of-site" in a valley surrounded by mountaintop digipeaters a mile above the valley floor. This is just one example of a case where Pocket Trackers have been used successfully in rural or smaller urban areas where there are good APRS repeaters and not too much APRS activity.

The situation can be quite different in large urban areas with much APRS activity. In such densely populated areas, the transmitter needs not only sufficient signal strength to communicate with the repeater, but must also compete with multiple APRS transmitters of greater power. Because APRS uses FM, the "capture effect" usually insures that the strongest signal captures the repeater receiver and weaker signals are not heard. In such situations as NX6B found in the Los Angeles suburbs, a higher-power transmitter is usually necessary. Under the conditions commonly found in the Pacific Northwest and other areas, Pocket Trackers work extremely well, all factors considered.

The "near space" balloon community appears to love their Pocket Trackers. We have documented numerous *direct* contacts (without the use of digipeaters) at distances of over *300 miles*.

I still have the **findu** raw data test logs for Lynn's Pocket Tracker that show it almost never failing to directly access a digipeater that is 14 air miles away, accessing it several times per minute over a period of hours, while sitting inside my home with a typical handheld transceiver antenna on it. In fact, its "hit rate" (percentage of posits making it to **findu**) was comparable to that of a typical mobile rig.

We agree completely with Lynn: Before buying one, any interested ham should test whether the Pocket Tracker is going to do the job. Better yet, if you are not completely satisfied with your Pocket Tracker purchase, please let us know and we'll do everything reasonable to ensure your complete satisfaction.

Best regards,
Tony, N7MTZ, and Jim, W4TVI

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

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

FEEDBACK

◊ The W1AW Qualifying Runs published in the October issue [p 98] actually cover the September dates. The text should have read: "W1AW Qualifying Runs are 10 PM EDT Monday, October 4 (0200Z October 5), and 4 PM EDT Wednesday, October 20 (2000Z October 20). The K6YR West Coast Qualifying Run will be 9 PM PDT Wednesday, October 13 (0400Z October 14) (40-10 WPM)." You can also find the Qualifying Runs schedule on the ARRLWeb at **www.arrl.org/w1aw.html#qualifying_run**.

◊ In the Product Review of "The Elecraft XV144 2 Meter Transverter Kit" [Oct 2004, p 68], the Elecraft K2 was referred to as a 5 W transceiver. It actually is specified as running up to 10 W output.

◊ In the Product Review of "A New Generation of Balanced Antenna Tuners" [Sep 2004, pp 60-66], some errors crept in while translating the tables from the earlier article by Frank Witt, AI1H. In both Tables 4 and 5, in the load column, change 6.25 to 12.5, 12.5 to 25 and 25 to 50. In Table 4 in the SWR 1:1 row, under 15 Meters, change the power loss from <10% to 11%. In Table 5, in the top 4:1 row, change the cell under 15 Meters from No Match to 15, 1 and 0. In the same row under 10 Meters, change the cell from No Match to <10, 3 and 0. You can find the corrected tables at **www.arrl.org/qst/feedback/2004/11**.

◊ *VHF/UHF Propagation—A Practical Guide for Radio Amateurs*, by Ken Neubeck, WB2AMU, and Gordon West, WB6NOA [New Products, Oct 2004, p 95], is also available from the ARRL Bookstore. Telephone toll free in the US 800-277-5289, or 860-594-0355; **www.arrl.org/shop/**; **pubsales@arrl.org**. Order no. 9428; $15.95 plus shipping.

◊ An editing error crept into "The Wheatstone Bridge" sidebar in October 2004, p 60. The first sentence of the second column should begin, "Since *no* current flows between the two dividers..." N2XE's original text was correct.

NEW PRODUCTS

WRISTWATCH WITH ELECTRICAL FORMULAS

◊ TechNote Time Watch Company has released a pair of watches designed for those working in the electrical and electronics fields. Their initial product line consists of specialty analog wristwatches displaying Ohm's law, power formulas and a resistor band chart, for ac (shown) or dc applications.

TechNote Time Watch Company is a new venture located in Ocala, Florida. Their product line will eventually be expanded to include desk and wall clocks. For more information, please visit their Web site, **www.technotetime.com**.

ARRL Gets Federal Grant to Tell Amateur Radio's Story to Communities

The ARRL has received new funding of nearly $90,000 from the Corporation for National & Community Service (CNCS) to execute a pilot program that will enlighten localities about the value of Amateur Radio to community safety and security. The one-year grant will enable ARRL to develop the Community Education Project (CEP) and carry ham radio's message to a dozen communities across the US. The CNCS also has renewed ARRL's Amateur Radio Emergency Communications course tuition reimbursement grant for a third, and final, year. The emergency training grant totals $179,600. ARRL Chief Development Officer Mary Hobart, K1MMH, says the CEP will work with Citizen Corps and ARRL personnel. The League is a Citizen Corps affiliate.

"While our friends and major partners understand the power of Amateur Radio in an emergency, a clear understanding of what certified Amateur Radio operators can accomplish to enhance safety and security has not trickled down to the general community," Hobart said. "We know that our best work happens at the local level to keep communities safe and secure."

As examples, Hobart cited Amateur Radio assistance following recent hurricanes and wildfires. The Community Education Project will be an extension of the role hams play as individuals, within local clubs and on Amateur Radio Emergency Service (ARES) teams, she said. The CEP will work through local civic organizations, news media, faith-based groups, schools, food banks and a variety of other community organizations to get Amateur Radio's message across, Hobart explained. The League is now seeking a CEP coordinator.

Corporation for NATIONAL & COMMUNITY SERVICE

Emergency Communications Training Grant Renewed

Hobart also said she was extremely gratified to see the third-year Amateur Radio Emergency Communications course tuition-subsidy grant come through.

"This grant award—totaling $266,599 for the two programs—is a vote of confidence for what hams have accomplished over the past two years by being responsive to national security needs and in times of emergency," she said. "We're thrilled that we got this." Hobart said that in the two years since ARRL signed a *Statement of Affiliation* with Citizen Corps the League has increased its involvement with homeland security. She notes the ARRL amply exceeded the goals of the first two years' CNCS grants, "and we want to continue that tradition."

During the first two years' grants, the ARRL certified nearly 2200 emergency communicators, including nearly 370 trainers. The third-year grant, which will provide training for another 1700 volunteers, will place even greater emphasis on providing Amateur Radio emergency communications training to licensees age 55 or older, since it requires that the number of senior volunteers certified rise from 50 percent to 75 percent. "This is a call to action to older hams who have not taken the ARRL Amateur Radio Emergency Communications course to enroll," Hobart said.

ARRL Emergency Communications Course Manager Dan Miller, K3UFG, will be traveling extensively to both Amateur Radio and emergency communications-related events and meetings to drive home the point that hams play a vital role in times of disaster and emergency. "With full reimbursement of the registration fee for ARRL members, the training is virtually free—but only for one more year," he said. He also urged those who have already completed Level I to further their knowledge by completing the Level II and Level III courses. Tuition is reimbursable for all three course levels.

"The demand for trained Amateur Radio operators continues to grow at a phenomenal rate," Miller emphasized. "By completing the emergency communications training, you are reinforcing the lifeblood of Amateur Radio—emergency communications."

Level I course registration opens on the first Monday of every month and is available via the ARRL Certification and Continuing Education page on the League's Web site, **www.arrl.org/forms/cce/**. Registration also is available by mail. Send check or money order to ARRL, ATTN CCE, 225 Main St, Newington, CT 06111. In the comment section, write EC-001 (for Level I) or the designator for the course you wish to enroll in.

"If you are 55 or over, write 'senior' next to the course designator, and your name will be added to the next available class for that course," Miller said. "If you hold an ARRL Field Organization appointment, add that title in the comment section. Field appointees move to the top of the list." Registrants also should include a preferred e-mail address, telephone number, age and veteran status. Missing information will delay processing.

The CNCS grants to ARRL were among $8.7 million for homeland security volunteer projects supporting more than 32,000 volunteers and sponsored by 29 national and local organizations.

A grant from ARRL's corporate partner, United Technologies Corp, will continue to subsidize Amateur Radio Emergency Communications course training until the end of 2005.

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

Spectrum Defense Fund 2005: Without Spectrum, Ham Ticket Useless, Haynie Says

ARRL President Jim Haynie, W5JBP, says that while interference from broadband over power line (BPL) technology is the most prominent and immediate threat to amateur spectrum, generous donations from ARRL members and supporters have enabled the League to face it and other spectrum challenges. Haynie made the comment as the League kicked off its 2005 Spectrum Defense Fund campaign, which has as its slogan, "*more* than just BPL!" Haynie says that not all of ARRL's advocacy efforts necessarily involve taking defensive measures, such as with BPL, but all of them are essential.

"Forty meters, 'Little LEOs' some years back, the work that the League's Technical Relations Office in Washington does—all of this makes the spectrum available to us," Haynie said. "And without spectrum, the license that we have in our pocket or hanging up on the wall is pretty much useless."

ARRL President Jim Haynie, W5JBP

Haynie says that, as he sees it, the League's job is to look out for the best interests of Amateur Radio and make sure that we have spectrum to operate on. "And that's a big job, it's a *huge* job that we've undertaken. It becomes very important because spectrum is so precious."

It's also a job whose cost and complexity have risen considerably in the past decade, as new technology-driven demand for spectrum has put increasing pressure on Amateur Radio frequencies. World Radiocommunication Conferences, at which the ARRL and the International Amateur Radio Union represent Amateur Radio's interests, now occur every two or three years instead of once a decade. As ARRL CEO David Sumner pointed out in his October "It Seems to Us . . ." *QST* editorial, in such an environment, the League no longer can cover the cost of its operations and advocacy efforts with dues revenue and the sale of publications and *QST* advertising.

In 1985, the League spent perhaps $200,000 on advocacy and spectrum defense. The League's Washington office at the time consisted of one staff member. As 2005 looms, it's a much different picture.

"Today we spend close to $900,000," Haynie said, "and I know it's something that hams can't see, touch or feel, but it's just as important as those things that they can—like *QST* and the *Handbook*, because we would not have all those things if it were not for the fact that we have a place to operate."

The 2005 Spectrum Defense Fund depends on membership support and is essential to the League's continued success. Radio amateurs may contribute online via the ARRL's secure donor Web site, **https://www.arrl.org/forms/fdefense/fdefense.html**. Those contributing at or above the $50 level may request a gift as a token of the League's appreciation.

For more information about the 2005 Spectrum Defense Fund or to discuss other ways you can support the ARRL's continuing work on behalf of Amateur Radio, contact ARRL Chief Development Officer Mary Hobart, K1MMH, **k1mmh@arrl.org**; 860-594-0397.

ARRL HAS ROLE IN MARYLAND AMATEUR TOWER CASE VICTORY

ARRL member John Evans, N3HBX, has said he'll go forward with plans to erect four 192-foot towers on a 44-acre farmland tract he owns near Poolesville, Maryland. ARRL General Counsel Chris Imlay, W3KD, testified as an expert witness on Evans' behalf September 9 when a Montgomery County Circuit Court judge denied a request for a preliminary injunction brought by Evans' neighbors in an effort to have his building permits for the structures rescinded.

"Thank you for your sterling support today!" Evans e-mailed Imlay after the ruling by Circuit Court Judge DeLawrence Beard. "I am sure it made a difference." While another court proceeding to deal with the interpretation of Montgomery County's zoning ordinance lies ahead, Evans' attorney, Steve Van Grack—a former Rockville mayor—has told him he's free to put up his towers, even at the risk that they might have to come down later if the courts ultimately rule against him.

"And that is what I plan to do," Evans said.

Imlay says Judge Beard was not convinced by the assertions of Evans' neighbors that installing the four antenna support structures would result in irreparable harm, and the judge declined to grant an injunction to stop the project until its legality could be established in court. "The issue was whether or not a special exception—like a conditional use permit—is required or just the building permits that were issued by the County," Imlay explained. A conditional use permit would have required a public hearing.

"Evans is not out of the woods yet, but this [ruling] allows him to put up the towers," he said.

Judge Beard ruled only on the preliminary injunction request, however. The neighbors earlier had attempted to get a temporary restraining order, but the Circuit Court denied that request on August 30. In turning down the injunction request, Judge Beard said the towers could come down just as they went up—if that was his final decision—so any harm to the neighbors would not be irreparable.

The county granted Evans a building permit to construct the towers as accessory use structures on June 23. Evans reportedly paid just over $1 million for the property, which is within Montgomery County's agricultural reserve.

Evans' neighbors have strenuously opposed the DXCC Honor Roller's plans to put up the towers for his new contest station, and they have told reporters the latest setback will not halt their efforts. Contending the tower project will destroy the "rural character of the area," more than 200 area residents have signed a petition requesting a public hearing.

Evans has met with delegations of neighbors in an effort to accommodate their complaints—including an offer to plant trees to obscure the towers. He also offered to remove the towers in 15 years when he'll be in his mid-80s and "probably no longer interested in pursuing the hobby," one news report quoted him as saying.

NEW ORBITAL DEBRIS MITIGATION RULES APPLY TO HAMSATS

Future Amateur Radio satellite projects will have to comply with new FCC Amateur Radio space station rules that impose requirements to mitigate orbital debris. Wrapping up a proceeding begun in 2002, the FCC adopted a *Second Report and Order* (*R&O*) in IB Docket 02-54 on June 9. The new rules, which appeared September 9 in the *Federal Register*, affect the Commission's Part 5—Experimental Service, Part 25—Satellite Communications and Part 97—Amateur Service rules. In general, they require submission of an "orbital debris mitigation plan" to the FCC with each license application. AMSAT-NA—the Radio Amateur Satellite Corporation—had wanted Amateur Radio exempted from any orbital debris mitigation requirements that went beyond what the FCC had initially proposed for Part 97 in 2002. AMSAT-NA President Robin Haighton, VE3FRH, said the organization has been discussing the implications of the *R&O* but had reached no formal position as of press time.

"While AMSAT does not like to be restricted—we are free enterprise people—we do acknowledge that even space is not limitless," Haighton told ARRL. "The more debris there is, particularly in lower orbits, the more danger there is of collisions and eventually the greater the difficulty in defining launch windows." He indicated that the AMSAT Board of Directors planned evaluate the FCC *R&O* prior to its annual meeting in October with an eye toward developing guidelines and requirements for building AMSAT satellites.

The AMSAT-NA president said that while he personally agrees with the notion of limiting space debris, "the application of this principle may be a problem."

The new rules the FCC ultimately ordered will significantly expand §97.207(g) of the Amateur Service rules governing space stations. The additional provisions will require "a description of the design and operational strategies the space station will use to mitigate orbital debris" that includes statements covering several specific areas. Space station license grantees will have to state, among other things, that they have "assessed and limited the amount of debris released in a planned manner during normal operations" as well as the probability that the space station itself could become a source of debris through collisions with other debris or meteoroids.

In its comments filed with the Commission, AMSAT took "strong exception when it comes to meteors." Those launching satellites, AMSAT said, can assess the orbital parameters of known objects but "no such information is available for meteors."

Satellite licensees also must state that they have assessed and limited the probability of accidental explosions during and after completion of mission operations. "This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft," a new 97.207(g)(1)(ii) rule section specifies.

Such a scenario occurred in the case of AO-40, which suffered a catastrophic onboard event—Haighton, in an interview at the time with ARRL, called it "a minor explosion"—not long after it went into orbit in 2000. AO-40 went silent earlier this year. AMSAT has commented that as a practical matter, the objective of minimizing debris from accidental explosions "is unlikely to be met by additional failure-mode analysis."

The demonstration also would have to address whether "stored energy" would be removed at the end of the spacecraft's life "by leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharged state and removing any remaining source of stored energy."

Satellite licensees will have to include a statement disclosing the "accuracy—if any—with which orbital parameters of non-geostationary satellite orbit space stations will be maintained." AMSAT has asserted that "state-of-the-art practices do not allow specification of the Keplerian orbital elements of spacecraft with sufficient accuracy to predict or avoid the collision of two space objects."

AMSAT pointed out that many smaller satellites of the type most likely to be launched for Amateur Satellite use lack propulsion systems to maintain a certain orbital tolerance or to deorbit the spacecraft when its mission is over. Most, AMSAT told the FCC, would burn up in the atmosphere.

AMSAT had suggested in its reply comments to the FCC that the issue of orbital debris needed more study and broader participation by stakeholders, "because of the complexity of the matter and the economic impact regulations might have on future satellites."

The FCC has not yet announced an effective date for the new Part 97 rules.

Amateur Enforcement

♦ **Let's make a deal: FCC agrees to trade amateur's license for big fine:** The FCC has agreed to write off a $12,000 fine it levied against an Iowa man in exchange for his giving up his Amateur Radio license for five years. The FCC last year affirmed a $12,000 fine against Technician licensee Scott E. Kamm, NØUGN, of Sioux City. Kamm later filed a *Petition for Reconsideration* that proposed the license-for-fine *quid pro quo*. The Commission formally granted his petition in a September 7 *Memorandum and Order* (*M&O*).

"In support of his petition, Mr. Kamm offers to immediately withdraw his pending application for renewal of his license for amateur radio station NØUGN, and to refrain from applying for any other license for a period of five years," the *M&O* said. "Accordingly, we conclude that cancellation of the $12,000 forfeiture is warranted."

The FCC said its Wireless Telecommunications Bureau (WTB) would process the withdrawal of Kamm's license renewal application concurrently with its order. FCC Enforcement Chief David Solomon signed the *M&O*, which was released September 9.

Following up on Amateur Radio complaints in the fall of 2002, agents from the FCC's Kansas City field office tracked interfering signals to Kamm's station—which was in Waterbury, Nebraska, at the time. Several months earlier, however, the FCC had granted Kamm's application to change his mailing address to a location in Sioux City.

In January 2003, the FCC issued a *Notice of Apparent Liability* to Kamm alleging willful and repeated interference to ongoing amateur communications, broadcasting of music, and failure to identify by call sign while operating on a 2-meter repeater.

During 2002, Kamm was the target of several letters and an FCC *Warning Notice* from FCC Special Counsel for Enforcement Riley Hollingsworth. In the fall of that year, the WTB set aside Kamm's renewal application based upon complaints about the operation of his station and questions regarding his qualifications to be a licensee. Kamm's license expired September 29, 2002, and his renewal application reverted to pending status while the matter was referred to the Enforcement Bureau.

ASTRONAUT COMPLETES WAC+ FROM NA1SS

OnSeptember 11, astronaut Mike Fincke, KE5AIT, became the first International Space Station crew member to contact all seven of the world's continents via Amateur Radio from space. Fincke worked KC4AAC at Antarctica's Palmer Research Station for his last contact—a bonus continent not required to earn the International Amateur Radio Union's Worked All Continents award. He spoke with ARRL Life Member Chuck Kimball, NØNHJ, of Colorado and a packed radio room during an 8° (above thr horizon) maximum pass over that part of the globe.

"I think the contact caught the interest of most everyone here, and raised everyone's spirits a bit," Kimball remarked afterward, calling it "the highlight of the day."

During their QSO, Fincke and Kimball compared and contrasted life in the two stations, discussed time zone differences and Fincke's ISS fluids experiments. There are several similarities between being aboard the ISS and wintering over in Antarctica. Like Fincke, Kimball and most of his team at Palmer arrived at their station in April and were scheduled to leave in late October.

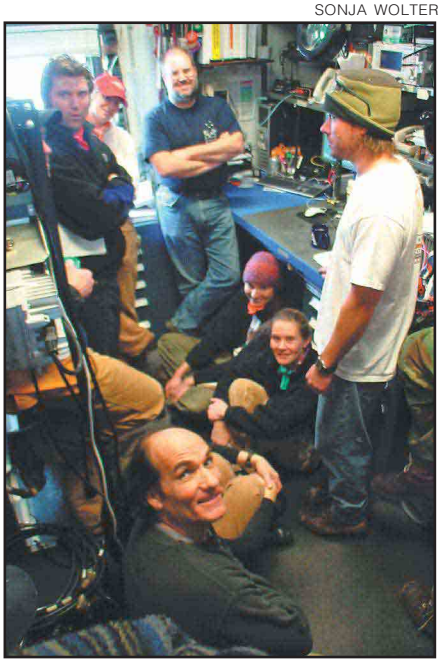
Kimball says Palmer is the smallest of the three US year-round Antarctic stations. "Most of the activity goes on during the austral summer, with the main thrust starting in October," he said. "For the winter, we have a couple of science support people to monitor and maintain the year-round experiments. The largest research activity here is biology related, so very little goes on during the winter once most of the animals have fled north."

Fincke is believed to be only the third astronaut to work the world's seven continents from space. In 1992, astronauts David Leestma, N5WQC, and Kathryn Sullivan aboard the space shuttle were the most recent when they also worked Palmer Station to complete their list.

NASA

Expedition 9 astronaut Mike Fincke, KE5AIT, works KC4AAC from NA1SS to log his seventh continent from the ISS. He's using the Amateur Radio on the International Space Station (ARISS) Phase 2 Kenwood TM-D700E transceiver located in the crew's quarters.

SONJA WOLTER



The Palmer Station crew in Antarctica. Chuck Kimball, NØNHJ, is wearing the blue shirt.

Media Hits

■ An article in the Algoma, Wisconsin, *Record Herald*, the Kewaunee *Enterprise* and the Luxemburg *News* recounted the adventures of a ham couple, Jim and Patty Martin, W5AZN and W5AZO, of Richardson, Texas. The Martins operated from several lighthouses in three Wisconsin counties August 5-14.

■ "Radio Stations Rally for Victims of Hurricane" in *The Sarasota Herald-Tribune* lauded John Duarte, KG4UMK, who helped put local radio station WIKX back on the air after it lost its roof, power and telephone service in the wake of Hurricane Charley.

■ As Hurricane Frances hit Florida, WWMT-TV in Kalamazoo, Michigan, provided viewers with a real-life example of how local Amateur Radio volunteers were working with Red Cross personnel to provide any needed communications assistance.

■ Florida's Palm Beach *Post* reported on Labor Day that ham radio—as well as cell phones, telephones and computers—were pressed into service when Hurricane Frances knocked out the county's emergency response radio system.

■ A BBC Radio 4 documentary "Unsung Heroes" aired September 4. It recounted the efforts of Amateur Radio operators on behalf of rescue and relief agencies following the September 11, 2001, World Trade Center attack. The program included interviews with several radio amateurs, among them Carlos Varon, K2LCV, and Jeff Schneller, N2HPO, of the Salvation Army Team Emergency Radio Network; Mark Phillips, KC2ENI/G7LTT; Charles Hargrove, N2NOV, and others.

■ The *Daily Local News* of West Chester, Pennsylvania, published an obituary of Louis Seltzer, WI3J, of Bryn Mawr. A ham from the age of 11, Seltzer co-founded Chester County's first radio station, WCOJ in Coatesville.

■ An article in the August 2004 issue of *EMS: The Journal of Emergency Care, Rescue and Transportation* summarized the efforts of both the Los Angeles County Disaster Communications Service and Amateur Radio's role in providing emergency communication.

■ The Detroit *Free Press* published an article by its technology writer, Mike Wendland, K8ZRH, entitled "Radio Operator Helps Track Hurricane." It recounted the efforts of Oakland County ham Floyd Soo, W8RO, a member of the Hurricane Watch Net, who relayed critical weather data to the National Hurricane Center in Miami during Hurricane Ivan when hams close to Miami were not able to make contact.

ARRL HEADQUARTERS WELCOMES NEW MEDIA AND PUBLIC RELATIONS MANAGER

Allen Pitts, W1AGP, is the newest member of the ARRL Headquarters staff. An Amateur Extra class licensee who lives in New Britain, Connecticut, Pitts came aboard September 20 as the League's new Media and Public Relations Manager, succeeding Jennifer Hagy, N1TDY, who was a member of the HQ staff for 10 years. As Pitts sees it, he's arriving at the League at a critical juncture for Amateur Radio.

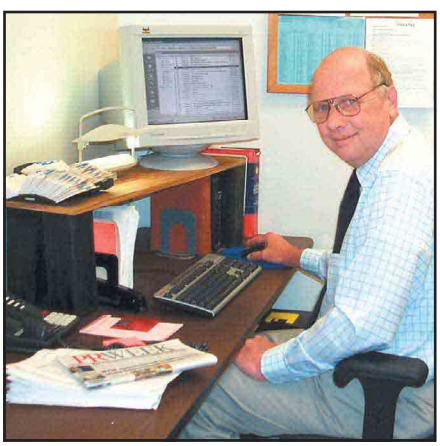
"I know of no time in history that our service has been under greater threats, nor any other time in which we have so many opportunities to shine," he said. Pitts emphasizes that while he takes his public relations role most seriously, he also wants it understood that he's an active radio amateur and "not just a PR person."

Pitts comes to the ARRL after a three-year stint as executive director of The Box Project Inc—a national, member-based charity that matches volunteers with families needing help. For eight years prior to that, he directed a multi-program human services agency that, among other things, was responsible for emergency shelters, transitional living, a court alternative sanctions program, emergency food services and an AIDS respite program.

A radio amateur for five years, he's no stranger to the ARRL Field Organization, having served as an ARES District Emergency Coordinator and later as Connecticut's Section Emergency Coordinator. He's also an ARRL Assistant Section Manager.

Pitts holds a bachelor's degree from the University of South Carolina and a master's degree from the Lutheran Theological Southern Seminary (he served congregations in Kansas and Connecticut in the 1970s and 1980s).

He and his wife, Donna, have three grown children and six grandchildren. They're currently "raising" an English mastiff named Dozer, who, Pitts says, "believes the radio room couch belongs to her."



ARRL Media and Public Relations Manager Allen Pitts, W1AGP.

Pitts is active on HF, VHF and UHF. Although primarily a phone operator, he says he tries to keep up at a "basic level" on CW whenever he can. He holds DXCC.

In addition to his interest in Amateur Radio, Pitts is an active member of the Society for Creative Anachronism and has gained "notoriety"—as he put it—as an expert with medieval crossbows, holding top state and national rankings.

ARRL INTERNATIONAL HUMANITARIAN AWARD NOMINATIONS CLOSE DECEMBER 31

Nominations close December 31 for the 2004 ARRL International Humanitarian Award. The award is dedicated to an amateur or amateur group devoted to promoting human welfare, peace and international understanding through Amateur Radio. The League established the annual prize to recognize Amateur Radio operators who have used ham radio to provide extraordinary service to others in times of crisis or disaster.

The ARRL International Humanitarian Award recognizes our unique role in international communication, and the assistance we regularly provide to people in need throughout the world. Amateur Radio is one of the few telecommunication services that allow people throughout the world from all walks of life to meet and talk with each other, thereby spreading goodwill across political boundaries.

A committee appointed by the League's President recommends an award recipient to the ARRL Board of Directors, which makes the final decision. The committee is now accepting nominations from Amateur Radio, governmental or other organizations that have benefited from extraordinary service rendered by an Amateur Radio operator or group.

Nominations must include a summary of the nominee's actions that qualify the individual or group for this award, plus verifying statements from at least two individuals having first-hand knowledge of the events warranting the nomination. These statements may be from an official of a group (for example, the American Red Cross, the Salvation Army, a local or state emergency management official) that benefited from the nominee's particular Amateur Radio contribution. Nominations should include the names and addresses of all references.

All nominations and supporting materials for the 2004 ARRL International Humanitarian Award must be submitted in writing in English to ARRL International Humanitarian Award, 225 Main St, Newington, CT 06111. In the event that no nominations are received, the committee itself may determine a recipient or decide to make no award.

Please see **www.arrl.org/FandES/field/awards/humanitarian.html** to check the terms of reference and find the directions to follow for nominations. The award winner receives an engraved plaque, and is profiled in *QST* and other ARRL venues.

The 2003 ARRL Humanitarian Award winners were Jan Heaton, KF4TUG, and Charles Mike Young, KM9D, who helped save a life while at sea.—*Chuck Skolaut KØBOG*

TEAM USA COMPETES AT ARDF 12TH WORLD CHAMPIONSHIP

A 21-member delegation represented the US and ARRL at the Amateur Radio Direction Finding 12th World Championship in the Czech Republic September 7-12. ARRL ARDF Coordinator Joe Moell, KØOV, says this year's global competition attracted 327 competitors from 28 countries to the town of Brno—some 110 miles southeast of Prague. ARDF is sometimes called foxtailing or radio orienteering, and world championships take place in even-numbered years.

"In ARDF championships, each entrant competes on 2 meters and on 80 meters, on separate days," Moell explained. "There are five age categories for males, and four age categories for females, in accordance with International Amateur Radio Union (IARU) ARDF rules. Each country may to have up to three persons per category on its team." Medals go to the top individuals

COURTESY CHARLES SCHARLAU, NZØI

Team USA. (L-R) Back row: Nadia Scharlau; Charles Scharlau, NZØI; Bob Cooley, KF6VSE; Jerry Boyd, WB8WFK; Vadim Afonkin; Richard Thompson, WA6NOL; Gyuri Nagy, KF6YKN; Bob Frey, WA6EZV; Csaba Tiszttarto; Dick Arnett, WB4SUV, and Matt Robbins, AA9YH. Front row: Jay Thompson, W6JAY; Karla Leach, KC7BLA; Harley Leach, KI7XF, and Jay Hennigan WB6RDV. (Jay Thompson was a winner—with Andrea Hartlage, KG4IUM—of the ARRL 2003 Hiram Percy Maxim Award.)

and teams in each age/gender division and on each band.

As they did for the 2002 world competition in the Slovak Republic, the ARRL Foundation and a Colvin Award grant provided a portion of the entry fees and in-country expenses of Team USA. Individual team members covered the remainder of the costs out of their own pockets.

The September event marked Team USA's fourth trip to the ARDF World Championship, Moell said. Team members ranged in age from 19 to 62 and hailed from nine states. This year's Team USA Captain was Harley Leach, KI7XF, of Bozeman, Montana. Veteran fox hunters Dale Hunt, WB6BYU, of Portland, Oregon, and Marvin Johnston, KE6HTS, of Santa Barbara, California, represented the US and IARU Region 2 on the international jury overseeing the competition. Each was assigned as a course marshal at one of the "radio foxes"—the objects of the hunt.

The courses may include three, four or five radio foxes—depending on the category. The test for the participants is to locate each using portable radio direction-finding equipment as the foxhunter travels between the starting point and the finish line. Total course length in championship hunt is between 5 and 10 km. Contestants get orienteering maps, and a beacon transmitter on a separate frequency near the finish assists hunters who get lost.

Two Team USA members garnered top-10 individual finishes in their categories. Nadia Scharlau of Cary, North Carolina, placed 6th out of 22 in the 2-meter competition, Her time in the 80-meter event was much better—just a shade more than 10 minutes behind the first place finisher in her category. Sixty-two-year-old Bob Cooley, KF6VSE, of Pleasanton, California placed 9th out of 34 on his 2-meter run.

"European and former Soviet countries have been holding ARDF events for over 30 years, so it is no surprise that they dominated in the standings," Moell observed. "Nine of these nations garnered all of the individual and team medals." The Czech Republic, Russia and Ukraine led the medal count with 34, 28 and 26, respectively.

Although their team members enjoyed the friendly rivalry of the world competition and the hospitality of the host country, the US, Australia and Great Britain were among the 19 nations that won no medals. "Each is relatively new to the sport and is building a national ARDF program," Moell said.

There's more information about ARDF, the World Championship and Team USA—including a member roster and team category standings—on Moell's "Homing In" Web site, **www.homingin.com**.

ARRL HOSTS 2004 SECTION MANAGERS' WORKSHOP

Ten ARRL Section Managers visited ARRL Headquarters over the September 17-19 weekend for a Section Managers' training workshop. The annual event, sponsored by ARRL Field and Educational Services, is designed to offer new SMs a chance to get better acquainted with ARRL programs and services, share ideas, explore common problems and learn more about their responsibilities as ARRL Field Organization leaders.

"This was also a good opportunity for the Section Managers to meet with ARRL Headquarters Staff and see the facilities and to operate W1AW," said ARRL Field Organization/Public Service Team Leader Steve Ewald, WV1X.

Discussions covered a variety of topics ranging from leadership to administrative details and emergency communication. Several ARRL Headquarters staff members pitched in to present portions of the workshop program. Affiliated Club/Mentor Program Manager Norm Fusaro, W3IZ, talked about his programs and plans while ARRL Marketing Manager Bob Inderbitzen, NQ1R, addressed the group on his area of expertise.

Amateur Radio Education and Technology Program Coordinator Mark Spencer, WA8SME, outlined the scope of "The Big Project" and how it relates to a Section Manager's activities. ARRL Emergency Communications Course Manager Dan Miller, K3UFG, discussed the emergency communication training classes and the grants that have subsidized tuition reimbursements for those taking the courses. ARRL Regulatory Information Specialist John Hennessee, N1KB, was on hand to discuss issues surrounding FCC rules and regulations and the services that ARRL provides. Field and Regulatory Correspondent Chuck Skolaut, KØBOG, focused on the Amateur Auxiliary/Official Observer program.

Eastern Massachusetts Section Manager Phil Temples, K9HI, lent his perspective and experience as a veteran SM. "Steve and the staff have once again, performed a splendid job in bringing us together and equipping us with the skills necessary to perform our Section Manager roles," Temples said afterward. "My hat is off to all the staffers who took precious weekend time from their families to instruct us."

Some of those attending already had SM experience under their belts. Among them was Sacramento Valley SM Jettie Hill, W6RFF, who had not had a chance before this year to attend the workshop. Also on hand was San Diego Section Manager Pat Bunsold, WA6MHZ, who was returned to office earlier this year after serving as an SM for two terms in the mid 1990s.

Skip Jackson, KSØJ, who began his term as Minnesota Section Manager October 1, expressed enthusiasm about his workshop experience. "The highlight for me was sharing the time and experience with so many fine people, both the League folks and the other SMs," he said.

Maxim Memorial Station W1AW was open for operating after the workshop sessions, and several attendees took advantage of the opportunity. Section Managers were among those operating W1AW on September 18 in conjunction with ARRL's Amateur Radio Awareness Day.

ALLEN PITTS, W1AGP

(L-R) Back row: Phil Temples, K9HI, Eastern Massachusetts; Jettie Hill, W6RFF, Sacramento Valley; Greg Sarratt, W4OZK, Alabama; Skip Jackson, KSØJ, Minnesota; Doug Dunn, K7YD, Montana; Kent Olson, KAØLDG, North Dakota; Pat Bunsold, WA6MHZ, San Diego; Larry Marshall, WB4NCW,Tennessee. Front row: Kevin Bogan, AH6QO, Pacific; Chuck Skolaut, KØBOG, ARRL HQ, Carl Gardenias, WU6D, Orange, and Steve Ewald, WV1X, ARRL HQ.

In Brief

● **Santa Clara Valley gets new Section Manager:** Kit Blanke, WA6PWW, of Milpitas, California, assumed the office of Santa Clara Valley Section Manager on October 1. He took over the reins from Glenn Thomas, WB6W, the SCV SM since March 1999, who has moved out of the section. "I've had a blast being SM!" Thomas said. "I'll be seeing you all on the air." Blanke is no stranger to the section's top job. He headed up the Santa Clara Valley Section from 1995 until 1998 and still has the SM certificate from his earlier tenure on the wall of his ham shack. He's served as the SCV Section's Technical Coordinator since last December. Blanke is a self-employed RF engineering consultant involved in the design of Part 15 devices.

● **Apparent oldest US radio amateur, ARRL member is 104:** William F. "Bill" Diaper, KJ6KQ, of Union City, California, appears to hold the honor of oldest radio amateur in the US—and quite possibly the world. Diaper, who turned 104 years old August 12, is a native of Great Britain. He now lives in a long-term care facility, but an acquaintance, Thomas "Fergy" Ferguson, N6SSQ, reports that Diaper remains alert and active and has access to a ham shack in the facility's basement, although he needs assistance operating the equipment. Ferguson says Diaper checked into the Pacific Amateur Radio Guild (PARG) net on one occasion in the past year. According to Ferguson, Diaper has been a radio amateur for a relatively short time—considering his longevity—apparently first licensed when he was around 75 years old. An Advanced class licensee, Diaper is an ARRL member. Byrl "Tex" Burdick, W5BQU, of El Paso, Texas, who died at age 103 last May 30, generally had been regarded as the nation's oldest Amateur Radio licensee. Diaper actually was born 44 days earlier than Burdick in 1900.

● **Bill Seabreeze, W3IY, wins August *QST* Cover Plaque Award:** The winner of the *QST* Cover Plaque Award for July is Bill Seabreeze, W3IY, for his article "2004 ARRL January VHF Sweepstakes Results." Congratulations, Bill! 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**. Cast a ballot for your favorite article!

● **Bruce J. Muscolino, W6TOY, SK:** ARRL Life Member Bruce Muscolino, W6TOY, of Silver Spring, Maryland, died August 20. He was 64. Well-known within the low-power operating (QRP) community, Muscolino was one of the founders in 1996 of the popular "Four Days in May" (FDIM) QRP convention and symposium sponsored by the QRP Amateur Radio Club International each spring to coincide with Dayton Hamvention. He also was the first QRP contributing editor to the ARRL Web site. "QRP with W6TOY" ran for a year in 1999 and 2000. He also authored a couple of antenna articles in *QST* and was a regular contributor to *QRP Quarterly*.

● **Stanley L. Burghardt, WØIT, SK:** Stan Burghardt, WØIT (ex-WØBJV), of Watertown, South Dakota, died August 22. He was 93. He was the founder of Burghardt Radio Supply Inc (now Burghardt Amateur Center). Licensed in 1931, Burghardt remained active on the air—especially on 6 meters—until his death. He also had been active in satellite work and was a member of ARRL, AMSAT and SMIRK. Burghardt sold his amateur equipment business to Jim Smith, WØMJY, but he remained active in the company until January 2002.

● **Michael J. Anuta, W8HKY, SK:** Mike Anuta, W8HKY, of Marinette, Wisconsin, died September 9. He was 103 and one of the oldest radio amateurs in the US. After leaving school following the eighth grade and working as a Western Union delivery boy and a railroad telegrapher, Anuta went on to become an attorney and enjoyed a 67-year legal career in Michigan that included stints as a prosecutor and a judge. "We are deeply saddened to hear of Mike's passing," said Wisconsin Section Manager Don Michalski, W9IXG. "He was truly a fine gentleman, and we'd like to think that Amateur Radio contributed to his long and happy life." Survivors include his wife of nearly 83 years, Marianne.

SECTION MANAGER ELECTION NOTICE

To all members in the ARRL Arizona, Arkansas, Iowa, Kentucky, Mississippi, Montana, North Texas, Orange and Wyoming sections. You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

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

(Place and Date)

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

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

(Signature___ Call Sign___ City__ ZIP__)

Any candidate for the office of Section Manager must be a resident of the section, a licensed amateur of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a petition for nomination. Petitions must be received at Headquarters by 4 PM Eastern Time on December 10, 2004. Whenever more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before January 3, 2005, to full members of record as of December 10, 2004, which is the closing date for nominations. Returns will be counted February 22, 2005. Section Managers elected as a result of the above procedure will take office April 1, 2005. If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning April 1, 2005. If *no* petitions are received from a section by the specified closing date, such section will be resolicited in the April 2005 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Field & Educational Services Manager. You are urged to take the initiative and file a nomination petition immediately.—*Rosalie White, K1STO, Field & Educational Services Manager*

REPEAT NOMINATING SOLICITATION

Since no petitions were received for the Puerto Rico Section Manager election by the nomination deadline of June 4, 2004, nominations are hereby resolicited. See above for details on how to nominate.

Ham Radio Comes to the Rescue for Volunteer Fire Department

By Grady E. McCright, KD5ZGU

"Chief, look up there. The fire is crowning in the trees and coming over the ridge."

Glancing up and over his shoulder, the Chief confirmed what the firefighter told him. The wild land forest fire was indeed coming over the mountain ridge and it was now in the treetops whipped into a frenzy by the gusty winds nearly 60 miles per hour.

Turning back to the firefighter, the Chief said, "Get on the radio and find out what the Forest Service knows about the changing behavior of the fire."

"Roger, Chief." The firefighter dashed to the nearby engine to use the 45 W mobile radio rather than his County handheld.

Anxiously awaiting the return of the firefighter, the Chief gazed at the spreading inferno. The fire had turned nasty and now became dangerous. He considered his options. Stand and fight, back off to a safe location and wait and see what the fire does, or evacuate his crew back to the staging area while he still could. Studying the growing inferno, he decided to wait for the fire behavior information and the immediate weather forecast before making his decision.

The firefighter trotted back from the engine. "Chief, this canyon is too deep. I can't contact anyone on any frequency. The repeaters are not within our line of sight. The cell phone won't even work way out here. We are alone." Lines of concern criss-crossed the face of the firefighter.

The Chief pondered the information, or lack thereof. He silently cursed the old, ill repaired, and low powered County repeater system. Maybe he could drive to higher ground in his command vehicle and possibly contact someone. These were his people and equipment and it was his responsibility to protect them.

Watching the fire leap across the ridge, treetop to treetop, he made his decision. "We're getting out. Cut the hoses and saddle up. We're evacuating back to the staging area while we can still get out."

As a Fire Chief of a rural, volunteer fire department in the New Mexico mountain country near the Village of Cloudcroft, which is surrounded by the Lincoln National Forest, dialogue of this type is feared by both me and my peers. Over the past two years, this lack of reliable communication on the County repeater system has happened to me several times. Last year, I vowed to do something to mitigate these frightening circumstances.

JOE BOYLE, KE5AHV

Former Chief Reg Duncan, W5UWY (left), is congratulated by Chief McCright, KD5ZGU, for his contributions to the Fire Department and Amateur Radio. The James Canyon Volunteer Fire Department Emergency Communications Station was named in Reg's honor.

The small James Canyon Volunteer Fire Department (JCVFD) certainly cannot afford to replace all the county repeaters, feed lines and antennas, so we sought other avenues. We found the solution in ham radio.

Amateur Radio came to the rescue in the form of Reg Duncan, W5UWY; Howard Shiplett, KD5BZF, and Tom Wuerschmidt, KC5LPR. Reg provided training for firefighters and staging officers to prepare for the Technician license exam. He also arranged for the Volunteer Examiners (Karl Larsen, K5DI, and others) to drive some 90 miles to test our firefighters and staging officers. Howard provided significant financial support for equipment purchases and other necessities. Tom provided technical support in building up repeater systems, advice on installation of a base station complete with a 48 foot tower, and suggestions of equipment to purchase that would best support our particular circumstances and our emergency communications system.

The JCVFD now has five trucks equipped with mobile 2 meter transceivers; we have seven handheld transceivers, a base station at our main fire station, and we have three repeater systems awaiting Forest Service approval for joint-use mounting of our amateur repeaters on their fire lookout towers. We are planning to build a portable repeater in an enclosed trailer that can be towed to a high ridge within line of sight of a wildland fire.

Our fire department owns three dual-band transceivers that can be configured as crossband repeaters. In this way, when our firefighters are away from the vehicles and cannot reach the repeater system by handheld, we can crossband repeat through the 50 W mobile and reach the repeaters.

This year, we had a crew dispatched to the Peppin Fire, north of Capitan, New Mexico for five days. They were sleeping in tents about 60 miles north of our main station. My only way to communicate with them was via 146.610 MHz repeater (owned and maintained by Kenneth Letcher, W5YFN) located on Capitan Peak. County radios would not reach their location and cell phones were out of the question. I was able to communicate with them at will.

This method of communication, the only one available, was a blessing to the families and the crew. It also provided me with the peace of mind that I could communicate with my crew while they were in harm's way.

Although our system is not complete, it is well underway. Once we have all the repeaters in place, the system will be far better than any other communications system in these mountains. The signal to noise ratio is great, the audio quality is much superior to the County system, and the equipment is several times cheaper than the County systems.

Our department has no plans to utilize the ham bands in normal operations. We are obligated to use the County repeaters whenever possible; but when that system fails us for whatever reason, we can now rely on the amateur repeaters for a reliable emergency/backup communications system.

The James Canyon Volunteer Fire Department thanks all the amateur operators, repeater owners and maintainers, the ARRL, and those hams cited above for providing a great communications service to our department.

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

On May 29, 2004, the JCVFD dedicated our Emergency Communications Base Station in honor of Reg Duncan, W5UWY, former Fire Chief and an active ham since 1961. This Amateur Radio emergency/backup communications system may well contribute to saving lives in these mountains. It will certainly provide a level of comfort to firefighters on the line and to their families back home. This is Amateur Radio at its best.

COOPERATION...THE KEY TO A SUCCESSFUL DRILL

By Sgt Mike Burg, N8QQN
Rittman, Ohio Police Department

It started out as a pleasant spring day in northeastern Ohio, sunny and warm. The Medina County Health Department was in the process of doing an inoculation program assisted by the local chapter of the Red Cross at one of the schools. Suddenly, and without warning, an explosion ripped through the school causing numerous casualties in various degrees of trauma.

As triage was being conducted and ambulances from surrounding areas were transporting the injured to three area hospitals one of the ambulances was involved in a crash, striking a stake bed truck hauling two 50 gallon drums of sulfuric acid. One of the drums fell over in the truck bed and began to spill sulfuric acid onto the roadway.

An explosion, a mass casualty incident and a Haz-Mat spill simultaneously? It was all part of a large scale disaster drill involving over 350 participants including Amateur Radio.

The drill also involved the Wadsworth, Ohio, police, fire and EMS departments, the Medina County Emergency Management Agency, the Medina County Health Department, the Wadsworth Chapter of the American Red Cross, the county Haz-Mat Team, the county Sheriff's Department, as well as three area hospitals whose emergency rooms were also taking part in the drill by treating the numerous casualties that were brought to them. Amateur Radio also played a big part in the drill and was asked to participate from the planning stages. The Silvercreek Amateur Radio Association (SARA) would work the actual site of the drill while the Medina Two Meter Group would be working the Emergency Operations Center (EOC) at the county Emergency Management Agency (EMA) as well as the other two hospitals. Additional hams from the Summit County ARES group were also used. Total, we had over 40 hams from three different clubs working together to assist in making the drill a success.

Lessons Learned

I would suggest that *prior* to a drill or worse yet, an actual emergency or disaster, your club works some with other area clubs. This drill went very well and smooth for not having worked together before, but I believe it would have been beneficial.

Drills and true emergencies are *not* a place for prima donnas. Support roles are just as important as primary communicators, sometimes even more so. Remember, sometimes you get the prime assignments and other times you won't. By working all areas, you become a better communicator because you are aware of what responsibility belongs with each role.

Participation in disaster drills such as this gives us the opportunity to showcase our skills and abilities to local hospitals, public safety departments, the media and citizens. Participation also enhances the stature of Amateur Radio among the safety services. Hospitals in our area have recently taken notice of how Amateur Radio can be beneficial in a time of crisis. A grant recently purchased a complete Amateur Radio station for 30 hospitals in our area (northeastern Ohio). My club is currently in the process of installing the radio in our local hospital and establishing an emergency operations center of our own within the hospital.

As Amateur Radio operators, we need to be united for a common cause, public service and support of public safety departments. We *are* a link in the Homeland Security chain, regardless if the threat is terrorists or a natural disaster.

Always keep in mind that we do what we do for the common good. National Football League Coach Tom Coughlin said it best when he said, "It's amazing what can be accomplished when no one cares who gets the credit."

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll August 2004

This listing is to recognize radio amateurs whose public service performance during the month indicated 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.

730 W7TVA
558 AB2IZ
500 N2LTC
480 N2YBB
445 KC2HUV
380 KA2ZNZ
370 W7ARC
340 N2YJZ
315 KC2MBC
245 K2AN KB2CCD
243 KB2DQ
240 KB2KOJ
239 KB3GFC
230 KK3F
225 NN2H
223 KA2GJV
216 WA1QAA
215 W2LC
213 K2ABX
210 K2MPE N2QZ
205 WB2ZCM
192 KB2SNP W5XX
190 KG0GG
180 KB2ETO KC2MQU W2FPG
177 K7EAJ KB5ILY
166 KZ7T
165 WB7WOW
161 KD5ONS
160 WA2YL W8IM
158 K4DND
156 KA2BCE
150 KG4VDR N2JBA W3YVQ
145 WB1CHU KØIBS WB1CHU
140 N8IO WB2KNS WB5ZED K7BFL WX4H
138 AC5SU
135 WB2UVB K5DPG
131 NN7H
130 W4EAT W4DAC KE4JHJ N4SGQ AA3SB
128 KC2MHI
126 N1IST
125 KD1LE WA2YBM
120 K2UL K6YR W1GMF N1LKJ KW1U K4BEH
K4IWW AD4XV AC4CS KD4CQJ N5IKN WB8RCR
119 N2JRS
117 KB5JBV
115 NV5D N2GJ KAØO
114 KBØDTI ABØUY
113 KA4FZI
112 KD1SM
110 AB4XK NF5B W5PY K5MC N7CM KK7TN N7YSS K1YCQ N2JWW N1IQI KC5OZT AD5IS N3SW W3ZQN N7EIE W7QM N7YSS W7GB N3YTD AF4NS WØUCE W4LN K4BMH W4NTI KD4GR W3BBQ KIØBK N2AKZ WA5OUV
109 W3CB
108 AL7N
105 W2DWR WB4NCW AI4JW
104 KO4SY
103 K2GW KAØDBK N2RTF
102 AE5V
101 KD4GBA NC2F
100 KA4UIV K4SCL WA8SST WNØY WB2QIX N3RB W7GHT WD8DHC KG4FXG WA2WMJ WA4EIC NR2F K3SS K3CN KG4OTL KV4AN KB2KLH KC2GOW KK5GY K8AE
99 KF6SHU W6QZ WX4J WB6UZX
97 W2QOB AD4BL KB8NDS WA1JVV
96 W7VSE KK1A W7LG
95 WG8Z K7UGT W8YS ABØWR
93 N8FXH
92 W8CPG AG4ZB AA4AT
90 WA2CUW WD8Q KC8UTL AC5VN N7DRP KG2D WB2IJH N1JX W3TWV W5UYH W6ZOH N8IY KA8WNO N3KB WW3JC WB4GGS K4FUM N9MN K1JPG KF4WIJ K2BCL K2VX W5CU N3OR AA3GV KA1GWE KA1RMV NX1Q
89 W2CC
88 KF6OIF W4ZJY
87 W4WXA
86 K6JT
85 K2YYF W9NXC
84 KG4OQA WB4UHC
83 WA2GUP WB7VYH KC6SKK K4ZC
82 W4DLZ WØHXB
81 N2VQA WD4LSS
80 AA2SV WA0KAQ KL7OR KD7ZLF N1TPU W2MTO K7GXZ AA4YW AB1AV WA0LYK W2DSX AA8SN N3ZOC
78 AB7AN
77 KA4LRM
76 KC7SGM
75 N4VVX KC6NBI N2VDK
72 WB4BIK K4BG W4DGH
70 KB1HDO K6RAU

The following stations qualified for PSHR in previous months, but were not recognized in this column: (July) WB9USI 89.

Section Traffic Manager Reports August 2004

The following ARRL Section Traffic Managers reported: AK, AR, AZ, CT, DE, EB, EMA, EPA, EWA, GA, ID, IL, IN, KY, LA, MDC, MI, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, OH, OK, ORG, SB, SC, SD, SDG, SFL, SJV, SNJ, TN, VA, VT, WCF, WI, WMA, WNY, WPA, WV, WWA.

Section Emergency Coordinator Reports August 2004

The following ARRL Section Emergency Coordinators reported: AK, AZ, EWA, GA, IN, KS, KY, MDC, MN, MO, NE, NC, NLI, NV, SD, SJV, SNJ, SV, TN, VA, VT, WTX, WWA.

Brass Pounders League August 2004

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*
W1GMF	0	702	2497	27	3226
KK3F	35	1540	1490	0	3065
W4EAT	0	1090	1067	6	2163
WB5ZED	66	1066	917	68	2117
N1IQI	0	579	1316	0	1899
N2LTC	0	835	816	67	1718
W4DAC	14	300	905	7	1226
K9JPS	0	542	31	525	1184
WX4H	2	508	610	23	1143
KW1U	0	636	481	6	1123
AK6DV	1	597	473	8	1079
WB4GGS	0	392	368	3	763
W4ZJY	0	353	369	0	708
N8IXF	—	–	–	–	553
N1LKJ	0	266	200	66	532
KA2ZNZ	38	238	242	13	531
K4SCL	0	243	230	33	506
WB1CHU	141	118	139	102	500

BPL for 100 or more originations plus deliveries: N9VE 156, W9IHW 125.

Rare Aves Island at the Heart of the Caribbean

By Martti J. Laine, OH2BH

Aves Island is located at 15° 40' 33" North and 63° 36' 27" West. Why is it that Venezuela owns this piece of property more than 600 km from the mainland? What do they have there today? Why do DXpeditions to Aves happen so infrequently? We had the pleasure to discover the truth about each question.

History

The Spanish adventurer Avaro Sanzze spotted Aves back in 1587 and named it Isla de Aves (Island of Birds). Venezuela gained independence from Spain in 1821 and Aves Island became part of Venezuela. No presence was established during those early years, and in 1878 the US Guano & Copra Company inhabited the island, built some wooden houses and mined guano until 1912 when the bird manure was practically exhausted. Following a dispute, it was concluded that the original discovery had to be honored and in 1979 the Venezuelan government erected a coast guard station on the island.

Current Venezuelan Interests

It is obvious that a piece of Venezuelan territory running far into Caribbean waters will extend the country's economic rights (200-mile Exclusive Economic Zone EEZ) to a large portion of the region, giving Venezuela access to potential natural resources there. Today, Aves is used as a military base and to develop the island as an international research center for the study of rare species around the island—birds and sea turtles. The local fishermen report rich waters around the island, regularly patrolled by the Venezuelan coast guard.

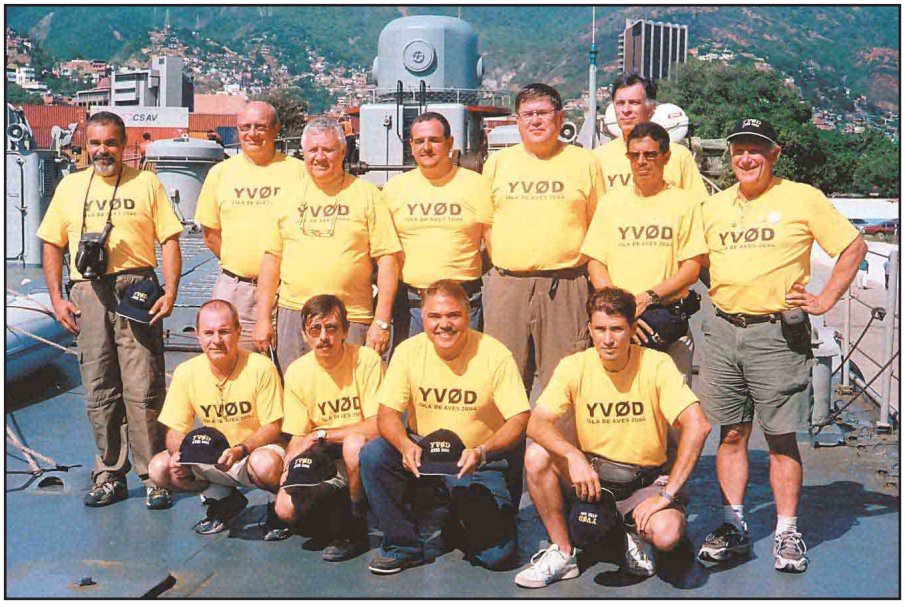
Aves Island Today

For the most part, only Venezuelans have been allowed to visit the island. There is no record in DX history of any non-Venezuelan-based expedition having been credited. The island is just a tiny sandbar 150 meters long and 30 meters wide, narrowing to some 10 meters in the center. With its sandy beaches, Aves is slowly disappearing from view, and today it is only a fraction of the size it was originally. While a previous garrisonor module, as it is called, was washed into the Caribbean some years ago during a hurricane, in its place they now have a new, modern three-story module and a large power plant, installed earlier this year. Staying on the sandbar without a rescue place in the module would not be possible; even one light storm would wash over the low-lying sandbar.

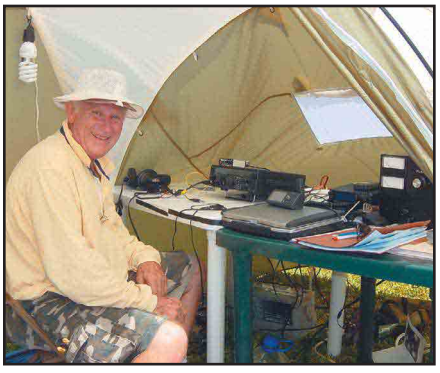
Traveling with the Venezuelan Navy

When the 105 meter Navy vessel with more than 300 men on board departed La Guaira, the port of Caracas, we felt highly honored, both as foreign guests invited by the Radio Club Venezolano (RCV) and as guests of the Venezuelan Navy. Yes, we had the pleasure to sail with top Navy brass with access to their exclusive galley, and it was very interesting to observe the order and discipline on a Navy ship with their daily routines. Life was plain and simple during those six days we spent on board. Loading and unloading 4000 kilos of equipment and supplies, transported in zodiacs in the choppy seas, required a maximum of stamina and strength. For some of us, hanging in a harness off the ship ready to be dipped into a zodiac, was an experi-

Ceremony at sea: **Paolo, YV1DIG, president of RCV, presents a 70th anniversary pin to Amilar Antonio Rivas, captain of the frigate, and Leon Pipett, commander of Aves Island.**

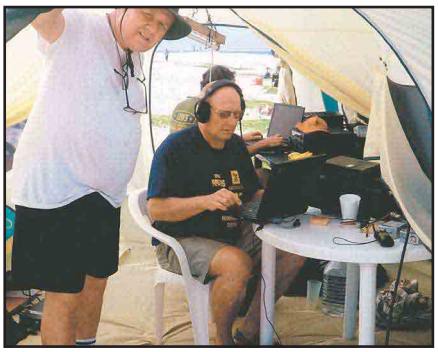


The YVØD team: **Standing (from the left) Lino De Nobrega, YY5FRD; Olli Rissanen, OHØXX; Reinaldo Leandro, YV5AMH; Gabriel Medinas, YV5KXE; Martti Laine, OH2BH; Pablo Alonso, YV5IVB; Jose Vicente Pinto, YV6BTF; Mike Staal, K6MYC; (kneeling) Juan Manuel Hernandez, YV5JBI; Paolo Stradiotto, YV1DIG; Reinaldo Mendez, YV4BOU, and Antonio Goncalves, YV5OIE.**

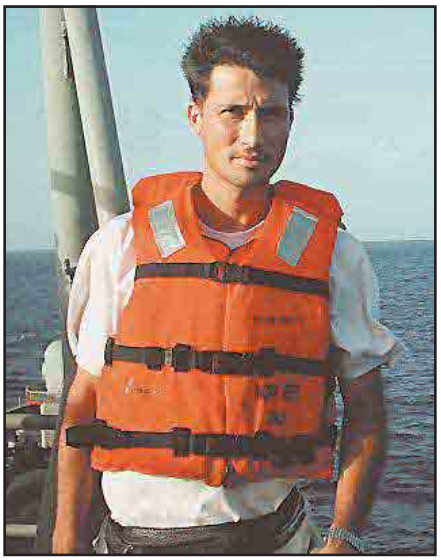


Mike Staal, K6MYC, kept a happy face, maintaining high spirits throughout the adventure. He worked the hardest but was left with the least. Only KB8RQ and KJ9I made it with the moon as their reflector on 2 m EME.

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org



Reinaldo, YV5AMH, observes the production rate while Olli, OHØXX, is running 30 m CW and Pablo, YV5IVB (back), is handing out 20 m SSB QSOs.



First-timer Antonio, YV5OIE, listened carefully at the operating strategy session and followed all instructions. He clearly completed each QSO, no matter what it took. This is not a contest and it is clarity that matters! Super job on 15, Antonio!

There are many DX stories and this is one of them. Martti, OH2BH, is waving goodbye to Aves Island only to depart soon for Sao Tome (S9BB) and then to Peter 1 Island (3YØX) in his quest to see more of this wonderful world through the eyes of a DXpeditioner. In the zodiac is his dear friend Reinaldo Leandro, YV5AMH, a former Venezuelan ambassador to Finland.

What is "Land-Based?"

DXCC Rule 8 calls for all operations to be land-based "land stations." Just what constitutes being land-based according to DXCC rules? Will the operation described in this article count for DXCC credit? (Yes it will.) Would an operation located on a pier at a major seaport be disqualified because the pier was actually built on pilings over water in the port? How about an ice shelf in the Antarctic? Being land-based means that you are not sea-based. If you are on a water-based vessel with access to international waters, there is an inherent uncertainty over where you might be operating. Even if you are anchored or tied up at the major seaport pier, such operation will not be credited. If you are on a non-mobile structure connected to land, however, there should be no uncertainty about your location. The basic question is how do we determine where a station is operating. If an operating location is obviously connected to land that is within the legal boundary of the entity, it's safe to say that it's land-based. The picture of the "module" at Aves Island clearly shows that it is built on pilings over water, but clearly connected to the island. (One station operated on this structure.) This operation meets the criteria for being land-based.—*Wayne Mills, N7NG*

The module is an impressive sight and has a high comfort level. At the very top is a heliport. But we landlubbers were left on the sand with our tents as we boiled in that intense Caribbean sunshine.

ence of a lifetime. We thank the brave Venezuelan Armada for their allowances, courtesy and safety measures.

Making YVØD Operational

We arrived in the evening and unloaded our valuable cargo onto the module and then carried it a second time to the sandbar. This was an ultimate undertaking; however, it enabled us to put the first signal on the air at dawn the following day. Getting the remote 40 meter SSB station operational by dusk was a record in itself, due to the hot bright sun. There were no trees or other structures for shade. Special UVA protected outfits were used to protect the team from sunburn. Although signals were on the air by late Sunday evening, we had missed the weekend prime time activity by a few valuable days.

The plan was to have two camps providing maximum separation and allowing CW and SSB signals on the best band (20 meters) at the same time. This did happen, and two camps were slowly getting their overall layouts established. On the second day as many as six signals were transmitting from Aves.

All radio operations except 15 m SSB were from four tents on the sand, employing four Yaesu FT1000MkV radios and two sturdy FinnFet solid-state amplifiers, one of which never got out of its case. We were pleased to have the famous Force-12 DXpedition kit, making use of smart vertical arrays right on the waterfront. We were told that YVØD did not lack signal strength on those bands that were activated. Again 160 and 80 m antennas never got out of their cases! Very sad.

The Team at YVØD

We had a variety of characters and experiences on board. This was obvious since the Venezuelan RCV had set the sights at taking along a maximum number of first timers and also young people to experience and learn the art of DXpeditioning. The team of nine YVs was led by Paolo Stradiotto, YV1DIG, RCV president, with Reinaldo Leandro, YV5AMH, providing valuable assistance. Four foreign guests

were invited: Mike Staal, K6MYC; Olli Rissanen, OHØXX, and Martti Laine, OH2BH, while the fourth seat dedicated to the US was canceled twice due to the uncertain final schedule and personal reasons.

While both logistical and radio operation strategies were discussed aboard the ship, serious challenges were encountered on these two fronts. All the stress, emotions and excitement added to a tiring trip, which took their toll. Flexibility was a key word behind our limited success, but some heroes also surfaced. On the first day while setting up we managed 4000 QSOs followed by 14,000 QSOs on the second day, still setting up. Having planned a one week operation, our group had multiple radio specialties and may have had a chance to rack up a reasonable total. However, we had to settle for 18,449 QSOs, serving 8870 individual Amateur Radio operators. The mammoth effort on 2/6 m EME resulted in only two QSOs. Our firm plan was to work down the US and Europe quickly while the more difficult JA path was scheduled to be emphasized in the morning, but we were already on our way off of the island. We were able to rescue 447 JAs in a hurry before leaving.

Mother Nature Hits Hard

It was during the second day when the people from the island's meteorological station advised everyone that a low pressure front from the east seemed to be developing into a major storm, heading right toward us. If it continued the same way, the operation would have to be called off during the night, and at 2:30 AM it was. We would have to rush everything back to the Navy vessel at sunrise. Instead of expanding the operation further, a part of the team transferred many bulky items back to the ship only a day after they had been ferried to the island with a lot of sweat and tears!

The beautiful sandy and narrow beach of Aves Island. Walking along the sandbar gives one a magnificent view and an interesting look at rare species that make Aves their home base.

In the morning it was "get the hell out of here" as long as you can. We obviously had a theoretical option to take shelter in the module but there was no storage space for the large size of our valuable cargo. The key factor was that the Navy ship had to leave as soon as possible, due north, to escape the storm. We had no choice as we were their responsibility. Some of us wanted to stay but the next ship was scheduled four weeks down the road and there was no allocation for any supplies for additional people on the island.

The last QSO was made with our head pilot, Bill Every, K6GNX, on that last night as he still reported good weather for the coming 5-6 days. No rough seas or anything. But in reality the sea was getting rough and stations on nearby islands and in mainland Venezuela suggested to us that we should get out of YVØ, if we still could.

Conclusions

The team spent 90-plus hours on the Navy ship, thinking of those thousands who had waited for more than 10 years to see Aves Island activated. We also thought of those almost 9000 who had read the book, "...work them the hour they come on, or even before, because of weather or broken generators may put them off the air sooner than you can even think. ..." This was a lesson learned and an obvious reward for those 8870 individuals who did work us. Surely it will also keep DX interest high until Aves Island is activated again by those who wander around in their mission to serve the multitudes. The wandering types are those who ask one another "Where do we go next?" in their quest to do good for the DX community and their desire to produce endless pileups in the limelight of DXpeditioning! QST

NEW BOOKS

SOS KOREA 1950

By Raymond B. Maurstad, W3HUV

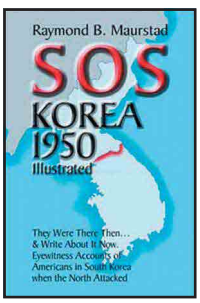
Published by Beaver Pond Press, Inc. First edition, softcover, 6×8 inches with black & white and color photographs. ISBN 1-931646-91-0, 396 pp.

Reviewed by Gil McElroy, VE3PKD

◊ North Korea is easily the most politically and socially isolated nation in the world. It has technically been in a state of war with South Korea for half a century, a grim, unsettling reminder of the consequences of its 1950 invasion of its southern neighbor and the war that followed in which thousands of US soldiers (and those of other nations fighting under the flag of the United Nations) gave their lives.

In November 2002, the only Amateur Radio operation in the country was shut down by North Korean authorities, denying DX-minded hams the rarest of the rare (see "How's DX?" *QST*, Feb 2003, p 92). Back in June 1950, South Korea was itself something of rarity, and the handful of American hams living there who were putting the country on the DX map were also the first to tell the world of the invasion by North Korean forces.

Raymond Maurstad, W3HUV, was right in the thick of it. A radio officer in the Merchant Marine, he had signed on to help the South Koreans create their own merchant marine fleet after the end of World War II. He brought his wife to Korea with him and joined a small contingent of other Americans—almost all of them civilians—engaged in the Herculean task of helping rebuild the country's shattered infrastructure. That all changed in June 1950 when North Korean troops poured over the 38th parallel that formed the border between the two nations and almost entirely overran the country before General Douglas MacArthur could coordinate a military response from his base in Japan.



Though Maurstad had disparaged ham radio prior to his posting in Korea, he quickly became a devotee after encountering another shipboard radio officer with his own ham station, and was licensed in 1950 as HL1CE. The morning of the North Korea invasion—June 25—Maurstad's Amateur Radio station made a Mayday transmission to Japan, two hours before the first official cable dispatches were sent to Washington, DC. For a critical period, Maurstad's station and that of some friends were *the* major communications channel between Korea and MacArthur's headquarters in Tokyo. *QST* published an article in March 1951 telling the story from the perspective of the hams at the Japanese end ("Hams Aid Korean War Effort"), but until now little has been known of the doings of the hams in Korea.

Maurstad's story is one of great courage and daring in the face of enormous odds. It tells of an otherwise little known aspect of the Korean War and of the important role Amateur Radio played in telling the world of the invasion. The only trouble is, Maurstad doesn't seem to trust his storytelling abilities. *SOS Korea 1950* is a little heavy with military jargon and acronyms—difficult stuff to wade through, even with the help of the legend he provides. And in his effort to get facts down accurately, he reproduces a series of military dispatches detailing the minute by minute responses to the invasion exactly as the messages were originally sent. They don't make for riveting reading, but when Maurstad gets down to brass tacks and tells us what happened as he personally experienced it, he is in fact an engaging storyteller, and *SOS Korea 1950* becomes a riveting story.

AT THE FOUNDATION

Summer is always very busy at the ARRL Foundation with the completion of the scholarship process. This year more scholarships have been awarded than ever before—41 awards! The new application period begins October 1, 2004 and ends February 1, 2005.

This fall another new scholarship has been added to the Foundation's extensive offerings. The Yankee Clipper Contest Club youth scholarship has been created to honor the memory of the club's past and future Silent Keys. One annual award of $1500-$2000 will be given to a ham holding a General class or higher license who is attending college within 175 miles of the YCCC center in Erving, Massachusetts, or is a resident of this area. The geographic area includes all of MA, RI, CT and Long Island, New York, most of VT and NH, portions of ME and Eastern NY, and extreme northeastern sections of PA and NJ.

Additional details on qualifications and application forms for this and other ARRL Foundation scholarships can be found on the Web at **www.arrl.org/arrlf/#scholgen**. The Web site also has application instructions and forms.

The summer months also saw the award of two new grants for projects related to Amateur Radio. In August, the ARRL Foundation awarded a grant of $2100 to match funding from the Colvin Award to support the US team of 14 radio amateurs participating in the World ARDF Championships in the Czech Republic.

In September, the ARRL Foundation awarded $1534 to the Sagamore Council, Boy Scouts of America from the Vic Clark Youth Incentive Program to supplement the equipment donated to the Sagamore Council by the late Waldo Fewell, N9DZY, and the modular building donated to the scout summer camp. The ARRL Foundation grant will add a new HF transceiver, a loop antenna and grounding and a mount for a 2 meter antenna. The Sagamore Council was able to raise additional funds to support the completion of a radio station that will introduce Amateur Radio to up to 24,000 young scouts in Indiana at Camp Buffalo each summer.

In July the ARRL Foundation received a generous distribution from the estate of Richard A. Keller, W7TWU, of more than $8800, which has been invested in the work of the ARRL Foundation on behalf of Amateur Radio.

Support of ARRL Foundation activities comes from individuals who make contributions and estate plans that include the ARRL Foundation. For more information on how to support the work of the ARRL Foundation, or to make a contribution, contact:

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Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

STRAYS

ARRL 2004 TECHNICAL AWARDS CALL FOR NOMINATIONS

◊ ARRL members and affiliated clubs are encouraged to send nominations to ARRL Headquarters.

Please include basic contact information for both you and the nominee. Submit support information along with a nomination letter, including endorsements of ARRL affiliated clubs and League officials. Nominations should thoroughly document the nominee's record of technical service and accomplishments. The nomination form for these awards can be found at **www.arrl.org/ead/award/application.html**.

ARRL Technical Service Award is to be given annually to the licensed radio amateur whose service to the amateur community and/or society at large is of the most exemplary nature within the framework of Amateur Radio technical activities. These include, but are not limited to:

- Leadership or participation in technically oriented organizational affairs at the local
- Service as an ARRL technical volunteer.
- Service as a technical advisor to clubs sponsoring classes to obtain or upgrade amateur licenses.

The Technical Service Award winner will receive an engraved plaque. In addition, the winner may request ARRL publications of a value of up to $100.

ARRL Technical Innovation Award is granted annually to the licensed radio amateur whose accomplishments and contributions are the most exemplary nature within the framework of technical research, development and application of new ideas and future systems.

- Development of higher speed modems and improved protocols.
- Promotion of personal computers in Amateur Radio applications.
- Activities to increase efficient use of the amateur spectrum.
- Digital voice experimentation

The technical innovation award winner will receive a cash award of $500 and an engraved plaque.

The ARRL Microwave Development Award is given each year to the amateur (individual or group) who conducts research and application of new and refined uses and activity in the amateur microwave bands. This includes adaptation of new modes both in terrestrial formats and satellite techniques.

The Microwave Development Award winner will receive an engraved plaque. In addition, the winner may request ARRL publications of a value of up to $100.

Nominate Now!

Send nominations to ARRL Technical Awards, 225 Main St, Newington, CT 06111. Nominations must be received by March 31, 2005. Direct any questions to Headquarters or e-mail **nfusaro@arrl.org**.

NEW PRODUCTS

GIGAVAC HIGH VOLTAGE RF RELAYS

◊ GIGAVAC has introduced three new high voltage vacuum relays designed for Amateur Radio operators. For 5 kW and lower power applications, GIGAVAC has created the GH1 Ham (shown), the G41C HAM designed for 18 kW applications and the new 42 kW rated G2 HAM. All of these relays come with a one year warranty and are available from stock. Price: GH1 HAM, $69; G41C HAM, $75; G2 HAM, $119.

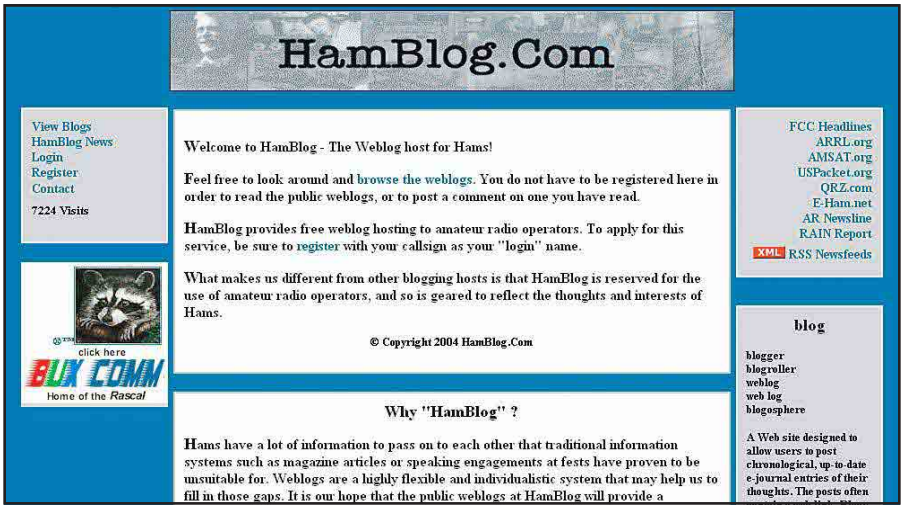
Information on the relays and purchase instructions can be found on GIGAVAC's Web site at **www.gigavac.com**.

Internet Killed the Radio Ham?

Bryan Smith, W3WOR, wrote recently that he remembered reading articles in the ham radio press back in the late '80s and early '90s about this "Internet thing" and/or "electronic mail" that is coming in the world of technology. What he remembered most is that "the articles spelled doom for Amateur Radio."

On the contrary, Bryan writes, "Not only did the Internet not spell doom for ham radio, hams grasped it and ran with it. Now almost all ham shacks use the Internet for one reason or another. We have married ham radio and the Internet. It hasn't hurt us; it has helped us."

I thought it would be a good idea to do an assessment of ham radio and see what the Internet and e-mail have done—good or bad—for this great hobby.



HamBlog.Com (www.hamblog.com) is a free weblog ("blog') service for Amateur Radio operators, where hams can post their thoughts on anything they desire.

The Bad?

The Internet and e-mail essentially killed the packet radio bulletin board system (PBBS). Many asked, "Why bother sending packet radio messages at 1200 bit/s when you can send e-mail via the Internet more reliably and at a much higher data rate?" After asking the question, many folks found the answer too tantalizing and abandoned PBBSs *en masse*. Similarly, the packet radio DX cluster system saw a mass migration to the Internet. But were these bad things?

I don't think so. Today, the PBBS network is a fading shadow of its former self, but hams are able to disseminate information almost instantaneously via the Internet. DX spots, weather warnings, calls for public service communications, propagation events, etc, are all available via e-mail and Web sites. Moreover, a lot of this information is ported to Amateur Radio so that it is distributed via RF, too. Are we not better off with the Internet than without it?

The Good

My wife and I were on vacation last August. Our hotel had high-speed Internet access. Every morning, I got on the Internet to check the weather at home. When I say "home," I mean *home* and I don't mean the National Weather Service's report for my area. I have a home weather station connected to my APRS station. Its weather reports are transmitted on 2 meters and relayed to the Internet via the APRS IGate (Internet gateway) system. I check the weather at home by going to my APRS weather station's Web site (**www.tapr.org/~wa1lou/wx.html**), which gathers weather information from the IGate data collected by APRS Internet servers.

One morning, I checked the weather and was very surprised that the temperature at my house was 150° F. I immediately called home, where my daughter was minding the store, to make sure everything was OK and that the house was not burning down. It seems that one of our cats got into the ham shack and stepped on the power switch on one of the power strips, thus shutting down part of the system and causing the weather station to generate the bogus data. After sighing relief, I went on to enjoy the rest of my vacation day.

I can go on and on how the APRS Internet interface has made a big difference in the Amateur Radio world, but then I can go on and on about EchoLink, Winlink, IRLP, etc.

Remember the good old days when you wanted to try the latest ham radio software? You mailed your order and waited a few weeks for the floppy disk to arrive. Today, you go to a Web site, download the software and experience instant gratification! What a deal, and what a ham radio world it has become! I don't know about you, but I don't want to go back to the good old days.

A Blog for Hams

HamBlog.Com (**www.hamblog.com**) is a free weblog hosting service for Amateur Radio operators. (A "weblog" or "blog," for short, is an Internet application that allows users to write about anything their little heart's desire on a regular or irregular basis. Blogs are like on-line diaries except that the blog entries appear in reverse chronological order, ie, the most current entry appears first.)

What makes it different from other blogging hosts is that HamBlog is reserved for the use of Amateur Radio operators, and so is geared to reflect the thoughts and interests of hams. The service went live a couple of months ago and it already has nearly 200 users who are posting their thoughts via their personal ham radio blogs.

Charles Brabham, N5PVL, is the administrator of HamBlog, and he explains the reason for the existence of HamBlog, "Hams have a lot of information to pass on to each other that traditional information systems such as magazine articles or speaking engagements at fests have proven to be unsuitable for. Weblogs are a highly flexible and individualistic system that may help us to fill in those gaps. It is our hope that the public weblogs at HamBlog will provide a wellspring of knowledge about Amateur Radio that would be difficult to express, access, or distribute via traditional methods." QST

Stan Horzepa, WA1LOU ♦ One Glen Ave, Wolcott, CT 06716-1442 ♦ wa1lou@arrl.net, www.tapr.org/~wa1lou

Fireworks in July: A Week to Remember—*Part 2*

As promised last month, this time we will look at the July E_s openings in more depth. We will see how we can spot these openings and further discuss unusual things that happened, almost happened or were rumored to have happened. We'll talk a little about how the very long-distance contacts occurred. Finally we will look at what has been happening in Europe in July and August, and wish we were there.

Finding 144 and 222 MHz openings. First, for a self-contained method that can suggest that an E_s opening is about to occur, review this column for June 2004. The alert service from the DX Robot run by Allard, PE1NWL, is a useful alternative; it will warn you when an E_s opening has actually been encountered. If you sign up at his Web site, **www.gooddx.net**, alerts will be delivered via either e-mail or to your cell phone. Notice that there are *two* alert systems, one for Europe and one for the US. For the latter, the robot trolls the propagation logger at **dxworld.com** and very effectively extracts lines that relate to 2 meter E_s, for example, "Jul06 14:51 NY2Z E_s from FN02>EL97 de K4MM." You can sign up for automatic aurora alerts as well. The site also has many very useful features including the Kp, the Bz components of the magnetic field and current space weather conditions.

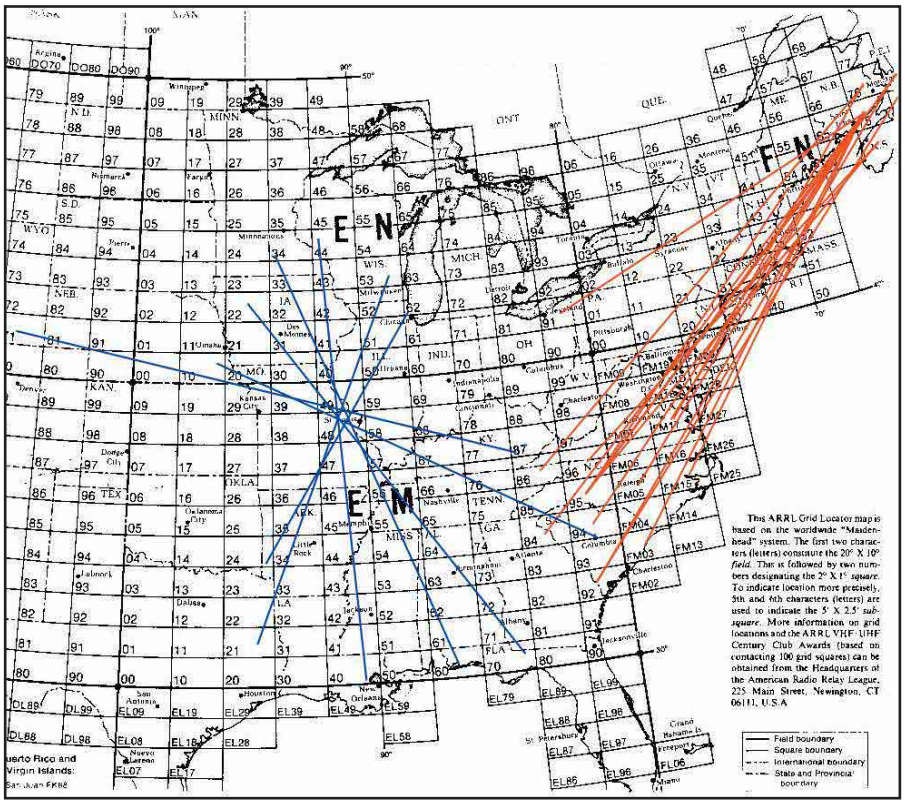


Figure 1—2-meter E_s opening of July 5, 2004, as displayed by APRS packet networks. Blue is 0120-0147Z. Red is 1941-2117Z. Compare this to Figure 1 in the September column.

A second possibility is the use of the extensive APRS networks scattered about the country. I have not seriously considered these in the past because they are FM contacts, which could compromise their sensitivity to some extent. Jon, NGØE (EN34) has been analyzing the global APRS network data to provide real-time propagation images. These are actual heard reports via RF and not anything from Internet connections. He notes that many APRS stations are in excellent locations: high and in the clear. I have compared some of his reports with actual openings (one tropo opening and some of the E_s openings in July). The data appears to be quite good. Compare the data in Figure 1 with Figure 1 from the October column and note that the beginning times are close. I would recommend checking his Web site (**www.mountainlake.k12.mn.us/ham/aprs/)** to spot openings on 2 meters. These maps are compendia of data throughout the US and other places in the world. I also got a report from Byran, W3WOR, in FN20 with his local APRS packet display showing dense circuits between his area and western Kentucky and Tennessee at the height of the July 6 opening. Again, the reports from FN20 are RF reports and not Internet connections.

The odd, the unusual and more. Peter, VE3AX, provides the most tantalizing report of the July 9 opening. Peter says, "At 1602Z I was working a string of loud W5s when I heard a weak station with heavy QSB call several times with a call sounding like K6KPS. I think only the P in the suffix was questionable. He acknowledged my grid, but I had trouble getting his. After a few tries, I am quite sure I heard him say twice 'Charlie Mike'—but with absolutely no intelligibility on the number. He then faded right out—it was not to be." There was no indication that stations at the Front Range worked anything in this contest, nor was there any E_s anywhere in the western states. So, was this just a mistake—and one with a CM grid square—or what? Peter would like to know and so would I.

The big excitement was on July 8, when a spot appeared on DX Summit claiming that VE1RG had worked GW3LEW on July 8 at 1603Z. In fact, K3CWH (FN10) heard a station in EL59 at 8 AM local time, though nothing more was posted, so it wasn't clear what was happening. Unfortunately, the spot was bogus. Geoff, GW3LEW, informed Joe, N6CL, my compatriot at *CQ Magazine* that someone was pirating his call. Dave, W6OAL, in Denver, who was shut out of this entire E_s event, reported two unconfirmed rumors: One, that someone on the East Coast worked a station in DM54. The second, that Pat, N6RMJ, was heard on the East Coast on 222 MHz. Neither

This Month

November 17	Leonids Peak 0640Z ±12 hr
November 21	Good EME conditions*

*Moon Data from W5LUU

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

sounds reasonable.

Mechanisms. With a refracting E layer at a maximum of about 110 km and very low takeoff angles, simple single-hop E_s is generally believed to have a range of about 2330 km. In the July 6 opening, several contacts exceeded that range by up to 250 km. Beyond that, there are at least two "heard" reports: NØDQS (EN22fd) and VP9GE (FM72pi) who heard each other at 2924 km but were unable to confirm a completion, and NØRQ (EM13rg) who heard K1WHS (FN43mj) over a distance of 2489 km. These are too long for a "normal" single hop, so how did they occur? "Very Long Distance Propagation in the 144-MHz Band" by DF5AI and DK5YA (at **www.df5ai.net**) describes other possibilities, but let us consider the two most obvious causes: double-hop E_s or single-hop involving some kind of chordal hop at midpath. As is often the case with very long distance E_s, deciding between even these two explanations will be very difficult. Conditions were (and often are) such that either explanation could be possible.

To summarize, all of the "long-distance" contacts listed last month for the July 6 opening deviated about 30° from a due East/West line. There was dense ionization—either a very large single cloud or many overlapping smaller clouds (functionally equivalent for all intents and purposes) extending from roughly EM59 to EM99. Consider first the SW/NE paths. If this were double-hop E_s, the refraction points would be roughly around EM65 and the border of FN11/21 with the midpoint near EM88. There is little evidence from the September column's Figure 2 that any such reflection points existed. In fact, Shelby, W8WN (EM78), who was near the midpoint, provides some important information. He says, "One hour into the opening, stations in New England were working into Florida and Texas. "Except for one brief signal from a pair of Minnesota stations, I heard *nothing* in those directions. I expected to get some weak signals from Texas, which are good E_s distances for me. Nil, but signals from the NE were the strongest I've ever heard on 144 MHz. I didn't see many reports of tropo in the northeastern states, but I couldn't be sure." So, while one of the paths—to the northeast—was open from the midpoint, the other, southwestward, was not. Shelby concludes that these were not double-hop E_s. He suggests that a chordal hop from cloud to cloud in the E layer is a more likely scenario and I agree. This is well known in F-layer propagation, particularly in transequatorial propagation (see J. Kennedy, K6MIO/KH6, in the summer-2004 issue of *CQ VHF*). In the E layer, the incident signal may not be refracted sufficiently to reach the ground. Yet, it may be bent enough to reach another portion of the same cloud, or an adjoining cloud (a chordal hop), thus extending the range a few hundred kilometers to distances seen on July 6. With the dense ionization, it is possible that the E layer may have been slightly higher than normal, but there appears little possibility that tropospheric duct-to-E_s link would have expanded the ends of the paths.

Table 1
Minutes of E skip (2004) Europe versus US

Month	*Europe*		*US*	
	Days	*Minutes*	*Days*	*Minutes*
May	7	373	—	—
June	8	1327	1	5
July	8	747	4	675
August	2	196	—	—
Total	25	2643	5	680

The "almost" contact between NØDQS and VP9GE is a different story. Gene, NØDQS, was hearing and working stations near the path midpoint around FM07. The distance was some 350-km longer than any other reported. The first midpoint, around EN60, was definitely part of the refracting cloud, although we know nothing about the second point, which would have been in an ocean grid somewhere around FM34/44. Ed, VP9GE, reports that he heard no stations at the East Coast midpoint, and no other stations during this opening. So, while this one looks a lot more like double-hop E_s, there is no way to draw a firm conclusion.

2-M E_s in Europe. The Europeans had another big summer, but not as big as last year. Comparing their 2-meter openings to those in the US (see Table 1), they had more than four times as many open minutes as we did. The opening of June 24, alone, lasted 10 hours throughout Central and Western Europe. Given that this July was perhaps the most intense and longest E_s sessions on record in the US, we did have almost as many minutes as the Europeans for that month, in half as many days. The common wisdom is that there are at least three confounding factors at work: There is much more VHF activity in Europe than the US. There is little VHF activity in large stretches of the American western mountains or very far north of the border in Canada. The activity is spread over a much larger geographic area, increasing the chances of finding a 2-meter E_s opening. Finally, the geomagnetic latitude in Europe is somewhat lower than in the US. Although the geographic latitude is quite a bit higher because the geomagnetic equator south of Europe is, relatively, much further north than it is here. E_s appears much denser and occurs more often at lower geomagnetic latitudes.

What if this is a real effect? In a recent posting at **www.df5ai.net**, Volker, DF5AI, and Allard, PE1NWL, in reviewing the data from Allard's DXRobot have noticed this discrepancy between 2 meter E_s in Europe and the US. Volker notices that there is much less 2-meter E_s in Europe than in 2003. Rather than a significant longitudinal variation in E_s and/or an absolute drop in such E_s, the activity this year could have changed its "geographical center of maximum activity." For example, to a sparsely populated area like central Asia where VHF activity levels are so low it might never be detected.

Thus, there are at least three possible mechanisms for 2 meter E_s variation from year to year: (1) Absolute E_s activity may change. (2) The center of maximum E_s activity moves longitudinally, and/or (3) there is much more E_s activity in Europe than in the US. (These mechanisms are not necessarily mutually exclusive.)

The first is clearly true to a greater or lesser extent for reasons that are poorly understood. The second is surely possible but unproven at this moment, and the third may be a good reason to move to Europe now.

Bottom line. VHF is not a sport of instant gratification. You must be alert for something good to happen. Yet, for many openings like the E_s in July, Art, KY1K, reminds me that it is more important to have a station that is ready to operate than to have huge antennas or great power. The vast majority of the participants in these E_s openings— especially those on 222 MHz—had modest power and small Yagis at relatively low heights. That's something to remember as we look forward to another exciting event.

ON THE BANDS

August marks the transition from E_s propagation to tropospheric enhancement. By the end of the month, E_s was definitely shorter and less frequent and even the Europeans had a total of only 3 hours of 2-meter E_s on August 1 and 6. Let's see what happened.

6 meters. Two DXpeditions enlivened the month: Mike, K6MYC, took a 1 kW amplifier and his two 12.5 m Yagis to the hurricane-shortened operation from August 2-4 at Aves Island, YVØD. Mike's perseverance, clever operating and excellent equipment yielded 121 CW and 56 SSB contacts with six countries under the most marginal of conditions. At best, this is a double hop E_s contact for almost everyone. With limited E_s but 1-kW and a 6M7JHV Yagi, Dennis, VP5/K7BV, had 157 contacts with eight on FSK441a during the week of August 8. On August 11, he encountered some unexpected double-hop E_s to W8 and WØ, the farthest westward being KØHA (EN10lw). The odd contact was with K5CM at 11 PM local

432 MHz Standings

Published 432-MHz standings include call-area leaders as of August 1. For a complete listing, check the Standings Boxes on the World Above 50 MHz Web pages at **www.arrl.org/qst/worldabove/**. To ensure that the Standings Boxes reflect current activity, submit reports at least every two years by e-mail to **standings@arrl.org**. Printed forms are available by sending a request with an SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

Call sign	QTH	States	DXCC	Grids	Best DX† (km)
K5QE	TX	20	2	77	1887
1					
W1JR *	NH	50	41	195	1397
W2SZ/1 *	MA	29	—	79	—
K1TEO	CT	25	3	115	1948
AF1T *	NH	24	7	—	1375
K1LPS *	VT	22	3	33	1357
W1ZC	NH	20	2	63	1984
W3EP/1	CT	19	2	50	1760
K1UHF	CT	18	2	71	1455
W1AIM	VT	17	2	47	1323
WA1ECF	MA	13	2	39	1527
AA1YN	NH	11	2	23	821
K1VU	MA	10	1	16	814
2					
K2AXX	NY	31	2	73	1963
K2OVS	NY	16	3	35	720
K1JT	NJ	16	2	45	757
3					
W3ZZ	MD	26	2	93	1526
WA2FGK	PA	22	2	74	—
N3JNX	PA	9	1	21	825
4					
WA4MVI *	SC	50	62	—	1771
W4TJ *	VA	43	40	190	8839
WA4NJP *	GA	41	42	138	16013
NB2T	FL	30	10	35	2310
W4WA	GA	22	1	46	—
KU4WW	AL	21	2	58	1240
AA4H	TN	21	1	57	1737
K4RTS	VA	20	2	65	986
N4MM	VA	18	3	58	—
WB5APD	GA	18	1	60	1306
W4WTA	GA	18	1	54	1319
K0VXM	FL	13	3	52	1974
W4TRH	SC	9	2	23	890
W4SW	VA	9	2	22	521
5					
W5LUA *	TX	50	—	—	—
W5RCI *	MS	47	41	227	1775
WB5AFY *	TX	46	27	172	7527
WD5AGO *	OK	40	23	150	1740
W5ZN *	AR	35	15	151	1850
K5UR	AR	31	2	201	—
K5YPV	MS	23	1	98	1327
WA5TKU	TX	23	1	89	—
W5HNK *	TX	20	1	—	1651
N5QGH	TX	17	—	48	—
K5LLL *	TX	15	2	61	1532
W5UWB	TX	11	1	27	2167
N5HYV	LA	11	—	60	—
6					
W6TOD *	CA	9	3	—	—
K6QXY	CA	4	3	36	3794
KC6ZWT	CA	4	2	50	3934
7					
W7MEM *	ID	16	9	47	12975
WA7KYM	WY	13	2	51	1337
W7RV	AZ	7	4	56	712
8					
W8MIL	MI	31	2	—	1738
W8PAT	OH	30	2	75	1919
K2YAZ	MI	28	2	107	2167
N8KOL	OH	28	2	90	1235
WB8TGY	MI	26	2	99	1487
WB8XX	OH	20	2	62	1570
N8PUM	MI	11	2	44	1368
9					
WB9SNR	IL	35	2	109	1420
N9LR	IL	33	3	134	1562
K3SIW/9	IL	32	2	131	1469
N9NJY	IL	26	2	78	1320
KA9UVY	IL	26	2	71	1409
K9SM	IL	25	2	105	1447
W9JN	WI	16	2	79	1402
Ø					
KØRZ *	CO	45	47	260	1083
WØRT	KS	29	1	100	1783
WØOHU	MN	26	2	119	1842
WØJRP	MO	25	2	95	1750
KMØA	MO	23	2	77	1524
NØPB	MO	22	2	96	1170
KØFF	MO	20	1	74	1189
KØSQ	MN	19	2	79	1295
KØCJ	MN	16	2	—	1375
KØAWU	MN	15	2	59	1555
KØVSV	IA	13	2	55	1440
NØUK	MN	12	2	63	965
Canada					
VE3DSS	ON	15	2	—	—
VE3TMG	ON	13	2	74	1305
VE2PIJ	PQ	8	2	32	694
International					
GW3HWR	—	15	36	2760	
G6LAU	—	12	35	1398	

† terrestrial
* Includes EME contacts
— Not given

time, when not another station was heard that evening.

Following a rather unimpressive E_s season, August was surprisingly decent. E_s was noted via direct communications or via the DXWorld and DXSummit propagation reflectors on 11 of the first 15 days and 9 of the last 16 days of the month. DX openings were reported to YVØ on the second and third, the latter including contacts into Kansas and Nebraska. Dave, N3DB (FM19), worked several Caribbean stations on the aourth and the East Coast was into Colorado, Hawaii and 6Y5 on the eighth. N3DB reports a weak but unusual opening to YU and DL on the fourth. VE1 was marginally into Europe on the sixth, and EA7RM heard K4RX (EM70) on the eighth. Bob, K6QXY, reports working KLØRG (CO45) on the fourth. Several strong E_s sessions were reported by Roger, K6LMN (DM04), up the Pacific Coast on the first and second. Tom, KCØIMN (EM28), on the fourth reached XE and VE1. Kent, K6FQ (DM12), and Chip, K7JA (DM04), double-hopped to the East Coast on the fifth. Steve, N5TEY (EM16), to the southeast on the eighth and Frank, K6IVP, to the Midwest on the 25th.

Perseids. Unfortunately, they were "ho-hum," at best. Very little activity was noticed during the traditional peak at 1000Z on August 12. There were either very few reflection-quality meteors or very little activity on SSB. The WSJT digital crowd was reasonably active, but I didn't get the impression that they were doing particularly well either—at least there were several negative outcomes reported on Ping Jockey. The visual observers noticed a "rev-1" encounter at 2100Z on August 11, but that is a poor time of day for us here in the Americas.

Tropospheric ducting. Tropo ducting was not very impressive this month; it focused at the beginning and end of the month. Mike, KØAZ (EM37cc) found conditions on the first to his liking on 144, 222 (a new band for him) and 432 MHz, with contacts out 1000 km north to WW8M (EN72xf) and 700 km southwest to AE5B (EM02mj). Lee, N5TIF (EM12hk), worked over 1000 km into EM37, EM38 and EN41 on 2 m and 432 MHz. On August 8, Sam, K5SW (EM25hr), had 222-MHz contacts 1200 km northeast to EM86 and 970 km north to EN53. Paul, K4MSG (FM19), reports strong coastal tropo August 25-27, extending from North/South Carolina north to the Maritimes. Paul's best 2-meter DX was 1400 km to VY2JC (FN76vs). The propagation logger reported that conditions extended to 6 meters. At and around August 27, Ev (W2EV) noted the possibility of a North Atlantic tropo duct forming between the western British Isles and northeastern North America, according to the Hepburn maps at **home.cogeco.ca/~dxinfo/tropo_nat.html** (new URL). Last August, I noticed a similar possibility between the western Iberian coast and the midAtlantic, so August may be the prime month for these routes.

Digital. Ernie, W7LHL (CN87), reports that he and Mike, KD7TS, have been experimenting with FSK441 using signals reflected from aircraft to communicate on 10 GHz. These signals appear to last from a few seconds to three minutes at those frequencies, and they exhibit high-to-low Doppler shift with fading. Both Ernie and Mike run 1-3 W to dishes 1 meter or less in diameter with elevation control pointed at a common sky volume. They use Larkin DSP10 144 MHz transceivers as IFs and for the waterfall. All equipment was phase locked to GPS reference 10 MHz standards. Signals were weak but readily decodable using 5 second TX/RX intervals. Later tests indicate that the JT6M mode may be the best for airplane scatter.

Aurora. The only aurora of consequence was a reasonable burst late on August 30 with a peak Kp of 6 and a resulting Ap of 28. According to the DXWorld logger, it was mostly a higher-latitude affair featuring stations in New England, Minnesota and Wisconsin. The southernmost stations were in EM95 (N1GC) and EM84 (W4WA). One interesting feature was a number of 70 cm contacts by W9ZIH (EN51) to K3KEL (FN11) and N3FZ (EN90).

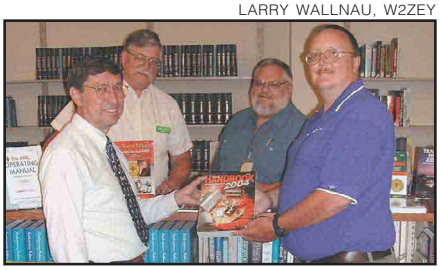
HERE AND THERE

Global Six Meter Marathon. OH3AG announces the results of the Marathon, the top number of countries worked between May 8 and August 8 this year. In spite of a mediocre E_s season, the top scores are impressive: IKØFTA (77), ON7GB (74) and PA4PA (69) in Europe; 5B4FL (67) in Asia; 7XØAD (56) in Africa; and K7BV/1 (58), NW5E/4 (51) and N3DB (42) in North America. Full results can be found at **www.50mc.tk/**.

Leonids. This once great event from the turn of the century has again been reduced to the status of a minor shower. The best predictions I see indicate the peak will be on November 17 at 0640Z ±12 hr at a maximum rate (ZHR) of 10-20/hr. As always, be alert because this shower is not easy to predict, but the possibilities do not look good.

STRAYS

LARRY WALLNAU, W2ZEY



When the Rochester (NY) Amateur Radio Association donated a set of ARRL books to the Webster Public Library recently, several club members were on hand. Donald Dunn, AB2NM (front right), presents *The ARRL Handbook* to library director Marvin Andrews. Looking on are George Masny, KA2GPJ, and Doug Howard, KC2KNH. For more information about the ARRL Library Book Set, see www.arrl.org/FandES/field/club/libookset.html.

Coaxial RF Connectors for Microwaves

There are two common ways to connect RF components—coax and waveguide. In this issue we will examine the coaxial connectors that are in use for microwave frequencies.

Equipment that microwavers buy new, find surplus, and build needs to be interconnected. Usually, low loss, ability to form repeatable connections and low cost are important issues.

What Makes a Good Coaxial RF Connection?

Coax is a very convenient transmission line for short runs of microwave energy. Although coaxial cables are lossy, except at the very highest frequencies most circuits can tolerate the small loss incurred in a few inches of cable. The benefits of easy interconnections offered by small microwave coax, such as 0.141, 0.085 and 0.047 inch Hardline (see Figure 1), hand formable semi-flex and braided varieties often outweigh the loss.

A good coaxial connector continues the transmission line characteristics through the interface to the other side, which can be another piece of coax or some kind of transition to a stripline circuit or waveguide. Because coax consists of a coaxial set of cylinders, where the internal conductor is surrounded by a dielectric and another "ground" external conductor, a coax connector follows the same geometrical form.

The only difference between coaxial cable and a coaxial connector is the need to break and make the connection. In most common connectors, the center conductor has one end with a pin (male) and the other has a socket (female). Because the female end must be made of sprung fingers in order to make good contact (usually four of them), it will change shape when the connection is made. Precision manufacturing results in perfect cylindrical shape of the internal conductor once the connection is made. Also, if one wants to reuse the connector, the springy female end must have sufficient strength to prevent weakening or breaking of the fingers.

JOHNSON COMPONENTS, INC

As the frequency is increased in any coaxial transmission structure, a point is reached where the wavelength approaches about one half the size of the coaxial diameter and the coaxial cable becomes a waveguide. Engineers refer to this as the "excitation of the first circular waveguide mode." At this critical frequency, coaxial cable can produce unpredictable results. The same is true of coaxial connectors. Connectors are often rated by their maximum usable frequency, which is defined by the frequency where a waveguide effect becomes possible.

Connectors in Widespread Use

There are so many RF connectors in use that there is not enough space available in this column to list them, let alone describe them. Fortunately, amateurs generally limit their use to those that are more common because they are installed on new and surplus equipment or are easily available at flea markets and hamfests. Here is a list of some of the many microwave connectors in use that will not be described in this issue: $^{7}/_{16}$ DIN, GR874, SMB, SMC, OSSM, SSMA, SSMB, SSMT, OSMT, MCX, OS-50P, BMA/OSP, OSMP, OSSP, GPO, GPPO, SMP, SSMP, Nanohex, MMCX.

The "UHF" connector does not enter a waveguide mode through the UHF bands, but it is not truly a 50 Ω connector and therefore does not perfectly match standard transmission cables. Various versions have measured from about 25 to 40 Ω impedance. Like other connectors, it is not physically long, so in use it presents the equivalent of placing an insignificant fraction of a wavelength of different impedance coax into your line—at least on bands up through 2 meters. At 430 MHz and above, the impedance "bump" that a UHF connector places into your transmission line starts to become significant. This is why you see very few radios with this connector for bands above 430 MHz. Generally speaking, microwavers who are on 902 MHz and above do not use UHF connectors.

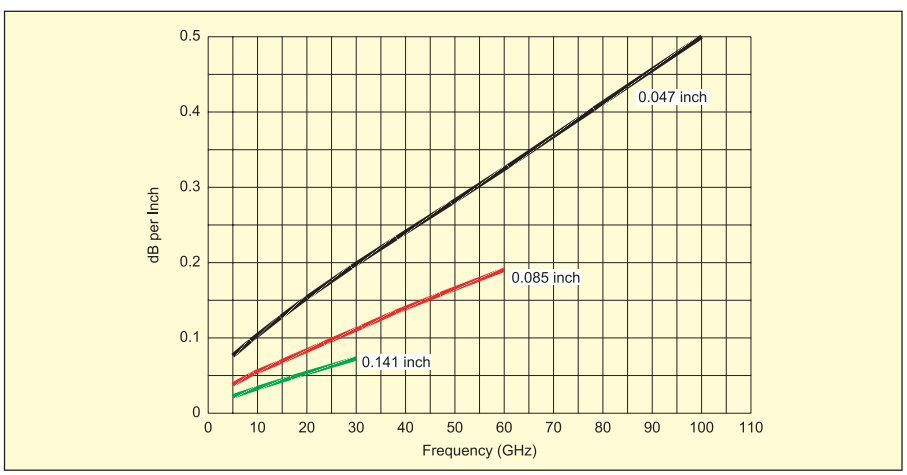


Figure 1—The small loss in small hardline is tolerable in most situations where only a few inches of coax are used to connect microwave components. Smaller diameter coax has greater loss but can operate at higher frequencies than larger coax.

The "N" Connector

A true 50 Ω connector, the N is a sturdy, gasketed connector. It was designed in the 1940s for military systems and follows the standard MIL-D-39012. Several sources

Tom Williams, WA1MBA ♦ wa1mba@arrl.org

WA1MBA

Figure 2—Male N connectors. On the left is a slotted, and on the right a higher performance slotless connector.

give different attributions to the name "N," the two most popular are Navy and Mr Paul Neil, an RF engineer at Bell Labs. Air is the dielectric between the center pin and the outer conductor inside the connection. Although originally designed to work up to 5 GHz, refinements in the 1960s pushed performance to 12 GHz and later to 18 GHz. Agilent, Kings, Amphenol and others offer some N connectors with slotless outer conductors for improved performance to 18 GHz and beyond. Waveguide modes begin at about 20 GHz. A 75 Ω version is in use by the cable-TV industry. It has a smaller center pin. Figure 2 shows slotted and slotless males and Figure 3 shows a female N connector.

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Figure 3—A female N connector. This one is intended to be chassis mounted.

The BNC Connector

Designed for military use to at least 2 GHz, the BNC uses a slotted outer conductor and some plastic dielectric on each gender. The dielectric causes increasing losses at higher frequencies, but the impedance remains fairly constant. Above 4 GHz the slots may radiate, so the connector is usable but not mechanically stable up to about 10 GHz. 50 and 75 Ω versions are available. The genesis of the name again depends on the source. One calls it the Bayonet Navy Connector, while another the Bayonet Neil-Concelman. My sources indicate that Karl W. Concelman created the "C" connector—another high performance constant impedance connector. Figure 4 shows a male and female BNC.

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Figure 4—A male BNC on the left and a female BNC on the right.

A threaded version, the TNC helps resolve leakage and mechanical problems, permitting stable operation up to 12 GHz. There are special extended frequency versions of the TNC that adhere to the IEC 169-17 specification for operation to 11 GHz or 16 GHz, and the IEC 169-26 specification that operate mode-free to 18 GHz (but with significant losses).

The SMA Connector

Bendix Scintilla Corporation designed the SMA (Subminiature A) connector. Omni-Spectra Corporation called this the OSM connector (see Figure 5). The SMA connector is perhaps the most widely used microwave connector, and is certainly in widespread use by radio amateurs. It takes the cable dielectric directly to the interface without air gaps. A few hundred interconnect cycles are possible if performed carefully. Care should be taken to join connectors straight-on. Prior to making a connection it is wise to inspect the female end to assure that the center socket is in good condition (fingers not bent or missing).

A standard SMA connector is designed for interconnects to 12.4 GHz. Fortunately, a good SMA is useable to 18 GHz in most cables, and if well constructed with greater loss and SWR to 24 GHz. Figure 6 shows the SWR for a very high quality SMA connector. Bumps at 12.4, 18 and above 24 GHz indicate geometric constraints within the connector that lead to limitations at these three frequencies depending on the quality of the connector. Problems in anchoring the dielectric

WA1MBA

Figure 5—A pair of SMA connectors, with male on the left and female on the right. Like many connectors, these are available in nickel, stainless steel or gold finish.

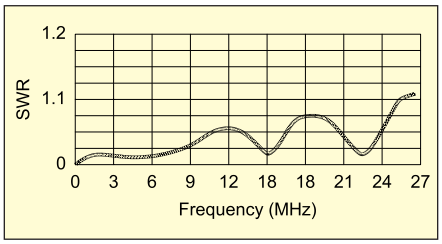


Figure 6—The SWR of a high quality SMA connector.

support limit the number of interconnect cycles and general performance.

Precision Connectors

Two precision SMA compatible connectors were developed. One is the 3.5 mm (also called the Wiltron WSMA) and the other is the Wiltron K (or 2.92 mm or SMK). All connectors in this family and the SMA mate to one another.

Although compatible, there is the possibility of damage to the (unsupported) female fingers of the 3.5/2.9 if an SMA male is inserted other than perfectly straight-on, or if the SMA is improperly prepared with a pin that is too long.

The 3.5-mm connector was primarily developed at Hewlett Packard (now Agilent), with early manufacturing at Amphenol. It was designed to be rugged and compatible with popular SMA dimensions, allowing thousands of repeatable connections. It is mode-free to 34 GHz. One obvious difference between the 3.5 and the SMA is that the 3.5 uses an air dielectric throughout the female connector (see Figure 7).

The K connector, trademarked by the Wiltron Corporation (now Anritsu), was developed in 1983. Also known as the 2.9 mm, the K offers mode-free performance to 40 GHz, usable to 46 GHz. Some manufacturers call this the "2.9" and others the "SMK." The K connector

WA1MBA

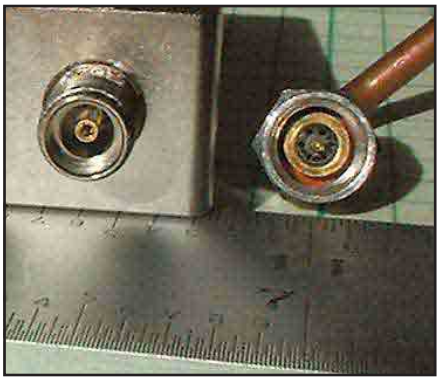


Figure 7—The 3.5 mm connector, female on left and male on right. A black plastic with air holes is used to support the male pin, while the female fingers are suspended in air.

has been successfully tested at over 10,000 (careful) interconnect cycles with negligible change in performance.

Beyond SMA Compatibility

The 2.4 and 1.85 mm geometries were designed to go beyond the SMA interface constraints, and as a result are *not* SMA compatible. These designs were meant to achieve the highest possible frequency along with repeatable measurements after hundreds or even thousands of interconnects.

RF COAX, INC

Figure 8—Here are a male 2.9 mm SMA compatible connector on left, and male 2.4 mm (*not* SMA compatible) connector on the right.

The male hex head is the same outer size as an SMA, 0.312 inch, tightened with a $^{5}/_{16}$ inch wrench. The threads, however, are metric, at M7 × 0.76-6G.

It can be difficult to distinguish between a 2.9 mm SMA compatible and a 2.4 mm (non-compatible) unless they are next to each other (see Figure 8). Because they are not mechanically compatible, if you have a male and a female SMA of professional manufacture (carry one of each with you to flea markets), you can put them next to the connector under question and decide whether it is an SMA compatible or a 2.4/1.85.

1.85 mm

The 1.85 mm connector was developed in the mid-1980s by HP for modefree performance to 65 GHz (see Figure 9). Hewlett-Packard offered their design as public domain in 1988 to encourage standardization of connector types; a few devices are available from various manufacturers for research work. The inside of the outer conductor is 1.85 mm in diameter.

SPECTRUM ELEKTROTECHNIK GMBH

Figure 9—A close-up photo of the 1.85 mm male connector. Anritsu calls this the "V" connector.

1.0 mm

Perhaps the ultimate in coaxial connectors, HP (now Agilent) developed the 1.0 mm connector that supports transmission and repeatable interconnections from dc to 110 GHz. Laboratory instrumentation technicians and engineers are beginning to use the 1.0 mm for millimeter-wave analysis. This connector (shown in Figure 10) is also often used on semiconductor probe stations for the evaluation of millimeter-wave RF MMICs. The use of coaxial connections greatly simplifies what would otherwise require several sets of waveguide-based measurements to a single step. Anritsu has also developed similar connector.

AGILENT, INC

Figure 10—A close-up photo of the Agilent (HP) 1.0 mm male connector. The dielectric diameter is only 1 millimeter.

For more information, see **www.wa1mba.org/rfconn.htm**. QST

NEW BOOKS

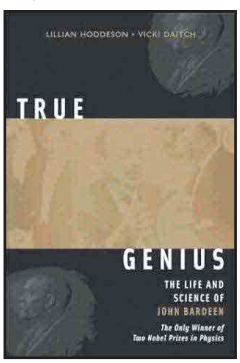
TRUE GENIUS: THE LIFE AND SCIENCE OF JOHN BARDEEN

By Lillian Hoddeson and Vicki Daitch

Published by Joseph Henry Press. 500 Fifth St NW, Washington, DC 20001; **www.jhpress.com**. *First edition, hardcover, 6¼ × 9¼ inches with black and white photographs. ISBN 0-309-08408-3, 482 pp.*

Reviewed by Gil McElroy, VE3PKD

◊ A "Stray" in the January 1965 issue of *QST* reported that ham radio was being used to keep a number of PhD students in Argentina in touch with their faculty advisor in the physics department at the University of Illinois. It was just another instance of a close brush John Bardeen would have with Amateur Radio throughout his life, for the faculty advisor in question, J. C. Wheatley, was part of a group loosely organized around Bardeen as he worked toward developing a theory of superconductivity. His eventual success would lead to his second Nobel Prize for Physics and make John Bardeen the only person to have ever won twice in the same discipline. It is, however, his first Nobel Prize, shared with Walter Brattain and William Shockley, that is of particular interest to hams. Awarded in 1956, it was for the invention that forever changed the face of electronics: the transistor.



True Genius: The Life and Science of John Bardeen biographically documents the life and work of this fascinating and modest man (for years, his long-time golf partners had no idea what he did for a living). Lillian Hoddeson, who coauthored this book with Vicki Daitch, has been this way before as coauthor of *Crystal Fire: The Birth of the Information Age*, which detailed the story behind the transistor and briefly laid out the lives of its inventors. Here, though, her attentions are focused entirely on both the biographical details of Bardeen's life—from his birth in 1908, son of the Dean of the University of Wisconsin School of Medicine, to his sudden death from a heart attack in early 1991—and his singular achievements at Bell Telephone Laboratories where the transistor was invented in 1947, and later at the University of Illinois where he developed the theory of superconductivity for which he received the Nobel Prize in 1972.

Bardeen's very first brush with Amateur Radio? That came in the 1920s when, like so many young men and women of his generation, he fabricated his own crystal radio so as to spend hours listening in to the sounds it pulled from the electromagnetic environment.

With this very readable biography, the authors lay out an excellent case for remembering John Bardeen as a *True Genius*. If only he had been a ham.

STRAYS

ANTARCTICA AWARD

◊ The Mediterraneo DX Club issues the *Antarctica Award* (**www.mdxc.org/antarctica/**) for contacting Amateur Radio stations operating from the various bases in Antarctica. The area encompassing Antarctica is defined as the area south of 60° S latitude, including islands and ice shelves, to which the provisions of the Antarctic Treaty apply.

The *Antarctica Award* is available to either licensed amateurs and SWLs. All contacts must have taken place since January 1, 1961. Contacts may be made on any amateur radio HF band from 10 to 160 meters, on CW, SSB and RTTY (neither single band nor single mode endorsements will be issued).

The Basic Award is issued for confirmed contacts with five different bases located in at least three of the seven sectors into which the Antarctic territory has been divided up for the purposes of this Award.

Full rules can be found at **www.mdxc.org/antarctica/rules.asp**.—*Antonio Cannataro, IZ8CCW, Secretary, Mediterraneo DX Club*

Yardley Beers, WØJF

By Dorothy Sands Beers

Yardley Beers, WØJF, sits in his wheelchair facing the table that holds his key, earphones and transmitter. Still active at age 91, he has vivid memories of the old days of ham radio.

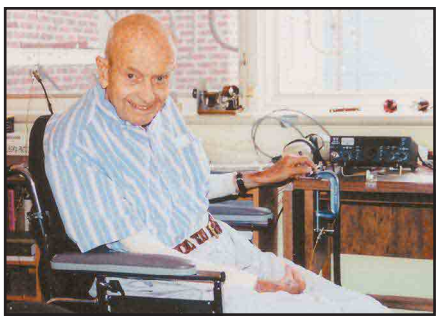
Back in 1917, at age 4, Yardley was fascinated with railroads and electricity. Later, at the age of 9, while at Camp Choconut in Pennsylvania near Binghamton, New York, he was introduced to ham radio, which became his main interest.

Atherton Noyes, a counselor, taught the Morse code there. At first, when listening to transmissions, Yardley could identify only occasional letters. Persisting, he gradually improved and at the end of the summer won the camp's award for efficiency with the code.

Returning home to Trenton, New Jersey, to build a crystal set, he calculated that he needed about 217 feet of number 22 enamel wire around and around an oatmeal box. This fine wire would be hooked to a device known as a "cat's whisker." Many years later during World War II, his knowledge of the cat's whisker was useful in building crystal detectors for radar, then very secret work. His original oatmea1 box radio still works today.

At age 13, Yardley went off to the Phillips Academy in Andover, Massachusetts. Students were not allowed to have any electrical equipment in their rooms, but Yardley got around this problem. By using a slightly altered receiver that he saw pictured in *QST* he turned an innocent looking lunchbox into a receiver and dangled an antenna out the window. No school inspector realized it was a radio.

Yardley joined the school's radio club, which met in a small shack with a wood stove at the edge of the campus. Then one day he took the train to Boston and passed the code test and won a license. Soon afterward he received his first call letters, W3AWH. [The Phillips Academy club, W1SW, has a long and storied history. It claims to be the first school station on the air, and is the oldest (continuously licensed) club station in the country. Some say Harvard's station is older, but W1SW was on the air first!—*Ed.*]



Yardley Beers today.

From that time on, his studies took him to Yale, where he became a charter member of their radio club. Later at Princeton he received a PhD that involved measuring the charge of the electron. While there he also met Einstein.

During the years before World War II, while he was an instructor at New York University and then at Smith College, he returned to his Trenton, New Jersey, home while on vacations, to the radio shack in his bedroom. From this location he made hundreds of contacts including one with Anton Hapsburg, the Archduke of Austria. He would visit all the local shops that now sold radio parts, and his equipment became more sophisticated. During this time he became a charter member of the Delaware Valley Radio Association.

In 1932 he visited with hams on the first of many trips to Europe. Then in 1935 as a guest of the Belgian Radio Club, aka "Réseau Belge," he attended the World's Fair in Antwerp and was royally entertained. This included an elaborate lunch at the chateau of Baron de la Roche, ON4AM. It stood in a huge open field. About 50 hams from a dozen or so countries were represented. He remembers looking through a wide doorway into an adjacent glassed-in room called the "Orangerie" where orange trees grew.

On this same trip he met Nel Cory, the first ham in the world, male or female, to earn the Worked All Continents Award on 10 meters. He also met Frederick "Dud" Charman, G6CJ, and John "Clarry" Clarricoats, G6CL, General Secretary for the Radio Society of Great Britain.

During World War II Yardley worked on radar receivers at MIT's Radiation Lab. Airwaves were reserved for government use at this time for security reasons, so hams put their rigs away. But when the war ended, Yardley was ready on the morning when hams could be active again. In his small bedroom on that hot summer morning, with a power supply under his bed and an antenna strung outdoors to a tree, Yardley started tapping out the code with his earphones on—and nothing else!

After the war he moved to a house in the Riverdale section of New York City and worked as a physics professor at New York University. With his call letters changed to W2AWH, he continued to work more hams.

He took time out to go to Australia on a Fulbright grant. He said he saw lots of

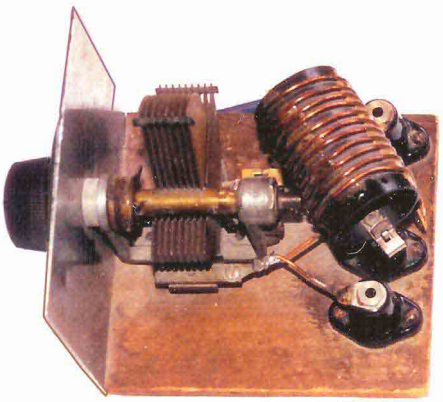
The caption from Jan 1971 *QST*, page 72, reads: Yardley Beers, WØJF, won the August Cover Plaque award with his article, "Short Antennas for the Lower Frequencies." Presenting the award is ARRL Vice President Carl L. Smith, WØBWJ (left).

"There are enough receivers, transmitters, and transceivers in this picture to put nine stations on the air at one time. The best six of them are five watts and less"—WØJF, 1971. (You can see the Cover Plaque award just above his head.)

John Dilks, K2TQN ♦ 125 Wharf Road, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

Yardley's lunchbox receiver from his school days.

Yardley's crystal set, built in 1923 at age 9.



W0JF's early homebrew wavemeter.

Three of W0JF's surviving Sardine Can transmitters.

kangaroos there, but none happened to be out in a field in the northern suburbs of Sydney when he was helping hams clear the bush for a new radio club building!

Back on the East Coast in 1951, Yardley decided that for the last half of his working life he would move at least 1000 miles away, so he chose Boulder, Colorado. While in Boulder he took an exam and, under the new rules, traded W2AWH for shorter call letters. As WØJF he worked thousands more hams.

Working at the National Bureau of Standards, he was involved with WWV and oversaw the division that maintained the atomic clock. He was active in and later an honorary member of the Boulder Amateur Radio Club. As a ham, he helped the fire department and police with communications at forest fires and at a marathon. Then one moonlight night on Colorado's Trail Ridge Road at 12,000 feet above sea level, he worked hams on both coasts with his transistorized transceiver named the "Black Rose."

He likes to tell about unusual happenings. Once a neighbor called his home to report that Yardley was interfering with his television—during a time Yardley happened to be away at a science meeting in Moscow. Another time a neighbor claimed Yardley was coming right into her mouth when a loose filling vibrated.

And then one time when he was opening a sardine can in the kitchen he had a bright idea. He built the first of several radios in sardine cans. He has built many since then and says, the smaller the better. He has worked both coasts with sardine cans!

On his many travels he often carried a suitcase full of radio parts and a homemade collapsible antenna. On one trip he paid a long visit to John Ogg, G47PP, at his hideaway croft house on the Isle of Col, in the Hebrides, an area so remote that steamships stopped there only twice a week. Twice he traded houses with another ham, Jack Etherington, GD5UG, in Peel, on the Isle of Man. Each used the other's station—and car!

The following is from a Web reminiscence, "Some Encounters in Western USA 1984," by Jack and Margaret Etherington (**www.isle-of-man.com/manxnotebook/famhist/v07n3.htm**):

> In June or thereabouts through the medium of one of my hobbies—Amateur Radio—I had spoken to an American radio ham whilst he and his family were on holiday at Woods Hole in Massachusetts, his home normally is at Boulder in Colorado. Following our radio contact the amateur in question, Yardley Beers and I exchanged quite a number of letters. I learned that he is a retired Professor of Physics who worked with the US National Bureau of Standards until he retired. At the age of just over 70 he has gone back to college at Boulder to follow a long-standing interest, and he is now taking a degree in history. Another of his interests is in archeology, and he told me his professor at Boulder was trying to arrange for him to take part in an archeological excavation somewhere in England this summer. When I told him of the Liverpool University Rescue Unit and the dig in Peel Castle he seemed to think this was very much the sort of thing he had in mind. In short he is coming to Peel for five or six weeks this next summer—at the invitation of Mr. David Freke—to take part in the next session of the Peel Castle Dig.
>
> Needless to say we just had to meet Yardley and his wife during our brief visit to Colorado's principal university city. We did have time though to take a tour conducted by Yardley of the Bureau of Standards and also the Atmospheric Research Center, a few miles to the north of Boulder.

Yardley also visited Les Moxon, G6XN, near London, an author and an expert on antennas. And on a trip in the other direction, he landed on Easter Island to discover that the driver of the van from the airport was a ham. He helped Yardley drape antenna wires overhead among the tropical plants and flowers in the courtyard where he stayed.

Over the years Yardley has had several short items in *QST*, and 11 articles. He received the *QST* Cover Plaque Award for one of them, "Short Antennas for the Low Frequencies," published in August 1970, after it was voted the most interesting article published in *QST* that month. As a result, his call letters were featured on the cover. He also wrote numerous scientific articles and was author of a book, *The Theory of Error*.

At present Yardley's room in Boston's Sherrill House contains two computers, piles of reference books, old *QST*s, a wide assortment of cables, wires, meters and radios. He never stops thinking up new ways of improving his radios. There are always new problems to work on, as there always have been.—*K2TQN*

Color photos by David Sawyer, W1PIE

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

N1BTE, Ellen S. Bennett, Mount Desert, ME
W1CO, Arthur Rieders, Wayland, MA
*K1DFC, Philip J. Carpenter, Belchertown, MA
KB1EV, Emerson H. Hiller, Fairhaven, MA
KB1GWX, Frederick P. Snay, Newport, VT
WA1HSG, Robert A. Green, Newport, VT
W1HVA, Charles Jobes, Hendersonville, NC
WA1IED, Raymond J. Smith, Gig Harbor, WA
N1LRL, Donald B. Coe, South Easton, MA
W1MPC, James J. Donahue, East Dennis, MA
W1OLF, Henry A. Gowing, Loudon, NH
WA1SQR, Julian Soshnick, Rockport, MA
K1UOR, Doris J. Young, Florence, MA
*W2AAF, John F. Pomfret, Stony Brook, NY
K2BHQ, Abner (Jack) S. Coriell, Franklin, NC
ex-WB2CRK, Benjamin Gelfand, Southbury, CT
AB2CV, George G. Earle, Toms River, NJ
W2EFI, Harold R. Phillips, Hicksville, NY
W2ENF, Charles P. Koehler, Southbury, CT
W2KW, Clarence Seid, Middletown, NY
W2TIX, Robert W. Perry, Painted Post, NY
N3AAY, George Holt Jr, Doylestown, PA
WA3ABN, Samuel W. Schuler Jr, Telford, PA
W3ATQ, Claude E. Feigley, Stephens City, VA
K3CH, William R. Faust, Huntingtown, MD
*K3DTD, Charles A. McCreary, Alburtis, PA
KC3DU, Charles J. Aiello, Dover, PA
KQ3E, John Parnell, Medford, NJ
W3FLE, Edward J. Savko, Baltimore, MD
W3IK, Joseph P. Fincutter, Bethesda, MD
N3WIA, Edward M. Reidell, N Versailles, PA
WA3WPE, Clyde G. Stacy, Oakdale, PA
W3YWK, Carmelita T. Gossard, Cudjoe Key, FL
WA4AFA, Charles H. Bell Jr, Valley, AL
N4EBV, Mark L. Krell, Buford, GA
K4HBH, Oliver S. Johnson, Flat Rock, NC
W4IBH, Albert M. Nance, Gainesville, FL
W4INM, C. A. Waterhouse, Chattanooga, TN
KC4KWI, James H. Swanzy, Mobile, AL
*KQ4LL, Martin J. Schaeffer, Melbourne, FL
*K4OPK, Eugene B. Melchor, Mooresville, NC
WA4RHF, Ruth W. Bond, Burlington, NC
K4RIG, John H. England, Corryton, TN
*N4SML, Opal A. Kay, Jasper, TX
KG4TVX, Janice A. Goodpaster, Waynesburg, KY
W4VAG, James B. Robison, Chattanooga, TN
W4WKQ, John F. Zwaska, Fort Walton Beach, FL
AF4Y, Frank G. Deak, Lawrenceville, GA
W4ZRG, Robert A. Buehn, Melbourne, FL
W5EGX, Franklin C. Burt, Dallas, TX
KA5EHF, Henry C. Sauer Jr, Houston, TX
W5INU, Glenn O. Thomas, Tulsa, OK
KC5JLT, Ronald D. Renfro, San Angelo, TX
W5KUF, Jerry L. Morris, Portland, TX
KC5LL, James L. Paul, Bruno, AR
KC5LRT, John B. Fleming, Livingston, TX
AC5OT, James E. Ayers, Lumberton, MS
KC5QGW, George E. Creel, Austin, TX
W5RUK, George E. Harmon, Biloxi, MS
W5SGL, Walter L. Daniels Sr, Gulfport, MS
W5SIF, Rudolph N. Starnes, Russellville, AR
K5SQP, W. F. Abright, Dallas, TX
KA5SYN, Harold W. Weeks Sr, Lubbock, TX
NF5T, Robert H. Oliver, Graham, TX
N5ZDF, H. Eugene Holcombe Sr, Hazlehurst, MS
W6EDL, Ernest L. Self, Yuma, AZ
K6EVP, Scott A. Rogers, Paradise, CA
W6FYT, Charles E. Nicks, Owasso, OK
W6GOO, Howard B. Johnson, Darrington, WA
K6HWR, Harry F. Schumann Jr, Gilroy, CA
W6IBU, Arthur L. Schelling, Napa, CA
WB6KTI, Claud A. Kreighbaum, Sacramento, CA
*N6OO, Claude Lievsay Jr, Mountain View, CA
AB6OZ, George F. Brady Jr, San Jose, CA
*W6TOY, Bruce Muscolino, Silver Spring, MD
KT6TT, Gary B. Jordan, Poway, CA
*WB7BLE, Stanley R. Mundy, Tacoma, WA
W7EM, Everett H. Marine, Powell, WY
KC7FCR, Dorothy Carter, Kennewick, WA
W7FLH, Heze C. Burkhart, Albany, OR
*WB7H, Herbert J. Ungricht, Sandy, UT
N7QL, Rickey Vehrs, Bremerton, WA
K7QOP, Clarence R. Andersen, Carson City, NV
KE7S, Elliott S. Harris, Atlanta, GA
WA7TAA, Edward S. Colby, Otis Orchards, WA
AD7T, Wilbert L. Lane, Florence, OR
K7ZOK, Harold P. Leary, Las Vegas, NV
W8BKO, Robert R. Adams, Columbus, OH
W8CDM, Paul D. Rubinstein, West Bloomfield, MI
K8GBU, Francis J. Nitz, Howell, MI
K8JFL, Eleanor Rickey Stevens, Cleveland, OH
KC8JFY, Donald S. Freeman, Piqua, OH
WD8OGD, Eleanor B. Manning, Malta, OH
KA8SZI, James R. Hargraves, East Liverpool, OH
W8TOM, Munson U. Robinson, Asheville, NC
N8WCE, William E. Mullins Jr, Trenton, OH
W9BKW, Clarence Holtman, Lindenwood, IL
K9HBY, John L. Conkling, Arlington, KS
W9INN, William E. Fanckboner, Mount Prospect, IL
KB9M, William F. Hall, Antioch, CA
KB9PFT, Michael L. Brewer, Kilbourne, IL
W9REE, Robert E. Engstrom, Moline, IL
KB9UIU, Frederick E. Beaulac, Streator, IL
KA9WWY, Louis D. Graber, Oshkosh, WI
KØALA, Bruce E. Alspach, Milton, VT
WØBB, Edward J. Bock, St Louis, MO
KAØFRC, Matthew A. Langley, Overland Park, KS
*NØMUT, Virginia R. Carey, Westminster, CO
WØOWF, Dale V. Lally Jr, Canton, NY
WØWTM, Michael M. Opitz, Affton, MO
WØWXY, Charles W. Naylor, Concordia, KS
DL7JF, Rainer Mertz, Schwalbach, Germany
G3IGW, Mike G. Whitaker, West Yorkshire, Great Britain
*VE2EM, Andrew F. Rugg, Cornwall, ON, Canada
*VE7CJ, Bernard A. Best, Kelowna, BC, Canada

*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

ARRL EXTRA CLASS CERTIFICATE

◊ The Awards Branch of the ARRL Membership Services Department offers the Extra Class License Certificate acknowledging the achievements of newly licensed Amateur Extra Class amateurs as well as those who qualified for this license class long ago. The attractive 8½×11 certificate is suitable for framing. For your certificate, ARRL members send $7.50 ($10 for nonmembers) to the Awards Branch, ARRL, 225 Main St, Newington, CT 06111. Be sure to include your name and call sign (exactly as you wish it appear on the certificate), address and the date your Extra Class license was issued (year is close enough). To learn more about ARRL awards, point your Web browser to **www.arrl.org/awards**.

QST congratulates...

◊ Ken Ralls, NØAUZ, of Clarence, Missouri, whose new novel, *McKays Island, The Beginning,* involves Amateur Radio.

◊ ARRL Life Member Kraig Krist, KG4LAC, of Annandale, Virginia, who recently received a Certificate of Special Achievement from Chief Justice of the United States William H. Rehnquist. As member of a team of three senior programmer/analysts, he received the award for the analysis, design, development and implementation of the Clerk's Office Docket System, allowing the Supreme Court to track Court cases through the various stages.

◊ those who received awards recently at the ARRL Kentucky State Convention near Louisville: ARES operator of the year for excellence in program building—KG4TND; ARES operator of the year for excellence in program operations—KA4UHL; Lifetime Achievement Award—NB4K; Ham of the Year—K4ULW; Newsletter Award (for the Northern Kentucky Amateur Radio Club's newsletter *The Feedline*)—AG4XM.—*John Meyers, NB4K*

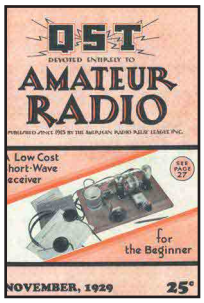
◊ Rus Burgess, WØPUP, of Velva, North Dakota, who celebrated his 100th birthday earlier this year. Rus remained active until last year.—*Jay Rice, KAØZUX*

I would like to get in touch with...

◊ anyone with pictures, stories or other information about a recent Silent Key, Captain Lee E. Reisenweber, K3RGD/VP2VE.—D. L. Borgman, 11111 NE 105th Ave, Archer, FL 32618; **dlb@borgmangroup.com**

75, 50 AND 25 YEARS AGO

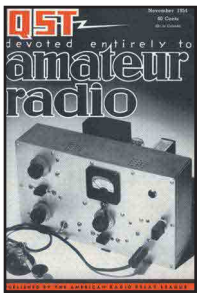
November 1929



♦ The cover photo shows "A Low-Cost Short-Wave Receiver for the Beginner." The editorial reports on the Federal Radio Commission's recent decisions not to give amateur frequencies to other services. The FRC decision explicitly commends amateurs for their services to the radio art and to the nation, and even states that "it is to be regretted that the provisions of the International Radio Convention have afforded them so little in the way of frequency bands." It makes a ham feel darned good to know that the Federal Radio Commission is aware of his value, and that the Commission is safeguarding his bands from intrusion by other services.

Assistant Technical Editor Beverly Dudley tells about "A High-C Heterodyne Frequency Meter." E. L. Battey reports on "The Hiram Percy Maxim Sixtieth Birthday Relay" and shows a photo of President HPM with a stack of ham radiograms that had originated from places "all over the world." Dudley also tells how to build "A Simple 1750- and 3500-Kc. Receiver." H. A. Robinson, W3LW, describes "Operating Characteristics of Vacuum Tube Oscillators." The seventh entry in the Station Description Contest is "W8CAU."

November 1954



♦ The cover photo shows a new design for a Novice rig that operates on 40 and 15 meters and which features shielding that "takes care of Old Man TVI." The rig will be in a forthcoming issue of *QST*. The editorial announces the retirement of FCC commissioner George Sterling, W3DF/W1AE, the only amateur to ever hold a seat on the Commission.

Ray Rinaudo, W6KEV, tells about his small but high-power amplifier, "A Multiband 813 Final." Bob Ehrlich, W4CUU, describes "The Lazy Man's Panoramic Adapter," built around a surplus BC-453 receiver. Now that the new device known as the transistor is available, W. A. Wadsworth, W2ZKE, builds "A Transistor Superregenerative Receiver for 10 and 6 Meters." Warren Bruene, WØTTK, discusses "Distortion in Single-Sideband Linear Amplifiers." W. W. Deane, W6RET, tells about a 10-meter transmitter and converter for mobile C.D. work, "The CD-10-TC." Part II of "A Step-by-Step Station for the V.H.F. Man," by Ed Tilton, W1HDQ, and Mason Southworth, W1VLH, describes the 120-watt amplifier for 6 and 2 meters. "Happenings of the Month," reports that all W4 call signs have been exhausted, so don't be surprised by the new K4 call signs.

November 1979

♦ The cover photo shows a scene at WARC 1979, with the note that "Your League Is There." The editorial asks, concerning FCC's position on the Morse requirement, "The FCC: Public Servant, or Public Enemy?"

Bob Luetzlow, K9ZLU, tells about "Building an Operating Impedance Bridge." Jim Prentice, VE4JI, tells about his own "Mayday." He and a fishing party were stranded in the wilds of Manitoba after their Cessna 180 was damaged. They got relays of several voice messages to Rescue by passing airliners, but then their mike went dead. Their final location was passed to Rescue by an airliner whose pilot didn't know Morse, but was looking it up one letter at a time in his flight manual. Doug DeMaw, W1FB, and Bob Shriner, WAØUZO, tell how to build "A Simple Utility Power Supply." Jim McDonald, WBØJQH, describes "A 'J' Driven 2-Meter Beam Antenna." Bill Alliston, W3ICB, helps the visually handicapped ham with "A Morse Readout for Your Digital Dial." Jim Kennedy, W7MID, tells about "A Simple, Accurate RF Wattmeter." Chet Opal adds new features to the Micro-TO Message Keyer, with "The Adaptamatic Message Keyer." Lee Aurick, W1SE, HQ's Advertising Manager, passes along some good operating tips in "Things Your Elmer Forgot to Tell You." Breckinridge Smith, K4CHE, explains "Transmitter Hunting for Beginners." 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 10 AM to noon and 1 PM to 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

Headquarters and W1AW are closed on New Year's Day, Presidents' 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

COMING CONVENTIONS

INDIANA STATE CONVENTION

November 13-14, Fort Wayne

The Indiana State Convention (32nd Annual Fort Wayne Hamfest and Computer Expo), sponsored by the Allen County AR Technical Society, will be held at the Allen County War Memorial Coliseum Exposition Center, 4000 Parnell Ave, at the corner of Indiana 930 (Coliseum Blvd) and Parnell Ave; I-69, Exit 112, go S to Coliseum Blvd, E to Parnell Ave. Doors are open for setup on Friday evening and Saturday morning; public Saturday 9 AM to 4 PM, Sunday 9 AM to 3 PM. Features include over 1000 commercial and flea market tables; new and used radio, computer, and general electronics items; vendors; several international ham equipment manufacturers; forums and meetings; VE sessions (Saturday); parking ($3). Talk-in on 146.88. Admission is $5 (at the door only), under 12 free with adult (good both days). Tables (8-ft) are $20 for flea market, $40 for premium, $27.50 for electricity. Send SASE to ACARTS/Fort Wayne Hamfest, Box 10342, Fort Wayne, IN 46851-0342; or contact James Boyer, KB9IH, 260-489-6700; or 260-484-1314; **kb9ih@arrl.net**; **www.fortwaynehamfest.com**.

WEST CENTRAL FLORIDA SECTION CONVENTION

December 4-5, Palmetto

The West Central Florida Section Convention (29th Annual Tampa Bay Hamfest), sponsored by the Florida Gulf Coast AR Council, will be held at the Manatee Civic Center, 1 Haben Blvd; at US-301/US-41 and Haben Blvd; Exit 43 off I-75, just N of the Manatee River; about halfway between downtown St Petersburg and downtown Sarasota. Doors are open Saturday 9 AM to 5 PM, Sunday 9 AM to 2 PM. Features include tailgating ($15 per space for the entire weekend); commercial booths; forums on numerous topics; VE sessions (both days); DXCC card checking; handicapped accessible; self-contained RV parking (limited number of spots, no charge); free paved parking. Talk-in on 145.19, 146.955 (100 Hz). Admission is $7 in advance, $8 at the door; under 12 free with adult. Tables are $20 each for the weekend, plus admission (electricity available for $32 for the weekend). Contact Jim Schilling, KG4JSZ, 44 Joel Massey Rd, Haines City, FL 33844; 407-356-3574; **jim@schillingdesign.com**; **www.tampabayhamfest.org**.

October 15-17
Pacific Division, San Ramon, CA*

October 23
South Carolina State, Sumter*

November 5-6
Michigan State, Holland/Zeeland*

November 6-7
Georgia State, Lawrenceville*

***See October *QST* for details.**

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance.

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 **November 1** to be listed in the **January** 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.)

†Alabama (Montgomery)—Nov 13; set up Friday 3-8 PM, Saturday 6-8 AM; public 9 AM to 3 PM. *Spr:* Montgomery ARC. South Alabama State Fairgrounds, Garrett Coliseum, Federal Dr; take Exit 6 off I-85, turn W, take Hwy 231 Exit, turn left, go about 3 miles to Fairgrounds on right. 27th Annual Hamfest/Computer Show, inside flea market, tailgating ($2 per vehicle space), vendors, forums, VE sessions (8 AM, on site; bring original and copy of your current license, picture ID, $3 fee), RV hookups, free parking. *TI:* 146.84, 147.18 (Ragchew), 444.5, 444.45. *Adm:* $5. Tables: advance $10, door $15. Phil Salley, K4OZN, 7173 Timbermill Dr, Montgomery, AL 36117-7405; 334-272-7980 (after 5 PM CST); **k4ozn@charter.net**; **www.w4ap.org**.

†Arizona (Mesa)—Dec 4, 5:30 AM to 3:30 PM. *Spr:* Superstition ARC. Mesa Community College, SE corner of Southern Ave and Dobson Rd; from US 60 (Superstition Freeway) turn N on Dobson Rd (just N of US 60), look for entrance before 2nd light (in West parking lot of college facing Dobson Rd). VE sessions (registration 8-9 AM, testing at 9 AM), free parking. *TI:* 147.12 (162.2 Hz). *Adm:* Free. Tables: $10 per space. Steve Gurley, KY7W, 1104 E Campus Dr, Tempe, AZ 85282; 480-620-2348; **steve.ky7w@gmail.com**; **www.wb7tjd.org**.

†ARRL Hamfest

†California (San Diego)—Oct 30, 8 AM to 4 PM. *Spr:* ARRL San Diego Section. Hilltop Recreation Center, 9711 Ovieda Way. Demos, displays, communications vehicles. *TI:* 146.265 (107.2 Hz). *Adm:* Free. Tables: Free. Patrick Bunsold, WA6MHZ, 1615 La Cresta Blvd, El Cajon, CA 92021; 619-593-1111; **wa6mhz@arrl.org**.

Florida (Coral Gables)—Nov 20. Bill Moore, WA4TEJ, 305-264-4465.

†Florida (Okeechobee)—Nov 27, 8 AM to 4 PM. *Spr:* Okeechobee ARC. Okeechobee County AG Center, 2801 NW SR 441 N, across from high school; 1½ miles N of SR 70 on W side of Highway 441. ARRL booth, catfish lunch. *TI:* 147.195 (100 Hz). *Adm:* $5. Tables: $5. Al Berryman, AD4RZ, Box 368, Okeechobee, FL 34973-0368; 863-697-6719 (cell); **ad4rz@earthlink.net**; **www.flweather.com/oarc**.

Florida (Palmetto)—Dec 4-5, West Central Florida Section Convention. See "Coming Conventions."

Illinois (Litchfield)—Nov 21. Scott Millick, K9SM, 217-324-2412 (Banquet/Swap).

†Indiana (Evansville)—Nov 27; set up Friday 3:30-7:30 PM, Saturday 6-8 AM; public 8 AM to 1 PM. *Sprs:* EARS and The Ham Station. Vanderburgh County 4-H Center Auditorium, 201 E Boonville-New Harmony Rd; take US 41 to N side of Evansville, 3.1 miles N of Airport, turn W at stoplight at Boonville-New Harmony Rd next to Buy-Low, look for entrance gate on left just past railroad track. 12th Annual Hamfest, prehamfest biscuits and gravy breakfast (7 AM, hosted by Old Post ARS), large indoor flea market, free tailgating with admission ticket (weather permitting), commercial vendors, VE sessions (CW exams at 10 AM, written exams at 11 AM), refreshments. *TI:* 145.15, 146.925, 443.925, 145.11 (107.2 Hz on all frequencies listed). *Adm:* $6. Tables: advance $10 (if paid by Nov 15), $12 (after Nov 15); wall tables are for commercial vendors only (call for pricing). Neil Rapp, WB9VPG, 2744 Pinehurst Dr, Bloomington, IN 47403; 812-333-4116 or 812-327-0749; **wb9vpg@w9ear.org**; **w9ear.org/hamfest.htm**.

Indiana (Fort Wayne)—Nov 13-14, Indiana State Convention. See "Coming Conventions."

†Indiana (Greenfield)—Dec 5; set up Saturday after 4 PM, public Sunday 8 AM to 2 PM. *Spr:* Hancock ARC. Greenfield Central High School (Pavilion Building), 810 N Broadway; I-70 to Exit 104 (St Rd 9), go S to first stop light past I-70, turn right (New Rd), turn S on Broadway, go past 4-way stop to school on right. Vendors, VE sessions (9-11 AM). *TI:* 145.33. *Adm:* advance $4, door $5. Tables: 8-ft $13 (includes 1 admission); additional tables $10 each. Mike Mallory, NE9O, Box 335, Greenfield, IN 46140; 317-861-1916; **tinman@on-net.net**; **www.w9atg.org**.

†Iowa (Davenport)—Nov 14, 8 AM to 2 PM. *Spr:* Davenport RAC. Mt Joy-Davenport Municipal Airport, National Guard Hangar, ½ mile N of I-80 and ½ mile W of Hwy 61; take I-80 to Hwy 61 N, take Mt Joy Exit, turn right at stop sign, go toward Davenport Airport, turn right at next stop sign, hamfest is in large hangar just ahead on the left. Flea market (large accessible show floor), commercial vendors, demonstrations, free parking, refreshments. *TI:* 146.88. *Adm:* advance $6, door $7. Tables: $15. Phil McMillan, K9ZK, 72 Spruce Ct, Hazelwood Heights, Geneseo, IL 61254-9567; 309-441-6884; **philhenry@arcsupport.com**; **www.arcsupport.com/drac/**.

†Kentucky (Hazard)—Nov 13, 8 AM to 1 PM. *Spr:* Kentucky Mountains ARC. Hazard National Guard Armory, 100 Armory Rd; on N side of Hazard, from KY Rte 15, turn W toward Hal Rogers Parkway, from Parkway turn onto Dawahare Dr, go past Hazard Hotel, turn left onto next street (Armory Dr), proceed approximately ½ mile to National Guard Armory on left. Indoor swapfest, flea market, forums, NWS information. *TI:* 146.67. *Adm:* $3. Tables: $3. John Farler, K4AVX, 109 Hall St, Hazard, KY

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

41701; 606-436-5354; **jfarler@peoplepc.com**; **www.qsl.net/k4avx/fest04.html**.

†Louisiana (Minden)—Dec 4, 8 AM to 2 PM. *Spr:* Minden ARA. Minden Civic Center, 520 Broadway St; from I-20 take Minden/Sibley Exit 47, turn N on US Hwy 371, go 1 1/2 miles to US Hwy 79/80 E, turn right, go 1/4 mile to Civic Center on right. Annual Christmas Hamfest, dealers, VE sessions. *TI:* 147.3. *Adm:* $4. Tables: $5 (swap), $10 (dealers). Dusty Collins, KB5WFE, 231 Garrett Dr, Dubberly, LA 71024; 318-371-0636; **dusty1@microgear.net**; **www.bayou.com/~k5dlh/mara.html**.

†Louisiana (Monroe)—Nov 13, 9 AM to 3 PM. *Spr:* Twin City Ham Club. Barak Shrine Temple, 6620 Frontage Rd; from I-20 take Exit 120 (Garrett Rd), go S to first stop light, turn left (E) on Frontage Rd, go approximately 1 mile to Shrine Temple on the right. Winlink 2000 Forum, VE sessions. *TI:* 146.85. *Adm:* $5. Tables: $10. David Gore, KC5LFB, Box 1871; West Monroe, LA 71291; 318-237-9245; **mail@aresnela.org**; **www.tchams.org**.

†Massachusetts (Falmouth)—Nov 13; set up 7 AM; public 9 AM to 2 PM. *Spr:* Falmouth ARA. Knights of Columbus Hall, 279 Brick Kiln Rd; from the N take Rte 495 S to Rte 28 S to Brick Kiln Rd Exit, go E on Brick Kiln Rd approximately 2 miles to Hall on left. Ham Radio, Computer, and Electronics Flea Market; vendors; VE sessions (9-11 AM; $12 fee, cash or check, no credit cards; free admission if you are taking an exam); free parking. *TI:* 146.655, 444.25 (141.3 Hz). *Adm:* $3. Tables: 8-ft space, advance $8 (by Nov 1), door $9. Ralph Swenson, N1YHS, 99 Fox Run Ln, E Falmouth, MA 02536; 508-548-6405; **depsher911@aol.com**; **www.falara.org**.

†Massachusetts (Framingham)—Nov 7, 9 AM to 1 PM. *Spr:* Framingham ARA. Walsh Middle School, 301 Brook St; Rte 9 to Edgell Rd, go N 1.3 miles to Brook St, take right onto Brook St, go approximately 1 mile to school on left. VE sessions. *TI:* 147.15. *Adm:* $5. Tables: advance $10, door $15. Beverly Lees, N1LOO, Box 3005, Framingham, MA 01705; 508-626-2012; **n1loo@arrl.net**; **fara.org/fleamarket**.

†Michigan (Harrison Township)—Dec 5; set up 6 AM, public 8 AM. *Spr:* L'Anse Creuse ARC. L'Anse Creuse High School, 38495 L'Anse Creuse Rd; I-94, exit Metro Beach (Exit 236), Metro Parkway to Crocker, left on Crocker to Reimold, right on Reimold to last school building. Amateur Radio/Computer Swap 'n Shop, trunk sales ($5 per space, weather permitting), vendors, new and used equipment, electronic components, computers, software, accessories, forums, VE sessions (9 AM; Don, WA8IZV, **donols@provide.net**; walk-ins welcome), free parking, refreshments. *TI:* 147.08, 146.52. *Adm:* $5. Tables: $12 (8-ft). David Herrington, N8NLK, 165 Crocker Blvd, Mt Clemens, MI 48043-2546; 586-465-2797; **n8nlk@arrl.net**; **www.n8lc.org**.

†Mississippi (Ocean Springs)—Nov 19-20; Friday 5-9 PM, Saturday 8 AM to 2 PM. *Spr:* Jackson County ARA. St Martin Community Center, Lemoyne Blvd; from I-10 take Exit 50 S (Hwy 609) to second stop light, turn right (W) onto Lemoyne Blvd, go approximately 1 mile to Community Center on right. VE sessions (Saturday, 9 AM), forums. *TI:* 145.11. *Adm:* $3. Tables: $7. Don Arnold, KB5FHX, 3206 Moreland St, Pascagoula, MS 39567; 228-762-9795; **kb5fhx@cableone.net**; **www.jcmsara.org**.

†New Jersey (Bayville)—Nov 28, 7 AM to Noon. *Spr:* Jersey Shore ARS. Bayville Firehouse, 450 Rte 9; take Garden State Parkway to Exit 80, take Rte 9 S to Firehouse. Tailgate hamfest ($10 per space), electronics, VE sessions, refreshments. *TI:* 146.91 (127.3 Hz). *Adm:* Free. Tables: $15. Ed Genoino, WA2NDA, 1429 Island View Dr, Forked River, NJ 08731; 609-971-2792; **wa2nda@aol.com**; **www.jsars.org**.

†North Carolina (Benson)—Nov 21, 8 AM to 4 PM. *Spr:* Johnston ARS. American Legion Complex, 605 N Wall St; near the intersection of I-40 and I-95. Indoor flea market, equipment dealers, tailgating (opens at 6 AM), VE sessions, refreshments. *TI:* 147.27. *Adm:* advance $4, door $5. Tables: $10. Bill Lambert, AK4H, 8917 NC 50 N, Benson, NC 27504; 919-894-3352; **ak4h@nc.rr.com**; **www.jars.net**.

†North Carolina (Gastonia)—Dec 4, 8 AM to 2 PM. *Spr:* Gastonia Area ARC. Gastonia Farmers Market, 400 E Long Ave (NC Hwy 7); I-85 S from Charlotte, take Exit 19, go right on Ozark Ave for 1.2 miles; or I-85 N from South Carolina, take Exit 17, go right on US 321 for 1.2 miles, go left on Ozark Ave (NC Hwy 7) for 0.6 mile. Indoor tailgating with gate admission. *TI:* 146.805 (100 Hz). *Adm:* $5. Glenn Adams, KD4TLC, Box 7, Bessemer City, NC 28016-0007; 704-629-2211 (ext 10); **glenn@adamshook.com**; **www.gaarc.com/**.

†Tennessee (Kingsport)—Oct 30, 7 AM to 2 PM. *Sprs:* Kingsport and Bays Mountain ARCs. Eastman's Toy F. Reid Employee Center, S Wilcox Dr and Industry Dr; go S on I-81 from Bristol to Knoxville, merge onto I-181 N/US-23 N via Exit 57B towards Kingsport, take TN 93 Exit (Exit 51), merge onto TN-126 E/S Wilcox Dr. VE sessions (9 AM). *TI:* 146.97 (77 Hz). *Adm:* Free. Tables: Free. Paul Marcum, AC4QZ, 999 Bell Ridge Rd, Kingsport, TN 37660; 423-230-0532; **marcump@preferred.com**; **w4trc.tripod.com/**.

†Texas (Azle)—Nov 13, 7 AM to Noon. *Sprs:* Tri-County ARC and City of Azle Department of Public Safety. Azle Ash Creek Park and Meeting Center, 605 SE Parkway; take Texas Hwy 199 NW from Fort Worth for 10 miles, exit at Denver Trail, proceed on Service Road to entrance of Ash Creek Park. Swapmeet, ARRL forums, emergency communications classes, VE sessions. *TI:* 147.16 (110.9 Hz). *Adm:* $4. Tables: $5. David Johnson, KB5YLG, 820 Wood Ln, Azle, TX 76020; 817-444-5165; **kb5ylg@yahoo.com**; **www.wc5c.org/nctech.html**.

†Texas (Corpus Christi)—Nov 13, 8 AM. *Spr:* South Texas ARC. Solomon P. Ortiz International Center, 402 Harbor Dr; exit Shoreline Dr off I-37 (last exit), go 2 blocks, turn left on Chaparral St, go all the way to the end, Center is right on the ship channel (under the Harbor Bridge). Swapfest, forums, demo station, VUCC and WAS card checking, VE sessions, BBQ lunch. *TI:* 146.82 (107.2 Hz). *Adm:* $5. Tables: Free. Mark Mireles, AD5CA, 430 Lantana St, Corpus Christi, TX 78408; 361-855-9634; **n5crp@arrl.net**; **www.n5crp.org**.

†Washington (Lynden)—Nov 13, 9 AM to 2 PM. *Spr:* Mount Baker ARC. Northwest Washington Fairgrounds Exhibition Hall, 1775 Front St, 12 miles N of Bellingham; northbound I-5, Exit 256 (Hwy 539), proceed 12 miles to Lynden, turn right on Front St to Fairgrounds; from Canada cross at Aldergrove crossing N of Lynden, then 5 miles S to Front St. Seminars, ham dealers, VE sessions. *TI:* 146.74. *Adm:* $5 (US), $6 (Canadian). Tables: $15 each; 4 or more $12 each. Al Norton, K7IEY, 1008 Liberty St, Lynden, WA 98264; 360-354-4622; **k7iey@netscape.net**; **www.qsl.net/k7skw/**.

NEW BOOKS

BUILD YOUR OWN LOW-POWER TRANSMITTERS

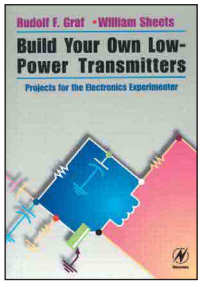
By William Sheets, K2MQJ and Rudolph Graf, KA2CWL

Published by Newnes Press, 320 pages, 10 1/2 × 8 5/16 inches, 220 black and white illustrations. ISBN 0-7506-7244-7. Available from the ARRL, order no. 9458, $41.95 plus shipping. Order toll-free 888-277-5289, or order on-line at **www.arrl.org/shop**.

Reviewed by Steve Ford, WB8IMY, QST Editor

◊ *Build Your Own Low-Power Transmitters* isn't written exclusively for Amateur Radio operators, but every ham is bound to find something of interest between the covers. As the title implies, this is primarily a practical, build-it-yourself book, with some theory on the side.

The list of ham projects includes some intriguing HF QRP transmitters, such as a 1-W 40-meter CW rig, an SSB generator/exciter and 2-W amateur television (ATV) transmitters for 440, 900 and 1300 MHz. In fact, the authors devote a substantial portion of the book to ATV projects of various kinds, including receive converters.



Among the non-ham projects you'll find FM mono and stereo transmitters and an AM broadcast transmitter—all low-power designs to conform to the Part 15 rules. I was particularly interested in the 1-W 1750-meter CW transmitter project. For uninitiated, 1750 meters is the so-called "Lowfer" band from 160-190 kHz. It isn't a ham band, but most of the active Lowfer stations are operated by hams. (No license is required if you operate within the FCC restrictions.) Lowfer projects aren't common, and this one was attractive with its frequency-synthesized design based on an MC145151-2 chip.

Build Your Own Low-Power Transmitters offers a few accessory projects such as an RF field-strength meter and a CW identifier. Also, a simple project for sending and receiving serial data has possibilities.

Most of the projects in the book include parts lists and printed-circuit board templates. You'll even find nicely illustrated diagrams for coil-winding and parts placement. Some projects, however, are just text and schematic diagrams (the Lowfer transmitter among them).

Build Your Own Low-Power Transmitters is a fine addition to any homebrewer's library. Its wealth of information and no-nonsense approach will keep your soldering iron busy for months and years to come.

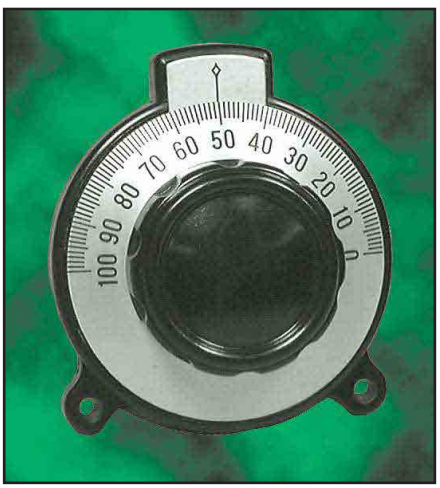
NEW PRODUCTS

VERNIER DIALS FROM PHILMORE/DATAK

◊ Vernier dials have been reintroduced by Philmore/Datak following the resolution of production problems. These vernier dials mount flush on a panel and fit on a standard 1/4 inch shaft, permitting precision tuning and read-out of either potentiometer or variable capacitor settings.

Three Vernier dial types are available. The S36 is 1.5 inches in diameter and graduated from 0 to 10. The S38 is 1.5 inches in diameter, and the S50 is 2 inches in diameter; both are graduated 0-100.

Philmore products are sold via local electronics parts distributors nationwide. See **www.philmore-datak.com** for product information or to find a local distributor.



CERAMIC STRAIN INSULATORS

◊ MFJ has announced the availability of ceramic strain insulators designed to be used to partition guy wires into non-resonant lengths. These are aircraft type compression insulators designed to fail in a safe manner, should they break. They are available to fit three wire sizes. The MFJ-17A01 is for 3/16 inch diameter wire, 5/16 inch hole size, 1 3/8 inches in diameter and 2 5/16 inches in length—$1.95 each. The MFJ-17B01 is for 1/4 inch diameter wire, 5/8 inch hole size, 2 1/2 inches in diameter and 3 1/2 inches in length—$3.95 each. The MFJ-17C01 is for 5/16 inch diameter wire, 3/4 inch hole size, 2 7/8 inches in diameter and 4 1/2 inches in length—$5.95 each. Quantity discounts are available. For more information, contact MFJ Enterprises Inc, 300 Industrial Park Rd, Starkville, MS 39759; tel 800-647-1800; fax 662-323-6551; **www.mfjenterprises.com**.

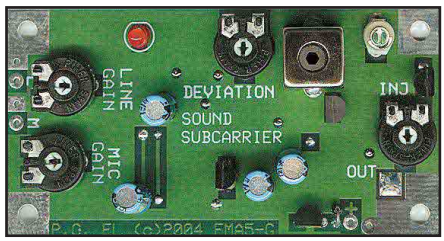
MFJ USB TO PC SERIAL OR PARALLEL PORT ADAPTERS

◊ MFJ has recently released adapters designed to allow devices designed for serial or parallel port connection to interconnect with a computer universal serial bus (USB) port. This may be of use to those with laptop or other PCs without the appropriate ports, or with all ports in use. The adapters come with drivers for *Windows 98/ME/2000/XP* on a 3.5 inch floppy disk.

The MFJ-5429 is a DB-9 male RS-232 serial port to USB 1.1 port adapter cable. The MFJ-5427 is a USB to parallel port cable/adapter. This lets you use a computer USB port to print to a parallel printer. The cable is 6 feet long and has USB and DB-25 female connectors. The MFJ-5428 is the same as MFJ-5427, but has a USB and a Centronics 36 pin male connector. Price for any of the versions: $24.95. For more information, contact MFJ Enterprises Inc, 300 Industrial Park Rd, Starkville, MS 39759; tel 800-647-1800; fax 662-323-6551; **www.mfjenterprises.com**.

ATV SOUND SUBCARRIER BOARD

◊ A new sound subcarrier board intended to improve audio quality is available from P. C. Electronics. The FMA5-G board employs a full wave detector to monitor both positive and negative audio peaks as an input to an automatic gain control specified with over 40 dB adjustment range. A visual *overdeviation* LED is provided to monitor operation. The board can be used to replace the usual back-to-back diode "soft limiter," which can add distortion to voice peaks that exceed the FM deviation



setting. Attack and decay times are set to the same standards as broadcast wireless mics to minimize voice pumping or missing words when shouting.

If the mic or line audio inputs gains are set too high, an LED indicator will blink off to simplify gain adjustment. The board is 1.5 × 3 inches in size and is usable directly in the TC70 or TX70 series of P. C. Electronics ATV transceivers or transmitters. The boards are normally supplied to the US NTSC standard of 4.5 MHz with 25 kHz deviation but may be ordered or field adjusted for frequencies up to 6.8 MHz and up to 50 kHz deviation.

The input is designed for low impedance dynamic mics at 100 to 600 Ω and line audio at 10 kΩ from camcorders or VCRs. The two audio sources are mixed to enable voice-over commenting when transmitting home videotapes to other hams. FM RF output is adjustable up to 1 V_{pp} into a 330 Ω load as found in P. C. Electronics ATV transmitters. Power requirement is +11 to 15 V dc at 60 mA. Price: $59. For more information, contact P. C. Electronics at **www.hamtv.com** or 626-447-4565.

IMPROVED SIX POSITION TRANSCEIVER/ANTENNA SWITCH

◊ MFJ has announced the MFJ- 1700C, a successor to its MFJ-1700B switch. The new version adds lightning surge pro-tection and is specified to have better isolation than the earlier model. With the switch you may select one of six different antennas and match to one of six different rigs in any combination. It is rated to handle 2 kW PEP in SSB with 50 to 75 Ω loads from 1.8 to 30 MHz. Unused terminals are grounded. Price: $99.95. For more information, contact MFJ Enterprises Inc, 300 Industrial Park Rd, Starkville, MS 39759; tel 800-647-1800; fax 662-323-6551; **www.mfjenterprises.com**.

CONTEST CORRAL

Feedback

A scoring error in the 2003 ARRL 10 Meter contest resulted in the **Florida Contest Group** being placed in the wrong category. Their club score of 16,882,444 points results in their placing first in the Medium Club Category.

W1AW Qualifying Runs are 9 AM EST Wednesday, November 3 (1400Z November 3) (35-10, QRSR), and 7 PM Friday, November 19 (0000Z November 20). The K6YR West Coast Qualifying Run will be at 9 PM PST Wednesday, November 10 (0500Z November 11). Check the W1AW Schedule elsewhere in this issue for details.

Abbreviations

SO—Single-Op; M2 – Multiop—2 Transmitters; MO—Multi-Op; MS—Multi-Op, Single Transmitter; MM—Multi-Op, Multiple Transmitters; AB—All Band; SB—Single Band; S/P/C—State/Province/DXCC Entity; HP—High Power; LP—Low Power; Entity—DXCC Entity

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.

Nov 6-8

ARRL November Sweepstakes—CW, 2100Z Nov 6 to 0300Z Nov 8. (Phone from 2100Z Nov 20 to 0300Z Nov 22, see Oct *QST*, p 107, or **www.arrl.org/contests/calendar.html**.)

North American Collegiate ARC Championship—CW (Phone, Nov 20-22). This is a competition based on Sweepstakes results between club stations at institutions of higher education beyond the high school level. Clubs enter Sweepstakes in any of the valid entry categories. Separate champions will be determined for CW, Phone and Combined scores. For more information: **www.collegiatechampionship.org**.

High Speed Club CW Contest, sponsored by the Radio Telegraphy High Speed Club (HSC) from 0900Z-1100Z and 1500Z-1700Z Nov 7. Frequencies: 80-10 meters, 10-30 kHz above band edge. Categories: SOAB-LP (<150 W), SOAB-QRP (<5 W), SWL. Exchange: RST + HSC member number or "NM." QSO Points: HSC member—5 pts, non-member—1 pt. Score: QSO points. For more information: **www.dl3bzz.de/**. Logs due 6 weeks after the contest to **hsc-contest@dl3bzz.de** or Lutz Schröer, DL3BZZ, HSC Contest-Manager, Am Niederfeld 6, 35066 Frankenberg/Eder, Germany.

IPA Contest—Phone/CW, sponsored by The International Police Association Radio Club. CW from 0600Z-1000Z and 1400Z-1800Z Nov 6, Phone from 0600Z-1000Z and 1400Z-1800Z Nov 7. Frequencies: 80-10 meters with 15-minute band change rule. Categories: SOAB, MS, MM and SWL. Exchange RST + serial number (IPARC members send "IPA" + state if US). QSO Points: IPARC members—5 pts, non-member—1 pt. Score: QSO points × DXCC entities + US states counted once per band. Multipliers are only counted for QSOs with IPARC members. For more information: **www.ipa-rc.de**. Logs due Dec 31 to **dl8kcg@darc.de** or Uwe Greggersen, DL8KCG, Hurststr 9, D-51645 Gummersbach, Germany.

Ukrainian DX Contest—CW/SSB/RTTY, sponsored by the Ukrainian Amateur Radio League and the Ukrainian Contest Club from 1200Z Nov 6 to 1200Z Nov 7. Frequencies: 160-10 meters, with 10 minute band change rule. Categories: SOAB, SOAB-QRP (<5 W), SOAB-RTTY, SOSB, MS, MM, SWL. Exchange: RST + serial number (+ Ukrainian region). QSO Points: same country—1 pt, same continent—2 pts, different cont—3 pts, Ukrainian station—10 pts. Score: QSO points × DXCC entities + WAE countries + Ukrainian regions. For more information: **www.qsl.net/ucc/**. Logs due 30 days after the contest to **urcc.com.ua** or to Ukrainian Contest Club HQ, PO Box 4850, Zaporizhzhe, 69118, Ukraine.

DARC 10-Meter Digital "Corona"—RTTY/AMTOR/PACTOR/PSK31/Clover, sponsored by Deutscher Amateur Radio Club from 1100Z-1700Z Nov 7. Frequencies (MHz): 28.050-28.150, work stations once per mode. Categories: SO, SWL. Exchange: RST + serial number. QSO Points: 1pt/QSO. Score: QSO points × DXCC entities + WAE countries + JA/VE/W call districts (all counted only once). For more information: **www.darc.de/referate/dx/cqdlcont/fgdcc.htm**. Logs due four weeks after the contest to **dl9gs@darc.de** or A. Schlendermann, DL9GS, Postfach 102201, D-44807 Bochum, Germany.

Radio Club of America QSO Party, SSB/AM, from 2100Z Nov 6-0100Z Nov 7 on 14.280 MHz and 0100Z—0500Z Nov 7 on 3.910 MHz. Exchange: RST, QTH, name, equipment used. RCA members sign their calls /RCA. For more information: **www.radio-club-of-america.org**. Logs to **mraide@rochester.rr.com** or Mike Raide W2ZE, 21 Canandaiqua St, Shortsville, NY 14548.

Nov 13-14

Japan International DX Contest—Phone, from 0700Z Nov 13 to 1300Z Nov 14 (see Jan *QST*, p 98, or **jidx.org/jidxrule-e.html**).

50th Anniversary European DX Contest (WAEDC)—RTTY, from 0000Z Nov 13 to 2359Z Nov 14. Same rules as WAEDC Phone and CW, except everyone works everyone. QTC can only be exchanged between continents. The WAEDC Super Bowl is new this year at **www.darc.de/referate/dx/xedcws.htm** (see Aug *QST*, p 94, or **www.waedc.de**).

OK/OM DX Contest—CW, sponsored by the Czech Radio Club (CRC) from 1200Z Nov 13-1200Z Nov 14. Frequencies: 160-10-meters. Categories: SOAB-HP (>100 W), SOSB-HP, SOAB-LP, SOSB-LP, SOAB-QRP (<5 W), MS, SWL, packet spotting allowed for all categories. Exchange: RST plus serial number or OK/OM district. QSO Points: EU to OK/OM—1 pt, non-EU to OK/OM—3 pts. Score: QSO points × OK/OM districts (OK/OM stations use WPX prefixes) counted once per band. For more information: **okomdx.radioamater.cz**. Logs due Dec 1 to **okomdx@crk.cz** or OK-OM DX Contest, CRK, PO Box 69, 113 27 Praha 1, Czech Republic.

Nov 20-22

ARRL November Sweepstakes—Phone (see Nov 6-8).

North American Collegiate ARC Championship—Phone (see Nov 6-8).

LZ DX Contest—CW/SSB, sponsored by the Bulgarian Federation of Radio Amateurs from 1200Z Nov 20-1200Z Nov 21. Frequencies: 80-10 meters with 10 minute mode change rule. Categories: SOAB (CW, Phone, Mixed), SOAB-QRP Mixed, SOSB-Mixed, MS-Mixed, SWL. Exchange: RST + ITU zone or 2-letter LZ district. QSO Points: same continent—1 pt, different cont—3 pts, LZ station—10 pts. Score: QSO points × ITU zones + LZ districts counted once per band. For more information: **www.qsl.net/lz1fw/contest**. Logs due 30 days after the contest to **lzdxc@yahoo.com** or BFRA, PO Box 830, 1000 Sofia, Bulgaria.

RSGB 1.8MHz Contest—CW, from 2100 Nov 20 to 0100Z Nov 21. (See Feb *QST*, p 103) For more information: **www.rsgbhfcc.org**. Logs due 16 days after the contest to **2nd160.logs@rsgbhfcc.org** or RSGB—G3UFY, 77 Bensham Manor Rd, Thornton Heath, Surrey CR7 7AF, England.

Nov 27-28

CQ WW DX Contest—CW, from 0000Z Nov 27 to 2400Z Nov 28 (see Oct *QST*, p 99, or **cqww.com**).

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

STRAYS

HOW THEY LEARNED CODE IN 1923

◊ A recent issue of *The Hook*, the newsletter of The Tailhook Association, included a short article and photo of flight students learning Morse code at Naval Air Station Pensacola in 1923—in their sleep! This technique had worked for Chief Radio Mate Phinney, so he suggested it for ground school. According to the article, "the plan was to have failing students sleep in the classroom wearing helmets with a headset while expert operators sent high-speed messages at about 10 words per minute faster than the individual student's capacity to receive. During the trial period, it was confirmed that the next day the students could receive messages at the speed they were sent while they slept."—*tnx Meyer A. Minchen, AG5G*

VA HOPSITAL NET

◊ Amateur Radio has proven to be useful in Veterans Administration hospitals, both for the introduction of patients into ham radio and as a valuable asset during local or national emergencies. A national net meets weekdays on 14,287 kHz at 1 PM Eastern Time. Any amateur is invited to contact a VA facility and volunteer for this useful service, and all amateurs are welcome to check into the net. My club, the Chippewa ARC, W8BAA, is net control from the Brecksville, Ohio VA Hospital on Mondays.—*Kirk Sanderson, W8WNA*

HAVE AN OBSOLETE COMPUTER?

◊ There may be something in there worth scrounging…but after you've done your personal recycling, you may want to contact Computer Recycling for Education (**www.computerecycleforeduc.com**). According to a recent news release, the organization promotes "the proper disposal of unwanted and obsolete electronics in the home, business and government," including computers, monitors, televisions, cell phones, video games, DVDs, VCRs and audio equipment.

SPECIAL EVENTS

Manchester, NH: New Hampshire Amateur Radio Service Club, Lawrence L. Lee Scouting Museum and ARRL New Hampshire Section, N1S. 1400Z-2200Z **Oct 16**. 47th Jamboree-On-The-Air. 20 40 m phone and SSTV. QSL. Daniel Webster Council Office, Max I. Silber Memorial Station, 571 Holt Ave, Manchester, NH 03103. **www.scoutingmuseum.org**.

Owosso, MI: Michigan Net, QMN, K8QMN. 1600Z-2000Z **Oct 16**. Telegraphers Reunion; American Morse will be retransmitted. 14.050. QSL. Morse Telegraph Club, PO Box 457, Allegan, MI 49010. **www.qsl.net/w8ihx**.

Pumpkin Center, Jacksonville, NC: The Onslow Amateur Radio Club, Inc, WD4FVO. 1900Z-2359Z **Oct 31**. Halloween from Pumpkin Center. 28.360 14.260 7.260 3.860. Certificate. The Onslow Amateur Radio Club, Inc, PO Box 841, Jacksonville, NC 28541. **www.onslowarc.org**.

Whitefish Point, MI: Stu Rockafellow Amateur Radio Society, N8F. 1700Z **Nov 3**-1700Z **Nov 7**. Remembering the *Edmund Fitzgerald*, lost November 10, 1975. 21.360 14.260 7.260 3.860. Certificate. Richard Barker, 264 N East St, Brighton, MI 48116. **www.qsl.net/w8njh**.

Portsmouth, VA: USCG Auxiliary Ham Radio Ops of Tidewater, N4I. 1300Z **Nov 5**-2100Z **Nov 6**. International Search & Rescue Competition. 146.52 14.255 7.255 3.945. Certificate. Richard Cook, AB4U, 14288 Riverside Dr, Ashland, VA 23005. **www.internationalsar.com**.

Knokke-Heist, Belgium: UBA Section ONZ, ON6ØCLM. 1200Z **Nov 5**-1200Z **Nov 9**. Liberation of our town in 1944 by allied forces—60th Canadian Liberation March. 28.545 21.245 14.145 7.045. Certificate. ON6ØCLM, Rijkswachtlaan 37, Postbox 1006, B-8300 Knokke-Heist, Belgium. **www.on4clm.be**.

Butler, PA: Butler County Amateur Radio Association, W3UDX. 1200Z-1700Z **Nov 6**. Veterans Day. General bands 80 to 10. QSL. BCARA, PO Box 1787, Butler, PA 16003.

Bonita Springs, FL: US Coast Guard Auxiliary Wiggins Pass, FL, W4W. 1300Z-2100Z **Nov 6**. US CG Auxiliary 65th and Canadian CG Aux 26th anniversaries. 28.380 21.375 14.275 7.275. QSL. Merle Zeek, W4MWZ, 86 8th St, Bonita Springs, FL 34134-7452.

Cincinnati, OH: US Coast Guard Auxiliary, W8C. 1400Z-2100Z **Nov 6**. Div 5 8ER commemorating USCGA 65th anniversary and ISAR. 28.405 21.405 14.345 7.240. QSL. Dave Stroup, 6095 Drum Hill Ln, Milford, OH 45150-2275. **www.uscgaux.org/~08205/**.

Cheverly, MD: US Coast Guard Auxiliary, K3A. 1400Z-2100Z **Nov 6**. 65th anniversary of USCGA. 28.350 21.340 14.280 7.282. QSL. W. Joe Saunders, K3UAL, 1520 Jutewood Ave, Hyattsville, MD 20785.

Escondido, CA: US Coast Guard Auxiliary District 11S, N6C. 1600Z-2300Z **Nov 6**. USCG Auxiliary 65th and Canadian CG Auxiliary 26th anniversaries and ISAR event. 21.350 14.250 14.070 7.250. QSL. Ed Cooper, N6NP, 611 Maze Glen, Escondido, CA 92025.

Flowery Branch, GA: United States Coast Guard Auxiliary, Division 2, District 7, W4B. 1400Z-2200Z **Nov 6**. Commemorating the 65th anniversary of the US Coast Guard Auxiliary and the 26th anniversary of the Canadian Coast Guard Auxiliary. 21.375 14.275 7.275. QSL. Albert Miles, KG4VIB, 3325 Rangers Gate Dr, Marietta, GA 30062.

Marco Island, FL: US Coast Guard Auxiliary, District 7, N2K. 1300Z-2100Z **Nov 6**. USCGAUX 65th anniversary ISAR 2004. 28.325 21.310 14.330 7.250. QSL. Robert B. Witte, PO Box 1814, Marco Island, FL 34146.

Media, PA: US Coast Guard Auxiliary District 5-NR, K3G. 1300Z-2100Z **Nov 6**. 65th anniversary of the US Coast Guard Auxiliary. 28.330 21.330 14.270 7.270. QSL. Daniel F. Amoroso, 196 Dam View Dr, Media, PA 19063.

Raymond, ME: US Coast Guard Auxiliary D-1NR Radio Raymond, K1G. 0900Z-1600Z **Nov 6**. 65th anniverary of the USCG Auxiliary and the International SAR Competition 2004 (N41). 28.320 21.315 14.310 14.250 7.262 7.250 146.520. Certificate. Keith C. Morton, W1NKH, PO Box 809, Raymond, ME 04071-0809.

St Thomas, VI: US Coast Guard Auxiliary, N2A. 1300Z-2000Z **Nov 6**. 65th Anniversary of the US Coast Guard Auxiliary. 28.320 21.310 14.260. QSL. Deborah Thomas, PO Box 9280, St Thomas, VI 00801.

Baton Rouge, LA: USS *Kidd* ARC/Baton Rouge ARC, W5KID. 1500Z-2300Z **Nov 11**. Veterans Day. General class bands, 14.250 to 14.320; CW QRP subbands. QSL. W5KID, c/o USS *Kidd* Museum, 305 S River Rd, Baton Rouge, LA 70802.

Nutley, NJ: Robert D. Grant United Labor Amateur Radio Association, N2UL. 1200Z-2200Z **Nov 11**. CQ Veterans Day. 449.975 28.460 14.260. Certificate. RDGULARA, c/o WA2VJA, 112 Prospect St, Nutley, NJ 07110-0716.

Marysville, KS: Marshall County Amateur Radio Club, WØGCJ. 1400Z **Nov 11**-0500Z **Nov 12**. 150th anniversary of Marysville and the 1st KS Territory Post Office. 14.250 14.050 7.250 7.050. Certificate. David Crawford, 905 Pomerory, Blue Rapids, KS 66411. **www.qsl.net/w0gcj/event.htm**.

Albuquerque, NM: Albuquerque Amateur Radio Club, N5VA. 1500Z **Nov 11**-0300Z **Nov 12**. Commermorating Veterans Day at VA Hospital. 28.460 21.360 14.260 7.250. QSL. Thomas R. Lea, 1009 Clancy Dr NE, Albuquerque, NM 87112. **www.qsl.net/albuquerquearc/index.html**.

Arlington Heights, IL: Armored Force Amateur Radio Net, KA9NLX. 1800Z **Nov 11**-2200Z **Nov 14**. Veterans Day. 21.375 14.325 7.283 7.040. Certificate. John Paskevicz, 1423 North Ridge Ave, Arlington Heights, IL 60004. **jpaskev@aol.com**.

Madison, MN: West Central Minneota Amateur Radio Club, KØD. 1400Z-2200Z **Nov 13**. Annual Norsefest (Lutefisk) Celebration. 28.450 21.350 14.260 7.260. Certificate. WAØKNP, 221 10th Ave, Madison, MN 56256.

Stuart, FL: Martin County Amateur Radio Association, K4ZK. 1300Z-1800Z **Nov 13**. 30th anniversary of MCARA. 14.253. Certificate. MCARA, PO Box 1901, Stuart, FL 34995.

Waterloo, IA: Five Sullivan Brothers Amateur Radio Club, WØFSB. 1500Z **Nov 13**-2200Z **Nov 13**. Anniversary of the loss of USS *Juneau* and the 5 brothers. 146.340 21.240 14.240 7.240. Certificate. Five Sullivan Brothers ARC, 4015 Independence Ave, Waterloo, IA 50703.

San Antonio, TX: San Antonio Radio Club, W5SC. 0000Z **Nov 13**-0600Z **Nov 14**. *Coral-Gold*: San Antonio Radio Club's 85th anniversary. 28.360 21.360 14.260 7.260. QSL. Steve Cerwin, 1619 CR 270, Mico, TX 78056. **www.w5sc.org**.

Little Rock, AR: Central Arkansas Radio Emergency Net, W5C. 1500Z **Nov 13**-2200Z **Nov 14**. William Jefferson Clinton Presidential Library dedication. 21.360 14.260 14.040 7.250. Certificate. Dennis Schaefer, 181 Schaefer Dr, Dover, AR 72837. **www.arkansashams.org**

Hackensack, NJ: WW2 Submarine USS *Ling*, NX2ND. 1300Z-2100Z **Nov 14**. 4th anniversary of NX2ND/USS *Ling*. 21.380 14.280 14.055 7.040. Certificate. Bill Stagg, KC2BLN, 38 Rutgers Dr, Oakland, NJ 07436. **www.10-70.org**.

Paulden, AZ: Yavapai Amateur Radio Club, K7NRA. 1500Z-2400Z **Nov 17**. From Gunsite Academy to celebrate NRA's 133rd birthday. 28.440 21.340 14.240 7.240. Certificate. Mike Campbell, K7NRA, 404 Lampliter Village, Clarkdale, AZ 86324. **www.w7yrc.org/specevent.htm**.

Joplin, MO: Joplin Amateur Radio Club, WØIN. 1900Z-2300Z **Nov 20**. Letha Dangerfield, WØOUD, Commemorative Special Event Station from the Joplin Association for the Blind. SSB: 14.260 CW 15 40 m. QSL. Joplin Amateur Radio Club, PO Box 2983, Joplin, MO 64803. **www.joplin-arc.org**.

The Villages, FL: The Villages Amateur Radio Club, K4VRC. 1600Z-2100Z **Nov 27**. Celebrating the Club's Ninth Anniversary. 14.260 7.030 147.030(+) Gen bands. Certificate. Don Edlund, 9616 SE 168 Elderberry Pl, The Villages, FL 32162.

Various, USA: 10-10 International, W6OI. 0000Z **Nov 27**-2400Z **Nov 28**. Celebrating four decades and just under 75000 members in all 10 call areas. 28.340-28.400. QSL. Jack Moore, K5CC, 371 Ridge Creek Ln, Bulverde, TX 78163. Certificate for working all areas. **www.10-10.org**.

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9 × 12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

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 **Jan** *QST* would have to be received by **Nov 1**. Submissions may be mailed (Attn: Maty Weinberg), faxed (860-594-0259) or e-mailed (**events@arrl.org**) to ARRL HQ.

STRAYS

SCIENCE FICTION HAMS

♢ Ham radio operators at the 2004 World Science Fiction Convention have started HamFen, a group dedicated to making the science fiction community aware of their close connection to ham radio. Anyone interested in getting involved with ham radio at science fiction conventions and related events should contact me at **ka1mom@arrl.net**. HamFen is also gathering historical material linking ham radio and science fiction authors, editors and publishers. If anyone knows of past or present writers, editors or publishers who are or have been licensed hams, please contact me as well.—*Bill McIninch, KA1MOM, 26 Margo Rd, Brighton, MA 02135*

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

2004 ARRL 10 Meter Contest Announcement

0000Z Dec 11 - 2400Z Dec 13

How to participate: Any amateur station on 10 meters can be worked, and you may contact the same station on both Phone and CW (all phone modes are equivalent). There are both Single Operator and Multioperator classes. As a single-op, you can enter as QRP, Low Power or High Power. Single-ops also choose to operate Phone Only, CW Only or Both Modes (mixed).

What to say: W/VE stations should give a signal report and your state or province. DX stations give a signal report and sequential number for the contact. Since everyone can work everyone, even smaller stations can try calling "CQ Contest." On phone, be sure to give your full call and use standard phonetics.

Special interest: There are number of expeditions to DX countries just for the contest. Check out the ARRL DX bulletins (**www.arrl.org/w1aw/dx/**) or log on to NG3K's Web site that contains a list of pre-announced contest expeditions (**www.cpcug.org/user/wfeidt/Misc/adxo.html**). K2KW writes a regular column in the *National Contest Journal* that covers upcoming contest expeditions (**www.ncjweb.com**). This is also a great time to work on your 5-band Worked All States (**www.arrl.org/awards/#was**), 10 meter specialty awards and DXCC.

Quirks: The District of Columbia counts separately from Maryland in this contest with those stations sending DC. KH6 and KL7 participate as states entities rather than DX entities. Novices and Technicians signing /N or /T count double on CW QSOs. You may operate 36 out of the 48 hour contest period.

Rule changes this year: Submissions may be made using the special Web application at **www.b4h.net/cabforms**.

Best reason to participate: If you think 10 meters sounds dead, it's usually because everybody's listening. Wait until the clock rolls over on Friday! Also, by spending a lot of time on the band, you may experience all the unusual propagation that this "nearly VHF" band has to offer: sporadic-E, skew, F-hop or skip, ground-wave, tropospheric—it's all there! Listen for propagation beacons before the contest to get an idea of where the band is open (**www.ten-ten.org/beacons.html**).

Relative challenge: We are nearing the bottom of the sunspot cycle, so this becomes a challenging event, especially in the higher latitudes. However it is still worth the effort to participate. Be sure to listen toward the equator following the sun. There are generally lots of mobile and portable stations, as well. While code speeds will be high at the low end of the band, listen around 28.090 MHz or in the Novice band above 28.100 MHz for slower CW contacts.

Scoring: CW contacts count 4 points each. Phone contacts count 2 points each. Multipliers are US states (and DC), Canadian provinces (and territories) and DXCC entities. Multipliers count once per mode. Your final score equals QSO points times your multiplier total. You count eight points for each Novice or Technician signing /N or /T on CW.

How to report your score: You must send in your entry by Jan 12, 2005. E-mail Cabrillo format log to **10meters@arrl.org** while paper logs are submitted to 10-Meter Contest, ARRL, 225 Main St, Newington, CT 06111. You may also use the Web applet at **www.b4h.net/cabforms** to report your score.

Complete rules: The complete rules may be found at **www.arrl.org/contests/forms** where you will also find links to the General Rules for all ARRL Contests, General Rules for ARRL Contests on bands below 30 MHz (HF) and other forms and operating aids, log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending an SASE with 2 units of postage to 10 Meter Contest Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: E-mail **contests@arrl.org** or phone 860-594-0232. QST

NEW PRODUCTS

DX ENGINEERNIG IMPEDANCE MATCHING BALUN TRANSFORMERS

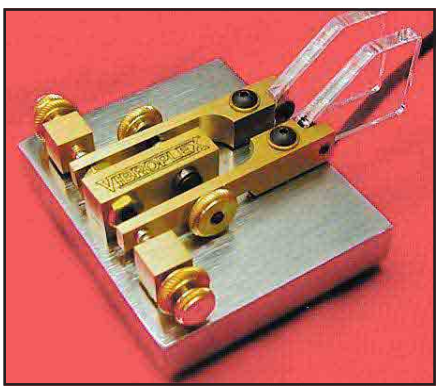
◊ DX Engineering recently introduced a dozen new baluns with transformation ratios of 1:1, 2:1, 4:1, 6:1, 9:1 and 12:1. Their line of MaxiCore current baluns are designed to provide minimal insertion loss and a low SWR across the range 1.8 to 30 MHz. (The H05-P model is specified from 1 to 60 MHz.) The product line also includes antenna tuner models designed to accommodate the stresses of tuning across the entire HF spectrum by being rated at up to 10 kW and 7 kV. Other features include gasket seals, Teflon and silver SO-239 connectors and ceramic output posts with stainless steel hardware. Price: $39.95 to $139.95 depending on model. For more information, contact DX Engineering, PO Box 1491, Akron, OH 44309; tel: 800-777-0703 or **www.dxengineering.com**.

ANTENNA REFERENCE MANUAL

◊ The National Radio Club, an organization focusing on MF DX listening, has announced the availability of the *Antenna Reference Manual Volume 3*. This volume includes 16 detailed construction articles on antennas, receiving amplifiers and matching networks designed for long distance reception in the 300 kHz to 3 MHz range. Price: $16.95. For more information, including details of earlier and still available volumes, see **www.nrcdxas.org** or order from the National Radio Club, PO Box 164, Mannsville, NY 13661.

NEW KEYER PADDLES FROM VIBROPLEX

◊ A deluxe version of the Vibroplex Code



Warrior Junior, the Chrome Warrior, is available from Vibroplex. This key features a brushed chrome base with polished brass upper parts and clear paddles. The Vibroplex logo is engraved on the top of the center block with the serial number engraved on the end of the block. Cords are available separately. Price: $139.95. Also available for either model are clear plastic dust covers and red conversion paddles ergonomically designed to give the sending hand more support. For information call the Vibroplex Company at 800-840-8873 or e-mail **catalog@vibroplex.com**.

2004 ARRL 160 Meter Contest Announcement

2200Z Dec 3 (Friday evening) - 1600Z Dec 5 (Sunday afternoon)

How to participate: An all-CW contest, W/VE stations work any station on 160 meters with activity concentrated below 1875 kHz. DX stations may only work W/VE stations. There are both Single Operator and Multioperator classes. Single-op stations can enter as QRP, Low Power or High Power. If you make use of any packet spotting assistance, you are a Multioperator station.

What to send: W/VE stations, including KL7 and US Pacific or Caribbean islands, give a signal report and their ARRL/RAC section. DX stations give only a signal report. If you are maritime or aeronautical mobile, give your ITU region.

Special interest: Entries are almost always received from all 50 states, which makes it possible to work a 160 meter WAS with some effort and luck. In addition, an average of 20-30 DXCC entities are active, providing a great start to chasing DX on the band.

Quirks: The frequencies 1830 to 1835 kHz (the "DX window") should be used only for long-distance intercontinental QSOs such as W/VE to Europe or South America. JA stations can only operate from 1810 to 1825 kHz and 1907.5 to 1.912.5 kHz.

Rule changes this year: Submissions may be made using the special Web application at **www.b4h.net/cabforms**.

Best reason to participate: "Top Band" is one of the biggest challenges around, but it also provides some of the most satisfying contacts. In the period of declining sunspots, conditions and propagation on 160 meters will continue to improve, making for interesting openings and opportunities.

Relative challenge: Hearing and being heard are a real test for many participants. Good antennas are a strong plus for contacts on 160 meters, but with all the activity, even a small antenna will give surprising results.

Scoring: Contacts with W/VE QSOs count 2 points. W/VE stations count 5 points for each DX QSO. Each ARRL/RAC Section worked is a multiplier. In addition, W/VE stations each DXCC entity worked as an additional multiplier.

How to report your score: You must send in your entry by Jan 5, 2005. E-mail Cabrillo format logs to **160meters@arrl.org** or send paper logs to 160 meter Contest, ARRL, 225 Main St, Newington, CT 06111. You may also submit your score via the Web applet at **www.b4h.net/cabforms**.

Complete rules: The complete rules may be found at **www.arrl.org/contests/forms** where you will also find links to the *General Rules for all ARRL Contests, General Rules for ARRL Contests on Bands Below 30 MHz (HF)* and other forms and operating aids, log sheets for submitting your entry. If you don't have Web access, you can obtain the complete rules and forms by sending a self-addressed, stamped envelope with 2 units of postage to 160 Meter Contest Rules, ARRL, 225 Main St, Newington, CT 06111.

For more information: E-mail **contests@arrl.org** or phone 860-594-0232. QST

NEW PRODUCTS

INSIDE-OUTSIDE THERMOMETER, CALENDAR AND ATOMIC CLOCK

◊ The MFJ-134RC Atomic Clock with indoor and outdoor temperature sensors receives time from The National Institute of Standards and Technology in Fort Collins, Colorado. The clock has a DST on/off option and different time zone settings. Time digits are 2 inches tall displayed via a liquid crystal display. It is switchable for 24 or 12 hour display including seconds. An alarm setting with snooze function is provided as is a calendar display. English, French and Spanish are supported.

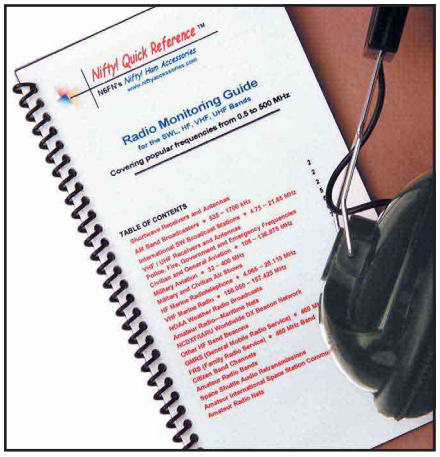
The Indoor/Outdoor thermometer can display in Celsius or Fahrenheit and has a wireless remote outdoor sensor. The outdoor sensor transmits outdoor temperature readings to the main clock inside on 433 MHz, reportedly up to 82 feet. It reads –21.8°F to +140°F with a 0.2°F resolution and it checks the temperature every five minutes. The indoor sensor is on the main clock cabinet and reads +32°F to +122°F with 0.2°F resolution. The temperature is updated every 10 seconds.

The unit can be wall-mounted or free-standing and has wood-grain looking cherry side panels with a black plastic face. Its dimensions are 7.75 × 11.5 × 5 (HWD) inches. Price: $39.95. For more information, contact MFJ Enterprises, Inc, 300 Industrial Park Rd, Starkville, MS 39759; tel 800-647-1800; fax 662-323-6551; **www.mfjenterprises.com**.

RADIO MONITORING GUIDE

◊ A *Radio Monitoring Guide* providing information on radio monitoring from .5 to 500 MHz is now available from Nifty Ham Accessories. Frequency and other information is provided to assist in monitoring international broadcasters, military, aircraft, public service and other transmissions.

The 16 page guide is printed on laminated paper and is 4.5 × 8 inches in size. Price: $15.85. For further information see **www.niftyaccessories.com**, or contact Nifty Ham Accessories, 1601 Donalor Dr, Escondido, CA 92027, tel 760-781-5522.



2004 "CHRISTMAS KEY" FROM MORSE EXPRESS

◊ Morse Express has released its 2004 Christmas Key, an 18 carat gold-plated miniature brass 19th century style camelback telegraph key that can also be used as a tree ornament. This key is fully operational and is hand machined from solid brass before being plated. Its base dimensions are $2^{9}/_{16} \times 1^{5}/_{16}$ inches and it weighs 8 ounces. All usual adjustments are provided and the knob is of hand turned olive wood. This key is available in a limited edition of 250 and each will have its serial number, Morse Express's "Speedy Key" logo and "Christmas 2004" engraved on the base. The price is $69.95 direct from Morse Express; **www.MorseX.com**; tel 800-238-8205.

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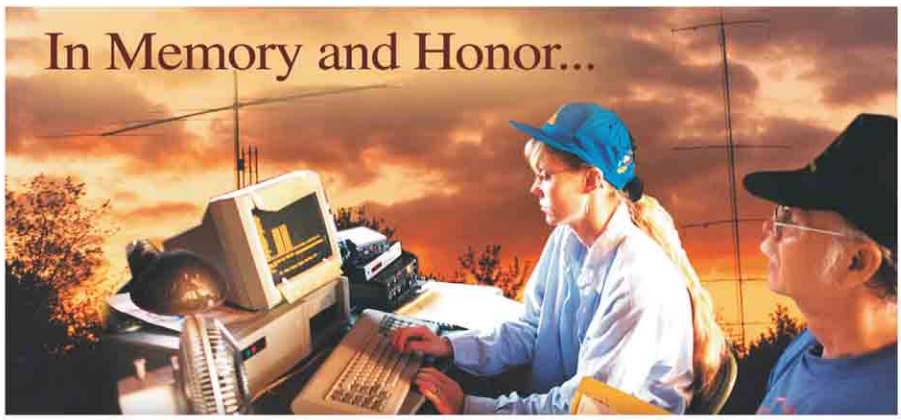

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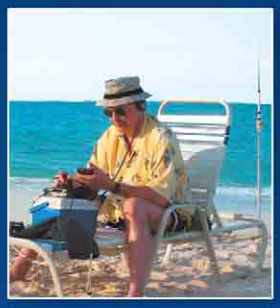

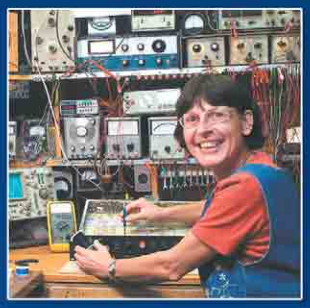

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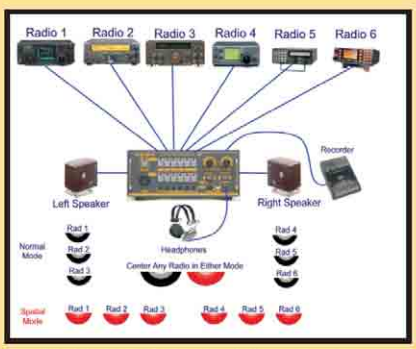

NCS-3230 Typical Application

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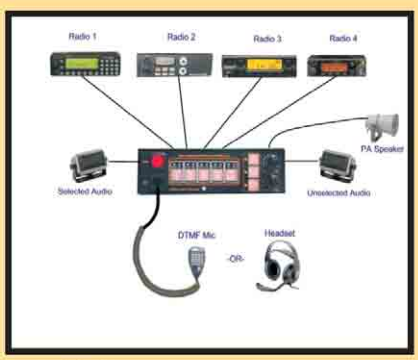

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COMET CX-333 • Tri-band 146/220/446MHz Base Repeater Antenna • Wave: 146MHz 5/8 wave x 2 • 220MHz 5/8 wave x 3 • 446MHz 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

COMET GP-3 • Dual-band 146/446MHz Base Repeater Antenna • Wave: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Max Pwr: 200W • Length: 5'11" • Weight: 2lbs. 9ozs. • Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

COMET GP-6 • Dual-band 146/446MHz Base Repeater Antenna • Wave: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

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COMET GP-24 The standard high gain 2.4GHz access point antenna for maximum range/signal strength • 2400-2500MHz • Length: 5'10" • Weight: 2lbs. 9ozs. • Conn: Gold-plated N-female • Construction: Heavy-duty white fiberglass radome

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IC-T7H Powerful output, ample receive audio. (mid-left) A 6W amp circuit provides superior transmit on VHF/UHF when 13.5 V DC is supplied. In addition, 500mW of AF is output. Separate CTCSS tone encoder and enc/decoder standard. This 2M/440 MHz meets MIL SPEC. 2.25"w x 4.34"h x 1.06"d, 10 oz... **$179.99**

IC-T2H SPORT More than enough power. (mid-right) The 6W T2H Sport meets MIL SPEC for shock and vibration and is more than enough for long distance communications. The 2M handheld boasts tone squelch, customizable keys, DTMF encode, 40 memories, 10 weather channels and cloning. 2.3"w x 5.5"h x 1.3"d, 14.8 oz. **$95.99**

IC-W32A User-friendly, independent band controls. (right) The 5W, 2M/440 W32A meets novice or experienced demands: simple use, advanced features. Simultaneous receive, 200 mem. 2.25"w x 5.41"h x 1.31"d, 1 lb..... **$249.99**

IC-V8000 75W of "base" power. Also offers 25/10/5W. With clear, operator-facing speaker, the 2M features CTCSS/DTCS, DTMF encode and 207 mem. 5.9"w x 1.97"h x 5.9"d, 2.22 lbs . **$185.99**

IC-2720H Twice the versatility, twice the fun! The 2M/440Mhz, 50/35W 2720H offers simultaneous rx capability, independent band controls, and DMS with 212 mem. Also has CTCSS/DTCS, wide rx, auto repeat, remote mic and remote control head (mnt. opt.). 5.5"w x 1.56"h x 7.38"d, 3 lbs (main). **$369.99**

IC-2100H-25N Durable 2M rig with superior RX IMD, performance. The 2100H25N offers 50W on transmit, extending its range. It also features CTCSS tone enc/decode, tone scan and 100 alphanumeric memories. Remote controlled using backlit mic. 5.5"w x 1.56"h x 7.09"d, 2 lbs, 10 oz **$169.99**

IC-2200H 65W and new digital features. With a familiar 2100H interface, the 2M 2200H adds optional digital capability providing modulated and demodulated clear voice and data. Also offers 207 memories with DMS, standard CTCSS/DTCS en/decode, weather channel/alert, and FM narrow. 5.5"w x 1.56"h x 5.75"d, 2.75 lbs **$229.99**

IC-706MKIIG Base features, mobile size. The 160-10M + 6M, 2M, 70cm Mark II G is constructed for stable, quality output with low IMD and spurious emissions. Tone squelch, DSP, auto repeater and 107 memories. 6.56"w x 2.28"h x 7.88"d, 5 lbs, 6 oz ..... FREE RMK706 **CALL**

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IC-703 For QRP enthusiasts. The 160-10M 703 is capable of 5/10W and focuses on QRP. A portable HF unit featuring relay-type antenna tuner, low current consumption, DSP, memory keyer and 105 memories. 6.56"w x 2.28"h x 4.88"d, 4.4 lbs ..... Closeout **$429.99**

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IC-T90A Compact, full featured. 50/144/440MHz T90A offers wideband rx with 5W. Features 555 memories with DMS scanning. Also provides DTCS/CTCSS, DTMF encode, PC programmability and weather resistance. 2.53"w x 3.44"h x 1.16"d, 8.47 oz **$249.99**

IC-208H High power, wideband. This 2M/70cm mobile provides 55/50W, plus reduced power for local. The 208H covers 118-173, 230-549 and 810-999MHz (cell blocked) rx as standard. With improved DMS, detachable front, and 500 memories. 5.56"w x 1.56"h x 7.31"d, 2.65 lbs..... **$299.99**

IC-910H 100/75W stable output. 2M/440MHz base provides 9600bps, satellite support. 9.5"w x 3.69"h x 9.4"d, 9.9 lbs **$1269.99**

IC-746PRO 32-bit DSP takes you higher. 100W, 102 memories, and a multi-function LCD command the HF/50/144 MHz 746PRO. 24-bit AD/DA converter and digital noise reduction. 11.3"w x 4.7"h x 12.5"d, 19 lbs, 13 oz.. FREE PS-125 © **$1299.99**

IC-756PROII Digital leap. All-mode, HF, 50MHz PROII offers 32-bit floating DSP, 24-bit AD/DA converter, selectable IF shape, and adjustable noise blanker. 13.38"w x 4.38"h x 11.2"d, 21 lbs, 1 oz ..... FREE PS-125 © Closeout **$2199.99**

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TH-F6A Head-scratching, unique features. (left) The FM 144/220/440MHz F6A offers dual-channel RX capability, 16-key pad, multi-scroll key, 5W, and 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 .....© **$324.99**

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TS-570S(G) Above, plus 6M.....© **$1049.99**

TS-870S DSP at the IF stage. The all-mode, HF 870S incorporates DSP with a full range of features including 100 memories, built-in keyer, interactive menu function, 4-stage attenuator, noise blanker, automatic antenna tuner and 100W power. 13"w x 4.75"h x 13.13"d, 25.35 lbs.....Closeout **$1999.99**

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TS-B2000 2000 with PC software. 10.63"w x 3.75"h x 12.5"d .....© **$1399.99**

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VX-5R/VX-5RS Setting water resistance standards. (mid-left) 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..... **$219.99**

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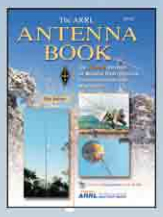

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COMET SBB-2/SBB-2NMO • Dual-band 146/446MHz
Wave: 146MHz 1/4 wave, 446MHz 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18" • Conn: PL-259 or NMO Style • Max Pwr: 60W

Maldol NEW EX-107RB/EX-107RBNMO • Dual-band 146/446MHz
Wave: 146MHz 1/2 wave, 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 29"
• Conn: PL-259 or NMO Style • Max Pwr: 100W

COMET SBB-5/SBB-5NMO • Dual-band 146/446MHz w/fold-over
Wave: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • Length: 39" • Conn: SBB-5 PL-259/SBB-5NMO NMO • Max Pwr: 120W

COMET SBB-7/SBB-7NMO • Dual-band 146/446MHz w/fold-over
Wave: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259/SBB-7NMO NMO • Max Pwr: 70W

NEW **COMET NEW C-757/C-757NMO** Challenger Series • Dual-band 146/446MHz w/fold-over
Wave: 146MHz 1/2 wave, 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less
• Length: 38" • Conn: PL-259 or NMO Style • Max Pwr: 80W

NEW **COMET NEW C-767/C-767NMO** Challenger Series • Dual-band 146/446MHz w/fold-over
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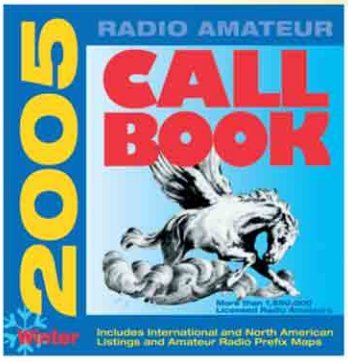

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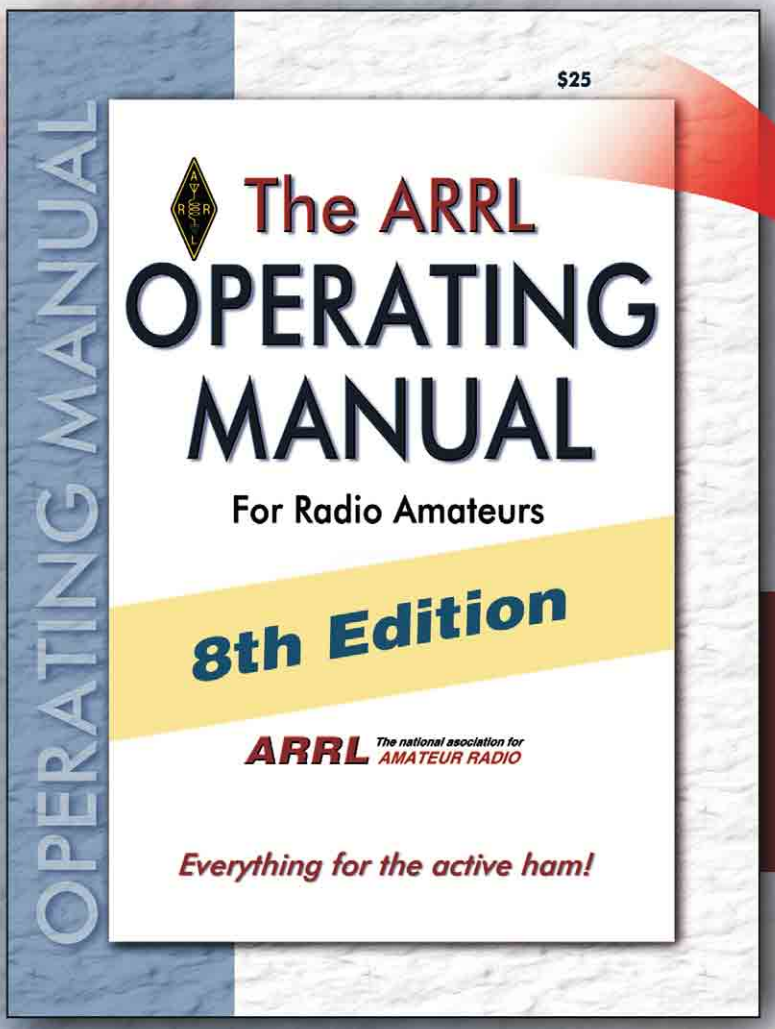

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Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

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You can tune your SWR down to the absolute minimum! **Why?** Because all network components -- roller inductor and variable capacitors are fully adjustable.

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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.

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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).

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Lighted Cross-Needle and *digital* SWR/Wattmeters lets you accurately read SWR, forward and reflected power at a glance.

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150 Watt Automatic Tuner

New!

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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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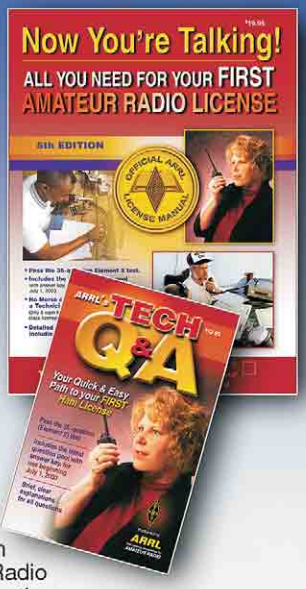

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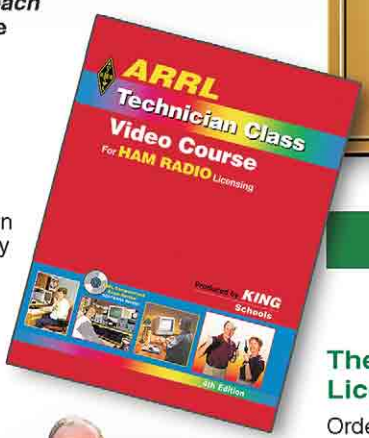

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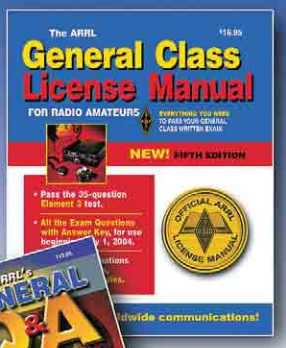

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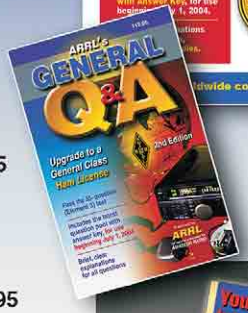

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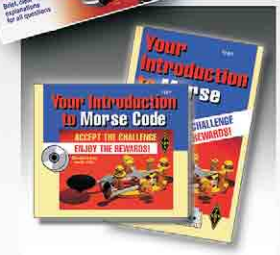

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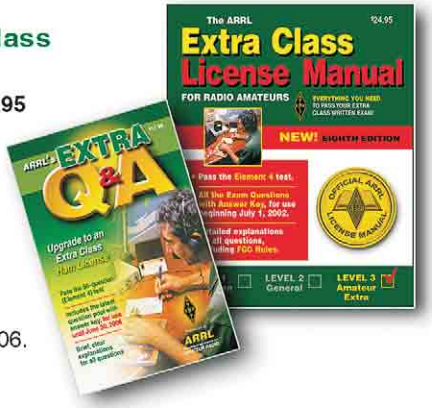

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Operate anywhere, anytime with a quick easy set-up! Tune out SWR on your mobile whip from inside your car. Operate in your apartment with a wall-to-wall antenna or from a motel room with a wire dropped from a window or from a mountain top with a wire 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.

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$79.95 **New!**

Tiny Travel Tuner with 4:1 Balun

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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
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10 Feet

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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.

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.

40-10M G5RV Junior
MFJ-1778M, $34.95.
Half-size 52 foot *G5RV Jr* 40-10 Meters, 1500 Watts.

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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MFJ Dummy Load/Wattmeter

1.5 kW Dry Dummy Load has built-in precision, true peak-reading SWR/Wattmeter switchable to external antenna!

MFJ-267
$149.95

World's most versatile 1.5 kW dummy load has a *built-in* true peak reading SWR/Wattmeter that you can switch and use independently!

You'll find tons of uses!

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power.

Use for testing/tuning transmitters, transceivers, amplifiers, antenna tuners, baluns, transformers, filters, matching networks, coax, stubs, transmission lines and antennas.

The 50-Ohm dry dummy load works DC to 60 MHz. SWR is below 1.3:1 at 30 MHz. Can handle 100 Watts for ten minutes or 1500 Watts for ten seconds. Comes with power derating curve.

Extra-large three-inch lighted Cross-Needle meter reads SWR (1:1 to 8:1), forward and reflected power *simultaneously*.

Reads *true peak* PEP or average power on 300/3000 Watts forward and 60/600 Watts reflected power ranges 1.8-54 MHz.

High accuracy comes from a carefully designed directional coupler, an accurate active-peak reading circuit and a precision d'Arsonval meter movement.

RF tight perforated aluminum cabinet. 4½Wx3½Hx10½D inches. Uses 12 VDC or 120 VAC with MFJ-1312D, $14.95.

Find Power Line Noise Fast!

MFJ-852
$99.95

Walk or drive around with this *handheld power line noise meter* to search out leaky insulators, loose hardware and corroded ground lines quickly. Track noise source right down to the pole, transformer or insulator. Sensitive .3 uV, 135 MHz superhet AM receiver has 70 dB range noise field-strength meter. Telescopic, direction-finding dipole is optimized and balun-isolated to give sharp, clearly defined null. Plug in headphones or tape recorder.

Field Strength Meters

MFJ-802
$39.95

Shows radiated antenna relative field strength. Determine radiation pattern. **MFJ-802** has huge 3 inch meter. Telescoping dipole reduces influence of surrounding objects and is more reliable, repeatable than monopole. Sensitivity control. Jack for remote sensor, MFJ-802R, $24.95.

MFJ-801
$19.95

MFJ-801 has 1¾ inch meter, sensitivity control, 20 inch extended telescoping monopole antenna.

81 dB Step Attenuator

MFJ-762
$69.95

81 dB Attenuator in 1 dB steps. 50 Ohms. Usable to 500 MHz. 250 milliwatt maximum input. BNC connectors. Shielded stages. Connect between receiver and antenna and use S-meter as a precision calibrated field strength meter. Prevent receiver blocking, cross-modulation. Determine gain/loss, ideal for fox hunting. Evaluate linearity. Isolate circuits. Extend range of sensitive equipment. Measure input/output level differences.

MFJ Frequency Counters

MFJ-886
$119.95

MFJ-886 covers 1 MHz to 3 GHz with 300 MHz direct count, 0.1 Hz resolution. 4 gate times. 10-digit high-contrast 3/4 inch LCD display. Lock display button. Bargraph shows RF field strength. Includes rechargeable Ni-Cad batteries, charger, telescopic antenna. Black anodized aluminum. 2¾x2¼x1¼ in.

MFJ-888
$184.95

MFJ-888, like MFJ-886, but covers *10 Hz*-3 GHz. Measures frequency/period, has 50/1M Ohm input, auto hold, LED backlight, beeper. 2¾x4¼x1¼ in.

MFJ Wireless Weather Station . . . $59.95!

Display

Remote Sensor

MFJ-192
$59.95
New!

You're ragchewing with a G3 in England . . . *"Temperature outside is a cool 53 degrees with falling barometric pressure -- looks like a rainstorm may be coming. Humidity here is 73%."* . . . while noticing it's 1900 hours GMT.

This informative MFJ Wireless Weather Station receives and displays outside temperatures from up to 3 remotes every 30 seconds up to 100 feet away.

You'll get barometric pressure trends, weather forecasting, severe storm detection with visual and audible alarms -- great for severe weather nets.

You can read inside and outside F/C degrees, relative humidity, forecast icons, pressure trend, hour, minutes, seconds, day, date and month *simultaneously*.

Has upper/lower temperature limit alarms, backlight. Read time in two zones -- local and GMT or other -- in 12/24 hour format.

Display (4x7x1") uses 2 AA, remote (2¼x3½x1") uses 2 AAA batteries, not included. *Includes one remote*, extra **MFJ-192S** remotes are $19.95 each.

MFJ CW Reader/Keyer

MFJ-464
$179.95

(Keyboard, paddle not included.)

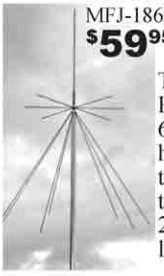
Plug MFJ's CW Reader with *built-in* Keyer into your transceiver's phone jack and key jack. Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you just passed the code test!* Sends and reads 5-99 WPM. Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard. Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ Atomic Wrist Watch

MFJ-186RC
$29.95

Receives atomic time signal WWVB and sets your watch automatically -- always accurate to milliseconds. Select 12/24 hour format and pacific, mountain, central, eastern time zones. Displays hour, minutes, seconds, day and date. Displays year, month and day in calendar mode. Alarm, stopwatch functions. Brilliant blue backlight. Water-resistant.

25-1300 MHz Discone Antenna



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$59.95

Ultra wide-band antenna receives 25-1300 MHz. Perfect for scanners. Transmit 50-1300 MHz. Handles 200 Watts. Ideal for 6/2/1¼ Meters, 70/33/23 CM ham bands. Excellent for testing various transmitters on single coax. SO-239, 50 feet coax, stainless steel elements.

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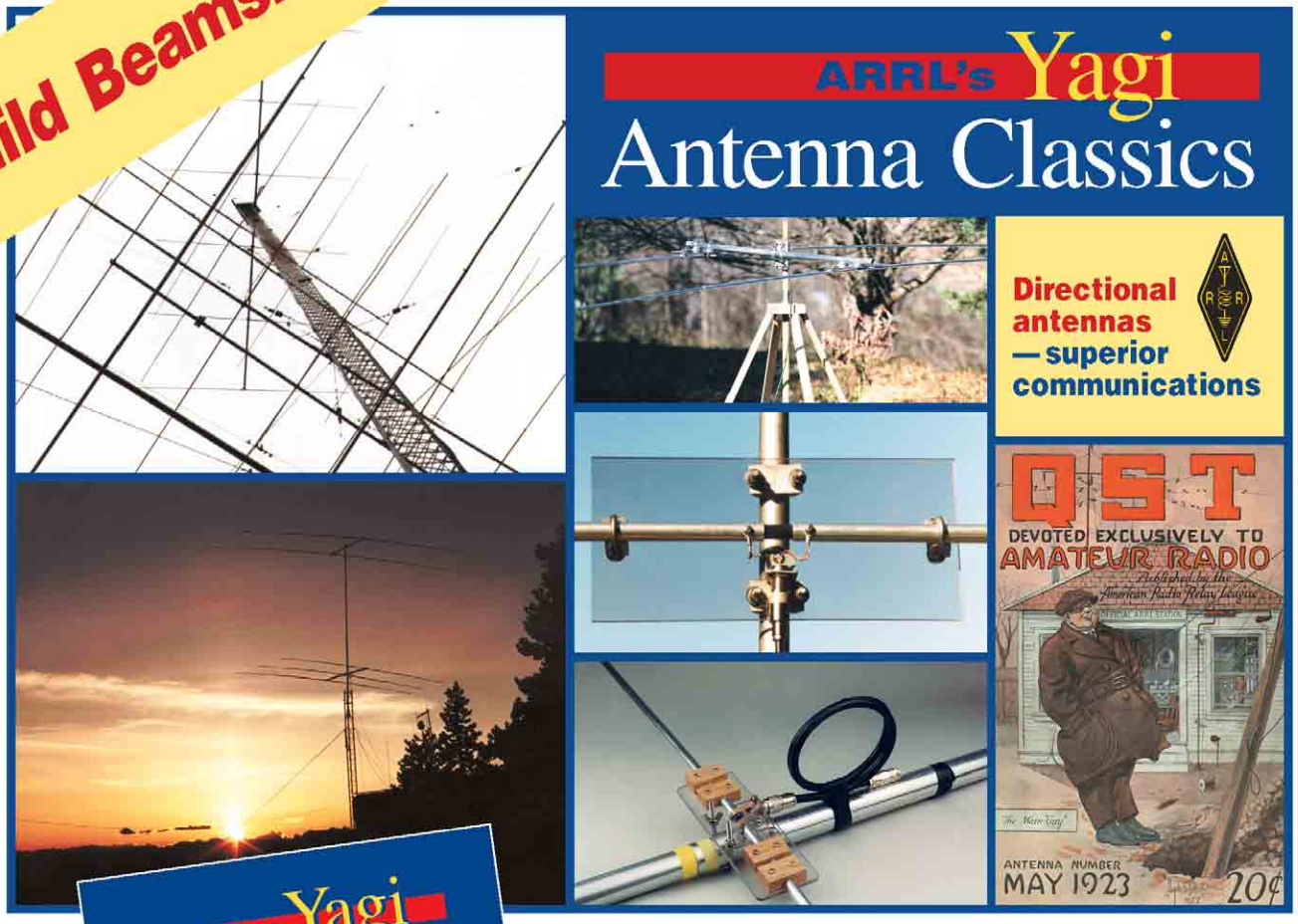

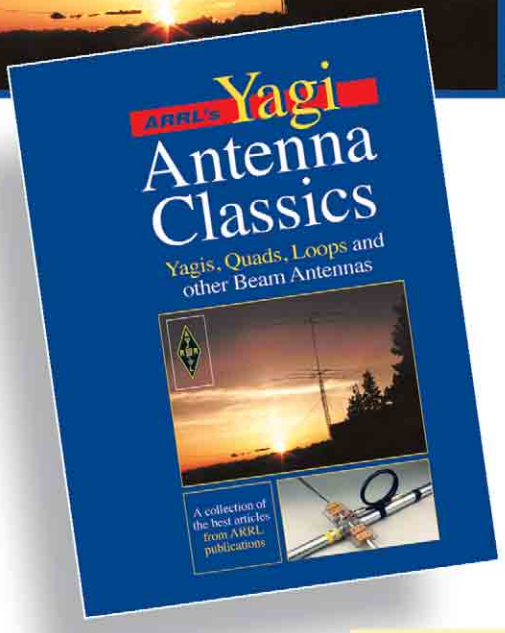

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MFJ TUNERS

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.

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.

MFJ-989C **$359.95**

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 unit *(at our option)* for 1 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* kW Tuner

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/6M *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 in.

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-921/924 **$69.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x2½x3 in. Simple 2-knob tuning for mobile or base.

MFJ-922 *144/440 MHz* Tuner

MFJ-922 **$79.95**

Tiny 4x2½x1¼" 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**

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground. Electrically places far away RF ground directly at your rig by tuning out reactance of connecting wire. **MFJ-934, $169.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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1.8-170 MHz *plus* 415-470 MHz
MFJ HF/VHF/UHF Antenna Analyzer

All-in-one handheld antenna test lab lets you quickly check and tune HF, VHF, UHF antennas anywhere. Covers 1.8-170 MHz and 415-470 MHz

Measures: SWR…Return Loss…Reflection Coefficient…Antenna Resistance(R), Reactance(X), Impedance(Z) and Phase Angle(degrees) . . . Coax cable loss(dB) . . . Coax cable length . . . Distance to short or open in coax… Inductance . . . Capacitance . . . Resonant Frequency . . . Bandwidth . . . Q . . . Velocity Factor . . . Attenuation . . . Has: LCD readout . . . frequency counter . . . side-by-side meters . . . Ni-MH/Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . One year No Matter What™ warranty . . .

MFJ-269

$359.95

You can instantly get a complete picture, check and tune any antenna from 1.8 to 170 MHz and 415 to 470 MHz -- an MFJ-269 exclusive -- with this rugged easy-to-use handheld antenna test lab! You can measure virtually every antenna parameter.

You won't believe its capability and versatility. This rugged handheld unit literally replaces a workbench full of expensive delicate test equipment.

SWR Analyzer

You can read SWR, return loss, reflection coefficient and match efficiency at any frequency simultaneously at a single glance.

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

Coax Analyzer

You can determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

CoaxCalculator™ lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and loss of coax with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Inductance/Capacitance Meter

Measures inductance in uH and capacitance in pF at RF frequencies, 1.8-170 MHz.

Frequency Counter/Signal Source

You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

Digital and Analog displays

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz Range features

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency.

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting frequency easy.

Take it anywhere

Take it anywhere - to remote sites, up towers, in cramp places. Fully portable -- battery operated, compact 4Wx2Dx6¾ in., weighs 2 lbs. *Free* "N" to SO-239 adapter.

Has battery saver, low battery warning and built-in charging circuit for rechargeables.

Use 10 AA Ni-MH or Ni-Cad or alkaline batteries (not incl.) or 110VAC with MFJ-1312D, $14.95.

MFJ SWR Analyzer Accessories

Carrying Case. **MFJ-39C, $24.95.** Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends.

Has clear protective window for LCD display and cutouts for knobs, connectors.

Dip Coils. **MFJ-66, $19.95.** **Plug** these MFJ dip meter coupling coils into your MFJ-269 and turn it into a sensitive, accurate *band switched* dip meter. Two coils cover 1.8-170 MHz.

Power Pack. **MFJ-99C, $34.95** -- ***Save $5!*** 10 MFJ Ni-MH batteries, MFJ-1312D AC adapter.

Accessory Pack. **MFJ-98, $54.85** -- ***Save $5!*** MFJ-39C *custom* Carrying case, MFJ-66 dip coils, MFJ-1312D AC adapter.

Deluxe Accessory Pack. **MFJ-98B, $77.85.** ***Save $7!*** Complete accessory pack! MFJ-39C carry case, 10 Ni-MH batteries, MFJ-66 dip coils, MFJ-1312D AC adapter.

MFJ-259B *SWR Analyzer*™

$259.95. Has most of the features of the MFJ-269, but covers 1.8-170 MHz.

Deluxe Accessory Pack **MFJ-99B, $77.85.** ***Save $7!*** 10 Ni-MH batteries, MFJ-1312D AC adapter, MFJ-29C carrying case, MFJ-66 dip coils.

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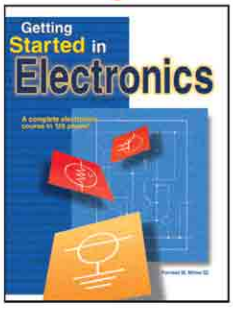

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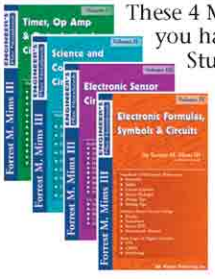

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WANTED: Late Round Emblem Collins or Rockwell Collins S-Line. Jim, WA3CEX, 1-661-259-2011, jstitz@pacbell.net

WANTED: PL172 or 8295A transmitting tube with full output. Yaesu FTDX-570, ART 13, BC-610. Frank, KBØW. 916-635-4994; fdellechaie@sbcglobal.net

WANTED: VACUUM TUBES - commercial, industrial, amateur. Radio Daze, LLC, 7620 Omnitech Place, Victor, New York 14564, Phone: (585) 742-2020, Fax: (800) 456-6494, email: info@radiodaze.com

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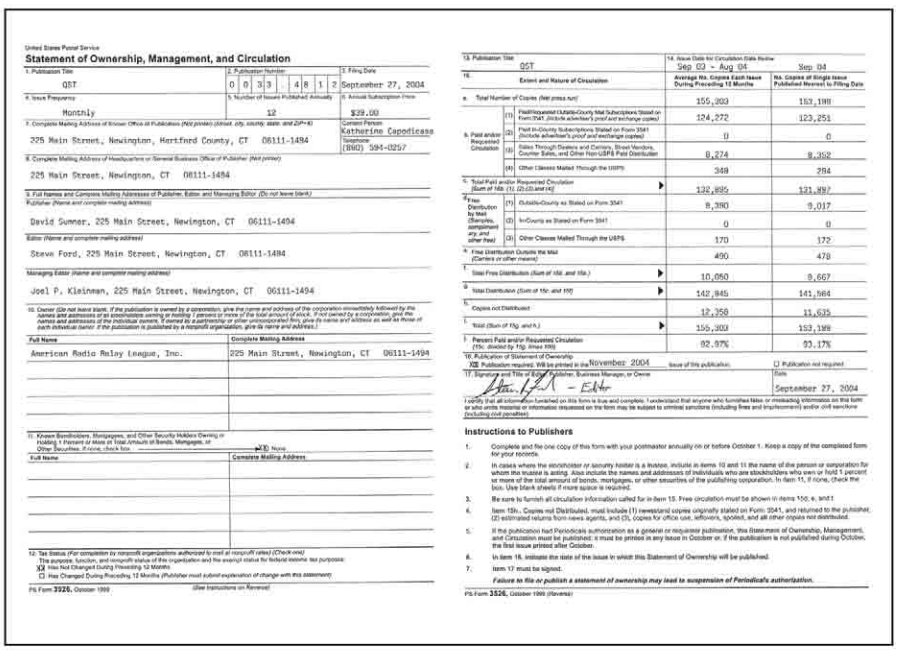

United States Postal Service
Statement of Ownership, Management, and Circulation

1. Publication Title	2. Publication Number	3. Filing Date
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9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do not leave blank)
Publisher (Name and complete mailing address): David Sumner, 225 Main Street, Newington, CT 06111-1494
Editor (Name and complete mailing address): Steve Ford, 225 Main Street, Newington, CT 06111-1494
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Full Name	Complete Mailing Address
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13. Publication Title: QST	14. Issue Date for Circulation Data Below: Sep 03 – Aug 04	Sep 04
15. Extent and Nature of Circulation	Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies (Net press run)	155,303	153,198
b. Paid and/or Requested Circulation (1) Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541. (Include advertiser's proof and exchange copies)	124,272	123,251
(2) Paid In-County Subscriptions Stated on Form 3541 (Include advertiser's proof and exchange copies)	0	0
(3) Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Non-USPS Paid Distribution	8,274	8,352
(4) Other Classes Mailed Through the USPS	349	294
c. Total Paid and/or Requested Circulation (Sum of 15b. (1), (2),(3),and (4))	132,895	131,897
d. Free Distribution by Mail (Samples, complimentary, and other free) (1) Outside-County as Stated on Form 3541	8,380	9,017
(2) In-County as Stated on Form 3541	0	0
(3) Other Classes Mailed Through the USPS	170	172
e. Free Distribution Outside the Mail (Carriers or other means)	490	478
f. Total Free Distribution (Sum of 15d. and 15e.)	10,050	9,667
g. Total Distribution (Sum of 15c. and 15f)	142,945	141,564
h. Copies not Distributed	12,358	11,635
i. Total (Sum of 15g. and h.)	155,303	153,199
j. Percent Paid and/or Requested Circulation (15c. divided by 15g. times 100)	92.97%	93.17%

16. Publication of Statement of Ownership
☒ Publication required. Will be printed in the November 2004 issue of this publication. ☐ Publication not required.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner: Steve Ford – Editor — Date: September 27, 2004

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

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PS Form 3526, October 1999 (Reverse)

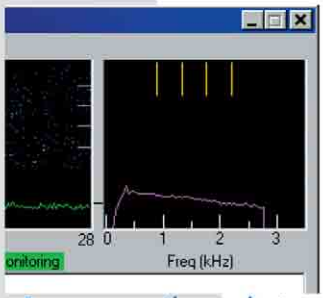
TECH TALK

6-Meter Weak-Signal Work with the IC-7800

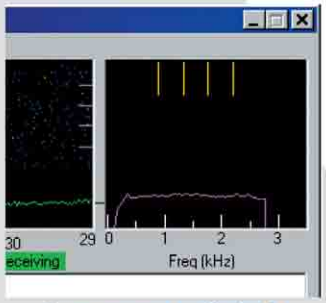
Weak-signal work on 6M demands a stable, sensitive, low-noise receiver and a stable, low-distortion transmitter preferably capable of running more than 100W output. For digital weak-signal modes, frequency *accuracy* is as important as frequency stability. A perfect application for the Icom IC-7800!

On CW and SSB, the '7800's feature set makes working 6M a pure joy. Using the dual receivers, you can simultaneously monitor both 6M weak-signal calling frequencies, 50.110MHz and 50.125MHz. You can monitor a 6M calling frequency while working stations on another 6M frequency. Or you can work DX on the HF bands while silently monitoring 6M for an opening by using the Sub receiver displayed on the high-performance spectrum scope!

QRM is not as severe on 6M as it is on HF bands such as 20M. However, when an opening occurs, the weak-signal portion of the band can fill up fast with SSB signals. The '7800's high-performance DSP-based IF filters can eliminate QRM while you work that really weak one.



System response with no equalization



System response equalized using IC-7800 tone controls

Some openings on 6M can be accompanied by very heavy QSB. When signals fade down into the noise, the IC-7800's DSP-based noise reduction works wonders for the signal-to-noise ratio. Because the '7800's ultimate-performance DSP processors operate at such high speeds, the noise reduction is more efficient than those in other radios!

Some of the most interesting weak-signal work on 6M occurs on new digital modes made possible by K1JT's *WSJT* software[1]. *WSJT* uses the sound card and processing power of your personal computer to implement several digital modes optimized for 6M and VHF propagation: high-speed meteor scatter, "moonbounce" or earth-moon-earth (EME), and ionospheric/tropo scatter. The only external hardware you need is an interface unit to connect your '7800 to your PC sound card.

The IC-7800 has several features that help you optimize 6M *WSJT* modes. For example, a "flat" audio passband is highly desirable. Using the '7800's SSB RX Tone controls, you can compensate for variations in the radio/interface/PC system frequency response. These two screen shots from *WSJT* show the '7800's receiver tone controls equalizing the system frequency response.

The IC-7800's high-gain receiver preamplifier helps amplify those weak meteor "pings" so that *WSJT* has a better chance of decoding them. You can also disable the '7800's AGC circuits to run the receiver "straight through" at maximum gain, another very desirable feature when using *WSJT*. Finally, when you make a schedule for a digital mode QSO, your frequency has to be accurate to within a few hundred Hz. The IC-7800's high-stability master oscillator guarantees that you'll be right on frequency to work that rare one.

The IC-7800: the ultimate transceiver for 6M weak-signal work! See your authorized Icom dealer.

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[1]J. Taylor, K1JT, "WSJT: New Software for VHF Meteor-Scatter Communication," *QST*, Dec 2001, pp 36-41

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December 2004	Wednesday, October 13, 2004	Monday, October 18, 2004
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