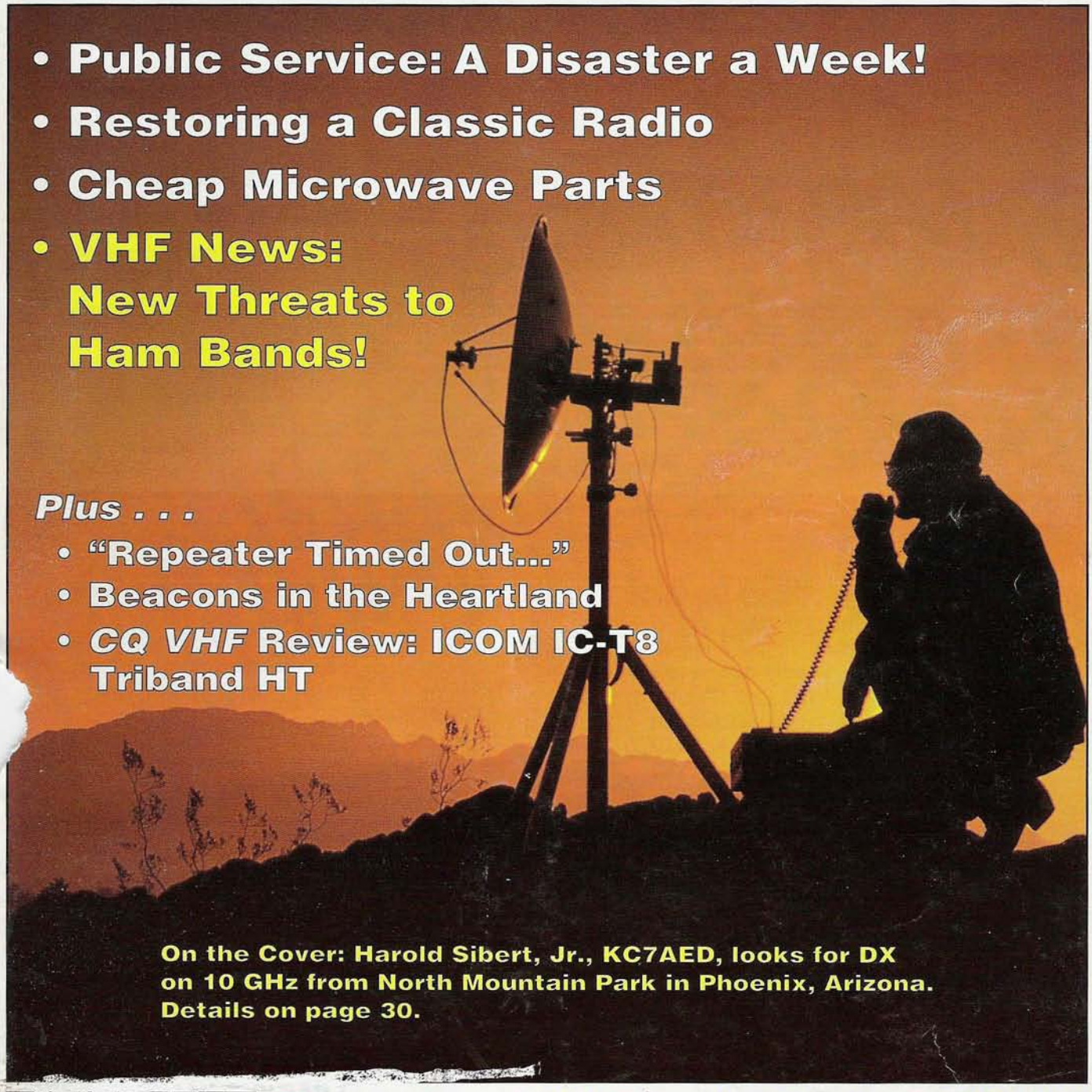
ICD 08237

CQ VHF Ham Radio Above 50 MHz

July 1998

- **Public Service: A Disaster a Week!**
- **Restoring a Classic Radio**
- **Cheap Microwave Parts**
- **VHF News: New Threats to Ham Bands!**



Plus . . .

- **"Repeater Timed Out..."**
- **Beacons in the Heartland**
- ***CQ VHF* Review: ICOM IC-T8 Triband HT**

On the Cover: Harold Sibert, Jr., KC7AED, looks for DX on 10 GHz from North Mountain Park in Phoenix, Arizona. Details on page 30.

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B-5016-G
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The MIRAGE B-5016-G gives you 160 watts of brute power for 50 watts input on all modes -- FM, SSB or CW!

Ideal for 20 to 60 watt 2 Meter mobile or base. *Power Curve* chart shows typical output power.

Hear weak signals -- low noise GaAsFET preamp gives you excellent 0.6 dB noise figure. Select 15 or 20 dB gain.

B-5016-G has legendary ruggedness. *We know of one that has been in constant use since 1979!*

Heavy-duty heatsink spans entire length of cabinet -- prevents overheating. Power transistors protected by MIRAGE's *Therm-O-Guard*™.

Fully protected from high SWR and excessive input power. Has warning LED.

Has smooth adjustable Transmit/Receive switching with remote external keying.

RC-1B, $45, Remote Control. On/Off, preamp On/Off, selects SSB/FM. With 18-ft cable.

Draws 17-22 amps at 13.8 VDC. 12x3x5½ in.

***Power Curve* -- typical B-5016-G output power**

Watts Out	130	135	140	145	150	155	160	165
Watts In	20	25	30	35	40	45	50	55

100 Watts for 2 Meter HTs

B-310-G
$199
Suggested Retail
MIRAGE RUGGED!

***Power Curve* -- typical B-310-G output power**

Watts Out	25	50	75	95	100	100+	100+
Watts In	¼	½	1	2	4	6	8

- *100 Watts out with all handhelds up to 8 watts*
- *All modes: FM, SSB, CW*
- *Great for ICOM IC-706*
- *15 dB low noise GaAsFET preamp*
- *Reverse polarity protection/SWR Protection*
- *FREE mobile bracket* • *Auto T/R switch*
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***Boost** your 2 Meter handheld to 100 Watts!* Ultra-compact all mode B-310-G amp is perfect for all handhelds up to 8 watts and multimode SSB/CW FM 2 Meter rigs. *Great for ICOM IC-706!*

35 Watts for 2 Meter HTs

B-34-G
$89.95
Suggested Retail

***Power Curve* -- typical B-34-G output power**

Watts Out	18	30	33	35+	35+	35+	35+	35+
Watts In	1	2	3	4	5	6	7	8

- *35 Watts Output on 2 Meters*
- *All modes: FM, SSB, CW*
- *18 dB GaAsFET preamp*
- *Reverse polarity protection*
- *Includes mobile bracket*
- *Auto RF sense T/R switch*
- *Custom heatsink, runs cool*
- *Works with handhelds up to 8 watts*
- *One year MIRAGE warranty*

MIRAGE RUGGED!

35 watts, FM only . . . $69.95

B-34, $69.95. 35 watts out for 2 watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛x1¾x4¼ inches.

MIRAGE Dual Band 144/440 MHz Amp

BD-35
$159.95
Suggested Retail

MIRAGE RUGGED!

***Power Curve* -- typical BD-35 output power**

Watts Out (2Meters)	30	40	45	45+	45+	45+	45+
Watts Out (440 MHz)	16	26	32	35+	35+	35+	35+
Watts In	1	2	3	4	5	6	7

- *45 Watts on 2 Meters/35W on 440 MHz*
- *Auto Band Selection* • *Auto T/R switch*
- *Full Duplex Operation* • *5x1¾x5 inches*
- *FREE mobile bracket* • *"On Air" LEDs*
- *Single Connector for dual band radios and antennas*
- *Reverse polarity protection*
- *Works with all FM handhelds to 7 watts*
- *One year MIRAGE warranty*

Add this Mirage *dual band* amp and boost your handheld to a *powerful* mobile or base -- 45 watts on 2 Meters or 35 watts on 440 MHz! **Mirage's** exclusive *FullDuplexAmp*™ lets you talk on one band and listen on the other band at the same time -- *just like a telephone conversation.* (Requires compatible HT).

6 Meter Amplifier (50-54 MHz)

FCC Type Accepted

The A-1015-G, $389, is the *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 watts out for 10 in. For 1 to 15 watt transceivers.

70cm Amplifiers (420-450 MHz)

D-3010-N, $365, -- 100 W out/30 in. For 5 to 45 watt *mobile/base*. **D-1010-N, $395,** 100 W out/10 in. *Dual purpose* -- for handhelds or mobile/base. **D-26-N, $269,** 60 W out/2 in, for *handhelds*.

Amateur TV Amps

Industry standard ATV amps -- **D-1010-ATVN, $414,** 82 watts PEP out / 10 in. **D-100-ATVN, $414,** 82 watts PEP out/2 in. (without sync compression).

Remote Control Head for Amps

RC-1, $45, remote controls most MIRAGE amps. Power On/Off, preamp On/Off, switch for SSB/FM. 18 foot cable (longer available). 1¾x3¾x2½ inches.

Repeater Amps

11 models -- continuous duty all modeFM/SSB/CW repeater amps for 6, 2, 1 1/4 Meters, 70cm, 450 MHz ATV.

Low noise GaAsFET preamps

KP-1

KP-2

High gain *ultra low noise* GaAsFET preamps for receiving weak signals. Selectable gain prevents receiver intermod. 15 to 22 dB gain. Less than 0.8 dB noise figure. Automatic RF switching up to 160 Watts. **Choose** In-*Shack* model or *Mast-Mount* (includes remote control) model to reduce loss. Rugged die-cast enclosure.

Frequency (MHz)	In Shack $139	Mast Mount $195
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

1¼ Meter Amps (223-225 MHz)

Choose from 10 models -- 20 to 220 watts out for 2 to 50 watts in, $129 to $655.

Commercial Amps ($199 to $395)

FCC Type Accepted

Commercial amps for 150 - 174, 450-470 MHz and VHF marine bands, 70 -130 watts out.

Accurate SWR/Wattmeters

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Next Month: "Make Project Labels with Your PC...on Paper," by Raymond Schneider, W6JXW

FULL-FEATURED!

RadioShack's 45-watt 2-meter FM mobile Amateur Radio transceiver

Now Only $249.99

NEW LOW PRICE! was $299.99 in our 1998 Catalog

RadioShack's HTX-242 brings you top-notch performance and an array of handy features. Automatic Memory Store finds active frequencies and stores them in memory—including correct repeater offsets—great for new Hams and travel. The tracking-type receiver front end quashes intermod interference and true FM transmit provides excellent voice quality. You get 40-channel memory, built-in subaudible tone encoder **and decoder**, 10 DTMF memories and group calling. HTX-242 includes a detailed manual *written by U.S. Hams* to get you up and talking fast. It's backed by a 1-year limited warranty and a service plan is available.

At your fingertips: Selectable 45/10-watt transmit power. Multifunction scanning. Memory scan skip. Priority channel. Dual VFOs. Extended receive 136-174MHz. Transmit range extendable to 142.5-149.5MHz for CAP/MARS operation. Programmable frequency step. 1⅛×5⁹⁄₁₆×6³⁄₁₆".

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CIRCLE 141 ON READER SERVICE CARD

The Internet Advantage

Prophecies can be self-fulfilling, so let's stop whining about the Internet killing ham radio and concentrate on using its enormous power to strengthen our hobby.

NEWS FLASH!
Land Mobile Frequency Grab for 440

As we went to press, we received word that the Land Mobile Communications Council (LMCC), the industry group representing the nation's business radio users, had filed a petition with the FCC requesting the *immediate* reallocation of several government frequencies—*including the 420–430 and 440–450 MHz portions of the 70-centimeter ham band*—to the Private Mobile Radio Service (PMRS). The FCC assigned rulemaking number RM-9267 to the petition. You'll find more details on Page 6 in "VHF News."

Unfortunately, the FCC's fast-track comment timetable (about one month) and our publishing schedule don't mesh well, and the comment date (June 1) will have passed by the time you read this. Nonetheless, if you use the 70-centimeter band, we encourage you to read as much as you can about this threat to our second-most-popular VHF/UHF ham band, perhaps send comments to the FCC anyway (with a request that the filing deadline be waived since it was only a one-month "window"), and be sure to tell your representatives in Congress why the 70-centimeter band is important, why sharing with other FM voice services (as proposed by LMCC) won't work, and ask why the FCC is allowed to provide such brief comment periods on matters of significant importance to their constituents.

Finally, if you're a member of the LMCC, or own a business represented by the LMCC, we urge you to contact the LMCC Board of Directors to protest this attack on the 70-centimeter band.

It is impossible to underestimate the importance of the Internet (including the World Wide Web) to communications, and to society in general. It ranks right up there with the telephone, radio, and television, and maybe even movable type, in revolutionizing the way we humans communicate with one another. We're only beginning to discover the tremendous potential—both good and bad—of this amazing tool, but one thing is certain: it isn't going to go away.

Threat or Opportunity?

Everywhere you turn in the world of ham radio today—magazines, hamfests, club meetings, on-air conversations, online conversations—it seems you'll find at least one person (usually more) complaining of how the Internet is siphoning off interest from amateur radio. And there's no end of examples offered to show how it's doing that. I won't try to prove them wrong. But there's another side to the Internet coin, and that's the side I'd like to share with you: *The Internet may be the greatest recruitment and education tool ham radio has ever had.* Far from killing our hobby, the Internet may help propel amateur radio into the 21st century...if we let it.

As I was editing the articles for this month's issue, I started checking out the Web sites listed in them, making sure that the sites were still active and that we didn't have any typos in the addresses. First, it struck me that practically every article offers a reference to one or more Web sites, either for additional information or for software you can use in your ham station. Second, as I checked out these sites, and followed a few links that caught my eye, I was truly amazed at the breadth and depth of ham radio information available on the Web, from the most basic "What's ham radio about?" page to in-depth technical discussions (like the 6-meter troposcatter page I just discovered on the UK Six Metre Group's Web site) and a page with streaming audio that lets you listen to a high-speed meteor scatter (HSMS) contact.

Finding a Ham

A perennial problem in recruiting people to ham radio has been that we're very hard to find. You generally won't get too far if you look up "ham radio" in the phone book. Most clubs don't have dedicated phone lines, and, if they do, they're either for autopatch or repeater control and they won't be listed in the phone book. *If* you manage to find a local ham, or *if* you manage to find the ARRL (which doesn't have "amateur radio" in its name), then you'll probably get a good referral to a club in your area.

But I just did a quick search on the Web for "amateur radio", and I came up with 973,834 possibilities. That's nearly one million Web sites containing either the word "amateur" or "radio." Now, that covers a lot of non-ham possibilities, too, so I did a couple of other searches specifying that all the words had to be there. For "amateur+radio", I got nearly 57,000 possible sites; nearly 80,000 for "ham+radio"; and to see what I could find in my

By Rich Moseson, W2VU, Editor (e-mail: cqvhf@aol.com)

"Every ham radio club should have a Web site....Make sure the site explains who you are and what you do, includes notices of license courses and exams, e-mail links to officers, and links to other ham-related sites."

home state, I did "amateur+radio+new+jersey" and came up with 2,290 Web sites (curiously, "ham+radio+nj" turned up only 1,080 sites).

In addition, many Web sites sponsored by non-amateur groups that work closely with hams provide links to learn about ham radio. For example, one of the sites I found in my New Jersey search was the Jersey Coastal Emergency Services, Inc., Web page. Under "Emergency Management Resources," along with links to FEMA (the Federal Emergency Management Agency) and the American Red Cross, there are links to the ARRL and ARES (the Amateur Radio Emergency Service). We're certainly not very hard to find anymore, all thanks to the World Wide Web.

Worldwide Resources

The fact that the World Wide Web is, indeed, worldwide, offers us the opportunity to learn from, and share our knowledge with, fellow hams all over the world. It's just as easy to connect to a web page in Finland as in Philadelphia. And as long as the page is written in English (as a great number are), you're in business. There's virtually no limit to the virtual traveling you can do on the Web, so it's possible to tap the expertise of people everywhere. And it's all available with a click of your mouse key.

In addition, the Web's unique ability to link you from one site to another gives you the unparalleled flexibility to follow the paths the you want to get the information you want on the topic that you want.

Of course, there's more to the Internet than just the Web. There are discussion groups ("newsgroups"), interest-specific e-mail lists ("reflectors")—"qsl.net" alone seems to have a reflector for every band, every mode and every brand of radio ever built—and the ham radio forums of the commercial online services. All of these forums allow hams with shared interests to exchange notes with each other, swap ideas, and, of course, complain about how much the Internet is hurting ham radio! The only drawback to these e-mail "coffee klatches" is that many of them generate tons of traffic, much of which is irrelevant to any given person at any given time. So you have to wade through lots of messages you don't want in order to find those few that you do want (the wonders of the "delete" key!)

Some of these reflectors have worldwide membership, but others are quite local. Many clubs, for example, have member e-mail lists for internal communications. Others have registered their own Internet domain and give members e-mail "aliases" that automatically forward mail to their "real" e-mail addresses. This makes it easy to get in touch with other club members without trying to remember complicated e-mail addresses. Just send mail to <callsign@clubname.org> and your message will be delivered.

Making Lemonade

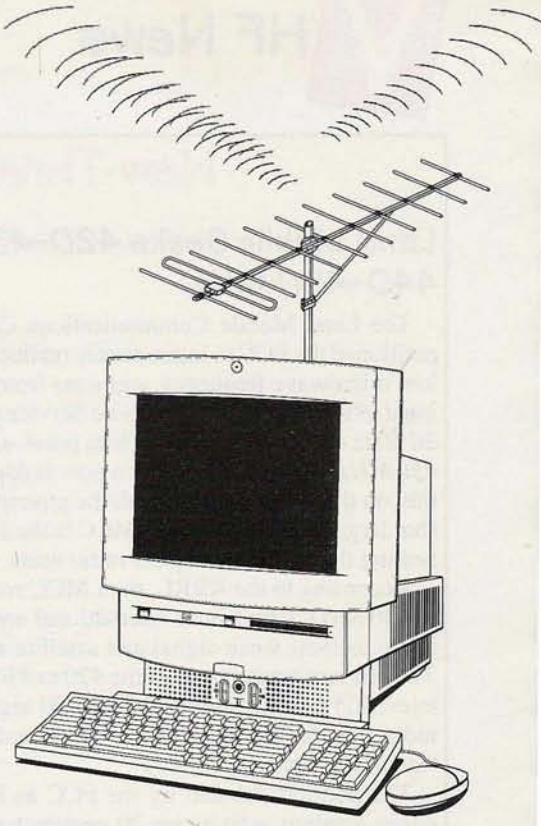
There's an old saying: "When life gives you lemons, make lemonade." In other words, make the best of what you've got. How can individual hams and radio clubs make the most of the opportunities presented by the Internet? Here are a few suggestions:

• Club Web Sites—Every ham radio club should have a Web site. This also applies to non-club groups, such as Skywarn units and traffic nets. Make sure the site explains who you are and what you do, includes notices of license courses and exams, e-mail links to officers, and links to other ham-related sites. A basic introduction to ham radio is always a good idea, as well.

• Personal Web Sites—If you're a ham and you have a personal or family Web site, include a brief description of your ham radio activities and offer links to other ham-related sites.

• Link to Link Sites—Several enterprising hams, both in North America and Europe, have developed Web sites that consist almost entirely of links to other ham-related Web sites. Some of these are general-interest, others are more closely focused on such topics as VHF, meteor scatter, or microwaves.

• Link to Non-ham Sites (and get them to link to you)—If you're involved with a non-ham organization that has ties to amateur radio, make sure that organization's Web site includes at least one ham link. Or even a link to your personal Web site, which has ham-related links.



Let's Be Friends...

The more information we provide about ham radio via the Internet, and the easier we make it for hams and non-hams alike to find and use that information, the stronger our hobby will be. If we build barriers between ham radio and the Internet, we will weaken our hobby. We will continue to limit access to amateur radio, and continue to isolate ourselves in a technical world we once led.

The Internet isn't going away. If we "make friends" with the 'net, it will serve us well. If we try to push it away, it may consume us. The choice is ours. ■

Help Wanted

If you're involved with a project or activity that you think would be of interest to your fellow *CQ VHF* readers, we'd like to hear from you. Article submissions are welcome, as are "Op-Ed" opinion pieces if you have a point of view you'd like to share about a VHF-related topic. You can contact us by mail at 25 Newbridge Rd., Hicksville, NY 11801 (send an SASE for writers' guidelines), by e-mail to <CQVHF@aol.com>, or via our World Wide Web page, <http://members.aol.com/cqvhf/>. We look forward to hearing from you.

VHF News

New Threats to Two UHF Ham Bands

Land Mobile Seeks 420–430, 440–450 MHz

The Land Mobile Communications Council (LMCC) has petitioned the FCC to immediately reallocate several UHF and low microwave frequency segments from the federal government to the Private Mobile Radio Service (PMRS)—*including 20 MHz of the 70-centimeter ham band, 420 to 430 and 440 to 450 MHz*. The amateur service now holds a secondary allocation on these frequencies, with the government as the primary (but largely inactive) user. LMCC is the industry group representing the nation's business radio users.

According to the ARRL, the LMCC request skips over 430 to 440 MHz, which is an international amateur allocation and home to most weak-signal and satellite activity on the band. The primary amateur use of the 420 to 430 segment is amateur television (ATV), and the 440 to 450 segment is the home of more than 6500 FM repeaters and countless links and other "auxiliary" stations.

The petition, labeled by the FCC as RM-9267, acknowledges amateur activity on 70 centimeters and suggests that hams could retain their secondary allocation on these frequencies, but it offers no suggestions as to how amateur TV and FM signals could successfully share the frequencies with PMRS voice and low-speed data communications, which the LMCC identifies as its "most urgent need." The LMCC petition says it feels that 430-440 "is more important to the amateurs for use in emerging technologies such as links with spacecraft and amateur television applications," and that having PMRS on 420 to 430 and 440 to 450 would actually *benefit* hams "pursuing such applications as compressed video television in the 430-440 MHz band." (*Apparently, the LMCC was less concerned with the importance of public service and emergency communications performed by hams using repeaters in the 440 to 450 segment and 440-MHz links between 2-meter repeaters; and this petition is the first I've heard of compressed-video ATV at 430 to 440.—ed.*) The petition also seeks immediate reallocation of 1390 to 1400 MHz, 1427 to 1432 MHz, and 1670 to 1675 MHz, plus a future reallocation of 960 to 1215 MHz.

Comments on RM-9267 were due by June 1, about a month after its release by the FCC, with reply comments due by June 15. The ARRL immediately began organizing opposition to the proposal.

Possible GPS Threat to 1.2-GHz Band

The ARRL says the lower end of the 23-centimeter amateur band may be threatened by the second civilian frequency for the Global Positioning Service (GPS). According to the League, the Departments of Defense and Transportation have agreed to place the second GPS frequency at either 1205 or 1250 MHz, with a final decision expected in August. Putting GPS at 1250 MHz would virtually shut down amateur use of the 1240- to 1260-MHz portion of the 23-centimeter band, which, like most of our other UHF/microwave allocations, is shared with government users, who have the primary allocation. Current amateur uses of this segment include ATV, digital communications, and non-repeater narrowband voice. More information on the proposal is available on the World Wide Web at <http://www.defenselink.mil/news/Feb1997/b022797_bt095-97.html>.

ARRL Requests Mandatory Bandplan Compliance

In response to a growing number of complaints that hams on the VHF/UHF bands were ignoring "voluntary" bandplans and causing interference to operators using other modes, the ARRL in April asked the FCC for a declaratory ruling that complying with the bandplans is "good amateur practice" (implying, of course, that failure to comply would be a violation of Section 97.101(a) of the FCC Rules, which states that, "In all respects not specifically covered by FCC Rules each amateur station must be operated in accordance with good engineering and good amateur practice.") According to *The ARRL Letter*, the League's request is based on a 1983 ruling by the Chief of the FCC's Private Radio Bureau that simplex operation on a recognized repeater frequency was contrary to good amateur practice.

The FCC declined to issue a declaratory ruling, but instead assigned a rulemaking number (RM-9259) to the ARRL request. Comments were due by May 21. The full text of the ARRL's petition is on the League Web site at <http://www.arrl.org/announce/declreq.pdf> (the ".pdf" in the filename suggests that an Adobe Acrobat reader is necessary to read the file on your computer).

FCC to Allow Electronic Filing

The FCC will soon begin allowing people to electronically submit comments in many cases via the Internet. According to the *ARRL Letter*, electronic filing of comments will be permitted on most rulemaking proceedings, notices of inquiry and petitions for reconsideration. At press time, it was not clear when electronic filing would begin, or how the Commission would let people know which cases were open to electronic filing.

Hams Help in Tennessee Twisters

When a devastating tornado ripped through Nashville, Tennessee, on April 16th, one of the buildings damaged was the Tennessee American Red Cross building. But that didn't stop the Red Cross—and Tennessee hams—from responding to the disaster. Several tornadoes actually touched down, according to reports in *The ARRL Letter*. Hams were

Compiled by the CQ VHF Staff

active on spotting nets before the storms struck, reported storm damage and funnel sightings, and stayed on the air well into the night as the threat of severe weather continued.

The next day, hams responded to Red Cross requests for communications assistance...including finding a functioning radio, power supply, and antenna at the disaster aid agency's damaged headquarters. *(The Nashville tornadoes were among a string of storms that swept through the south and midwest this spring. These storms and the amateur response to them are the topic of this month's "In the Public Interest" column, which begins on Page 32.—ed.)*

Virginia Tower Bill Now Law

A new law "makes Virginia the most permissive state in the nation when it comes to amateur radio antennas," according to a report in the *Washington Post* on successful efforts by Virginia amateurs to enact a statewide limit on restrictive tower ordinances. The new law, reported on here last month while it was still awaiting Gov. Jim Gilmore's signature, mandates minimum tower-height allowances of 75 feet in urban areas and 200 feet in rural areas. The measure, approved despite massive opposition from local governments, was signed by the governor in mid-April and takes effect July 1.

According to reports in *The ARRL Letter*, the bill was spearheaded by Virginia amateur Bob Ham, KK4IY, and sponsored in the state legislature by State Senator John Edwards of Roanoke. Supporters are hoping it will now serve as a model for similar laws in other states.

Satellites: Good News/Bad News

Two amateur satellites-in-waiting have received tentative launch dates, but one new "bird" already in orbit doesn't appear to be working.

The AMSAT News Service (ANS) reports that the Israeli Techsat-1B satellite (previously dubbed Techsat-II) has received a tentative launch date of June 23–24 from the Russian Space Agency, which will loft the Pacsat-style digital satellite into orbit. Techsat-1A was lost in a 1995 launch accident, along with the Mexican UNAMSAT-1 satellite.

SEDSAT-1, a combination voice/digital amateur satellite built at the University of Alabama/Huntsville, is now scheduled for launch "sometime in October," according to ANS. This is a rescheduling of previous plans for a July launch due to delays associated with the booster rocket's primary payload, the Jet Propulsion Laboratory's Deep Space One mission. SEDSAT-1 will carry a Mode L (1.2 GHz up/435 MHz down) digital transponder for packet and a Mode A (2 meters up/10 meters down) analog transponder for SSB and CW.

On the bad news side, ANS reports that attempts to activate the Mode A transponder on the RS-16 satellite appear to be failing. The satellite was launched on March 4, 1997, and its beacon transmitters have been working fine. However, command station UA3CR reports no luck in turning on the transponder and putting the satellite on the air for general ham use. UA3CR reportedly says he'll keep trying but is not optimistic.

New Satellite Ground Station Software

The AMSAT News Service reports that John Melton, N6LYT/GØORX, has released a preliminary version of his "Java Satellite Ground Station" software. According to Melton, the fully-automated digital store-and-forward satellite ground station software includes AX.25, KISS and Pacsat protocols, message composition and viewing screens, orbital prediction and satellite scheduling functions, and provisions for controlling both radios and antenna rotors. The program is shareware and may be downloaded from <http://www.qsl.net/n6lyt>. John asks for e-mail reports at <n6lyt@qsl.net> on how well the program works or notes from anyone who wants to help with development.

(If this item is of interest to you, be sure to read this month's "Orbital Elements" column, in which N2WWD takes a close look at two of his favorite ground station programs—STSPlus and "The Station Program."—ed.)

Balloon-to-Balloon Repeater Link

Ham radio balloonists in Indiana and Alabama were planning a balloon-to-balloon repeater linkup during simultaneous flights in early May. The Windtrax-18 flight, launched from Clayton, Indiana, on May 9, carried slow-scan TV, fast-scan ATV, GPS tracking, and a 2-meter-up/70-centimeter-down crossband repeater. Participating along with some two dozen hams were 12 fifth- and sixth-grade students from Mill Creek East Elementary School in Clayton, along with some 20 parents. Controllers said the flight was a complete success.

Meanwhile, Bill Brown, WB8ELK, in Alabama, planned a simultaneous launch of a balloon carrying a 70-centimeter-up/2-meter-down crossband repeater (with the uplink frequency matching the Indiana downlink frequency), in hopes of picking up and relaying the conversations of the Indiana hams. The link was one-way only, so the Alabama hams could not talk back to Indiana. At press time, there was no word on whether the link was successful. For up-to-date information, check ot WB8ELK's Web page at <http://fly.hiwaay.net/~bbrown/>, and the Windtrax Web site at <http://www.windtrax.org>.

Balloon Flight Benefits Future Space Designers

Edge of Space Sciences, a ham radio ballooning group based in Denver, made its 34th flight in late April, in support of freshmen in the astroengineering program at Colorado University/Boulder. According to an Internet posting by Larry Cerney, NØSTZ, the goal of the mission was to provide the students with a real-time telemetry stream to decode and manipulate, including raw data of temperature, pressure, and GPS readings.

Cerney said rainy weather threatened to postpone the flight, but it had cleared by launch time. The balloon rose to 84,000 feet before bursting, and was recovered about 50 miles away from the launch site. Trackers were able to follow the balloon as it descended and watched it land about 100 yards away from them. "Balloon flights just don't get any better than this one," Cerney noted.

6-Meter "PropNET" Update

Progress continues on developing a system to use APRS (Automatic Position Reporting System) to study propagation on 6 meters. It requires a dedicated 6-meter FM transceiver on 53.530 MHz, a packet TNC, and a computer with APRS software. The project's Web site now includes information on setting up what's called a "Peer-class station," or the typical user station (as opposed to a "Hub-class" station, which is a high-power digipeater at some high location). More information can be found on the PropNET Web site at <http://www.greeceny.com/propnet>.

CQ VHF Ham Radio Above 50 MHz

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CQ Communications, Inc.
25 Newbridge Road
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Letters

Your Spot to Speak Out

CQ VHF *welcomes comments and suggestions from readers. We'll print a representative sampling each month, and we reserve the right to edit letters for length or style. All letters must be signed and show a return mailing address or valid e-mail address. Writers' names will be withheld from publication upon request. Address letters to: Letters,* CQ VHF, *25 Newbridge Rd., Hicksville, NY 11801; or via e-mail to <CQVHF @aol.com>; <cqcomm@delphi.com> or <72127.745@compuserve.com>. Please specify that it is a letter for* CQ VHF *magazine.*

May Op-Ed: The ARRL Responds

Dear *CQ VHF*:

I would like to respond to the "Op-Ed" by Ronald T. Cyre, KE4QWP, in the May issue of *CQ VHF*.

On behalf of the ARRL officers, directors, staff, and members who attended the 1997 ARRL National Convention in Jacksonville, Florida, and especially on behalf of those who came from outside the Jacksonville area, I want to begin by thanking Ronald and the other volunteers who made us feel most welcome last August. Whatever problems the convention may have had did not arise from a lack of hospitality.

While I am sorry that the convention fell so far short of his expectations, to at least some extent those expectations were unrealistic, and, I suspect, not shared by all of the Jacksonville-area volunteers. Ronald compares the ARRL National Convention to the national conventions of the many professional associations to which he belongs. He did not specify which professional associations he had in mind, so it is not possible to make a direct comparison. However, unlike the conventions of most professional associations, the members attending an ARRL convention are paying their own way and are not being subsidized by an employer, union, or local or state chapter. This means that the expense of attending must compete with other family expenses, including other expenditures for amateur radio. The national conventions of some organizations are their ultimate governing authority. The ARRL National Convention is not; the ARRL is governed by a Board of Directors elected by mail vote of the membership, so every member has an equal voice in the governance of the organization regardless of whether they can afford to attend an in-person convention.

The ARRL did what we could to attract members to Jacksonville last August. The convention was featured on the cover of August 1997 *QST*, using artwork supplied by the local convention committee. This was the culmination of monthly *QST* publicity that began in the December 1996 issue. The ARRL headquarters staff, with considerable assistance from volunteers, assembled a quality program that drew standing-room-only crowds to several sessions.

Like Ronald, I wish more ARRL members from outside the Jacksonville area had come to enjoy the convention. Those who did had a greater opportunity to meet ARRL and FCC officials than at any other event of the year; those who didn't missed a friendly affair in a fine facility.

There are no ARRL National Conventions scheduled for 1998 or 1999. In 2000, the Dayton Hamvention will also be the ARRL National Convention. We're looking forward to an outstanding event, with all of Dayton's traditional attractions supplemented by programs of special appeal to ARRL members. I can't think of a better way to usher in amateur radio's new century.

Sincerely,

David Sumner, K1ZZ
Executive Vice President, ARRL
Newington, Connecticut

Dave—Thanks for the ARRL perspective. As I write this, I'm reading an editorial in the NOFARS (North Florida Amateur Radio Society) newsletter, Balanced Modulator, *in which club president Billy Williams, N4UF, adds some comments of his own, and I'd like to share excerpts of his editorial with you and our readers, because much of what he says could have been written by a hamfest sponsor anywhere.*

Reports that our National Convention lost money are not true. Net proceeds were marginal and no distributions were made to clubs, but our amount of capital for future hamfests increased slightly. We avoided a net loss through a rent subsidy by the City, based on our public service work/emergency communications, and through ARRL picking up part

of the tab for audio-visual equipment, something they were not required to do.

But Ronald does alert us to future problems. And it's hard to fault a guy like Ronald, who consistently volunteers for not just one, but several, security shifts at the hamfest as well as other activities. I imaging he feels that, while he can't be paid for his labor, our causes and projects should benefit.

1998 is a pivotal year....Another flat year caused by a small crowd will send a clear message. Rising rental rates and higher costs associated with staging a hamfest will continue ....Personal promotion of our hamfest by members of all participating clubs is the key to reversing a downward trend.

To limit the number of ARRL conventions may not be a good idea. The medium-sized hamfests such as Jacksonville would be cut out of the picture in favor of other hamfests in areas of higher population density....You might find more hams in one housing complex in southern Florida than in a whole county in northern Florida. And that is the basic problem. Relatively few people will drive more than 50 or 60 miles to a hamfest....If attendance does not increase and our hamfest has to be discontinued or altered, it should come as no surprise to anyone, especially those who fail to promote our hamfest....

Let's not fall into the trap of trying to compare a professional organization convention with that of a volunteer outfit. I get several flyers at work each month publicizing professional...conventions. Most have entry fees in excess of $100....We priced advance tickets at $6, which included free parking....But economics probably will dictate radical change as expenses continue to rise and income stays flat.

A parallel can be drawn between our hamfest and the Gator Bowl football game... College football's Bowl Coalition has made most post-season bowls superfluous. And other activities, some technologically-oriented, have led to hard times for many hamfests. The only answer to keeping both the hamfest and the post-season bowl viable is for more people to buy admission tickets and promote aggressively. [This] will occur only when rank-and-file people jump into the effort.

"It Works!"

Dear *CQ VHF:*

Thank you for printing that great article some months back (November, 1997) by Arnie Coro, CO2KK, suggesting we treat 10 meters as a "VHF" band. I worked my first 10-meter simplex FM DX, and noted that there's plenty of room from 29100–29300 kHz for simplex line-of-sight and scatter communications using FM.

As many ops tried to outshout one another on 29600 kHz (the main FM calling frequency), I had a neat 45-minute QSO with VE3KO after we went down to 29200 kHz—with no interference and little fading. Sounded much like a local VHF-FM simplex contact despite our distance.

As the repeater operators battle over channel pairs, our simplex subbands above 29 MHz remain surprisingly quiet. With only 50 watts from my Alinco DX70T to an AEA Isoloop mounted horizontal and up 35 feet, I can work locals and DX alike on 10 meters alone. Add in 6 meters, 2 meters, and 70-centimeter FM—maybe even 222 MHz FM—and we could have scores of conversations going on at the same time with no mutual interference.

I noted that locals can't hear me if they run vertical antennas. Hmmm? That might work quite well! If the VHF+ FM simplex users have antennas for both horizontal and vertical polarization, that could reduce interference even more.

Say "no" to repeaters. Practice safe simplex. Treat 10 meters as a VHF band. Use both horizontal and vertical polarization with FM—not just vertical. And, work some surprising DX!

73,

Robert Homuth, KB7AQD
Phoenix, Arizona

Dear *CQ VHF*:

I built the 6-meter beacon in the March '97 issue. Thanks to you and Ken Neubeck, WB2AMU, for this article. I'm about as dumb as a rock, but it works just fine. It carries the call KE4SIX on 50.078 from EM83 and has been heard from Canada to Haiti. I am going to build the 2-meter notch filter described in the June '97 issue and have been looking forward to the 2-to-220 transverter mentioned in one of the past issues. Where is it on the burner? I look at the microwave articles with interest and want to get into 70-centimeter ATV.

A note to the so called appliance operators: Isn't this a great hobby? Something for everyone. Fellows, it just doesn't get any better than this.

Mike Dickens, WA4GLV
Augusta, Georgia

Mike—Glad that your beacon is working well and that it's being well-used by other hams. The only 222-MHz transverter article I can think of is a review of the Down East Microwave 28–222-MHz unit that we hope to have in one of the next couple of issues. If there was mention of a transverter project in a previous issue, it must have been one of those article ideas that just didn't come together. We're certainly open for any projects of that sort—especially if they'll promote activity on 222, which is one of our most underutilized bands.

Column Kudos

Dear *CQ VHF*:

Thanks guys, for covering ham radio's response to the February snowstorm in central Kentucky ("In the Public Interest," May, '98). You just don't know what that column did for our ARES groups in this part of the state. Thanks for letting us be a part of your magazine.

Ron Ritchie, KF4MOM
EC, Fayette County
Lexington, Kentucky

Ron—We *should be thanking* you. *It was you and your fellow ARES members who devoted your time (30 hours straight, in your case, I believe) and talents to providing emergency communications. All we did was tell people what* you *did! And I hope you'll consider* CQ VHF *to be your magazine as well as ours! Thank you, and all hams everywhere, who volunteer their services "in the public interest."*

Dear *CQ VHF*:

Ken Ernandes's Pass Predictions article in the April issue of *CQ VHF* was a wonderful surprise! As a relatively new, non-technical and non-computer ham, the mystery of how to at least listen to a satellite perplexed me no end.

My initial interest was piqued by the January, 1998, "Picture This" feature showing Ray Soifer, W2RS, and Chuck Duey, KIØAG, working AO-27 with their handhelds. I immediately ordered and received an MFJ-1717 antenna for my HT. However, I then faced the almost impossible question I couldn't answer—when to listen and where to point.

Someone at CQ must be psychic—I guess it's K4TWJ and W2VU—because your article could not have been more timely. Since it's not yet April as I write this, I can't tell whether I'll be successful, but at least my odds have increased tremendously. Thanks again for writing such a readable tome, and for the wealth of information it contains.

Lou Goudzwaard, W8UGM
Kentwood, Michigan

Lou—I'm glad we were able to provide you with the right article at the right time! Please let us know how you did.

Product Update

Two New Alinco Radios

Something New on 222—Alinco USA announced the release of the DJ-280T, a handheld for the U.S. 1.25-centimeter (222 to 225 MHz) band. The DJ-280T features a base set of 10 memory channels (expandable), CTCSS encode and decode, a DTMF tone pad, and a rechargable NiCd battery.

The 10 memory channels can be expanded to 50 or to 200 with the addition of optional memory boards. The DJ-280T can accommodate standard and non-standard repeater offsets and store CTCSS encode/decode tones in its memories. The unit has flexible power requirements, operating in a range of 5.5 VDC to 13.8 VDC. Transmit power output varies with input voltage to a maximum of approximately 4 watts. The DJ-280T has an illuminated display, a wide selection of user-defined operating profiles, and it can be modified for authorized use on MARS frequencies.

Accessories for the Alinco DJ-180 and DJ-580 radios will be interchangeable with the DJ-280T. List price is $249.95. Alinco USA Sales Manager Doug Wynn, KB6YZD, expects the street price of the DJ-280T to fall "around that of comparable 2-meter handheld transceivers."

Dual-Band "Credit Card" HT—Alinco has also announced the introduction of the DJ-C5T, a credit card-sized handheld transceiver designed to operate on the 2-meter (144 to 148 MHz) and 70-centimeter (420 to 450 MHz) amateur bands. The new HT, only slightly larger and thicker than a credit card, features an internal speaker, runs on an internal lithium-ion battery, has 50 memories, CTCSS encode and decode, and includes AM aircraft band receive. The DJ-C5T puts out 300 milliwatts and features a removable "rubber duck" antenna. The lithium-ion battery is long lasting and recharges in two hours or less. Lithium-ion batteries are also free of the "memory effect" often associated with NiCd power sources. List price for the DJ-C5T is $239; street prices will likely be lower.

For more information on either radio, see your favorite Alinco dealer or contact Alinco Electronics at (310) 618-8616, or on the World Wide Web at <http://www.alinco.com>.

Circle 100 on reader service card

P.C. Electronics TX70-10 ATV Transmitter

The new P.C. Electronics TX70-10 ATV transmitter puts out more than 10 watts in the 70-centimeter band (420 to 450 MHz) continuous duty. This fast-scan ATV (amateur television) transmitter is designed for those who already use their cable-ready TV set on channels 57 through 60 or have a down converter to receive ATV signals; and for those using a crossband ATV repeater or in public service applications where only the transmitter is necessary.

There's a built-in T/R relay to switch between the external ATV receiver or transmitter and the antenna. The unit is packaged in a rugged 7.3 x 4.7 x 3-inch die cast aluminum box. With 10 watts peak envelope power, the snow-free line-of-sight DX range is 90 miles (assuming 15.8-dBd Yagis)—more than enough for good color and sound on most local ATV repeaters. However, there are adjustable power controls to properly drive the RF Concepts' 4-110 100-watt or 150-watt Teletec DXP-U150 linear amplifiers for greater DX or pushing through non line-of-sight conditions.

You can transmit live action color or black and white video. The front-panel RCA jacks accept video and audio from most camcorders, cameras, or VCRs. A

video monitor jack outputs the camera video while in receive mode to enable setting up the focus and lighting of your next scene before transmitting, and then presents the actual detected composite video in transmit so you can fine-adjust the video gain. There is a low impedance mic jack for mixing with the line audio input to allow voice over commenting while showing your home video tapes to other hams. The PTL jack (Push-To-Look; after all, this *is* video) is in parallel with the transmit/receive toggle switch.

This transmitter is AM, same as broadcast TV, so all you need for receiving is a down converter and a TV set. There are no computers or any other black boxes required for fast-scan TV, just your camera, TV set, 70-centimeter antenna and 13.8-VDC regulated power supply at 3 amps. The down-converter output uses a BNC connector and the common antenna is type N.

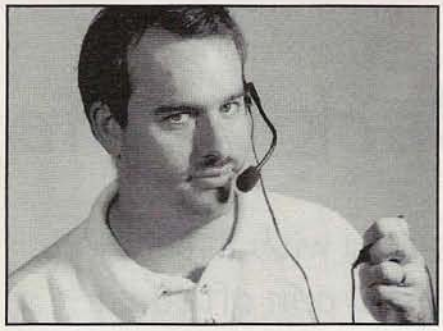
The TX70-10 comes with one crystal which you must specify—439.25, 434.0, 427.25 and 426.25 MHz are the most common and stocked frequencies. A second front-panel-selected crystal is available as an option for $20. There is also a repeater transmitter version, the RTX70-10.

The suggested retail price is $439 delivered UPS surface in the contiguous U.S. and sold only to licensed radio amateurs for legal purposes. For more information, hams can call, write, or e-mail for their complete 10-page ATV catalog from P.C. Electronics, 2522 Paxson Ln., Arcadia, CA 91007; Phone: (626) 447-4565; E-mail: <tomsmb@aol.com>. Send Inquiries to Tom O'Hara, W6ORG at the above address.

Circle 101 on reader service card

Hear and Be Heard...

MFJ has introduced three new "audio input/output devices" to make your handheld communications more convenient and efficient.



The new MFJ Deluxe Headset Microphone™ is super lightweight, comfortable, and durable, with superb transmit and receive audio. This headset gives you the ability to carry on a private QSO while doing other things. A small PTT switch can be conveniently attached to your shirt or pants pocket, your lapel, or inside your shirt. This PTT is very compact (1 inch high x 1/2 inch wide) but durable.

The headset is made of sturdy black plastic and strong metal sliders—one size fits all. A microphone element is attached to the headset with a flexible rubber extension. This allows the positioning of the mic to be anywhere within the reach of your voice. The earphone gives superb tonal quality, so even distant stations will come in loud and clear. Speaker and mic foaming protects the mic and speaker elements as well as making the ear-fit very comfortable. A four-foot-long cord from the headset to the PTT switch lets you put the switch wherever it feels most comfortable; another two feet of cord goes from the PTT switch to the two-prong plug with heavy duty insulation around the bend points.

Receive impedance is 150 ohms with a sound pressure level of 108 dB. Maximum input power is 30 mW and frequency range is 100 Hz to 5 kHz. The microphone is a condenser type with low impedance and -42 dB V/Pa sensitivity. Frequency range is 20 Hz to 16 kHz. The MFJ-288I works with ICOM, Yaesu, Standard, ADI, RadioShack, and other compatible handheld transceivers. The MFJ-288K works with Kenwood and compatible handheld radios. Suggested retail price for the Deluxe Headset Microphone™ is $24.95.

The MFJ-295Y Yaesu Minispeaker-mic™ is designed specifically for the Yaesu FT-10R, FT-40R, FT-50R and VX-1R handhelds. It uses a high-quality non-directional electret condenser microphone to give your Yaesu handheld radio superb crystal clear audio, and a 1/4-inch speaker to produce 83 dB of

crystal clear audio. A built-in earphone jack lets you plug in an external earphone for private listening. There's also a rugged PTT thumb switch and an eight-position swivel lapel clip. Suggested retail price is $15.95 each.

Finally, the new MFJ HandyPat™ earbud earphone is a super lightweight ear-

(Continued on page 81)

Bringing a Swan 250 Back to Life

Radios from yesteryear are making a comeback. And with little more than elbow-grease and a few replacement parts, you can often turn a hamfest bargain into an on-air treasure.

By Dave Booth, KC6WFS*
Photos by Bill Pasternak, WA6ITF*

If you're the type of ham who sees those old tube type "boat anchor" radios at swap meets and hamfests and thinks, "Wow! those radios from the past are neat!" then this article is for you.

"What band is that for? How much power does it run?" you ask the seller. "Well, it's an old 6-meter job," he replies, "and it would put out about 100 watts if it worked. I've had it in the garage for six years since I got my newer radio and I never fixed it." But alas! You have never worked on tube radios! Your heart sinks.

Well, I have a surprise for you. Many of these old "boat anchor" radios are a lot easier to work on than the newer radios. There's a lot more room to work in there, and you don't need all the high-tech scopes and such.

In this article, I'll help you through the basics of what to look for in terms of both working and non-working radios that you find at swap meets and hamfests, and how to get them back on the air. For illustration, I'll take you step by step through my restoration of a Swan 250 6-meter transceiver (see Photo A).

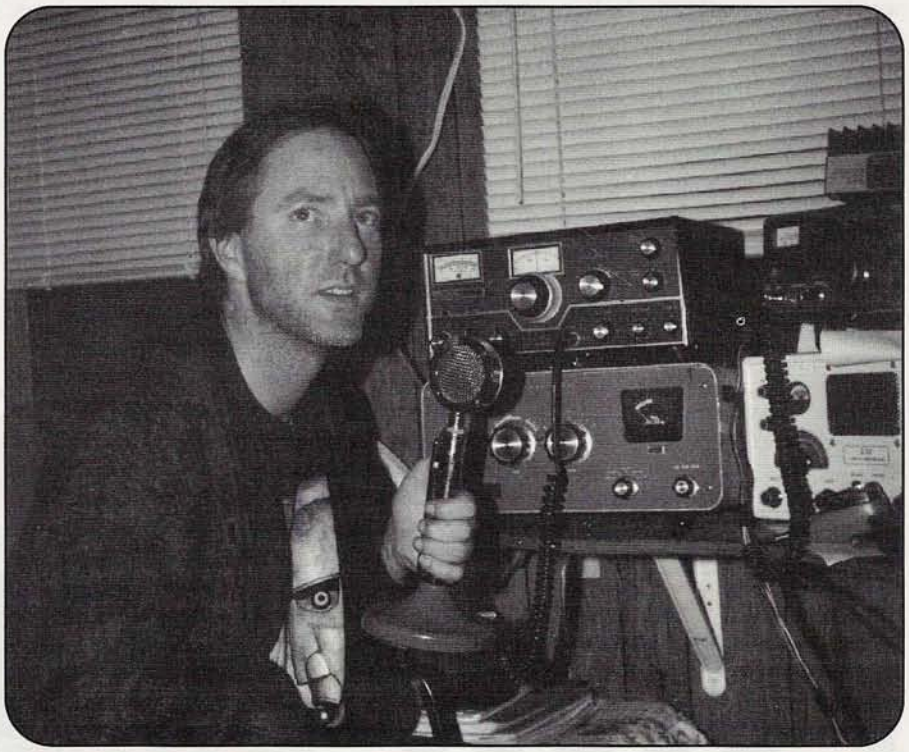


Photo A. The author with his restored "boat anchor," a Swan 250 6-meter rig, on the air (it's the one on top of the Heathkit amplifier). The mic is also a classic, the Astatic D-104.

Safety First... Common Sense Next

I am not an electrical engineer nor am I an electronics wizard. Rather, I'm a person who loves the radios of the past. I also know that all these tube radios generate lethal voltages inside their cases. In the case of the Swan 250 that I'll be working on, the power supply (117XC) puts out 800 volts (v) at 300 milliamps (mA)! Yes, that will wake you up if you don't take certain precautions when you work on these radios (*if it doesn't put you to sleep...permanently!—ed.*).

I cannot stress SAFETY enough when working on these radios, whether or not they're plugged in. Those big power supply caps (capacitors) hold enough current to make you wish you hadn't shorted them with your ring on your finger. Basic safety tips: Be sure to remove all jewelry, wear long pants, and wear your sneakers. You never want the shortest path to ground for stray voltages to be *you*!

Next, use a lot of common sense when working with these radios. The first thing to do after you get the radio home is to remove the cover and inspect the inside to see what's missing, heat-damaged, or otherwise destroyed (see Photo B). If you don't have the manual for the radio, be sure to order one from any of the manu-

Dave Booth, KC6WFS, enjoys restoring and operating old ham gear, especially on 6-meter AM, a topic on which he maintains an authoritative Web site. This is his second article for CQ VHF. *Bill Pasternak, WA6ITF, is Executive Producer of* Newsline *and a regular contributor of both words and photos to these pages. He shot these photos with a 120 camera, using ASA 400 film at 1/125 sec.*

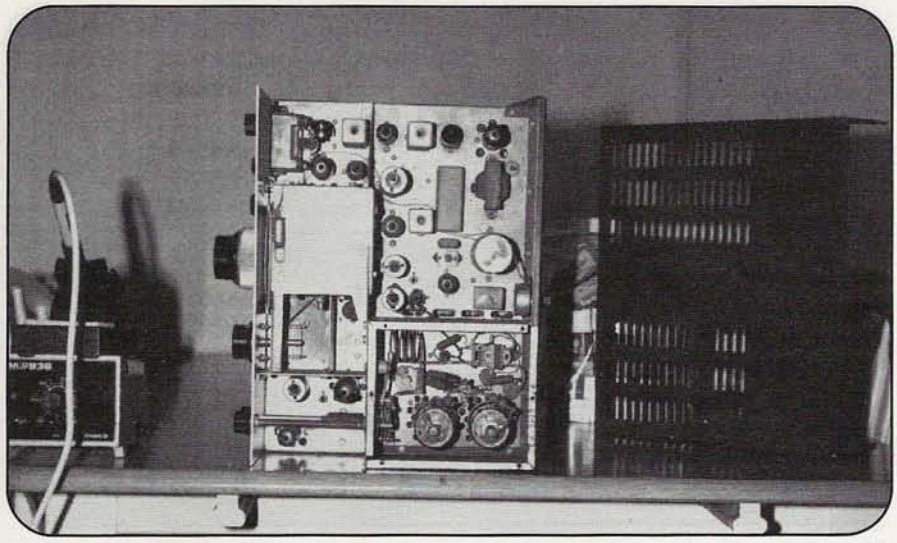


Photo B. The first step in restoring an old radio is removing the covers and making a visual inspection for missing parts and obvious damage.

al companies that I have listed at the end of this article (see "Resources").

The Ugly Duckling

The radio we're going to rebuild is a Swan 250, made by Swan Electronics in Oceanside, California, from 1961 to about 1966. The Swan 250 is a single sideband (SSB), AM, and CW multimode radio for 6 meters. It produces around 100 watts on SSB, 60 watts, on CW and 35 watts on AM. It's powered by an external power supply, either a 117-XC (120 VAC) or a 14-117 (12 VDC), and it uses twin 6146B tubes to produce the output power.

My Swan 250 sat around unused for a long time before I acquired it. The outside case looked fine, but on the inside there was a lot of dust and grease on the chassis and tubes. Here's how I turned my ugly duckling back into a beautiful Swan:

Step 1: Remove all the tubes and the covers for the relays and place them in a box or other storage unit. Remove all the knobs (Photo C) and set them in a glass containing a mixture of 1/4 dish washing detergent and 3/4 water. (Note: Do not soak the knobs if they have the centers glued on, as this will loosen the centers and you'll have to glue them back before you reassemble the radio.)

Photo C. Next, remove and set aside tubes and relay covers. Knobs also need to be removed and cleaned in a solution of dishwashing detergent and water (see text for details).

Step 2: If you have a high-power air compressor at home, all the better. If not, it's time to go off to a local gas station and ask to use their supply of compressed air to blow out the radio. Before you hit the radio with the air, though, be sure to blow out any condensation from the compressor. I've seen some pretty mucky stuff come out of the gas station compressors. Also, be sure secure meter wires and other thin wires so they're not blown loose or otherwise damaged by the air stream.

While you're blowing out the radio, be sure to get the coils in the final amplifier section. If they're covered with cobwebs and the like that don't blow out easily, use a toothpick or toothbrush to loosen or remove them. They could cause arcing when you go to fire up the radio.

Step 3: Once the dust and cobwebs have been removed from the radio, get a sponge, a toothbrush, and a little dish soap. The idea is to scrub and clean up the inside chassis. Don't use too much pressure around comments or lettering, as the ink and paint are old and may be easily washed away. There's generally not enough room to scrub the underside chassis due to component placement, so leave that area alone. Just be sure there are no cobwebs and other debris in the wiring (see Step 2).

Step 4: Clean all connectors. Pay special attention to the coax and power connectors. Here, you may see pitting and dark areas where arcing may have occurred. This is an unsafe condition and cleaning and/or replacement is mandatory. Don't skimp here!

Step 5: Next step is to clean the relays. I spray them first with contact cleaner and then use a small emery board from my wife's make-up kit to ensure that the contacts are clean and free of pitting.

Step 6: Now that the inside is all clean, clean up the front face of the radio. But don't get too carried away here. You just want to remove any cigarette tar and dust; leave the paint alone! (I use a little oven cleaner on a damp sponge. The oven cleaner will add to the lost luster of the paint while removing the grime that has accumulated for many years.) As an aside, the hardest radio to clean that I have come across is the old Gonset G-50. It's all bright shiny white!

Step 7: Remember those knobs we left on the kitchen counter soaking in dishwashing detergent? Go spill out the solution, rinse the knobs in clean water, and look at them. If they're clean, put them on some paper towels to dry. If not, spray

with some Windex™ or similar cleaner. Just spray it on and wipe off. Most will be clean.

For those occasions when you find a build up of crud on the etched center part of the knobs, do some extra cleaning with a toothbrush dipped in diluted dishwashing liquid and a rotating action. Once dry, put the knobs back on the radio.

Now that the inside chassis, front and rear are all clean, it's time to check for bad wires, resistors, and solder joints.

Inspecting the Electronics

Step 8: The Swan 250 was a hand-soldered, mass-produced radio using point-to-point construction. As such, the solder joints should be OK. But be sure to inspect them visually for any signs of corrosion or arcing. With this radio, I thought that the large electrolytic capacitor I'm pointing to in Photo D was bad. But it turned out that the only problem was a loose tab from the case to chassis ground. Resoldering fixed it. If a component has overheated to the point where you can't make out its identity or value, replace it. You'll have to refer to the schematic for the correct component and value. Likewise, if you find a cracked, burned, or otherwise bad resistor, replace it. And, while you're replacing things, invest in a new set of pilot lamps (Photo E). The bulbs are cheap and easy to replace while you have everything opened up.

Step 9: Back to those tubes. After you've inspected all the wires and electrical connections, it's time to clean the tubes and place them back into the radio (Photo F). To clean the tubes, spray a light mist of Windex™ or a similar window cleaner on them and gently wipe them clean. Don't rub too hard where the lettering is or it will rub off.

While you're cleaning the tubes, look for cracks or excessive discoloration at their bases. If a tube has a lot of blackening at the bottom, it's probably seen better days and you should replace it. (My Swan 250 had a 6EW6 that was totally discolored on the inside. I figured it would save time in the long run to replace it now rather than try to troubleshoot a problem later.)

Step 10: Now that all the tubes have been cleaned for appearance, it's time to clean their pins and each tube socket itself to assure good, noise-free contact. For this, you'll need a good cleaner, such as those manufactured by Caig Laboratories or Miller-Stephenson. These two are the standards for the broadcasting and computer service industries, and they have excellent reputations. To use them, first spray the tube socket, then the tube base. Insert the tube into the socket and quickly remove it. Repeat this process four or five times and then firmly seat the tube. Allow at least five minutes for the chemicals to dry before applying power.

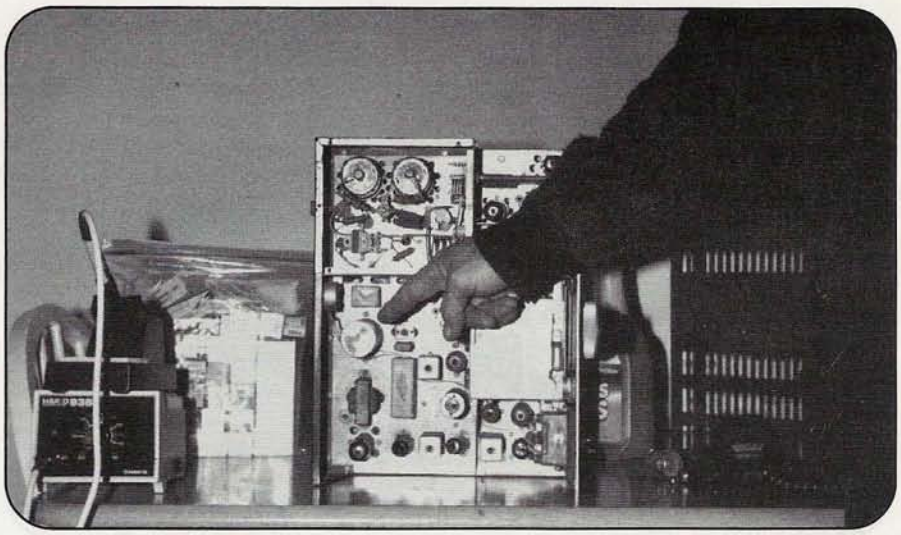


Photo D. This big electrolytic capacitor appeared to be bad...until a loose connection was found between the metal tab on the case and chassis ground. Check all solder connections!

By the way, the Swan 250 uses 16 tubes. All the tubes can still be bought new or used from several places. I do all my tube shopping on the Internet and have listed several places to buy tubes in the "Resources" section. I always try to keep a few of the most common tubes handy for quick replacement.

Step 11: Next comes the power supply. The Swan 250 has an external power supply and speaker combo. First, be certain that the supply is disconnected from the AC power mains. (*Remember, capacitors will hold a charge for quite a long time, so be careful even if the supply is unplugged—ed.*). If your supply uses an older two-wire power cord, replace it with a grounded three-wire line cord, following the convention for proper wiring of such a power cable (*if you're not sure, ask an electrician or consult a copy of the* National Electrical Code *at your public library—ed.*).

Then follow the same procedures with the power supply and cabinet as with the radio (remove the cover, blow out the dirt and look for burned wires, corroded connections, etc.). Make certain that the cone on the speaker in the 117XC cabinet is not torn or cracked. If it is, drop by RadioShack and buy a replacement. It's worth the investment to have clean, clear audio. Once all is OK, replace the cover.

Next, inspect the connector on the umbilical cable that goes to the radio. Make certain that there are no loose or frayed wires. If there are, open the Cinch-Jones connector and repair them.

Time for the Smoke Test

Step 12: Set up the radio for initial testing. Get a small table, place the radio on it, and plug the power supply into the radio. I always keep a fire extinguisher handy—my wife, Cindy, KE6FPP, gets very nervous when she knows I'm going to fire up a restored radio, and the fire extinguisher puts her mind more at ease.

Step 13: Get yourself one of those three-wire grounded power strips and plug it directly into a three-wire grounded outlet. *Do not use a ground lifter as this will compromise your personal safety!* If you don't have grounded outlets in your home—preferably with built-in ground fault circuit interrupters (GFCIs)—**STOP** now! Call an electrician and get your outlets replaced. It's a small expense for your safety and that of those around you.

Step 14: Connect the umbilical from the 117XC to the 250 and be certain it's secure. Be sure to have the power/volume knob on the 250 in the off position. Next, plug the power supply into the AC mains. If no smoke comes out of either unit, it's time to turn it on and let it warm up, while watching the inside of the radio

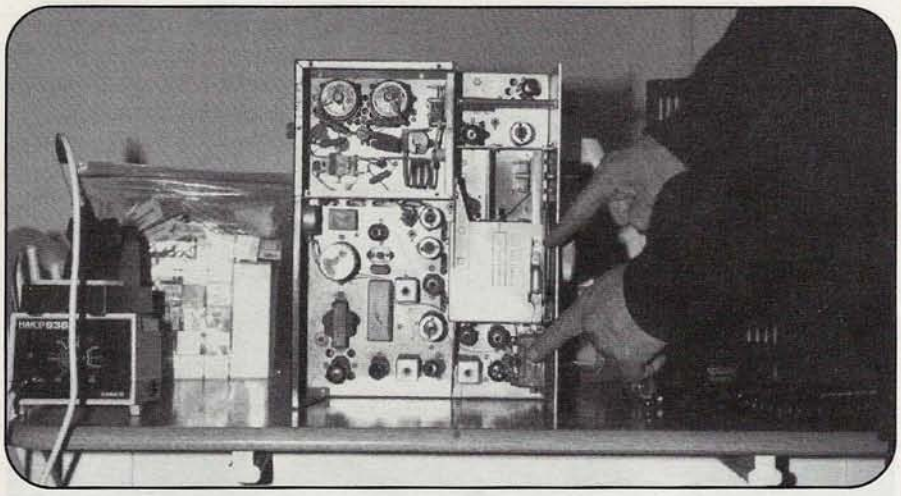


Photo E. While you have everything torn apart, take the time to replace the pilot lamps. Old bulbs will burn out relatively quickly, and replacing them now will save you time and trouble later.

for the tubes lighting up. Keep your eyes open for smoke, your ears open for arcing sounds, and watch for anything that may not look correct. If you spot something that doesn't seem just right, shut it down immediately.

After about 30 seconds of warm-up, you should hear some sound or rushing noise coming from the speaker. If you do, try peaking the "drive" control to maximize that noise.

Step 15: If you hear nothing, but there's no smoke, look to see if all of the tubes are lit. If any one of them is out, shut off the power and replace it. If the new tube fails to light, turn the power off, disconnect it from the AC mains and look for a broken filament wire under the chassis.

At all times, use extreme caution when reaching into the radio to replace a tube, especially if it's one or both of the final tubes. Even when the radio is unplugged from the power supply, the electrolytic capacitors in the main 250 chassis may still be charged and you could still get zapped! Use an insulated clip lead from ground to discharge them before you begin your inspection or repair.

Step 16: If you hear noise, it's time to check the receive end of the radio. Use the manual and follow its instructions for receiver tuning.

First, connect a resonant antenna, then calibrate the dial. I set the frequency on my other 6-meter radio to 50.150 and call CQ or test *into a dummy load* while tuning the Swan to find my signal. Once I do, I retune the Swan to 50.150 MHz and use the calibration control to bring the dial into accord with my test signal.

Now re-peak the drive control for maximum band noise and start looking for signals. One way to know if your 250 is receiving is to listen with its noise limiter "off" as an automobile passes close to your house. If you hear its ignition noise, your 250's receiver is probably pretty close to proper alignment. On the other hand, if your radio is "numb" on receive, you may have a bad receive RF amplifier tube or a bad receive mixer tube. Try replacing them and see if that helps. If not, go to your schematics and try to trace the problem. Look once again for any bad components you missed the first time through. You may have to trace voltages to see where they stop. And, again, be very careful!

Step 17: Now it's time to check the power output and mic audio. Attach a through-line VHF wattmeter and a dummy load. If you do not have either, try a 200-watt household lamp soldered to a six-foot length of RG-59/U coax, terminated on the other end with a PL-259 coax plug. It will be a bit reactive at 50 MHz, but it will give you a good indication of how well your 250 is emitting RF.

Tuning Up

Follow the radio's instructions for transmitter tuning and keep the tuning time to a minimum! You can burn up a new set of final amplifier tubes quickly if they're run out of resonance for more than 10 to 15 seconds—and these tubes are not cheap!

What you want to do is to peak the plate, load, and drive controls for maxi-

mum forward power as indicated on the wattmeter or by the brightness of the lamp load. At the same time, you don't want to exceed the maximum rated plate current for the final amplifier tubes. If maximum output occurs at a plate current higher than that specified, reduce the loading and re-dip the plate to stay within rated tolerance. (*If you're not familiar with the tuneup process for a tube rig, read the steps in the manual carefully before you start.—ed.*)

By the way, if you use the light bulb dummy load method, remember that you're really transmitting into an antenna—not a very efficient one, but an antenna nonetheless. As longtime 6-meter operators will tell you, many DX contacts have been made by hams testing into such lamp-loads. You might be heard several states, or even a nation, away if there's a sporadic-*E* or F_2 opening at the time of your test. Even local QSOs are not uncommon. I've worked Bill Pasternak, WA6ITF, up two miles away on 50.4 MHz AM when he was testing a 7-watt Clegg 99'er into a lamp load. and the signals were 59-plus both ways.

Step 18: If all is fine with the transmitter tuning, you next need to check the transmitter audio and quality. For this, while still hooked up to the light bulb, I'll call CQ while listening on my other radio and judge the quality.

This Swan 250 uses a 12AX7A for the mic audio. If your audio is very weak, you probably need to replace it. Also, the mics for this radio are of the high impedance type. I like to use the Astatic D-104s. They have very good mic elements and can be found at swapmeets for under $50.

On the Air

Step 19: If all is fine with the mic audio and level, you're ready to unplug the rig from the AC mains, put the cover back on, and get on the air! Six meters may be quiet in the rural areas, so if there's not a lot of activity where you live, you may have to call a friend on the phone to get him or her on the air to evaluate your signal. On the other hand, if you live in a big city like Los Angeles, you should have no problem finding someone on the SSB calling frequencies of 50.125- or 50.200-MHz USB.

Step 20: Remember that the older tube-type radios are drifty. The operating frequency changes slowly with the temperature of the tubes. There is no way around this, but you can minimize drift by installing a muffin fan on the rear chassis, behind the final tubes, to pull out the hot air and keep the temperature in the final tank circuit a little more consistent.

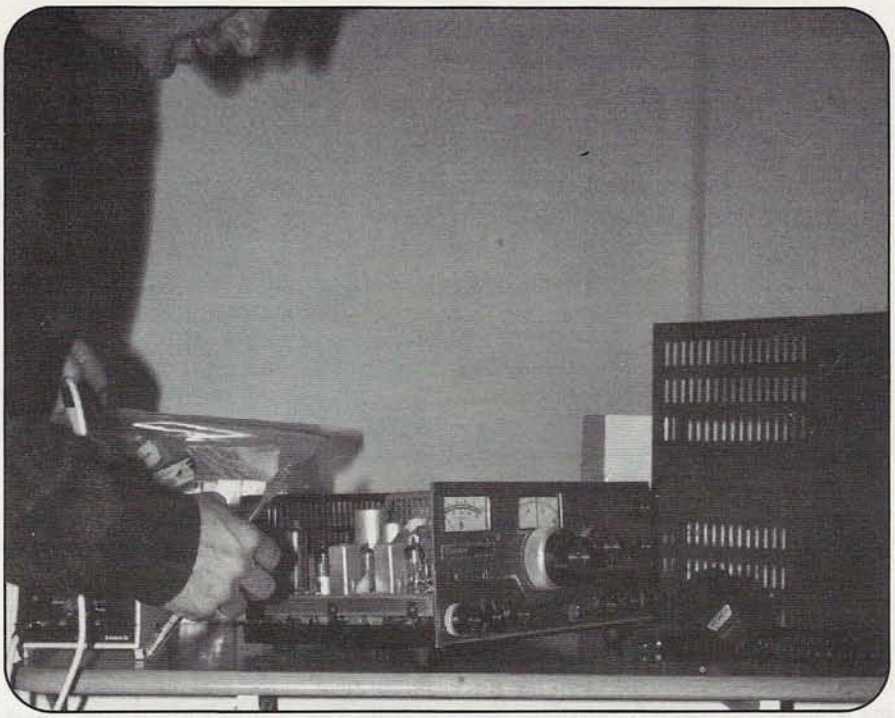


Photo F. Once everything is cleaned up, replace the knobs, tubes, and relay covers. You're ready for the "smoke test"!

Some Final Notes

The Swan 250 has no S-meter. Swan did incorporate an S-meter in the later model 250C, and did send out a mod (modification) for wiring one up in earlier models. I've scanned these pages, as well as some other mods from Swan, and posted them on my 50-MHz AM Web page, <http://Geocities.com/Hollywood/5860/50am.html>.

I hope that you'll enjoy restoring and using the old "boatanchor" radios as much as I do, and that these tips will help you get started. ■

Resources

Sources of manuals for vintage radios include:

The Raymond Sarrio Co., 6147 Via Serena, Alta Loma, CA 91701; Phone: (800) 809-7096 or (909) 987-7761; e-mail: <wb6siv@cyberg8t.com>; Web: <http://www.sarrio.com/sarrio/>.

A. G. Tannenbaum, P.O. Box 386, Ambler, PA 19002; Phone: (215) 540-8055; Fax: (215) 540-8327; e-mail: <k2bn@agtannenbaum.com>; Web: <http://www.agtannenbaum.com/>.

W7FG Vintage Manuals (no mailing address available); e-mail: <w7fg@w7fg.com>; Web:<http://www.w7fg.com/>.

Sources of tubes include:

Hammer Thor Tubes (no mailing address available); e-mail: <bbi1744@vip.cybercity.dk>; Web: <http://users.cybercity.dk/~bbi1744/home.html>.

Cwest, P.O. Box 22443, Salt Lake City, UT 84122; Phone: (801) 363-TUBE; *E-mail preferred*: <tubes@usa.net>; Web: <http://www.xmission.com:80/~cwest/>.

Thomas J. Bruckner, 179-9 U.S. Rt. 46-S251, Rockaway, NJ 07866; Phone: (973) 227-1085; Fax: (973) 227-8469; e-mail: <tjbruckner@aol.com>; Web: <http://www.tubes4u.com/>.

Picture This!

"Phun Photos"

ICOM America's "Fun Mobile" is making the rounds of the U.S. this summer (Photo A). And our own Gordon West, WB6NOA, was on hand to help with setup when the van started out in southern California. The equipment in the van—all of which will be on the air at each stop (and sometimes in between)—includes a satellite station and an APRS (Automatic Position Reporting System) demonstration station.

At this stop outside a meeting of VHF weak-signal operators in Southern California, Gordo was on hand to install a pair of KB6KQ Superloop antennas for 2-meter SSB operation (Photo B). He also brought his own van and set up a demonstration station at which visitors could operate (Photo C). The van's schedule should be available on ICOM's Web site at <http://www.icomamerica.com>.

Photo A. The ICOM America "Fun Mobile" at a stop in southern California.

Photo B. Gordon West, WB6NOA, installs a pair of KB6KQ Superloop 2-meter SSB antennas on the ICOM Fun Mobile.

Photo C. Gordo looks on as a guest operates the demonstration station he set up outside his own "NOA's ARC" radio van.

If you've got a cool snapshot to share with us, but don't have a whole article to build around it, send it in to "Picture This," along with a brief description of who and what we're seeing. If we like it, too, and have the space, we'll print it (no pay, just glory). Send your color prints to CQ VHF, 25 Newbridge Road, Hicksville, NY 11801. Please don't write on the front of the photos or use ballpoint pen on the back. If you'd like your photo(s) returned to you, please tell us so and include an SASE (self-addressed, stamped envelope) with sufficient postage. Thanks!

ICOM IC-T8A Triband Handheld

It's the same size as many dual-band HTs, but the IC-T8A, with its funny-looking antenna, puts you on 6 meters as well as 2 and 440. And what about 222?

By Gordon West, WB6NOA*

Brand new from ICOM America is the IC-T8A, a handheld with not one, not two, but *three* band coverage. About the same size as the new Kenwood TH-G71 and the popular Yaesu FT-50, the IC-T8A is fat and stubby, but very comfortable in your hand (see Photo A).

The three bands offered are 6 meters, 2 meters, and 440 MHz (70 centimeters). The receiver covers 50 to 54 MHz to include 6 meters, 118 to 174 MHz to include the 2-meter band, and 400 to 470 MHz to include the 440 band. You can expand the receiver's coverage further by turning the radio off, pushing and holding the band and squelch keys, and then turning the unit back on. Besides the three ham bands, you now get TV audio, the FM music band, the AM aircraft navigation (NAV) frequencies, and a slug of additional reception between 174 and 999 MHz, *excluding* the forbidden cellphone frequencies.

And if you can get on the inside of the equipment and follow the directions in the ARTSCI mod (modification) book, there's even more that you can get for authorized MARS (Military Affiliate Radio System), CAP (Civil Air Patrol), and Coast Guard Auxiliary beyond-band-edge transmit. And, yes, the rumor of a doctored ICOM T8A giving you transmit and receive capabilities on the 222-MHz band has indeed been investigated with my own unit in pieces on the test bench; and, in a way, the rumors are sort of true. *But* put away those wire-cutters for the time being, because I'll tell you later what it's going to take to finally get inside of this nifty tri-band transceiver and what kind of "performance" you'll get on 222.

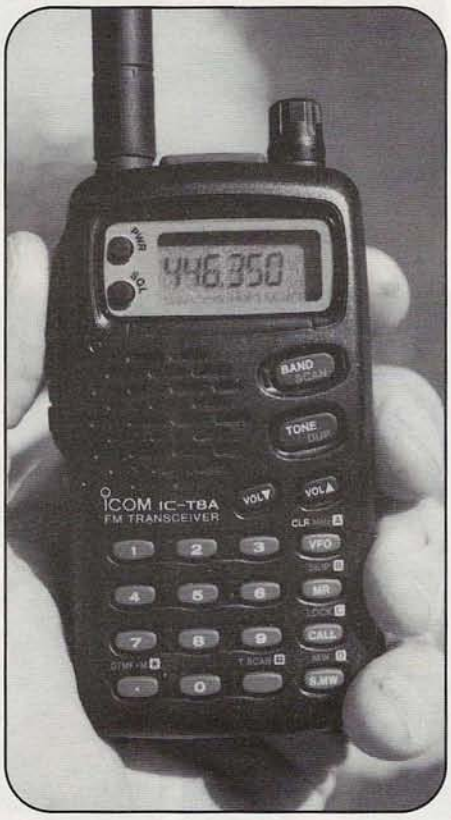


Photo A. The ICOM IC-T8A packs three transmit bands—6 meters, 2 meters, and 70 centimeters—into a very comfortable-to-hold handheld radio. (Photos by the author)

Finally! An NiMH Battery!

The included battery pack is the BP-200, a 9.6-volt, 680-milliamp-hour nickel metal hydride (NiMH) setup that's contained within the snap-out back of the transceiver. NiMH! At last! Cellular-type technology coming to a ham radio product as standard equipment. You snap on the hefty ICOM plastic belt-clip on the back of the battery pack. The battery then simply snaps onto the full back of the triband transceiver.

ICOM includes a small wall charger that can trickle-charge the NiMH pack without overcharge. Also available is a desk-top rapid charger which picks up the three copper tabs on the back of the handheld. Keep in mind that the extra-long life of this NiMH pack is only assured by proper charging techniques.

The antenna jack is SMA, not BNC (see Photo B). The antenna ICOM supplies covers all three of the IC-T8A's transmit bands as well as its full receive range. Because of its 6-meter capabilities, though, it was necessary to top-load the rubber duck antenna. This earns ICOM my highest award for the ugliest looking HT antenna (see Photo C)! Its top-loaded performance really lets this unit get a decent signal out on 6 meters, but, if you never plan to transmit on six, put their included antenna aside and screw in a Comet, Diamond, or similar SMA-style, dual-band, skinny whip for transmitting on 2 meters and 70 centimeters. Now, if you try to transmit on six with a dual-band, 2-meter/440 antenna, forget about any kind of range at all. So you'd better drag along the ugly ICOM whip just in case you want to try some 6-meter FM skywave action during the summer (or winter) sporadic-*E* season.

Antenna Connections

Don't be put off by the SMA antenna connector. More and more professional (*and amateur—ed.*) handheld radios are going to this type of connection because it's waterproof, provides a great positive

Gordon West, WB6NOA, is Senior Contributing Editor of CQ VHF.

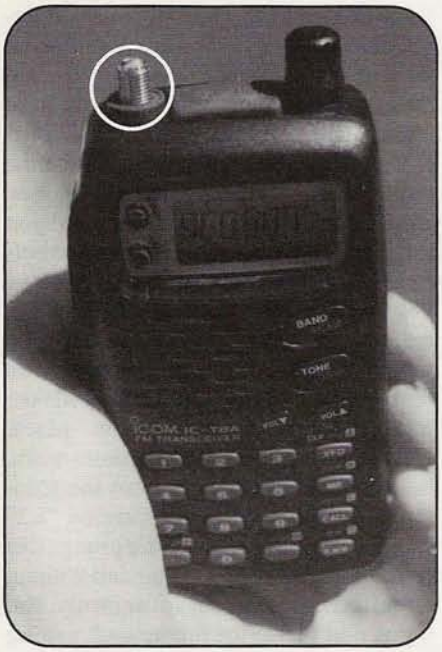


Photo B. BCNU, BNC....With the T8A, ICOM has joined the growing trend toward using SMA antenna connectors instead of the venerable BNC. The SMAs are tougher and more water-resistant.

connection without the BNC antenna rattle syndrome, and will stay well-connected after years of service. The problem with many BNC antenna receptacles is that the locking nut eventually vibrates loose and the connector wiggles around and ultimately pops off the printed circuit board. The way this SMA antenna post is connected; it's not going to easily fail.

Still, you have to be careful if you're not using a rubber duck-type of antenna. For example, when you run this handie on 6 meters, you no doubt will want to use some sort of an external antenna, and indeed SMA to SO-239 adapters are available. But I suggest that you don't use an adapter itself, but rather an SMA that ultimately terminates to an SO-239 through a small length of RG-174 cable to take up the shock. This way, you're not constantly flexing the SMA connector itself on the top of the handheld.

I'd also offer the same advice if you plan to run 2 meters and 440 with this unit off of a mobile antenna: use an SMA to SO-239 assembly with cable in between, rather than everything all within one nice, neat connector. You'll be much happier in the long run.

Memories and Cloning

The ICOM T8A will hold 100 channels of any-band memory, plus 10 scan edge memories, and one call channel for each band. This works out to be around 123 channels of stored info, and this is *plenty*. All of these memory channels can hold in-ham-band or out-of-ham-band frequencies, offset, and the (thank goodness!) CTCSS encode *and decode* tone settings. No optional tone decoders to buy! At last!

Photo C. The IC-T8A is topped off by the world's ugliest HT antenna, but it was necessary in order to get reasonable performance from the radio on 6 meters.

And best of all, the T8A clones, using either another handheld or a personal computer. This *could* allow a ham radio dealer to clone up brand new T8As and sell them to hams wanting a completely loaded transceiver with all the repeaters, FM music stations, TV, police, fire, aviation, and other hot frequencies in the area—all pre-programmed into memory. Any ham dealer that does this will surely offer the beginner a real head start when working their new equipment (see "An Editorial Comment").

And if you decide to load your own frequencies into memory, rather than cloning them, an auto-repeater function is also available as one of the many menu items. Just double-check your frequency directly to make sure that frequencies like 147.000 and splinter repeaters get the proper offset. And, because there are three different offset schemes on the 6-meter band, you'll need to check your local repeater directory and pick your split. The radio comes with a default offset of -500 kHz.

When you're in the "menu," you'll see that they also give you rolling letters that may help you figure out what menu item you've selected and what you can do with it. Forget about the rolling letters—hit the book. It's a lot more explanatory!

Tone and Scanning Options

Let's see, when it comes to tones, I already mentioned that it has both CTCSS encode and decode included. You also get nine DTMF channels to hold up to 16 digits per channel. This is great for auto-dialing. You can even control how fast the dialer does its thing for those geriatric repeaters that may need you to slow down.

And, of course, there are lots of scanning options. Memo scan, memo-skip scan, program scan, band-edge scan, scan everything, forward scan, sideways scan, reverse scan, scan resume, scan for CTCSS, and scan for tone page, too. I don't think they left anything out when it came to tone signaling or scanning.

One caution: Be careful what you turn on. I accidentally enabled the automatic power off function on my unit, and then it abruptly shut down just as I was entering some keystrokes. I thought I'd killed my radio until I discovered it was just doing its thing as programmed every hour or fraction thereof. By the way, even though it may have automatically shut off, there are still a couple of milliamps of current getting sucked out of that new NiMH battery. So be sure to turn it on, and then turn it off to get it out of the auto-power-off mode.

Additional Features

The display has a little back light, and you can turn it off, up, or dim on. There is also a way of setting the LCD contrast,

Table. ICOM IC-T8A Expanded Receive Coverage (after modification)

50–76 MHz narrow FM
76–108 MHz wide FM
108–136 MHz aircraft AM
136–174 MHz narrow FM
174–230 MHz wide FM, selectable to narrow
300–400 MHz military AM
400–600 MHz narrow FM
600–824 MHz narrow FM
849–869 MHz narrow FM
894–999 MHz narrow FM

A relatively simple modification will open up the IC-T8A's receive coverage to virtually everything between 50 and 999 MHz, minus cellphone frequencies, of course. See text for details.

and of course, a way to disable the beep tone every time you push a button. There's also battery voltage indication, plus power saver. On power saver, you sometimes miss the first syllable of someone calling you when the unit is in its rest mode. And, if you're feeling secretive, you can go into the channel indication mode where frequencies are no longer indicated on the display, but rather just your secret channel number.

Squelch is automatic. For squelch override, just push the little squelch button. The keypad has a nice feel to it, and the display is crisp and clear. Speaker volume is adjusted by up/down buttons, and this leaves only the channel-changing knob on the top. There are also jacks for the speaker/ microphone. Don't lose the little black rubber stoppers; if you do, rain could get inside and kill your little T8A.

Volume was better than usual for a radio this size. If you poke at the control buttons, volume goes up and down slowly. If you just hold one of the buttons, volume races up and down with little squares on the LCD face showing how you have the volume set. The volume was full-sounding, not thin and without bass, as I have sometimes heard on other handhelds. Good healthy audio.

The Good Stuff

OK, now let's get to the good stuff—all the tricks that this radio can do.

While monitoring out of band, public safety on 460 and 859 MHz was *not* troubled with intermod. On some other equipment, out-of-band operation usually induces so much intermod on some of the public safety frequencies that monitoring is no longer enjoyable. I don't know what ICOM did with the T8A's receiver design, but listening to the ambulance at 156.8, the medics at 464 MHz, and police and fire up at 859 MHz on an outside antenna was just about intermod-free. Spectacular reception!

Down at 50, it won't go lower. Why not? This would be a fun set if it went down to, let's say, 40 MHz. It could double as an emergency Red Cross receiver, plus a double-check that your cordless phone and baby monitor are transmitting as they should be. But no, despite all of my modification efforts, it won't budge below 50.000. (*Reminder: listening to other people's cordless phone calls is illegal.—ed.*)

The television audio was nice, and so was the FM music band. The unit goes to wide FM for this reception. You don't get the first couple of TV channels, but you get the rest of them. And if you search around UHF, you'll find low-power TV stations, too.

Wide-Band Receive Mod

Modifying the equipment for wide-band reception is relatively straightforward. Whack diodes D54 and D61 on the logic unit (see Photo D). I was able to score one of the technical manuals to figure this out on my own. Chances are ARTSCI modification books will soon cover the procedure, and you won't have a problem finding the right little diodes.

But what you *will* have a hard time doing is getting into the inside of the set. The battery comes off the back, and you remove two little screws holding the bottom section together. But don't tug yet—you first need to remove the black channel selector knob, which is done by just giving it a yank. And then you need to remove the retaining ring that holds the SMA antenna connector in place. Needle-nose pliers will sometimes work, but the tool of choice is from the auto-stereo industry with identification "L2" (see Photo E). It has two little prongs that fit right into the SMA collar and without any effort unscrews the collar nicely. But if you don't have the proper tool, getting the collar off is next to impossible trying to use a screwdriver and a hammer. Believe me, I tried until a friend in the auto-stereo biz laid the right "L2" on me. And what did I get for RX after the mod? Take a look at the Table for the impressive answer.

And What About 222?

And now, the big question about the 222-MHz band. First of all, *yes*, the IC-T8A will hear strong repeaters and simplex transmissions. You'll do better with an outside antenna; but, nonetheless, when a buddy next to you with an old

An Editorial Comment...

The ability to "clone" frequencies—or transfer memory data into a radio either from another radio or from a computer—provides a great headstart for a new (or not-so-new) ham in getting active on local repeaters. But don't expect to get a "pre-cloned" radio from your dealer.

Ham dealers will give you excuses for why they won't offer a pre-programming service. Despite the efforts of almost all the handheld manufacturers, dealers routinely refuse to offer ham radio handhelds completely cloned up and ready to run all of the local channels straight out of the box. If I were selling handhelds in this very competitive market, my sales strategy would be a fully loaded handheld, including a freshly charged battery, as opposed to selling a handheld brain-dead out of the box. Can you imagine buying a television set where the factory has not pre-programmed the audio and video frequencies for each of your 161 TV channels? Preposterous! Come on, dealers, let's put some excitement into taking home a box that instantly begins playing all of the local channels when turned on for the first time.

Editor's Note: I agree with Gordon 100%. Several years ago, before the days of cloning—or even memories—I decided to buy a new 440 HT at Dayton. And I wanted to use it right away to talk to my friends at the hamfest. I had nearly endless choices, but the dealer who got my money was the one—the only one—who offered a fully charged battery pack along with the radio.

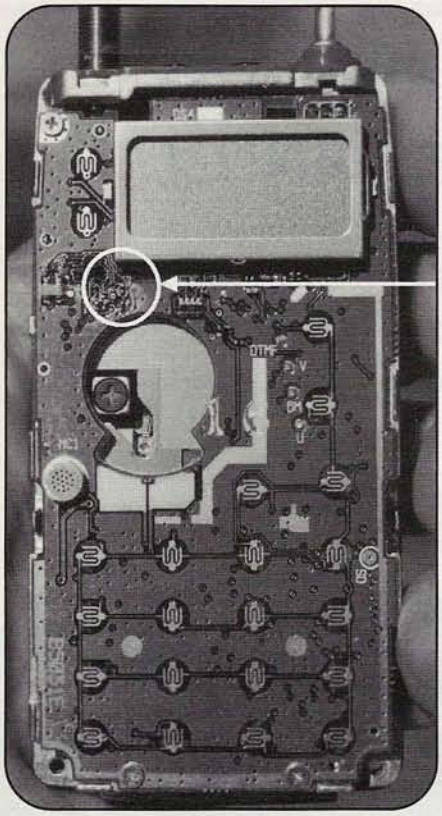


Photo D. Clipping two diodes in the logic circuit (see highlighted area) opens up the IC-T8A's receive coverage to include nearly everything between 50 and 999 MHz. Expanded transmit coverage is available as well, for authorized MARS, CAP, and Coast Guard Auxiliary members. See text for details.

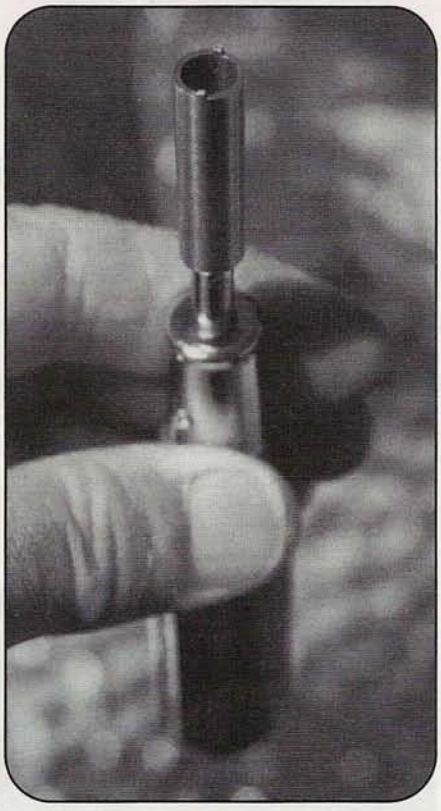


Photo E. Opening up the case on the T8A requires removing the collar on the SMA antenna connector. And that requires this special tool, called an "L2." They're used widely in the auto stereo industry.

ICOM 03 is picking up a medium-strength 223-MHz repeater, you, too, can hear it by moving your handheld around until you find the "sweet spot."

I know, I know—will it transmit on 222? Well, it's like this…after modification, keying down into a dummy load on the 222-MHz band, and watching the results on a spectrum analyzer indeed shows a watt of power output. And yes, it will key up a 223-MHz repeater system. In fact, it will key up probably *every* open-carrier 223-MHz repeater system in your vicinity—*ALL AT ONCE*!

Looking at the spectrum analyzer, the output on this band, for which the unit is specifically *NOT* designed, looks like a forest of signals extending well out of band. You could confirm this by watching an Optoelectronics frequency counter refusing to give you any kind of 223-MHz count hold. You can also confirm this by transmitting into a dummy load and tuning around with another 222-MHz transceiver—all you'll hear are spurs (spurious signals), with little increase in signal strength on what you would hope would be the desired signal.

Bottom line: *DON'T TRY USING THIS SET FOR TRANSMIT ON THE 222-MHz BAND*! Not only will you wipe out all the other ham operators on adjacent frequencies, but you'll be transmitting well out of the ham band limits, and you'll risk getting your butt busted. Keep in mind there's a lot of military stuff on each side of our ham band.

"… yes, it will key up a 223-MHz repeater system. In fact, it will key up probably every open-carrier 223-MHz repeater system in your vicinity, ALL AT ONCE!"

On-Air Performance

When you operate on frequencies for which the radio *was* designed, it does an excellent job. On 6 meters, using the "world's ugliest" ICOM rubber duck antenna, I was able to key up all of my local 6-meter repeater frequencies quite nicely. On an outside antenna, I snagged some *E*-skip and worked a mobile station almost 900 miles away on 52.525 MHz.

On 2 meters and 440, I changed over to a nicer looking Comet whip, and the set performed flawlessly. It also gave me great reception on public safety at 460 and 856 MHz.

Overall, the ICOM IC-T8A is a dandy little radio. Too bad the receiver doesn't go below 50 MHz, though; there's lots of juicy stuff down there. But it does a good job with what it does offer, including wide-band FM reception of television channels and FM music frequencies (it's just as much a neat little scanner as it is a tri-band handheld). Keep in mind that only one band plays at a time. No double- or triple-simultaneous band coverage.

But it's a handful of great technology that you *must* feel and listen to next time you're at a hamfest or the local ham store.

The list price of the ICOM IC-T8A is $419, but you can expect to see it actually selling in the $350 to $380 range. ■

Beacons in the Heartland

If there's a band opening on 6 or 2 meters from wherever you are to the Midwestern U.S., chances are you'll be able to hear one of the NØLL/B propagation beacons. Here's a close-up look at them.

By Deborah L. McKay, WX2DEB*
(deborah@warwick.net)

Now that summer is upon us, the stage is set for picnics, camping trips, and vacations...unless, of course, you're an avid VHF DXer. In that case, it's "*E*-Season," when sporadic-*E* propagation hits its annual peak, along with additional enhancements from meteor scatter and tropospheric ducting.

Seasoned VHFers know how to spot band openings and take advantage of them, but the growing popularity of 6- and 2-meter multimode radios (and HF rigs including six and/or two) has resulted in an influx of new operators to VHF DXing. For the benefit of those newcomers, here's one secret to spotting band openings: *beacons*.

Beacons

Beacons are continuously operating transmitters, used as tools to "test the waters" for enhanced propagation on a given band and to determine the quality of signal that can be heard from a given location. Beacons are generally found in the 50.06- to 50.08-MHz segment on 6 meters and the 144.275- to 144.300-MHz segment on 2 meters. Most use omnidirectional antennas so as not to favor any particular direction (see "Resources" for pointers to additional information).

Among the most widely heard of these stations—anywhere in the world—is the 6-meter beacon operated by Larry Lambert, NØLL, a longtime VHF enthusiast and member of the ARRL Contest Advisory Committee. On the air since 1985, this beacon transmitter, along with his new 144-MHz beacon, is strategically placed only 20 miles from the geographic center (Lebanon, Kansas) of the 48 contiguous United States. The 6-meter beacon has been heard all over the world, and Larry says he has a collection of QSL cards to prove it.

Photo A. An aerial view of NØLL's family farm outside Smith Center, Kansas—home of the NØLL/B beacons on both 6 and 2 meters (the antennas are on the roof of the building on the far left). The farm is in a relatively hilly area, at some 2,000 feet above sea level. (All photos courtesy Larry Lambert, NØLL; except as noted, photos are by Mike Saft, KBØQGT)

Origins of NØLL/B

Building and maintaining the NØLL beacons has been an ongoing project of nearly 15 years for Lambert, who became interested in amateur radio, and particularly VHF, while growing up on a farm near Smith Center, Kansas (see Photo A). That farm is today the site of his beacon transmitters. Larry operates without interference from the beacons at his home, 11 miles away in Smith Center, where he has run his own electronic sales and service business for over 26 years.

The 6-meter beacon project began unintentionally back in the winter of 1984, when Larry started building a GLB Electronics 6-meter kit. After being given a pair of Hy-Gain halo antennas (see Photo B) from fellow VHFer Jerry Robb,

Deborah McKay, WX2DEB, is SKYWARN Coordinator for her county, ARRL NNJ Section Public Information Coordinator and an ARRL Hudson Division Assistant Director.

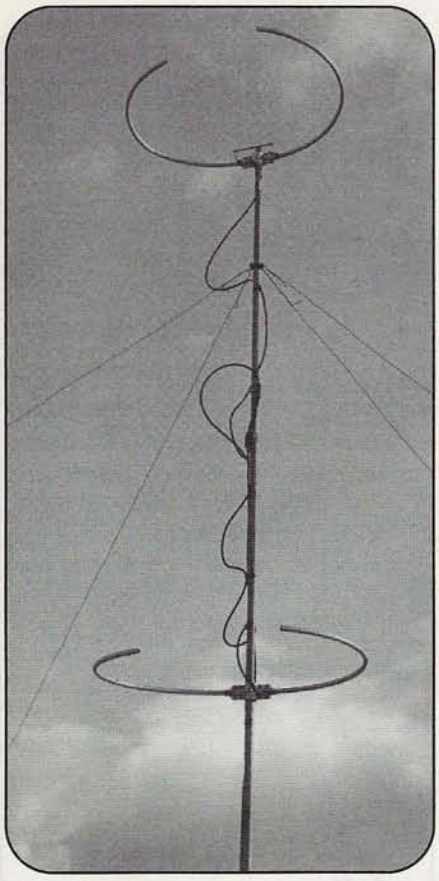


Photo B. The 1965-vintage Hy-Gain 6-meter halos are stacked 10 feet apart, increasing gain over a single halo by more than 3 dB. Guy wires secure the mast against the windy conditions of the Great Plains.

KCØQR, on the condition that he put up a 6-meter beacon, Larry took up the challenge and went to work. Coupling his transmitter with a GLB ID module, an Astron power supply (he's currently using a Pyramid), and one of the two halos (the phasing harness between them needed to be replaced), the beacon went on the air on May 4, 1985, transmitting 21 watts from an elevation of 2,030 feet above mean sea level (Photo C shows the station interior).

As is the case with many of us, it took Larry several years to get around to fixing the wiring harness between the antennas (*after all, the single halo was working fine, why rush?—ed.*). He finally did make the repair, though, in late 1988, and the two antennas were stacked 10 feet apart. The new antenna configuration increased the gain by over 3 dB. This improvement, along with good propagation, has resulted in an influx of DX QSL cards over the past 10 years, from as far away as Alaska, Japan, and Australia!

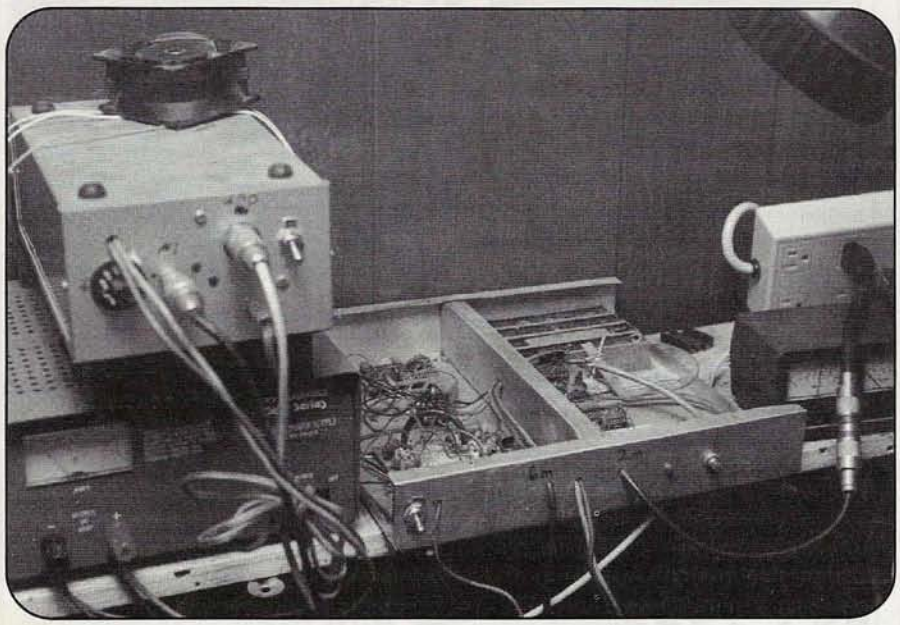


Photo C. Inside NØLL/B. Here are the "guts" of the beacon stations. On the left are the Pyramid power supply and Hamtronics 6-meter amplifier; in the center are the GLB 6-meter exciter/IDer and the WW2R 2-meter ID module. Not visible in the photo is the 2-meter transmitter, a modified Heathkit HW-202.

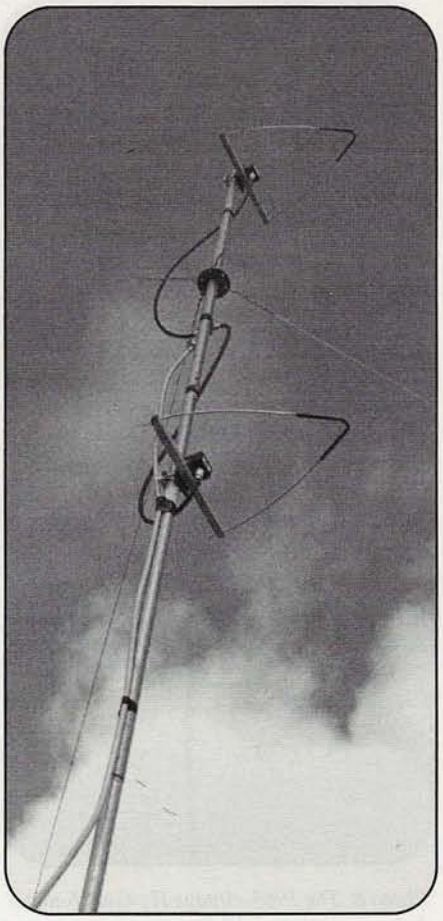


Photo E. A pair of stacked Par Triangle antennas transmit the 2-meter beacon signal far and wide. The two omnidirectional antennas are stacked six feet apart.

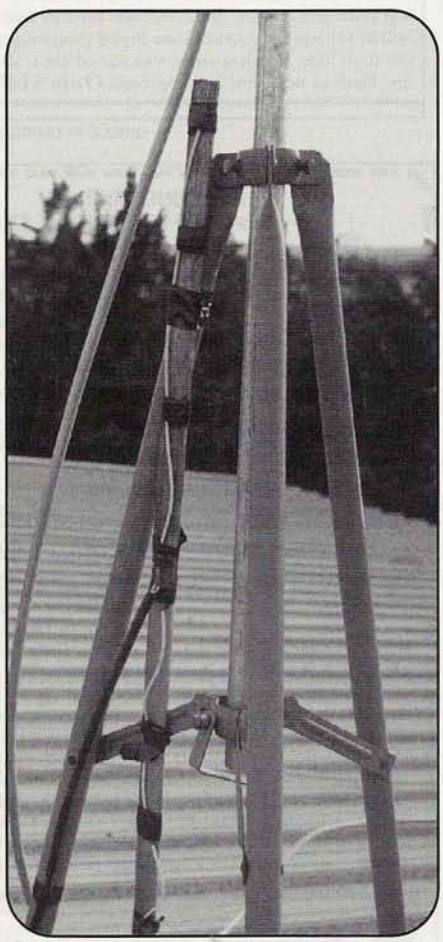


Photo D. Initial tests of the 2-meter beacon were conducted with this simple dipole antenna, strapped to the leg of the 6-meter tripod.

The station has proved extremely reliable. Using a Panamax surge protector to protect against the frequent threat of lightning, and Larry's own "preventive maintenance" program, the beacon has experienced only 10 days of downtime in the past 13 years (although he notes that he's had to change the final in the 2-watt exciter so many times that the foil on the circuit board has come loose!).

Adding 2 Meters

Co-located with the 6-meter station, a 2-meter beacon was placed on the air on February 28, 1998. The station, transmitting on 144.275 MHz, consists of a modified Heathkit HW-202 2-meter FM transceiver powered by an Astron power supply. A "homebrewed" IDer was donated by David Robinson, WW2R, of San Antonio, Texas. Initially, this beacon was tested through a dipole cut to 2 meters (see Photo D) while awaiting the receipt of a pair of omnidirectional Par

NØLL/B—At a Glance

Both of NØLL's beacons are located 11 1/2 miles north northwest of Smith Center, Kansas, in grid square EM09ow, just 20 miles from the geographic center of the 48 contiguous United States, at an elevation of 2,030 feet above sea level.

The 6-meter beacon, on the air since May 4, 1985, on 50.077 MHz, consists of the following equipment:

- GLB Electronics 2-watt exciter and IDer
- Speedcall DTMF decoder for radio control
- Pyramid power supply with Panamax surge protector
- Hamtronics 21-watt amplifier
- Pair of stacked Hy-Gain halo antennas (10 feet apart)

The 2-meter beacon, on the air since February 28, 1998, on 144.275 MHz, consists of:

- Modified Heathkit HW-202 transceiver producing 13 watts output
- Homebrew ID module (by WW2R)
- Astron power supply with (separate) Panamax surge protector
- Pair of Par Electronics Triangle antennas (stacked 6 feet apart)

QSLs and comments should be sent to Larry Lambert, NØLL, QSLs at 405 Shelton Dr, Smith Center, KS 66967, or via e-mail to <n0ll@ruraltel.net>.

Photo F. NØLL installs a guy wire for the 2-meter Par Triangle antennas. His 2-meter beacon went on the air in February, 1998. The 6-meter beacon's been on the air nearly continuously since 1985.

Triangle antennas (see Photo E). The beacon first hit the air using an amplifier, but, after overloading the noise-blanker of a receiver located at his home 11 miles away, Larry opted to run the transmitter "barefoot" at only 13 watts.

The entire project was completed with encouragement from Gregory Cerny, WQØP, Gary Krenzel, NØKQY, and others. Erection of the antenna (see Photos F and G) was completed with the assistance of Larry's 11-year-old son, Mark. And Larry is quick to credit the encouragement of, and donations from, other dedicated hams in the area for his ability to place these beacons on the air.

Turn On, Tune In...

So, if you're looking for a band opening to Kansas on 6 or 2 meters, turn your beams toward grid square EM09ow and listen on either 50.077 or 144.275 MHz for the NØLL/B beacon ID (*it's in CW, so you need a multimode rig—ed.*). I am sure that Larry would welcome your QSLs and comments. ■

Resources

For additional information on propagation beacons in general, we recommend the following:

"Lighthouses of the Airwaves: VHF and UHF Beacons," by E. R. Hall, Jr., WD4GSM, February, 1997, *CQ VHF*, p. 40; and "VE1SMU and the Beacons of Sable Island," by Gil McElroy, VE1PKD, July, 1997, *CQ VHF*, p. 40.

The VHF "How-To" Book, by *CQ* "VHF Plus" columnist Joe Lynch, N6CL (CQ Communications)

Back issues of *CQ VHF* and *The VHF "How-To" Book* are available from CQ Communications, Inc., 25 Newbridge Rd., Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926.

Photo G. Despite the low temperatures and the 20-mph winds of a typical Midwestern winter day, NØLL's son, Mark, 11, stands eager to assist the 2-meter antenna-raising effort. (NØLL photo)

GPS Rollover "Hiccup"

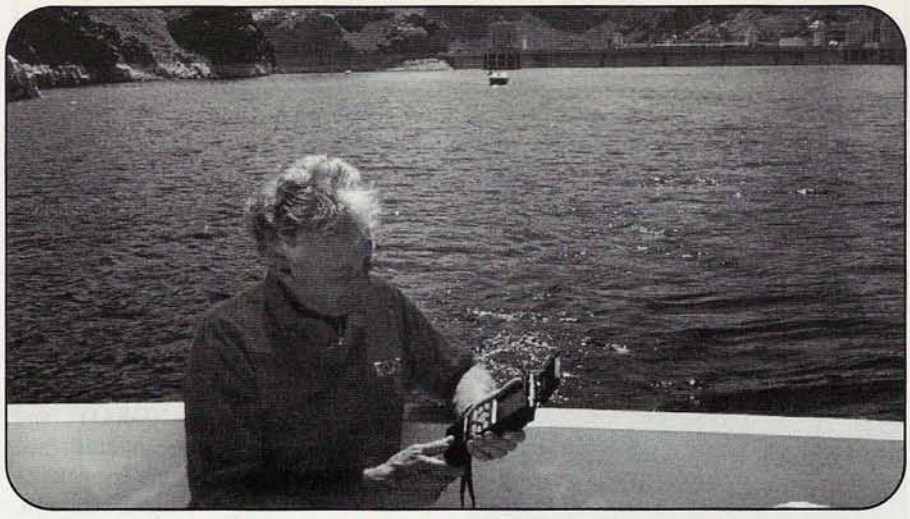
You've probably heard of the "Y2K"—or Year 2000—problem facing many computer systems. Well, how about the "W1K"—or Week 1,024—problem facing the Global Positioning System?

By Gordon West, WB6NOA*

We've received many nice comments about our coverage earlier this year on the Global Positioning System (GPS) for figuring out which grid square you're in. But one letter in particular caught our eye: "GPS Warning!" it said. It was from *CQ VHF* reader Bob Snedeker, N2WRC, and read:

The global positioning system is going to "roll over" at midnight, August 21, 1999. It seems that the 13-bit PROMS (programmable read-only memory) in the date value portion of the GPS signal standard will overflow, causing the week number counter to reset from 1,023 weeks to zero weeks (*in the computer world, 1024, or 1K, is kind of a magic number and is the basis for many other things, such as counters—ed.*).

It looks like this snafu is going to create some very real problems with affected GPS equipment. Problems like inaccurate time/date, or inaccurate position information! Right now would be a real good time to find out if your current GPS receiver will be affected. If it will, then how do you go about getting it fixed? I would also make certain that any newly purchased equipment include a written, iron-clad moneyback guarantee that it will function properly after the rollover. Lastly, I would make sure that I had an alternative way to fix my location—anybody know where I can find classes on how to use a sextant?



Will your Global Positioning System (GPS) receiver know where it is on August 22, 1999? How about January 1, 2000? If the receiver is more than three years old, don't count on it!

What's the Real Story?

CQ VHF Editor Rich Moseson, W2VU, asked me to do some additional research, and here's what I found:

The letter from N2WRC is right on target: we should all have an alternative way to fix our location, just in case our GPS black box decides to hiccup or simply fail completely. But manufacturers of GPS equipment all claim that the rollover may be more of an inconvenience on some older equipment than a catastrophic failure or position inaccuracies.

Two Rollovers

There are actually two rollovers that could affect GPS equipment. The millennium rollover occurs at midnight in the year 2000, January 1. The clock on your GPS receiver will suddenly register "00." Your GPS receiver may interpret this as the year 1900, or the year 2000. This is because a time span of only 99 years can be built into most GPS software programs. (*This is the same bugaboo faced by thousands of other computer systems as we approach 2000.—ed.*)

A second rollover is called "end of week." This is a problem within the GPS receivers that keep track of time and dates. Some equipment designers started with the digital number 1000, which is actually 0–1023 in digital computing. The GPS system counts weeks starting at January 5, 1980. This means that the clock will roll over from week 1023 to week 0000 at midnight, August 21, 1999. This "end of week" rollover is documented in GPS specifications ICD-GPS200, Paragraph 3.3.4(b).

Yes, Bob, there indeed may be a couple of bumps in the road for GPS receivers next year. Luckily, though, there will be

"...on either August 22, 1999, or January 1, 2000, some older GPS sets won't start tracking the satellites in a minute or less as they did before."

**Gordon West, WB6NOA, is Senior Contributing Editor of* CQ VHF.

no accuracy degradation! Checks with GPS manufacturers, as well as calls to the Department of Defense (DOD) test facilities, have provided assurances that 2D RMS receiver accuracy will remain exactly the same, once the GPS unit locks onto the visible satellites.

Where It Gets Interesting

And this is where it will get interesting—on either August 22, 1999, or January 1, 2000, some older GPS sets won't start tracking the satellites in a minute or less as they did before. Rather, these units will look to the sky for what they "think" is an accurate almanac of satellite information, not see the satellites they expect to see, and then revert back to a "sky search" cold start. This is where the GPS has absolutely no idea where on Earth it is and needs to "read" some satellite almanacs to figure out the correct time, the correct date, and the correct constellation of visible satellites it should be seeing in this part of the world.

This means that on either August 22, 1999, or January 1, 2000, some older GPS equipment may take as long as 30 minutes to download new information and get back in step with the satellites in view. Manufacturers indicate that, if you regularly use this same older equipment at least once every week after the rollover, the cold start 30-minute wait should only occur once after the week *and* millennium hiccups.

Worst case: on some *very* old GPS equipment, it may take an agonizing 15 minutes to 30 minutes for satellite lock-on *every time you turn it on*. But once it locks on, accuracy will be back to normal.

Possible Memory Loss

Manufacturers also indicate that some GPS sets may lose track of memorized checkpoints previously stored in waypoint routes. So, before next August, it would be a good idea to write down all of the latitude and longitude coordinates for your favorite microwave DX spots. That way, if your unit loses this information, you'll have a hardcopy for re-entry.

Many manufacturers I interviewed indicate that they've already taken steps to ensure that equipment manufactured after 1995 will pass through August and the millennium without *any* problems.

"All Furuno GPS receivers are free from potential GPS clock problems on August 22 and the millennium," comments Marc Malkin, representing Furuno.

"...it would be a good idea to write down all of the latitude and longitude coordinates for your favorite microwave DX spots....if your unit loses this information, you'll have a hardcopy for re-entry."

"We will not need to update the software for any Furuno GPS receiver, because our company has...planned ahead for this specific situation."

Garmin and Magellan representatives also indicate equipment purchased after '94–'95 will be problem-free. And, if there are any older units that might have problems, they assured me they'll let me know the specific model numbers, so this information can be published in an upcoming issue of *CQ VHF*.

A Final Thought

"Makes you wonder just how carefully the government plans for the future, doesn't it?" noted Bob Snedeker in his letter. "With around 10,000,000 pieces of equipment already out there, things could get real interesting come August, 1999."

I couldn't agree more, Bob. Better keep that sextant handy! ■

"Repeater Timed Out..."

Why do repeaters have timers, anyway? Is it just to keep blabbermouths from hogging the frequency? (No.) Or is there a more important reason? (Yes.) And is there an alternative? (Yes.)

By Rich Moseson, W2VU*
E-mail: cqvhf@aol.com

Editor's Note: "I have a question about repeater regulations," began the letter, "that is the result of some local (hams) being unhappy about the fact that (our) repeater has a 'timer' that cuts their transmissions off after several minutes of operation. I was wondering if you could provide some insight... and would be willing to write something up for CQ VHF *on the subject since there appears to be some real confusion as to why repeaters have timers...."*

Now, normally, I would have directed this letter to our "Q&A" column and written up a brief response on why timers were important and required. But this letter was from a repeater trustee whom I know to be a highly experienced ham. So I wanted to provide a more detailed response...especially when a quick glance at Part 97 showed me that I *wasn't too clear on the subject, either. Since this is a question that affects so many hams, and since the answer is not as simple (or as short) as it might seem, I felt that the topic deserved examination in a full article.*
—W2VU

If you've been anywhere near a repeater output frequency in the past 15 years, then you've almost certainly heard that ubiquitous computerized voice, at least once, saying "repeeter tiimed ouut." And if you've never been the one talking when that voice comes on, then you either don't use repeaters very much or you're a far better-disciplined person than I am.

**Rich Moseson, W2VU, is Editor of* CQ VHF. *He's not a lawyer, so his interpretation of FCC rules is not a "legal opinion," just a common-sense one.*

In case you fall into the former category and don't know what I'm talking about, virtually all amateur repeaters have automatic timers installed that limit the length of individual transmissions, generally to no more than three minutes. Some are set for shorter times, but all serve the same function: If you talk too long (anything longer than the setting on the timer), it will cut you off and shut down the repeater until you stop jabbering.

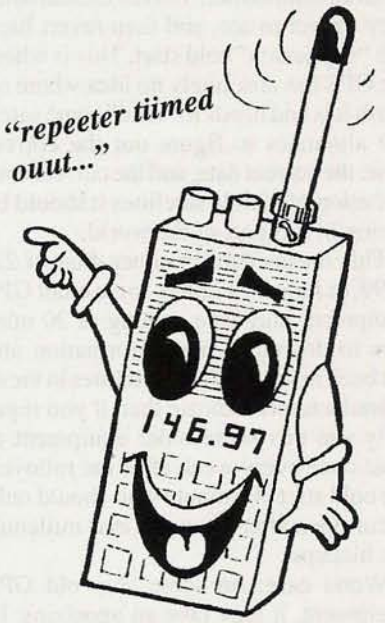
But why? What's wrong with talking forever? After all, there are no time limits on simplex frequencies or on HF. And, as was pointed out to me in the letter that prompted this article, there are no timers on amateur satellites, which are essentially orbiting repeaters.

One Question, Many Answers

If you ask around on your local repeater, you're likely to get a variety of answers, most of which are accurate...to a point. Among some of the more common responses are:

• *The timer keeps one person from monopolizing the repeater.* A repeater is a shared resource, this explanation goes, and a timer assures that others will get to talk. In theory, perhaps. But how many times have you heard someone say, "Let me drop it to reset the timer," wait for the beep if the repeater has one, and start right in again? The timer by itself won't prevent a long-winded ham from tying up the repeater.

• *It provides an enforced break in case there's an emergency or if a mobile station needs help.* Again, this is good in theory and it's good amateur practice to keep repeater transmissions short. But if our blabbermouth above is rude to boot, and especially if he has a stronger signal than the mobile station trying to break in, he'll just keep going anyway. Once again, the timer won't force him to give up the frequency.



• *It keeps the repeater transmitter from overheating due to excessive "key-down" time.* Even the venerable *ARRL Operating Manual* tells you this one, saying that one purpose of a repeater timer "is to prevent extraneous signals from holding the repeater on the air continuously, potentially causing damage to the repeater's transmitter." But if a repeater is busy, it's transmitting all the time anyway, even when there are plenty of "breaks" between transmissions. It's only the receiver that gets a little break every now and then. Besides, most repeater transmitters are designed for continuous duty, and the RF folks will tell you that frequently switching a solid-state trans-

"...most repeater transmitters are designed for continuous duty, and the RF folks will tell you that frequently switching a solid-state transmitter on and off puts more strain on it than leaving it on transmit for extended periods."

mitter on and off puts more strain on it than leaving it on transmit for extended periods. So that's not quite right, either.

• *It's the law. The FCC says a repeater can't transmit for more than three minutes at a time.* Oh, yeah? Show me the rule. Even before the FCC deregulated repeaters in 1989, there was no such rule in Part 97 (even though my 1987 *ARRL Handbook* says "FCC rules require that some means be incorporated for disabling the transmitter if a carrier holds the receiver squelch open for more than three minutes." They didn't then, and they don't now.).

So why *do* virtually all repeaters have three-minute timers?

A Matter of Control

"My understanding of the law," wrote the repeater trustee in his letter asking about timers, "is that timers are not required for repeaters or any station under local control. The problem arises when a repeater or any other station is placed under automatic control. A timer is then required by law in case the transmitter should go out of whack and the control link used to kill the transmitter fails...It's really hard to judge what's right and what's wrong based on what I've observed on the air over the years."

Like the explanations offered above, this one also is accurate...to a point. And he's a lot closer to the correct point than the other explanations—focusing on questions of *control*—but it took quite a bit of detective work for me to find the exact point in Part 97 that applies here (mostly because it's hidden, but we'll get to that in a little while).

The most logical place to look for a rule relating to repeaters (since this timer rule seems to apply only to repeaters) is in Section (§) 97.205—Repeater station. But all you'll find there that's relevant is "A repeater may be automatically controlled." [§97.205(D)]. If you look back at the definitions in §97.3(a), you'll find that "automatic control" is defined as "The use of devices and procedures for control of a station when it is transmitting so that compliance with FCC Rules is achieved without the control operator being present at the control point." And "remote control" (since automatic control, after all, is a form of remote control) is defined as "The use of a control operator who indirectly manipulates the operating adjustments in the station through a control link to achieve compliance with the FCC Rules."

Well, the main FCC rule that has to be complied with here is in §97.7: "When transmitting, each amateur station must have a control operator." The rules go into more detail in §97.109, "Station control," adding that "automatic control must cease upon notification by an EIC (FCC Engineer in Charge) that the station is transmitting improperly or causing harmful interference to other stations." But, again, it says nothing about timers.

Where's the Beef?

I had to go back 20 years, to a 1978 copy of Part 97, to finally get pointed in the right direction. Under the old §97.85, "Repeater Operation," subsection e) says, in part:

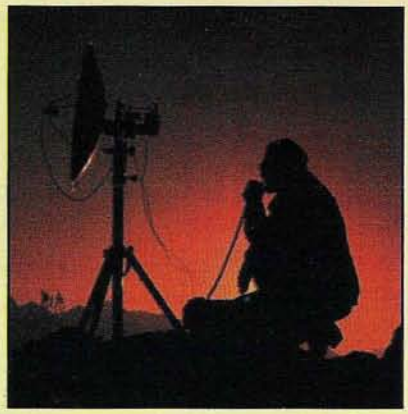
A station in repeater operation, either locally controlled or remotely controlled, may also be operated by automatic control *when devices have been installed and procedures have been implemented to ensure compliance with the rules when a duty control operator is not present at the control point of the station.* (Emphasis added)

This is very similar to the definition of automatic control in the current rules. But then my eye caught §97.88, "Operation of a Station by Remote Control." Subsection d) said *"Provisions must be incorporated to limit transmissions to a period of no more than 3 minutes in the event of malfunction in the control link."* Bingo! Finally, a three-minute connection.

But where is it in today's rules? The 1989 rewrite did away with sections 97.85 and 97.88 altogether. A little more detective work, helped along by a pointer in Chapter 6 of the current (10th edition) *FCC Rule Book,* by the ARRL, turned up the answer.

Telephone, Telegraph, Telecommand

"If you control your station *indirectly,* it's *remote control,*" explains the *Rule*



On the Cover

Harold Sibert, Jr., KC7AED, operates 10 GHz at sunset from North Mountain Park in Phoenix, Arizona, where he and two other members of the Phoenix Area Microwave Association (Ward Wheaton, WB7VVD, and Scott Duval, WB5LCQ) were experimenting with microwave and laser communications. This is Sibert's second appearance on our cover...but you could see his face the first time! Both he and Wheaton were on the cover of our very first issue, back in January, 1996, operating 222-MHz SSB (single sideband) from the other end of town—South Mountain.

Sibert and Wheaton hold the current distance record for red-laser communications, at 119.6 miles, and were thwarted by snow in a recent attempt to stretch that mark to 201 miles. Another effort was planned for June.

Their group's major activity right now is trying to get an all-mode 10-GHz repeater (actually more like a linear translator) on the air from a mountain outside Phoenix. They anticipate a range of over 200 miles. Sibert says group members are working on building portable 10-GHz transverters so they'll be able to make contacts while mobile.

Professionally, Sibert is a Senior Network Analyst for an insurance company. He's been a ham since 1993 and holds a Technician class license, but plans to upgrade soon. Future hamming plans for Sibert include building an EME (Earth-Moon-Earth) station on property outside of Phoenix that he and Wheaton recently bought.

For more information about the Phoenix Area Microwave Association, K7UHF, and its activities, check out KC7AED's Web page at <http://www.primenet.com/~hsibert>. (Cover photo by Larry Mulvehill, WB2ZPI)

"If you're operating a station by remote control (not only a repeater, but any station under any form of remote control), you need to have a way to shut down the transmitter within three minutes if the control link fails."

Book, adding, "Another FCC definition applies in remote control situations: *Telecommand* is 'a one-way transmission to initiate, modify, or terminate functions of a device at a distance.' [97.3(A)(41)]." So...telecommand is what you send on the control link. Are there rules for telecommand? You betcha. It even has its very own section of Part 97, §97.213, "Telecommand of an Amateur Station."

> An amateur station on or within 50 km of the Earth's surface may be under telecommand where...
>
> (b) Provisions are incorporated to limit transmission by the station to a period of no more than 3 minutes in the event of malfunction in the control link.

Finally, there it is—hidden away but virtually unchanged in two decades of repeater deregulation. If you're operating a station by remote control (not only a repeater, but any station under any form of remote control), you need to have a way to shut down the transmitter within three minutes if the control link fails. And note that this applies only to stations "on or within 50 km of the Earth's surface," which is why satellites don't need timers.

We're Not Done Yet

But wait a minute! What if the control link is working fine? Do transmissions *still* have to be limited to three minutes? Not as far as I can tell. And if you can come up with some other way of shutting down the transmitter within three minutes if the link *does* fail, then a timer doesn't seem to be necessary, either.

My correspondent notes that when he's in his office, "[I] am within a 3-minute run to the repeater site should anything go wrong. Under these conditions, I change the controller's timing parameters so that the repeater never times out." As I read the rules, this is perfectly legal and within both the spirit and the letter of the law. If there's a problem on the remote control link, he can be at the repeater itself (the local control point) within three minutes and either shut it down or put it under local control (as long as he's sitting there). When he leaves the office, though, he has to turn the timer back on.

As a practical matter, though, most repeater control operators are *not* within a three-minute run of the repeater site, so this option is not viable in most situations. That means that three-minute (maximum) timers will continue to be a part of the repeater landscape for a long time to come.

On the other hand, if the trustee is concerned only with meeting Part 97 requirements and isn't worried about all those other reasons for having a timer (or realizes that the timer doesn't really solve any of those problems), then there is another option: a timer that functions *only* when the control link fails.

Doin' It Digitally

One approach I can envision in today's digital world is to have a timer circuit at the repeater site connected to a microprocessor that digitally polls the control link every minute or so—just a brief "are you there" bit of data (TAPR's "MICe" microphone encoder for APRS bursts would work well here). If there's a response from the other end of the link, then the timer stays offline. But if there's no response, then the timer starts counting down two minutes (assuming that the link failed immediately after the last acknowledgment and one minute has already gone by), while the polling circuit continues to look for a response on the control link (perhaps every 15 seconds at this point). If there's a response from the link within the two minutes, the timer is turned off until next time. If there continues to be no response, then the transmitter shuts down at the end of two minutes (perhaps with a voice notice saying "control link failure") and *stays* shut down until the link is restored and a "turn on" command is received. This achieves the goal of the rule—to assure that the transmitter can always be controlled—far better than a simple timer that limits transmission length even when the control link is working fine.

Anybody wanna build it? We can split the profits. ■

The Great Field Day 1994 Opening

You've convinced the club to add 6 meters to its Field Day station. Now, will the added investment in time and effort pay off?

In recent years, many Field Day groups have been making sure that they have a transceiver set up for 6 meters as more and more stations get on the Magic Band. The hope for any Field Day group is that a major sporadic-*E* opening occurs sometimes during the 24-hour Field Day period. For Field Day 1994, this hope became reality in one of the most amazing days of sporadic-*E* activity that has ever occurred on 6 meters, let alone during Field Day.

Table. Stations Worked by KJ4E

5T (Mauritania): 1	9A (Croatia): 1	CT (Portugal): 1
DL (Germany): 18	EH (Spain): 2	EI (Ireland): 1
F (France): 6	G (England): 42	GD (Isle of Man): 1
GU (Guernsey): 1	GW (Wales): 5	HB (Switzerland): 1
I (Italy): 3	LX (Luxembourg): 1	OK (Czech Republic): 1
ON (Belgium): 3	OZ (Denmark): 2	PA (Netherlands): 17
S5 (Slovenia): 2	SM (Sweden): 3	YU (Yugoslavia): 2

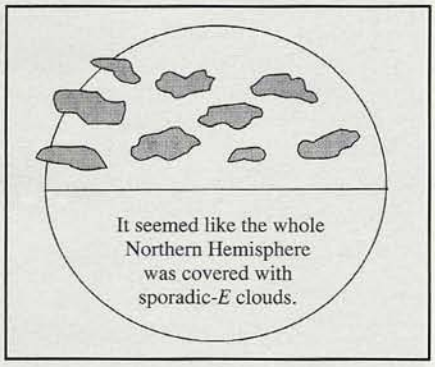
Country-by-country breakdown of stations worked by KJ4E during a tremendous sporadic-E opening on Field Day, 1994.

Starting with a Bang!

At 1800 UTC on June 25th, Field Day started for many groups with 6-meter openings between the southwest and the northeast. I remember being at Field Day station AA2DR in Long Island, and hearing a few stations out of Missouri and Florida. The only thing unusual about this opening was that some of the Florida stations I heard in the CW band did not seem to be calling "CQ FD." Instead, they were calling "CQ DX." It became apparent that they were working stations in Europe via a double-hop sporadic-*E* opening!

One of the stations, Damon Morrison, KJ4E, was able to work into Europe from 1700 until 2100 UTC. He worked 114 stations during this four-hour period, and all on CW! Signal strengths were never much higher than 559 or so, so CW was the most practical mode, especially since most of the Field Day stations were using SSB (see Table for a breakdown of stations that KJ4E worked, by DXCC country prefix).

A number of other Florida stations also tied into this opening, including Pete Moritz, K4SC, who worked 70 European stations, and Tom Colyard, N4EJW (now AE4RO), who worked 130 European stations. Jordan Mash, WB2QLP, who was operating K4FA, reported that he was torn between making regular Field Day contacts and working the Europeans on 6 meters (*DX contacts don't count for Field Day credit—ed.*). Jordan noted that many hams who had not done much 6-meter work were completely stunned at the 20-meter-like conditions on six during this time.



By 2100 UTC, stations in the northeast were able to work into Europe as well, with CU3AC in the Azores and PAØOOS in the Netherlands, among others, being worked by W1s and W2s.

Wait, There's More!

But that wasn't all. At the same time of the Florida-to-Europe opening, there was also a double hop opening connecting the U.S. west coast into Virginia, Maryland, and Delaware. This was the case for the TRW Field Day station, W6TRW, in Los Angeles. Later in the same day, W6TRW worked into the state of Washington and into British Columbia, Canada.

After tallying many of the Field Day reports, a conservative estimate using the midpoint plotting method* indicated that there were at least six different sporadic-*E* cloud formations that occurred simultaneously, possibly as many as seven or eight! It seemed like the whole Northern Hemisphere was covered with sporadic-*E* clouds.

The high amount of activity generated by Field Day played a very important role in gathering data that indicated how many clouds had to have been present. Perhaps the biggest news was the high number of European stations that were present, indicating good things to come when F_2 skip arrives again. ■

* The midpoint plotting method of locating and tracking a sporadic-*E* cloud involves plotting on a map the end points of each contact reported over a 30-minute period, then measuring and plotting the center point of each contact and "connecting the dots" to form a rough location and shape of the sporadic-*E* cloud.

Do *you* have a 6-meter adventure to share? If so, we'd love to hear about it. Just contact us by mail or e-mail.

By Ken Neubeck, WB2AMU

A Disaster a Week! Spring Storms Bring Out the Best in Hams

Early spring brought a flurry of amateur radio emergency response to many areas of the country. This month we'll look at a few of the hardest-hit areas as amateurs provide valuable communication... in the public interest.

Sunday, March 29, 1998, began with a word of warning from the National Weather Service (NWS) that there was the possibility of severe thunderstorms and tornadoes in southern Minnesota and northern Iowa through 10 p.m. Some of the storm chaser Web pages were already focusing their sites on this area and there was heightened awareness in the Amateur Radio Emergency Service (ARES) units that, at a minimum, Skywarn operations would probably be required (Skywarn is the National Weather Service's network of volunteer severe weather spotters, many of whom are hams).

But little did Minnesota amateurs know that before the sun set, many communities in southern Minnesota would be struck by devastating tornadoes which killed two people and injured dozens more. Several thousand people were left without homes and the clean up and restoration of services was going to be long and involved.

Tornado...

Minnesota Section Emergency Coordinator Gary Peterson, NØZOD, reports that word of the storm came during the Sunday HF ARES net, and that a picture began to develop on trouble occurring in the state. "Bob Meyer, WØLAW, reported hearing the city of Comfrey had been hit by a tornado," Peterson told us. "He said that his parents lived there, but they

Tornadoes that swept through various parts of America this spring created scenes of destruction like this one outside Birmingham, Alabama. Wherever twisters touched down, hams were on hand to help restore communications. (Photos courtesy National Weather Service)

By Bob Josuweit, WA3PZO (bjosuweit@aol.com)

"The trees, homes, and cars bore witness to the terrible force," said Minnesota Section Emergency Coordinator Gary Peterson, NØZOD, describing a tornado that hit St. Peter, Minnesota. This photo is from Alabama, but the description still fits.

were all right. I asked him to keep us posted and if ARES assistance was needed, to please contact us. Other links to the area were non-existent and we began to make plans 'in case.' "

Early Sunday evening, Minnesota Section Manager Max Wendel, NØFKU, called Peterson on the landline and said that he had just heard that St. Peter, Minnesota, had been hit hard by a tornado and that power was out in the whole city with many buildings destroyed. Wendel also said that his parents lived in the affected city and that he was concerned with their safety.

Peterson said,

> Max and I agreed that we should start alerting ARES members to go to St. Peter to assist with communications and to other cities if necessary. I placed a call to Russ Marsolek, NØQKG, the District Emergency Coordinator for the area, to begin alerting the local ARESMAT [ARES Mutual Assistance Team] group for possible deployment to the communities. Luckily, the [ARRL] Emergency Coordinator for Olmsted County, Steve Wiebke, KBØPSS, was on the Rochester repeater and was able to immediately call an emergency net to line up radio operators for standby.

Helping St. Peter

In the meantime, Wendel called back and said that he had just spoken to a ham in St. Peter and that the city had been hit hard and would need help. Units placed on standby just minutes earlier were now given the "go" signal to arrange for deployment. ARESMAT units from Rochester, Winona, Caledonia, Faribault, and Cresco, Iowa, said they were in the process of loading equipment and would be ready to leave shortly. Peterson decided to hold back the Winona, Cresco, and Caledonia units until the Rochester team could arrive on the scene and then would bring in additional personnel and equipment as needed.

The State Duty Officer was informed that ARES units were ready and assembled and was asked if they should go to St. Peter. The answer was that St. Peter had been hit hard, that communications were down, and they were glad to hear we were on the way.

The tornado was "really a monster," said Todd Krause, a meteorologist with the National Weather Service (NWS) office in Chanhassen, Minnesota. "It was a mile and a quarter wide, on the ground for at least 15 miles and possibly 30 or 40 miles." Wind speeds were as high as 200 miles an hour, according to the weather service, which received a total of 16 touchdown reports.

Within two hours, the team of five ARES members (including Peterson) left Rochester, heading west toward St. Peter. Everyone was equipped with the standard ARESMAT equipment list (see the ARRL's *ARES Field Resources Manual* for details), along with tents, sleeping bags, generator, etc. They arrived at Gustavus Adolphus College in St. Peter, where severe damaged occurred. College President Axel D. Steuer said nearly 80 percent of all glass on campus was broken, the roofs of many buildings sustained major damage, and thousands of trees were uprooted.

When they arrived at the college, the first thing the hams did—after finding a safe place to park—was to hook up with the ham on site and relieve him so he could return to his family. Next, the Rochester group got busy setting up a base station with outside antenna. A generator provided power to the unit as well as to an outside work light, which served as a beacon for many people from the neighborhood, who stopped in to get a status check.

Luckily, classes weren't in session because of spring break, but the 28 students who were on campus were without contact to the rest of the world...except via ham radio. "We had made it through the night performing a service," according to Peterson. "If nothing else, we were a comfort to the students and staff in

knowing they had a connection to the outside world....That in itself was well worth the trip!"

The next morning, Peterson and his group reported to the St. Peter Emergency Operations Center and were assigned to the American Red Cross Damage Assessment Team. Peterson said,

Until you get out of the car and start talking to residents where the homes are leveled, you have no idea as to the impact. Only foundations were visible where homes once stood. The trees, homes, and cars bore witness to the terrible force. A car was tossed a quarter of a mile into a field. Lumber lay in a perfect southwest to northeast pattern and a bicycle was rolled up in a two-foot bunch. Chunks of concrete broken and scattered, but yet pieces of toilet paper in trees with no rips! A cap stuck on a branch...a small Christmas ornament on a tree blocks from a residence...pictures, clothing, a braided rug, tools, snowmobiles, boats, farm implements, pieces of metal... everything the victim of the tornado! I had been in Charles City, Iowa, in the late '60s after a devastating tornado...it wasn't this bad!

No place, it seemed, was immune to this spring's rash of tornadoes. We have reports here from hams in Minnesota, Georgia, and Alabama. We didn't have space to include reports from Tennessee or any of the several other areas struck by the spring twisters, but hams everywhere responded to meet the needs of their communities—and many traveled great distances to assist.

More Twisters in the Southeast

ARES and Skywarn groups around Georgia were very busy on Friday, April 3, during an outbreak of severe weather there. Ed Ferguson, N4YTR, an ARRL District Emergency Coordinator responsible for interfacing with the National Weather Service, sent in the following information:

At 5:30 a.m., the National Weather Service (NWS) in Peachtree City called Ferguson as well as Assistant Emergency Coordinator Robert Burton, KD4YDC, to alert them to possible severe weather expected that day. While some thunderstorms were already floating around the state when they called, none had yet become severe. By 11:15 a.m., the NWS decided to activate the ham station and the Skywarn spotters. Reinforcements arrived by early afternoon as the severe weather moved into full swing.

The operations that day included VHF voice, APRS packet, HF, and the Georgia Skywarn Linked Repeater System. This system links repeaters in Dalton, Dahlonega, Yorkville, and Macon. The 8 repeaters all link into the N4YTR UHF repeater (444.675 MHz) located in Peachtree City.

Ferguson said it was a very busy day...and night:

Our activation and station operation continued for a total of 12 hours until it was shut down at midnight. During those 12 hours, the NWS issued 132 severe weather warnings (thunderstorm and tornado), which—according the NWS personnel that we spoke to—was a record number. It was, without a doubt, the busiest activation our group had experienced. In order to keep up, we had nine amateur radio operators help run the station, totaling 32.5 man hours. Everyone put in whatever time that they could spare. The time ranged from 30 minutes up to 8 1/2 hours.

To say that the operation was, at times, very stressful was an understatement. Even our people were 'under the gun' as a tornado was spotted in Coweta County, only a few miles from the NWS office, moving in the direction of Peachtree City. But, everyone did a great job and I'm very proud of the work everyone put into the operation. The activation was smooth and we had a great, continuous, two-way flow of information between our people and the NWS personnel."

Georgia Flooding

Nothing makes a dedicated ham operator more proud than to be able to use his equipment and unique communications skills to help his fellow man during a time of disaster. There is a deep sense of satisfaction in knowing that what you did truly made a difference. Acting ARRL Emergency Coordinator Arthur Shipley, N4GPJ, provides a story of how ham radio and dedicated operators worked together with disaster relief and emergency management agencies to help people who were flooded out of their homes in south Georgia in early March, 1998. It is also a story of experiences gained and utilized, as many of these same operators also have had the "opportunity" to participate in tornado disasters in the same area in 1993 and '95, and additional floods in 1994.

Saturday, March 7, 1998 started out like most any other rainy day. The area of south Georgia was already inundated with water, as it had rained at least a couple of days every week since the first of the year. Overnight, a torrential rain fell with large heavy rain drops, thunder and lightning. The local Skywarn net was activated and reports from NWS were passed along as needed to make our people aware of anticipated weather conditions through the night.

The next day, the Skywarn coordinator warned of unstable weather conditions and the possibility of heavy thunderstorms throughout the day. Before long, the torrential rain started once again. This kept up off and on all day and it was evident by mid-afternoon that there was a lot of localized flooding to come.

Stan Halstead, W4GOD, maintains a strong working relationship between the Albany Amateur Radio Club and the NWS in Tallahassee, Florida. Reports of weather conditions and projections flowed back and forth continuously between our spotters and the

NWS. As stations checked into the net from across south Georgia, the picture was the same everywhere. If the rain didn't stop soon, we were in for big trouble. Local rain gauges had registered at least 9 inches of rain on Saturday night and Sunday. There was a good chance that they could be headed for another flood.

Over the next few days, water continued to rise, homes were being flooded, roads and bridges were being closed. Shipley stopped by the Albany Red Cross chapter building to see if there was word of any shelters to be opened. As you might expect, as EMA (the Georgia Emergency Management Agency) took note of the growing number of evacuees, word came down to open shelters immediately in Lee and Dougherty Counties. Local hams from the Albany area immediately moved into action. N4GPJ picks up the story again:

Based on previous emergencies, local hams had a good working relationship with Emergency Management, Baptist Disaster Relief and Red Cross officials here. They knew where to find us and what we could do for them. With an initial response of a few operators, key officials from each agency were targeted. A radio operator acted as a shadow to each of them in order to keep vital time sensitive information flowing to them and from them when you could not afford to wait for a free phone line.

It was estimated that some 700 homes were affected by the flood in the immediate Albany/Lee County area and about 11,000 people were evacuated at one time. Surprisingly, only 400 people or so had to go to shelters here in Albany, largely because of lessons which the evacuated people had learned in the flood of '94. As with any disaster, the main focus for the first three or four days was emergency, or high priority traffic. A dike burst near one shelter which prompted an immediate call to send buses and move people as rapidly as possible to an alternate shelter. Communications had to be in place. There was no time to wait.

This map shows the paths of three tornadoes that swept through Alabama on one day in early April, along with their intensity levels on the Fujita Tornado Intensity Scale. The twister that struck suburban Birmingham was rated at F5, meaning it had winds over 260 miles per hour. (Map courtesy National Weather Service)

Fujita Tornado Intensity Scale

The intensity of a tornado is rated from F0 to F5, based on the Fujita Tornado Intensity scale. A storm classified as F0 to F1 is a weak tornado; F2 to F3 is considered a strong tornado; and F4 to F5 is a violent tornado. There is also an F6, for tornadoes with winds above 318 mph, but they are exceedingly rare. Here is a detailed description of the rankings of F0 through F5, courtesy of the National Weather Service:

F0—Gale tornado (40 to 72 mph): Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage sign boards.

F1—Moderate tornado (73 to 112 mph): Moderate damage. The lower limit is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads.

F2—Significant tornado (113 to 157 mph): Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.

F3—Severe tornado (158 to 206 mph): Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.

F4—Devastating tornado (207 to 260): Devastating damage. Well-constructed houses leveled; structures with weak foundations blown some distance; cars thrown and large missiles generated.

F5—Incredible tornado (261 to 318 mph): Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

On the sixth day, local amateurs began to turn their support efforts from the shelters to the support of agencies that had moved into the area. As the focus began to shift from emergency needs to long-term needs, our people went out with Red Cross, EMA and FEMA (Federal Emergency Management Agency) officials to look at and assess the damage. However, as high priority traffic began to ease, we began to back off on the long hours spent by our operators in order to keep from burning ourselves out and to let those who had taken a whole week off (sometimes without pay) to devote to this effort return to work.

By Monday, March 16, most of the emergencies were behind us and our support was becoming more routine, however, the teams which came into town continued to use their own ham operators to support their specialized cleanup and recovery units. These people bring in specialized communications teams made up of amateur radio operators who are either retired or otherwise able to continue working disaster relief long after the rest of us are forced to go back to our regular jobs. The emergency needs have been met by local operators, but the role of ham radio lives on in these people and agencies who have come into the community to lend long term support and relief.

Messages handled included those to and from EMA about shelter openings and closings or evacuations, head counts at shelters, special needs info, requests for feeding, emergency supply requests, logistical information, anticipated water level reports and early damage assessments. In addition, hams relayed anticipated feeding needs to cooking units from shelters and work parties. And there were cleanup unit communications, messages to and from Red Cross, Georgia EMA, FEMA, National Guard, Baptist Disaster Relief, Salvation Army, etc. Hams directed workers into the area and helped them locate their headquarters; and they acted as a central point of reference for phone numbers, callsigns and names of key personnel for relaying to other interested agencies. No small task, but amateur radio was ready.

Next...Alabama

On April 8, a tornado packing winds of more than 260 miles per hour—making it an F5 on the Fujita Tornado Intensity Scale (see sidebar)—roared through the Birmingham, Alabama, area, leaving massive destruction in its wake (see photos). Both President Clinton and Vice President Gore visited to view the damage. And once again, hams responded. David Black, KB4KCH, is President of ALERT, the Alabama Emergency Response Team, and he provided us with the following report:

Before the storm hit, amateurs across north and central Alabama (who regularly take part in the local Skywarn network) had already been on the air nearly nine hours, relaying important storm-related messages to assist the National Weather Service in Birmingham. The NWS later said of the amateurs, 'we couldn't have done it without them.'

As the tornado hit, more frequencies were pressed into service for disaster relief and additional storm-spotting needs. At one point, more than half a dozen VHF and UHF repeaters in the Birmingham metro area were used in some capacity, either for the weather emergency itself, EMA operations or for storm report relays. Valuable reports were also received via an Internet/packet radio gateway developed by hams.

In the third phase, still more radio amateurs remained on the air in the disaster zone for several days, assisting with relief communications to assist the hundreds of people displaced from their homes. Members of a federal disaster survey team sent to Birmingham were reported to be planning to interview local radio amateurs who provided Skywarn communications services during the crisis.

A Salute to Hams in Action...

This past spring has pressed amateur radio operators into service. Arthur Shipley, N4GPJ offers this reflection on the work of hams in Georgia. It equally applies to amateurs across the country. He says,

Most of [the hams] helped directly with communications. Some were tied up in law enforcement or specialized duties such as damage assessment for FEMA or the Red Cross. Some of these people are our club members, while many came into our area from across the nation. Some came as specialized communicators to support efforts like the Baptist cooking, child care and/or cleanup crews. Some came in with other church groups or the National Guard. But we all share a common bond through amateur radio. We are able to coordinate communication through a common repeater or simplex frequency. Due to ham radio, we are not stopped at organizational or territorial boundaries and we all worked together in great harmony.

Have a story to tell? We're always looking for information on emergency communications and public service events. Send your information to Bjosuweit@aol.com or CQVHF@aol.com. ■

Update (and Oops...)

CQ VHF author Bill Sharp, W8HI ("How to Wire a Bike for Ham Radio," May, 1998), writes:

I've gotten many e-mail requests for information about the Bicycle Mobile Hams of America (BMHA). It would simplify my life if you would tell your interested readers to send an SASE (self-addressed stamped envelope) to BMHA, Box 4009-CQ, Boulder, CO 80306-4009. In return U.S. mail, they will receive full information about the club, along with a sample newsletter. Readers with questions about wiring the bike can now reach me at <bsharp@blueplanet.net>.

Bill also tells us that he has moved from Ohio to Texas. Good luck in your new digs, Bill!

In addition, we had a typo in the World Wide Web address for Larsen Electronics. The correct URL is <http://www.larsenet.com>. We apologize for any inconvenience this may have caused.

Finally, the URL for the European contest calendar on DK3XT's "Make More Miles on VHF" Web site has been changed ("Annual VHF Contest Calendar," June, '98, p. 39). Go to his main page at <http://www.ilk.de/sites/gap/>, then click on VHF Traffic and look for the contest calendar there.

Resources

The *ARES Field Resources Manual* ($5) and the ARRL *Public Service Communications Manual* ($1) are available from ARRL, 225 Main St., Newington, CT 06111; Phone (orders only): (888) 277-5289 or (860) 594-0355; Fax: (860) 594-0303; Internet: <http://www.arrl.org>. Add $3 for shipping on orders of $10 or less ($4.50 outside the U.S.).

CQ VHF Ham Radio Above 50 MHz

Reader Survey—July, 1998

We'd like to know more about you...about who you are and where you live, about the kind(s) of work you do, and about your ham radio interests and activities. Why? To help us serve you better.

Each month, we'll ask a few different questions and ask you to indicate your answers by circling certain numbers on the Reader Service Card and returning it to us (we've already paid the postage).

And, as a bit of an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to CQ VHF. *Over the next few months, we'd like to find out—from your perspective—how* we're *doing*:

1. Please indicate whether this issue of *CQ VHF* was addressed to you:

	Circle Reader Service #
Yes	1
No	2

2. If you are a subscriber, you should have received this issue in mid-June. Was it...

Early?	3
On time?	4
Late?	5

3. If your answer to Question 1. was "No," please indicate where you got this issue of *CQ VHF*:

At a bookstore/newsstand	6
From a ham radio dealer	7
Directly from CQ (e.g., at a hamfest)	8
From a friend	9
From a club, school, or public library	10
Other	11

4. Please indicate whether—overall—*CQ VHF* (circle all that apply):

Meets the needs of newer hams	12
Meets the needs of experienced hams	13
Meets *your* ham radio needs	14

5. Please indicate whether *this issue* of *CQ VHF* (circle all that apply):

Meets the needs of newer hams	15
Meets the needs of experienced hams	16
Meets *your* ham radio needs	17

6. Please indicate whether you would like to see future issues of *CQ VHF* include (circle all that apply):

More high-level technical articles/projects	18
More beginner-level technical articles/projects	19
More operating-related articles	20
More news/opinion-related articles	21
The same mix of articles as in this issue	22

Thank you for your responses. We'll have more questions for you next month.

What You've Told Us...

Ham radio is a microcosm of our society and, like Americans in general, we hams spend a lot of time in our cars. Many of us occupy at least part of that time by operating our ham rigs. Among those of you who responded to our April survey on mobile operating, 6% operate mobile exclusively, 68% do so regularly, 23% occasionally operate on the road, and only 3% say they never do.

Not surprisingly, a car is your vehicle of choice for mobile hamming (83%), followed by your feet (50%) and a work van or truck (42%). Another 8% operate bicycle mobile, and 7% operate marine or maritime mobile. Four percent of you operate from airplanes, while 2% get on the air from a bus or train.

Two meters is your top mobiling band with 97% active there, followed by 70 centimeters (58%), and a very respectable 28% on 6 meters. The 222-MHz band sees mobile operation by 12% of you, while 3% are on 1296 mobile (not bad!), and 1% are even on 902 MHz mobile.

FM rules the roost for mobile operating modes (98%), but SSB put in a very healthy 27%. AM comes in next at 6%, followed by CW (5%), packet (4%), APRS (3%), satellites (3%), and ATV (2%).

As always, thank you for your responses to our survey. This month's winner of a free one-year subscription to *CQ VHF* is Ed Butler of San Diego, California.

STSPLUS and The Station Program: A Look at Two Satellite Tracking Programs

STSPLUS and The Station Program offer the PC user complementary satellite tracking features. If you're looking for satellite tracking software, one of these programs probably has the features you want.

Back in the January 1997 "Orbital Elements" column, Gould Smith, WA4SXM, gave you some great information about satellite tracking software and highlighted five popular programs. This article will give you my own perspective on satellite tracking software and highlight two more outstanding programs that are available. I'll describe the key features of both programs so you can decide if one of them will meet your satellite tracking needs.

What Does Tracking Software Do?

I define satellite tracking as monitoring the position and flight progress of an orbiting object. You see where the satellite is now and which way it's going. The tracking software we hams use computes a satellite's location, speed, and direction from a mathematical description of the satellite's orbit called Keplerian elements or "Keps." While the tracking reports are *predictions*, they are (with rare exception) very accurate predictions.

Most tracking programs have two basic modes of operation: pass predictions and real-time tracking. Pass predictions are the times the satellite will *pass* in direct line-of-sight of your location (i.e., above your local horizon). Pass predictions give the amateur satellite operator the ability to know (within a few seconds) when "band openings" (i.e., satellite passes) will begin and when they will end. Real-time tracking lets you follow the satellite's location and motion during a pass (or at any other time, for that matter).

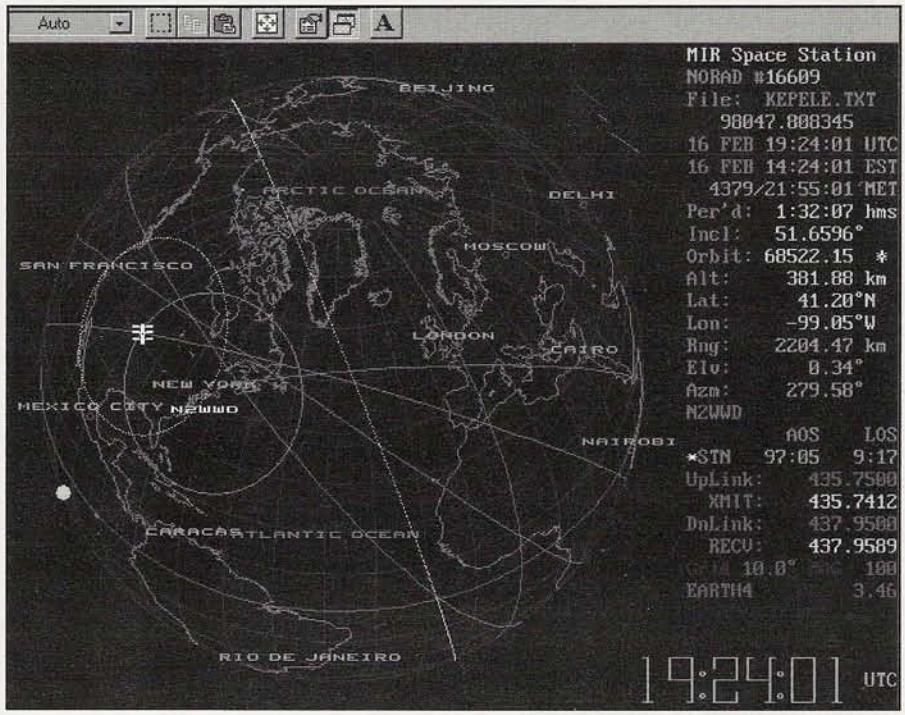


Figure 1. The orthographic projection, or globe display, produced by STSPLUS. This is kind of a "satellite's eye view" of the planet. The circle around the satellite (Mir, in this case) indicates the area within its "view" at any given moment.

What's Special about These Two Programs?

STSORBIT PLUS (STSPLUS) and The Station Program both do the basic satellite tracking functions. Each program also has its own additional features that we'll discuss later. You'll want to see these features before you decide if one of these programs is for you. However, the quick answer is that STSPLUS is well suited to both the beginning and advanced satellite tracker, but provides no external control of peripheral devices, such as

By Ken Ernandes, N2WWD (n2wwd@amsat.org)

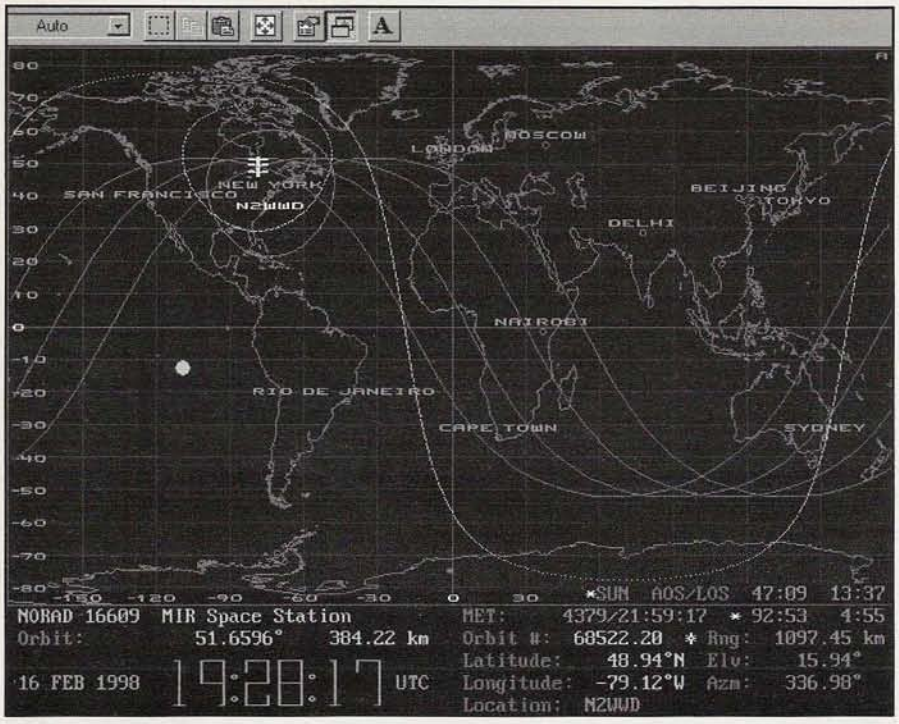


Figure 2. A more traditional rectangular projection from STSPLUS. In this view, you see the track of the satellite during recent orbits as information on the bottom of the screen regarding its specific location, etc.

radios and antenna rotors. The Station Program, on the other hand, excels at automatic control of radios and antenna rotors but has a relatively involved one-time setup and does not have all the graphic or data options of STSPLUS.

STSPLUS

STSPLUS is an MS-DOS-based program that runs well on a PC equipped with an 80386 (with a math coprocessor) or better processor. The program has a semi-automatic configuration when run for the first time. You operate the program from a list of choices that has sub-menus in some cases. STSPLUS automatically saves the last operating settings for the next time you run the program.

The STSPLUS real-time tracking display is outstanding for visualizing satellite orbital motion. It has four selectable map displays. My favorites are the orthographic projection (or globe display) shown in Figure 1 and the rectangular world map display shown in Figure 2. The program also has a quadrant map that covers one fourth of the Earth and a "zoom" map that allows you to select the map surface coverage from eight zoom levels. The center of the map normally follows the satellite, but you can override this setting and force the center of the map display to your location.

The real-time tracking display also allows you to tailor the tabular information to suit your needs and preferences. The information that's especially useful to the amateur satellite operator are a satellite's Azimuth (Azm) and Elevation (Elv) for antenna pointing, the Doppler compensation frequency information (Uplink, XMIT, Dnlink, and RECV), and the real-time UTC clock. (The Uplink and Dnlink are a pair of uplink and downlink frequencies in the satellite's transponder; the XMIT and RECV are the corresponding Doppler-shifted transmit and receive frequencies for setting the frequency display on your radios.)

Figure 3 is an example of STSPLUS's satellite pass predictions. This is the Tabular Line-of-Sight Predictions, one of nine data output options. Each prediction has the date, time, and azimuth of both Acquisition of Signal (AOS—satellite rises above the horizon) and Loss of Signal (LOS—satellite sets below the horizon). These predictions also have the time, elevation (called Alt), and azimuth of the maximum visibility point (the point at which the satellite is at its highest angle above the horizon).

STSPLUS is licensed as shareware. Author Dave Ransom doesn't require that you register this software, but certainly appreciates it when satisfied users send in the $10 registration fee. STSPLUS is available from a variety of sources including AMSAT and Dave's STSPLUS Web page (see "Resources").

Figure 3. A text version of STSPLUS's satellite pass predictions. This is known as a Tabular Line-of-Sight screen, showing all predicted passes of a selected satellite during a given time period. Each line provides information on the beginning (AOS) and end (LOS) of each pass, plus the period of "maximum visibility."

The Station Program

The Station Program is a Windows 3.1™-based program that runs on 80386DX and higher processors (80486 or higher is recommended). It requires a minimum of 6 MB of memory (8 MB is recommended for Windows 95™). This program is excellent for computer-automated antenna tracking and radio tuning for Doppler compensation. Since the software automates so many things, the one-time setup is somewhat involved. However, once set up, the program will take full command of your satellite station on demand.

The Station Program supports any of the following automatic rotor control interfaces: Kansas City Tracker, AEA ST-1 (not Windows 95), TrakBox, DDE-controlled homebrew rotors, the XQ2FOD FODtrack interface, and the AMSAT-DL IF-100. The Station Program author Paul Willmott, VP9MU, is also developing support for the SASI tracker and the Easy Comm 1/2 controlled homebrew rotors.

The Station Program automatically sets the transmit and receive modes (CW, USB, LSB, FM) and frequencies, automatically compensating for Doppler shift, in the following radio interfaces: ICOM CI-V, Kenwood TS-790, Yaesu FT-736R, and Yaesu FT-900. The software can also control other Kenwood radios via the IF-232 interface.

Figure 4 is The Station Program's map display. In addition to the attractive world map, this display gives date, time, and basic antenna pointing information. Figure 5 is the full-duplex tuning console. This gives you a full set of frequency and Doppler information and the ability to activate and deactivate the Computer Aided Transceiver (CAT), which is the automatic radio control. Also notice that there's a set of mode override buttons (USB, LSB, CW, NCW, NBFM).

For Doppler tuning control, you can choose to correct the transmit frequency, maintaining a constant receive frequency (Fix RX) or correct the receive frequency, maintaining a constant transmit frequency (Fix TX). When choosing either Fix RX or Fix TX, the bottom "slider bar" lets you adjust your transceiver's "fixed" (RX or TX) frequency to any position in the satellite's passband. The upper "slider bar" lets you finely tune the other frequency (TX or RX) so you have a properly aligned full duplex link (i.e., your receive signal is tuned and Doppler-corrected exactly to the frequency on which the satellite is repeating your transmitted signal).

Once you've established a full duplex link, you should activate the Full Doppler Tuning (FDT). The FDT adjusts both transmit and receive frequencies for Doppler so your signal remains in a fixed spot on the satellite's passband.

Figure 6 is the SAREX/Mir tuning console. This is another handy feature that The Station Program offers that adjusts both the transmit and receive frequencies of single band Variable Frequency Oscillators (VFOs). Once again, The Station Program automatically changes the radio's frequencies to compensate for Doppler shift. The SAREX/Mir tuning console lets you quickly switch between different uplink (or downlink) frequencies. Since you're not sure which frequency the astronauts are listening to during SAREX "pile-ups," the quick switch lets you try them each in turn, with the program applying Doppler correction. The SAREX/Mir tuning console also greatly simplifies operation on the 70-centimeter Mir SAFEX repeater. (In case you're not familiar with these terms, Mir is the Russian space station, SAREX is the Shuttle Amateur Radio Experiment, and SAFEX is the German manned space/ham radio project.)

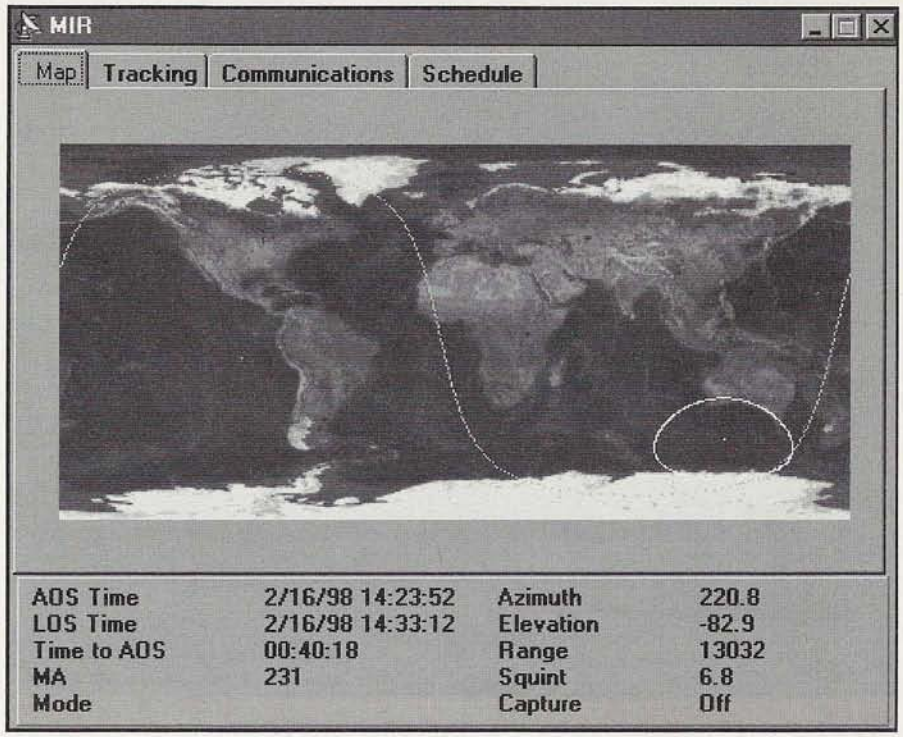


Figure 4. World map display from The Station Program. Unlike STSPLUS, this program will fully automate your satellite station (but because of this, initial setup is much more complex).

Figure 7 is an example of The Station Program's pass predictions (called "Today at a Glance"). This is a 12-hour graph illustrating the times that the satellite is above your horizon (and thus available for communications).

You can download The Station Program from the AMSAT Bermuda (AMSAT-BM) Web site at <http://www.amsat.bm>. You unzip the four downloaded files to floppies that become the installation diskettes. If you don't have Web access, the only other way to get The Station Program is to copy somebody else's installation diskettes.

You need to register The Station Program before it will save your settings. (Unregistered versions using the default 11111-11111-1 serial number need to be set up each time you run the program.) The $40 registration fee goes to AMSAT to support the Phase 3D satellite program. Each serial number is tailored to your name and callsign at the time of registration. Several national AMSAT groups can give you a registration number for The Station Program. See "Resources" for details.

Keeping Predictions Accurate

For satellite tracking software to make accurate predictions, you need to keep two things up-to-date: the computer's

"[The Station Program] is excellent for computer-automated antenna tracking and radio tuning for Doppler compensation...the one-time setup is somewhat involved [but] once set up, the program will take full command of your satellite station on demand."

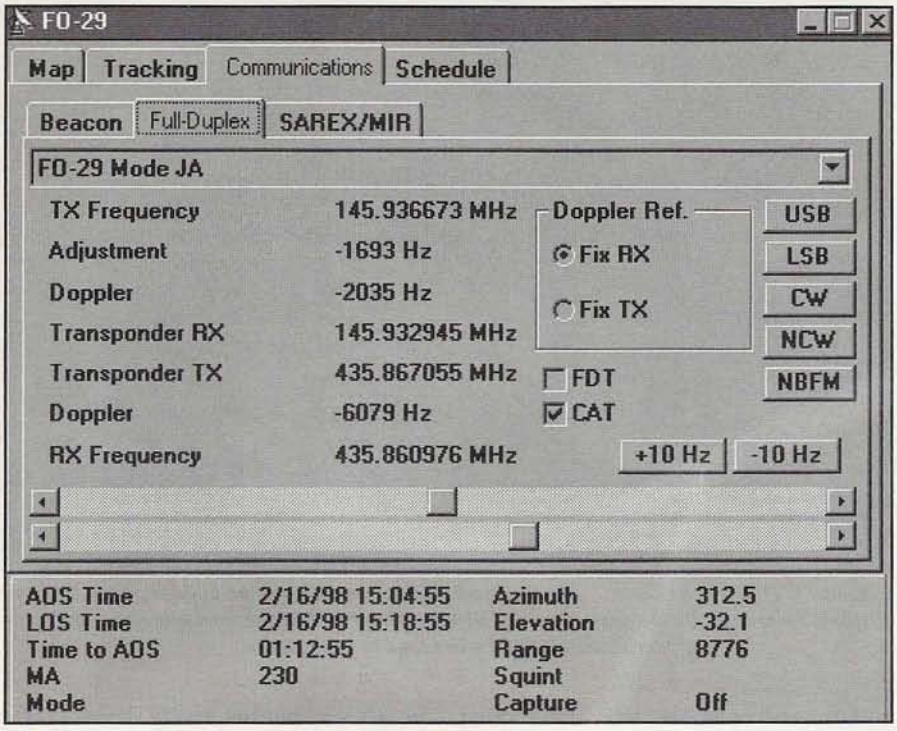


Figure 5. The Station Program's "Full Duplex Tuning Console." This is your control panel for setting and adjusting your radio's frequencies, and where you can switch into and out of automatic station control.

clock and the satellite Keplerian elements. I usually recommend that you synchronize your computer clock to within a second of UTC before a satellite pass. You can use WWV broadcasts (2.5, 5, 10, 15, or 20 MHz), a Global Positioning System (GPS) receiver, the National Institute of Standards and Technology

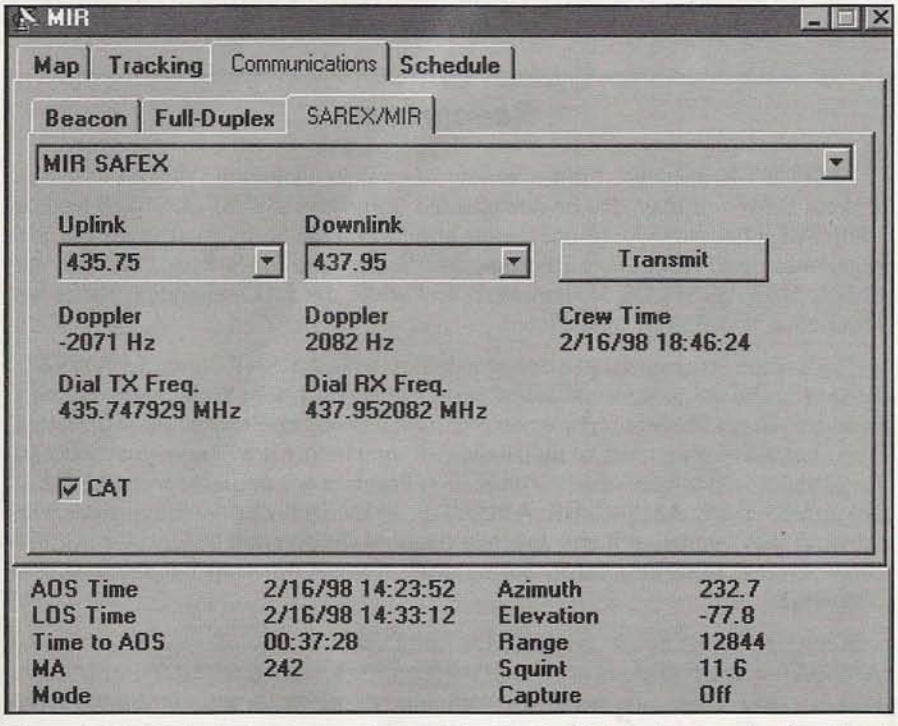


Figure 6. This is The Station Program's specialized SAREX/Mir tuning console. Since Shuttle ham operations in particular are set up with a single downlink and multiple uplink frequencies, this gives you maximum flexibility in switching among those different frequencies. It also greatly simplifies operating through the 70-centimeter repeater on Mir.

(NIST) Web site at <http://www.boulder.nist.gov/timefreq/>, or the U.S. Naval Observatory Web site at <http://tycho.usno.navy.mil/>. Precise time is especially important for maintaining good automatic Doppler shift compensation.

Keplerian elements give the tracking software a mathematical description of the satellite's orbit. These can normally make accurate predictions for two weeks to a month, beyond which the Keps become "stale" and prediction accuracy begins to degrade. (Mir's Keps should be updated weekly and the Space Shuttle's should be updated daily, as their orbits tend to change more often than those of unmanned satellites.)

Both STSPLUS and The Station Program will automatically read Keplerian elements in the standard NORAD/Space Command Two-Line Element (TLE) format. (This is sometimes known as NASA format since NASA Goddard Space Flight Center releases this data to the public.) You can get Keplerian elements in this format from a variety of sources, including AMSAT's Keplerian elements e-mail subscription service. You can participate by sending a "subscribe Keps" message to <listserv@amsat.org> ("subscribe Keps"—minus the quotes—should be your entire message text). You'll get updates every Friday directly to your e-mail address. You can also download current Keplerian elements from my personal Web site (again, see "Resources").

"For satellite tracking software to make accurate predictions, you need to keep two things up-to-date: the computer's clock and the satellite Keplerian elements."

The Choice Is Yours

STSPLUS and The Station Program are two great satellite tracking programs that appeal to different types of amateur satellite operators. STSPLUS is easy to operate and gives you quite a variety of attractive map displays and data options. It's also a very effective tool for amateur satellite communications. However, STSPLUS doesn't give you any computer-controlled antenna pointing or radio tuning. Therefore, this program usually appeals to the beginning satellite tracker, those with fixed antennas and/or basic radios, and operators who don't mind controlling the rotor and correcting for Doppler shift manually.

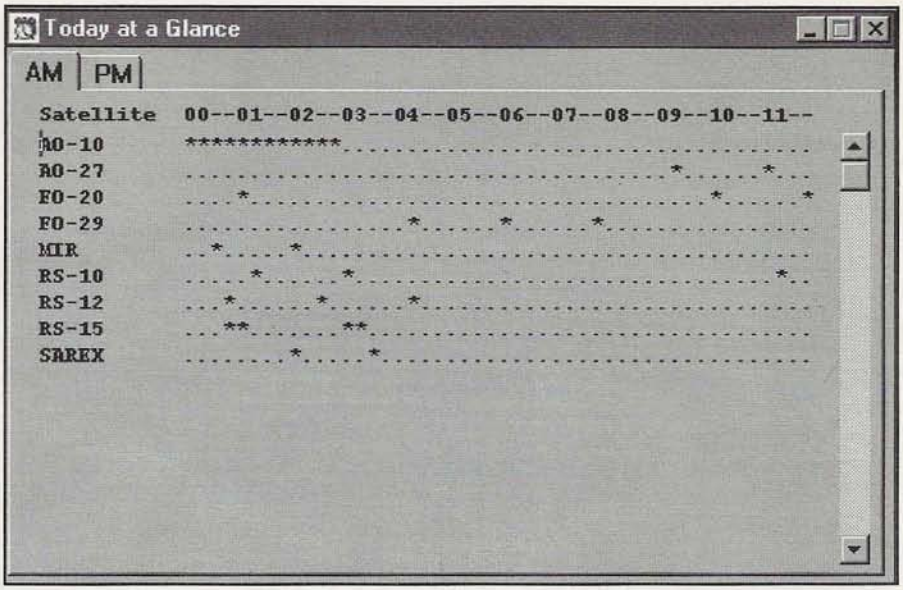


Figure 7. "Today at a Glance," The Station Program's version of the tabular pass prediction display. Stars indicate the times during a given 12-hour period that any one of several amateur satellites will be in range of your station.

The Station Program is designed for automatic computer control of an amateur radio satellite station. This software can command many different modern satellite radios, automatically compensating for Doppler frequency shift caused by satellite motion. The Station Program can also command many different rotor interfaces, automatically keeping the antennas pointed at the satellite as it moves across the sky. This program usually appeals to satellite operators with beam antennas, two-axis rotors, and multi-band full-duplex satellite radios.

Which, if either, of these best suits your needs is a decision that only you can make. But some sort of tracking software will certainly make your satellite operating much easier and much more fun. ■

Resources

STSPLUS is available from a variety of sources including AMSAT-NA (see address below). It may also be downloaded from Dave's STSPLUS Web page at <http://tie.jpl.nasa.gov/dransom/stsplus.html>, or ordered by mail (with the $10 registration fee) from Dave Ransom, 240 Bristlecone Pines Road, Sedona, AZ 86336, USA. STSPLUS is shareware, and while the $10 registration fee is not required, it is definitely appreciated.

The Station Program may be downloaded from the AMSAT Bermuda (AMSAT-BM) Web site at <http://www.amsat.bm>. If you don't have Web access, the only other way to get The Station Program is copy somebody else's installation diskettes. The Station Program must be registered ($40 fee) before it will save your settings. Registration serial numbers for The Station Program are available from AMSAT-NA, AMSAT-DL, AMSAT-UK, AMSAT-F, or AMSAT-ZL. You can register with AMSAT-NA by mail at Radio Amateur Satellite Corporation (AMSAT-NA), 850 Sligo Avenue, Suite 600, Silver Spring, MD, 20910-4703 or by telephone at 301-589-6062.

Keplerian elements are available for free from a variety of sources, including AMSAT's Keplerian elements e-mail subscription service (see text for registration details), and from my personal Web site at <http://www.mindspring.com/~n2wwd>. The Keplerian elements on my Web site are usually updated every Monday, Wednesday, and Friday so no matter when you download the file, the Keplerian elements will be current.

Announcing

The 1998 CQ World-Wide VHF Contest

Make the most of enhanced summer propagation with the CQ World-Wide VHF Contest! Here are the complete rules.

Dates/Times:

Starts: Sat., July 11, 1998, 1800 UTC
Ends: Sun., July 12, 1998, 2100 UTC

I. Contest Period: 27 hours for all stations, all categories. Operate any portion of the contest period you wish.

II. Objectives: The objectives of this contest are for amateurs around the world to contact as many amateurs as possible in the allotted 27-hour period, to promote VHF and above activity, to allow VHF and above operators the opportunity to experience the enhanced propagation available at this time of year, and for interested amateurs to collect VHF and above Maidenhead grid locators ("grid squares") for awards credits.

III. Bands: All authorized amateur radio bands above 50 MHz may be used, as authorized by local law and license class.

IV. Class of Competition:

1. Single op fixed station.
2. Multi op class I fixed station.
3. Multi op class II fixed station.

A fixed station is one that is a regular home station location. You may operate from your home station or you may be a "hired gun" at another home station to qualify for a fixed station category.

A multi op class I station is one that operates five or more transmitters simultaneously on all authorized amateur frequencies above 50 MHz.

A multi op class II station is one that operates four or less transmitters simultaneously on all amateur frequencies above 50 MHz.

4. Single op portable station.
5. Multi op class I portable station.
6. Multi op class II portable station.

A portable station is defined as one that you set up away from a regular home station location.

7. Rover station. A rover station is one that is manned by no more than two operators, must travel to more than one grid locator and must sign "rover" or /R. The spirit of this class is to encourage operation from rare grid locators by persons who are inclined to do so. It is not the intent of this class to encourage one operator to move from one super station to another super station in another grid locator in order to compete in this category.

8. QRP station. Anyone operating a station running 25 watts output, or less, is eligible to enter this category. There are no location restrictions. You can operate from your home QTH, or from the highest mountain you can find. However, you cannot run more than 25 watts output on any band.

V. Exchange: Callsign and Maidenhead locator grid locator (4 digits, e.g., EM15). Signal reports are optional and need not be included in the log entry.

VI. Multipliers: The multiplier is the number of different grid locators worked per band. A "Grid Locator" is counted once per band. Exception, the rover who moves into a new grid locator can count the same grid locator more than once per band as long as the rover is himself or herself in a new grid locator location. Such change in location must be clearly indicated in the rover's log. It is required that rover category operators maintain separate logs for each grid locator location.

A. The rover who changes location during the course of the contest is free to contact as many other stations as he or she wishes. The rover becomes a new QSO to the stations working him or her when that rover changes grid locator.

B. The grid locator is the Maidenhead grid locator to four digits (FM13).

VII. Scoring: One point per QSO on 50, 70, and 144 MHz; 2 points per QSO on 222 and 432 MHz; 4 points per QSO on 903 and 1296 MHz; 6 points per QSO on 2.3 GHz and above. Work stations once per band, regardless of mode. Multiply total QSO points times total number of grid locators (GL) worked. Contest entrants may not transmit on 146.52 MHz, or your country's national 2 meter FM simplex calling frequencies, or commonly recognized repeater frequencies for the purpose of making or requesting contacts. Contacts made within your own country, in the DX window of 50.100– 50.125 MHz, are discouraged. Contacts made on the SSB calling frequencies of 50.110 MHz, 50.125 MHz, and 144.200 MHz are discouraged. Contest participants are required to use UTC as the logging time. Incentive scoring: Operators completing two-way CW or MCW contacts may add one point to the QSO value for each contact.

Example: W1XX works stations as follows:

37 QSOs, with 3 QSOs on CW (34 x 1 = 34; 3 x 2 = 6; 34 + 6 = 40) and 10 GLs (10 multipliers) on 50 MHz.

45 QSOs (45 x 1 = 45) and 8 GLs (8 multipliers) on 144 MHz.

26 QSOs (26 x 2 = 52) and 4 GLs (4 multipliers) on 222 MHz.

38 QSOs (38 x 2 = 76) and 5 GLs (5 multipliers) on 432 MHz.

2 QSOs (2 x 4 = 8) and 2 GLs (2 multipliers) on 903 MHz

6 QSOs (6 x 4 = 24) and 2 GLs (2 multipliers) on 1296 MHz.

W1XX has 245 QSO points (40 + 45 + 52 + 76 + 8 + 24 = 245) x 21 multipliers (8 + 4 + 5 + 2 + 3 = 21) = 5,145 total points.

VIII. Awards: Engraved plaques will be awarded to the top scoring stations in each category in the world (for a total of eight plaques). Parchment certificates suitable for framing will be awarded to the top-scoring stations in each category in each continent. Certificates may also be awarded to other top-scoring stations who show outstanding contest effort. Certificates will be awarded to top scoring stations in each category in geographic areas where warranted. Geographic areas include states (U.S.), call areas (Japan), provinces (Canada), and countries, and may also be extended to include other subdivisions as justified by competitive entries.

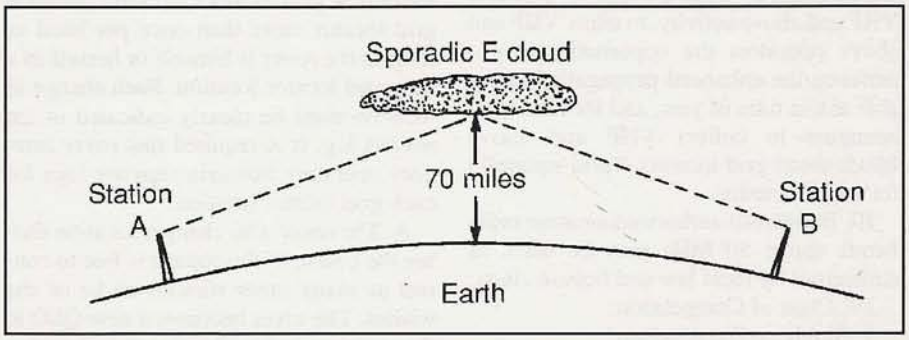
IX. Miscellaneous: An operator can sign only one callsign during the contest. This means that an operator cannot generate QSOs by first signing his callsign, then signing his daughter's callsign, even though both callsigns are assigned to the same location. All contacts above 300 GHz must use coherent radiation on transmissions and employing at least one stage of electronic detection on receive. A station located exactly on a dividing line of a grid locator must choose only one grid locator from which to operate for exchange purposes. A different multiplier cannot be given out without moving the complete station at least 100 meters.

X. Log Submissions: You must request log sheets from: the CQ VHF Contest, *CQ* magazine, 25 Newbridge Road, Hicksville, NY 11801. Please include an SASE with your request. Completed logs must be postmarked no later than August 31, 1998, to be eligible for awards. All logs should be mailed to: Joe Lynch, N6CL, VHF Contest Chairman, P.O. Box 73, Oklahoma City, OK 73101. Logs may be submitted on disk, provided a hard copy of the log is sent with the disk and the data is in an ASCII format compatible with an IBM-PC type computer.

Summertime Propagation on 6 Meters

Six meters sizzles in the summertime! But while sporadic-E gets most of the headlines, there's a whole bunch of other propagation possibilities that await you on the Magic Band!

Thank God for sporadic-*E* (*Es*) propagation. Without it, life on the VHF bands would be much more sedate. Now that we're into the heart of the summer *Es* season, I think it's time to begin examining each of the bands, starting with my favorite: 6 meters, or 50 MHz.



How sporadic-E reflects radio signals in the HF and VHF bands. Distances of up to 1,300 miles can be covered by one cloud reflection. The cloud itself is made up of metallic ions and does not have uniform density throughout. The surface of the cloud can be envisioned as rough, like the surface of a sponge.

The Allure of Six

What attracts me to 50 MHz? What keeps me coming back again and again? Many things...first and foremost is that you never know what it will do next. It could be totally quiet for months at a time, only to pop open with such speed and strength as to take your breath away! The 1995 CQ World Wide VHF Contest was just like that. Picture my portable station atop 9,000-foot Arena Rock near Austin, Nevada, in DM19, baking in the 90-degree desert heat. After three hours of very slow going on 2 meters and nothing happening on six, I was about to take a short nap when it happened...

Sitting in the left front corner of the camper shell was my FT-620B, filled with quiet static one moment, then, milliseconds later, its front end went into overload as the leading edge of an *E* cloud rolled over me like a wave crashing on a rocky shoreline. (If you're not familiar with sporadic-*E* propagation, it occurs when clumps, or "clouds," of ionized particles in the *E* layer of the ionosphere reach a sufficient density to reflect and refract radio waves, generally to a range of some 1,300 miles. The higher the density, the higher the frequency on which an "opening" will occur. If two of these "clouds" line up just right, you get the thrill of a "double-hop" opening at twice the distance.)

For the next five hours, I ran a 20-over-S9 double-hop *Es* pileup into W1, W2, W3, and W4-land—up and down the east coast—with many stations remarking that I was the only station they were hearing from the west. Rick Roderick, K5UR, told me, "The minute you quit CQing, the band will be dead." Not wanting to be held responsible for such a terrible event, I kept working stations till the generator ran dry. By the time I had the AC going again, the sun had set and a Coleman lantern had to be lit. When I finally got back to the radio, Rick's prediction came true: six was deader than a doornail.

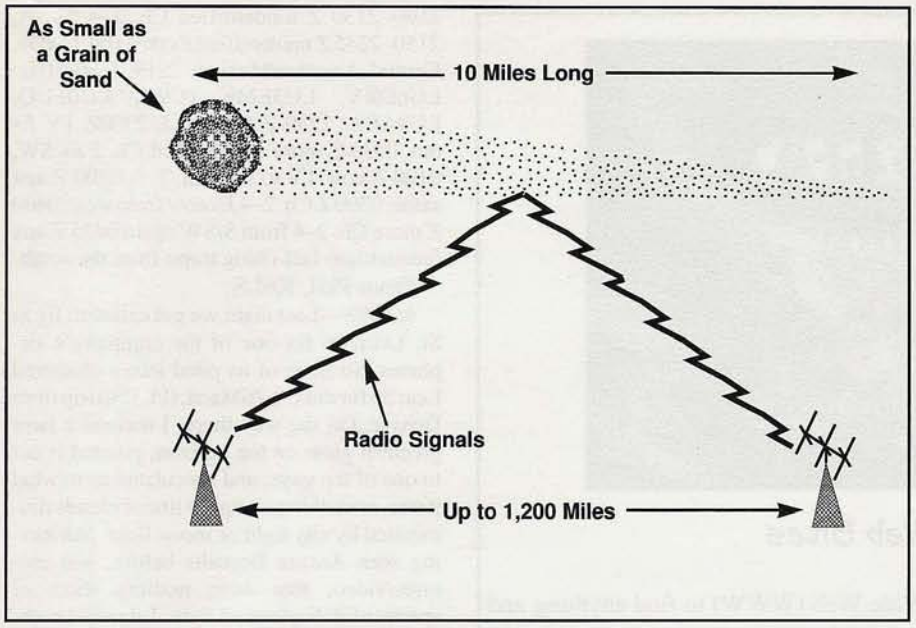
The western end of the opening must have covered a small piece of the Earth, a footprint as it's known, since it never extended any further west than my location, irritating more than a few W6s in California who heard me. In the short time 50 MHz was open, I managed to work 350+ Qs (QSOs) with 135 grids in 39 states...all while using only 100 watts into a four-element Yagi up 20 feet and no preamp on receive.

It's openings like this one that leave you craving more! I freely admit it, I'm addicted! Why else would I spend so much time, money, and effort each year preparing for the June contest?

More than E-Skip

Six meters is host to all kinds of anomalous propagation. Besides *Es*, there is *Meteor Scatter* (MS), *Aurora* (Au), *Field Aligned Irregularities* (FAI), *Forward Scatter*, *Troposcatter* (Tropo), etc. For sources of more information on 6-meter propagation, and the Magic Band in general, see "6-Meter Web Sites." But let's take a quick look right now at each of these major propagation modes.

By Tim Marek, K7XC (K7XC@vhf.reno.nv.us)



A piece of "space dirt" as small as a grain of sand can leave behind a 10-mile-long trail of ionized air. VHF radio signals can be bounced off this trail for contacts up to 1,200 miles away.

Meteor Scatter is what happens when you bounce radio signals off of the ionized trails left by meteors as they burn up while entering the atmosphere (your signal bounces off of these trails rather than the meteors themselves). MS works very well at 50 MHz, with burns off of any one "rock" lasting three to four times as long as a reflection at 144 MHz. Random meteors (as opposed to the concentrations found during meteor showers) are so plentiful every morning that several commercial data gathering systems employ 49-MHz MS as the primary means of uploading their data. If it works that well on 49 MHz, it's just as good on 50.

Au propagation, in which your signals are actually bouncing off the Northern Lights (or Southern Lights in the southern hemisphere), is usually strong enough to support SSB contacts on 6 meters, but 2 meters is so full of Doppler shift (from the movement of the auroral "curtain") that the only practical mode on two is CW.

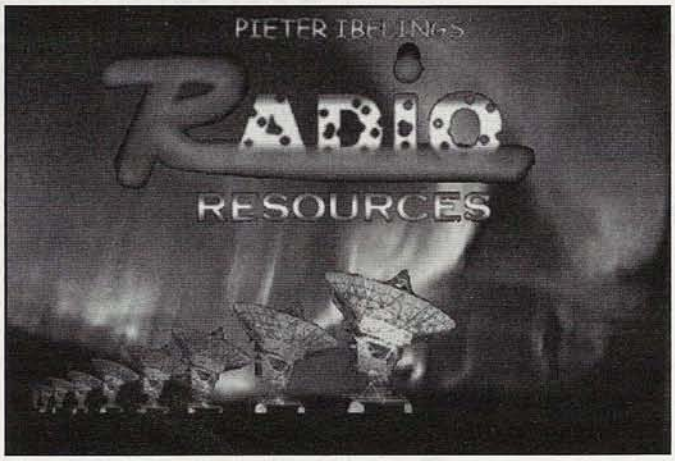
FAI is a weaker scattering component usually found as larger 50-MHz *Es* sessions are beginning to wind down. This is primarily a CW-only mode, but some big stations can work FAI on SSB.

With enough effective radiated power (ERP), it's possible to take advantage of the weak but ever present *forward scatter* mode. Typically running a kilowatt with long-boom Yagis (30-plus feet), these powerhouse stations tend to trigger a response in the "Ether" and create their own conditions. It still amazes me what brute-force power can do when I'm at the helm of a large 6-meter station. *Troposcatter* (Tropo), or what some call *ground wave*, is the range one can usually expect just from using SSB/CW instead of FM. Enhanced by the radiation inversions of sunset and sunrise, these conditions make it possible to work out to 300 miles or more without a "band opening"!

A Typical 6-Meter Station

The typical 6-meter station consists of a 10-watt all-mode SSB/CW transceiver driving a 100-watt solid-state "brick" amplifier into a three- or four-element Yagi up 25 feet or so. A station of this caliber is capable of using each of the above propagation modes with fairly good results. *Es* is by far the easiest and the most fun to operate. Its yearly season runs between May and August, with the ARRL June VHF QSO Party scheduled right near the peak time. When the band is open, 1 watt into a rubber duck will work thousands of miles! When it's closed, 1500 watts and seven elements at 80 feet sometimes isn't enough to get out of your own grid.

As you become familiar with its rhythms, 50 MHz begins to make more sense. One way you can tell that something is about to happen is by monitoring 28 MHz. When you begin to hear stations 400 miles away *and closer*, the Maximum Usable Frequency (MUF) has risen high enough to support long-range con-



6-Meter Web Sites

Some wonderful places on the World Wide Web (WWW) to find anything and everything on 50 MHz include:

Central States VHF Society Home Page: <http://www.csvhfs.org/>

DX Summit: <http://oh2aq.kolumbus.com/dxs/>

Meteor Showers: <http://medicine.wustl.edu/~kronkg/ meteor_shower.html>

N4IP Specialized Radio Resources: <http://www.ibelings.com/n4ip/index.html>

N4IP's 6-meter Page: <http://www.mindspring.com/~wave/6me.html>

Northern Lights Radio Society Page: <http://www.tc.umn.edu/nlhome/m374/husby002/>

NS9E VHF Contesting Page: <http://www.servtech.com/public/lionlamb/vhftest.html>

Six Meters World Wide Page: <http://6mt.com>

Southeastern VHF Society Home Page: <http://www.akorn.net/~ae6e/svhfs/>

Strictly 6: <http://ns1.qsl.net/vk1zfg/>

The Aurora: Information and Images: <http://www.pfrr.alaska.edu/~pfrr/AURORA/INDEX.HTM>

UK Six Metre Group Home Page: <http://www.uksmg.org/>

From these sites you'll find a wealth of information large enough to keep you busy throughout the entire *Es* season.

tacts on 50 MHz. Likewise, when stations 400 miles *and closer* appear on 50 MHz, it's a fair bet that the *Es* MUF is well above 144 MHz, so pick up the 2-meter microphone and start CQing there, as these events are rare and short in duration. We'll talk more about 2-meter propagation next month.

Activity Reports

Things are beginning to heat up as I write this in late April/early May. Plenty of activity was reported in all the VHF Spring sprints. Aurora was worked as far south as DM07 on 5/2/98 (more on that next month). That's good stuff!

From Rich, NØHJZ EN34fv:

4/11/98 0200 Z—LOUD 144-MHz aurora. Stations in EN34 working Au on 50, 144 & 222 MHz and looking for it on 432.

From Bill, WØMTK:

04/18/98 19:48 Z—Surprise opening when I heard W1LP/MM calling CQ from DL42. Worked Clint at 19:48-54 Z on 50.125. He heard my beacon, so did what the beacon message said and "CQed 50.125." The band was open from about 19:46Z to 19:53 Z. On 22 April, I worked both KD6FYK, Steve, CM88 at 16:45 Z & KA6VNU, Walt, CM88 at 16:46 Z from my mobile in the Grand Junction area. Spot-checked from my mobile and heard signals until about 19:00 Z.

From Pat, WA5IYX EL09ql:

Apr 23/24—A mess of mixed VHF propagation modes Thursday aft/eve here. 2100–2130 Z unidentified Ch. 2–4 *Es* s/s, 2150–2245 Z unidentified *Es* thru 104.1 MHz, Central America/Mexico, 2219 Z 50-MHz: LU6DRV, LU3EMK (CW), LU6EUQ, LU9AEA, 2230 Z CX4AAJ, 2300Z TV *Es* out, 0030 Z more unidentified Ch. 2 *Es* SW, 0100 Z now TV to NE; Ch. 2, 3, 0200 Z apx same, 0300 Z Ch. 2–4 *Es* now from west, 0400 Z more Ch. 2–4 from S/SW again 0425 Z apx fadeout into fast-rising tropo from the south.

From Phil, K6LS:

4/24/98—Last night we got called to fly to St. Louis to fix one of the company's airplanes. So three of us piled into a chartered Lear 35 for our (~).76Mach, (FL380) trip from Denver. On the way there, I noticed a faint greenish glow on the horizon, pointed it out to one of the guys, and speculated as to what it was, something along the line of clouds illuminated by city light or moon light. Not having seen Aurora Borealis before, just pictures/video, that were nothing short of spectacular displays of light, I thought nothing more of it. A short while later, the pilot commented about the "lights" as Aurora Borealis, I took a look again and this time, from horizon to horizon to the north, there was the "light" again, but this time, a spectacular show of bright greenish light, "shooting" into the sky and "dancing" at amazing vertical distances. This is what I recalled in the pictures of such. Truly an awe-inspiring sight. Imagine the fun you could have with an aeronautical mobile weak-signal setup!! I thought about the possible QSOs one could have and also wondered about what kind of QSOs could be bouncing off it. This rates up there with the ion trail left by the space shuttle as it passed over northern CA on its re-entry path to FL a couple years ago.

From Lowell, WØVHF EL87:

25 Apr 1998 20:35 Z—I Worked TI5KD in EJ79 and heard Clint, W1LP in EK90 from my home QTH.

In Conclusion...

Clint, W1LP, made many folks out west happy by offering an easy shot at the all-water grids off the west coast during one of his sea voyages. I hope that the next time he comes through, I'll have some free time to track him down. I hope to work many of you in the CQ World Wide VHF Contest/Internet 6 Meter Contest this month (see rules for both, elsewhere in this issue). I should be portable in either DN00 or DN01, trying to finish off 50 MHz VUCC (VHF-UHF Century Club) from my fifth grid.

73 from DM09bp de Tim Marek, K7XC/R, 360 Prestige Ct., Reno NV 89506; Phone: (702) 972-4722; Fax: (702) 972-5011; E-mail: K7XC@vhf.reno.nv.us ■

Second Annual Internet 6-Meter DX Contest, July 11–12, 1998

If you like 6 meters and you like contesting, hold open the weekend of July 11–12 for the second part of this 6-meter doubleheader!

Editor's Note: This is the second running of this 6-meter-only contest, which runs concurrently with the CQ World Wide VHF Contest. Despite its name, you don't have to be on the Internet to participate, and in fact, you must use "snail mail" to send in your logs. If you're active on 6, we encourage you to operate in both events. Here are the rules for the Internet 6-Meter DX Contest.

Objective—Work as many stations as possible on 6 meters, especially DX, in the allotted timeframe. Extra credit is given for those who work DX stations in faraway grids. SSB/CW Only. See scoring below.

Eligibility—All Amateurs World Wide are eligible for awards.

When—Runs concurrently with the CQ World Wide VHF Contest, 11–12 July, 1998 for 30 hours–Same start time as the CQ contest (1800 Z July 11); Ends 3 hours later (23:59:59 Z July 12).

Exchange—Callsign and grid square.

Awards—Plaques to the top finishers in each sponsored category. Ask last year's winners about the great plaques!

Categories-

Single Operator — USA/VE and DX
Single Operator QRP — USA/VE and DX
Multioperator — USA/VE and DX
Rover — USA/VE or DX

Plaque Sponsors — We need sponsors!

Category Description

Single operator—One operator performs all logging and operating functions of the station. Multipliers can be passed from other VHF bands if desired. A single operator means the same operator for the duration of the contest.

Single operator QRP—Same rules as above but station is limited to 10 watts or less RF output.

Multioperator—One or more operators. Having a second operator searching for multipliers, the use of a packet spotting network, or the use of relief operators places you in the multioperator category. Only one transmitted signal at a time is allowed. Passing QSOs from other bands is allowed.

Rover—One or two ops QRV from a minimum of three (3) grids Portable or Mobile only.

Scoring—Each QSO in your continent is worth 1 point. QSOs with stations outside your continent count 3 points. For this contest, North America is USA/VE only! For example, W/VE ops: you count C6, KP4, CO, etc., as 3-pointers. KP4, CO, C6, etc. count W/VE as 3 points. Bonus—10 QSO points for every unique grid *field* worked. (EM, FM, FN, FL, DN, IM, etc.)

Multipliers are unique grid squares the first time they are worked, plus each unique ARRL DXCC country the first time it is worked including W/VE. Count your own country for credit the first time it is worked.

Final score: Add QSO points plus bonus points and multiply the sum times the total of grids worked plus DXCC countries worked.

Example: W1XXX works 300 QSOs (290x1 W/VE+10x3 DX contacts) and the FN, FM, EM, EN, EL, FL, DN, IO, and IM grid fields for 9 grid fields equaling 90 bonus points. 290+30+90 = 410 QSO points. He also has worked 125 grids and the following DXCC countries: C6, VE, W, EA, CT3, G and CO for 7 DXCC countries, for a total of 125+7 = 132 multipliers. 410 x 132 = a score of 54,120 points.

W2XXX works 400 QSOs (398 USA/VE + 2 DX contacts) but only 7 grid fields and 4 DXCC countries and 100 grids. 398+6+70=474 x104 mults. His score is - 49,296. It pays to work DX and weak signals! The *first* unique DXCC country in a new grid field is worth 13 QSO points and 2 mults!

Rovers Only—Calculate the points and multipliers as for the other categories *for each grid square from which you operated*. Then add up the QSO points *per grid square* and multiply by the sum of the multipliers *per grid square* to give the final score.

Example: W4XYZ/R operates from EM84, EM85 and EM95. EM84: 100 QSO points 50 multipliers EM85: 50 QSO points 25 multipliers EM95: 50 QSO points 30 multipliers Score: 200 QSO points x 105 multipliers = 21,000 total points.

Log—Logs must be postmarked not later than 30 days after the last day of the contest. Send either paper or a .txt file log on 3.5 inch diskette. A signed summary sheet is also required. The log checking committee will consist of volunteers who are very active 6 meters ops. Entrants will lose an extra multiplier for each incorrectly logged unique multiplier. Entrants will lose an extra QSO for each incorrectly logged QSO.

Miscellaneous—The use of: repeaters, remote receive sites, illegal power, improperly adjusted transmit equipment, the DX window (50.100–50.124) by non DX, etc. is deemed not in the spirit of the rules of the contest. Please do not "read" into the rules. All station equipment must be located on the confines of the station owner's property or within a 150-meter radius circle.

Send disks or paper logs to: Internet 6m DX Contest, 2131 Woodruff Rd. 2100-250, Greenville, South Carolina 29607 U.S.A.

After submitting your CQWW VHF log to the sponsor, you can just separate the 6-meter log and re-score it to reflect the different multiplier, bonus point values and score. This will be very simple to do! Anyone participating in the CQWW VHF Contest is eligible to send in an Internet 6M DX Contest log! Please pass this info along to all your 6-meter friends and disseminate to other 6-meter newsgroups and newsletters. Good luck to all!

A Close-up Look at Power Supplies—Part 2

Finishing up his discussion on how power supplies really work, Dave has us compare a bridge rectifier to a baseball diamond, but says "running the bases" isn't the same for an electric current as it is for a ballplayer.

As you will recall, last month's column featured a "how it works" overview of power supplies and explained the basic operating concepts of their components and circuitry. This month, we continue with more details and inside views of various size power supplies used with amateur radio gear.

Why focus on power supplies, you ask? Many amateurs instinctively appreciate knowing more about the inner workings of their equipment, and the simplicity of power supplies makes them an ideal starting point. Unlike transceiver designs that become more complex and microchip-oriented every year, power supplies generally tend to stay the same and use components large enough to make home repairs or mods (modifications) feasible.

Here's another point: Assuming you start with a nice hefty power supply, it does not need upgrading each time you change transceivers. Indeed, I feel quite comfortable saying that—like antenna tuners, power supplies offer us "I can understand that" reassurance in today's world of "gee whiz" electronics, and that is a blessing.

We must also remember, however, to respect power supplies for their shocking potentials (pardon the pun). Accidentally shorting even a low voltage/high current output line with a ring or couple of wet fingers can cause severe burns. Remember that before dinking with an in-use high current power supply during a rainy Field Day. Probably the greatest safety hazard in modern 13-VDC supplies, however, is accidentally touching internal wires carrying 115-VAC input power. Such high voltage and current (which might be limited only by a high-ampere circuit breaker in your home's fuse box) can have serious "close to electrocution" consequences. I say that not to frighten or intimidate you, but as a warning to avoid working on or internally checking a voltage-active ("hot") power supply without due caution. Keep an unused hand in your lap or behind you. Don't allow your body or fingers to become a path for current flow. Don't work on power supplies (or rigs!) when you're tired, sleepy, or when the lighting is dim, and watch test lead tips to ensure they don't fall and cause short circuits in equipment under test or study. Follow those common sense guidelines, and you should do fine when working with both power supplies and transceivers. Pardon the soapboxing, but an ounce of prevention is always worth a pound—or more—of cure.

Now let's talk power supplies. Rather than backtracking, I'll assume you read our introduction in last month's column and continue on from that point.

Bridge Rectifiers Simplified

Modern power supplies must use the most efficient circuitry possible to deliver pure DC output without hum or AC ripple, so their designs typically start with a hefty transformer and a full-wave bridge rectifier. Sometimes the rectifiers are enclosed in a fairly large potted-type case with four wire leads. Other times, four

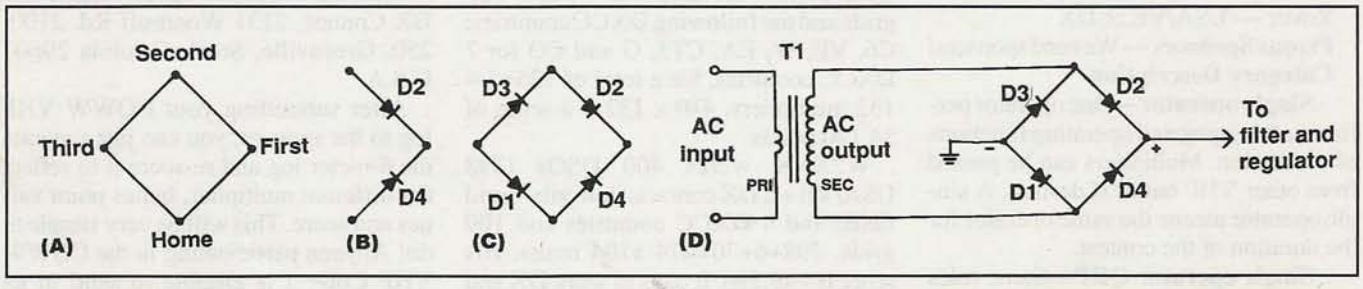


Figure 1. The easy "no miss" way to draw a bridge rectifier circuit. Combine A, B, C, and D with procedure described in text and remember—each line you draw first makes an arrow or anode symbol.

By Dave Ingram, K4TWJ

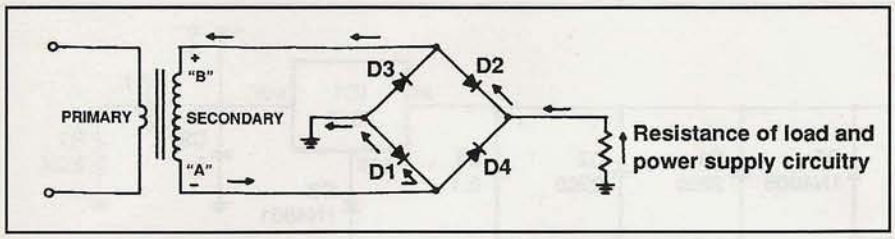


Figure 2. Outline of current flow in a bridge circuit during one alternation of AC. Check your electronic knowledge by using a colored pen to trace the path of current flow during the next alternation of AC, then compare your work with description in text.

separate diodes ("discrete components") are used and interconnected by their leads or pc board "runs." Some folks say understanding how this diode maze conducts current is a mite confusing, but relax and I will show you the easy way.

First, visualize (but do not draw) a baseball field like the one in Figure 1A. This will be the sketch format for our bridge. Now starting from home plate and second base, draw two lines with arrows (diodes) pointing to first base as shown in Figure 1B. Remember, both arrows point to first base. For reference, I labeled these diodes D2 and D4. Next, from third base, draw two more lines with arrows (diodes) pointing to home plate and second base, as shown in Figure 1C. I labeled the latter two diodes D1 and D3 for reference. Finally, add a minus/ground connection at third base, a positive/output connection at first base, and a transformer with its secondary connected between second base and home (Figure 1D). That's it: you've drawn a no-errors bridge circuit! Now try it again without peeking at Figure 1 so it will be retained in your non-volatile memory.

Let's now trace current flow through the bridge, beginning with one alternation of AC when the "bottom" of the transformer's secondary winding is negative and the "top" is positive (Figure 2). As indicated by the arrows, current flows from point A to the junction of D1 and D4. Diodes pass current in only one direction ("against their arrow" or anode), so D1 conducts, and D4 is cut off. Current flows to ground, through additional power supply circuitry and the load, and back to the junction of D2 and D4. Although both of those diodes can conduct, only one (D2) completes the path for current to flow back to its source, the secondary winding (if it went through D4, it would "be going the way it came." Nay, Nay: two wires are required to make a complete circuit).

CQ VHF does not usually print figures in color, so I invite you to use a red or green pen to trace current flow during the next alternation of AC (which will also complete the bridge's sequence of operation). Start by placing a (colored) "+" symbol at the secondary's "bottom" and a "-" symbol at the winding's top. Current will now flow from point B to the junction of D3 and D2. Which one conducts? Not D2. It has negative voltage on its (positive) anode. Current goes through D3 to ground, through additional circuitry and the load, and back to the junction of D2 and D4. Will both diodes conduct simultaneously? No. only D4 conducts because it provides a return path to the secondary's positive wire.

Following alternations of AC toggle between my black dotted lines and your colored dotted lines, producing 120 pulses of DC per second. The pulses are smoothed to pure DC by filter capacitors and their voltage level stabilized by a regulator as discussed last month, and that completes our nutshell story of power supply operation. You learned some facts beneficial for life. Congratulate yourself!

Is knowledge of bridge rectifier circuits useful? Yes indeed, especially if you leave a power supply plugged into an AC outlet when not in use. Lightning spikes "running in" on AC power lines during surprise storms are a major cause of problems with most power supplies. Such high voltage and short duration pulses can zip right through a fuse before it pops—and guess what components are most often damaged? Yep, the diodes. Mild spikes can cause one or more to short (which, in turn, shorts the transformer's secondary and pops the power supply's fuse). Replace the supply's fuse, and it will pop again...until you replace the detective diodes(s). Stronger lightning spikes (close to a direct hit!) can actually disintegrate the diodes, leaving only wires. In either case, knowing how to draw and connect a bridge circuit can change a "return for ser-

Photo A. New MFJ-4110 13-VDC, 2-amp power supply consists of two units: a hearty wall transformer and a circuit box containing rectifiers, filters, and regulator. (Photo courtesy MFJ Enterprises, Inc.)

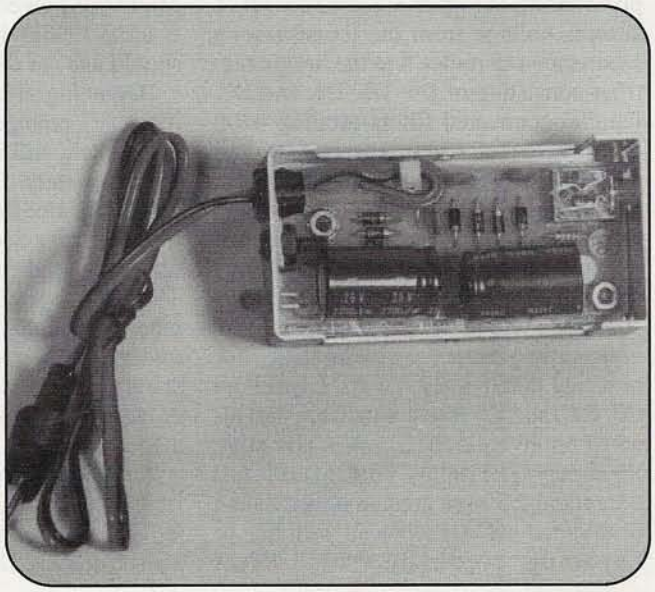


Photo B. Inside view of MFJ-4110 circuit box reveals two large filters, four diodes for a bridge rectifier and three diodes for adjusting output voltage. Regulator is bolted to left side of box for heatsinking and cooling. (Photo courtesy David Branch, KB5VKY of MFJ Enterprises, Inc.)

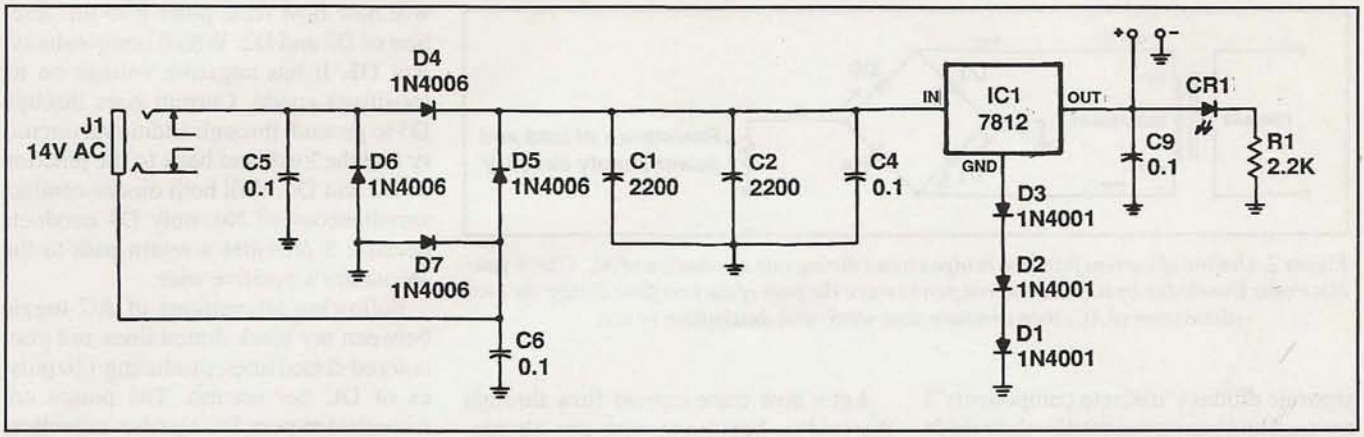


Figure 3. Circuit diagram of the MFJ-4110 power supply. Wall transformer plugs into stereo jack J1, and diodes D4, D5, D6, and D7 function as a full wave bridge rectifier. Can you determine the purpose of D1, D2, and D3 before reading explanation in text?

vicing" dilemma into a quick home repair. Need more confidence building? OK, let's do a quick overview of a couple of commercially made power supplies and visualize how they work.

Checking Out a Small Power Supply

One of the most versatile items found in many amateur setups is a 1- or 2-amp, 12- or 13-VDC power supply for operating a 5-watt FM talkie or low power (QRP) rig at home. Such units need not be elaborate, but they should exhibit stiff voltage regulation and good output filtering (not to mention low cost!). Filling that bill is the new MFJ-4110 shown in Photos A and B. This power supply is separated into two sections: a hefty plug-in wall transformer and a circuit box containing rectifiers, filters, and a regulator.

The circuit diagram of this power supply is shown in Figure 3. Stereo socket J1 accepts voltage from the transformer's secondary and routes it to the bridge rectifier consisting of D4, D5, D6, and D7. Parallel-connected filters totaling 4400 µfd smooth the 120-Hz pulsating DC into pure DC, which is then stabilized by the 7812 regulator. Three more diodes (D1, D2, and D3) lift the regulator's control pin above ground, thus producing a regulated output of 13.8 volts. Jumpering one diode will lower the voltage to 13.1 volts, or two diodes can be jumpered for reducing output to 12.4 volts. Capacitors C3, C4,, and C5 (each .1 µfd) are included to remove glitches, spikes and stray RF energy. The supply's output cable has a standard 2.5-mm. coaxial plug that can be snipped off and replaced with one to fit your rig, if necessary. Overall, this is a neat, compact go-anywhere power supply that's easy to understand and built to last. Neat!

Overview of a Large Power Supply

What is the difference between a small power supply and a fancy-featured "big daddy" supply used with a large 100-watt-plus transceiver? Let's use the Vectronics PS-30F shown in Photo C to answer that question. This 17-pound powerhouse delivers 13.8 VDC output at 25 amps continuous, 30 amps intermittent, current—almost enough to run two rigs (transmitting) simultaneously. Peeking inside the cabinet (Photo C) substantiates that. Notice the BIG transformer, massive filter capacitor, heavy duty bridge rectifier, and large whisper fan to pump out the juice while running cool as a cucumber hour after hour. Whew! Might this power supply work as good as it looks? Studying its circuit diagram should answer that question.

Beginning at the left top of Figure 4, input AC voltage passes through a fuse and switch, and is then stepped down to approximately 18 volts by the transformer. Notice the rectifier bridge on the transformer's secondary is symbolized by a diamond rather than four diodes. This is a common engineering practice when a modular bridge is used, and we understand (or are expected to understand) the bridge consists of four diodes. A large 48,000-µfd capacitor is a super-effective filter.

The supply's regulator section consist of the MC1723 IC (integrated circuit) and its associated circuitry. Input voltage is sensed on pins 11 and 12, then output for controlling the four parallel-connected 2N3055 pass transistors goes to a TIP-31 transistor driving their (parallel-connected) bases. The 0.1-ohm resistors on each emitter of the (well-heatsinked) 2N3055s equalizes current flow. This way, each transistor handles only 1/4 of the power supply's total output current. A voltage-dividing sensor circuit consisting of two series-connected 1K-ohm resistors senses or samples output voltage and directs it back to a comparator circuit in the MC1723 to further stabilize the output. The 10K potentiometer on pins 5 and 6 permits front-panel adjustment of output voltage to a desired level.

Directly below the transformer is the blower control circuit. A temperature-sensitive thermistor mounted on the pass transistor's heatsink causes the LM311 to switch on when temperature rises above

Technically Speaking

Over a period of time (10 or 15 years), electrolytic filter capacitors used in power supplies can dry out and decrease in value (µfds). If and when that happens (and assuming the associated power supply's circuitry is similar to our highlighted MFJ and Vectronics units), the power supply's regulator section can serve double duty as an active filter. That is, the regulator senses minute output voltage variations as AC ripple and sends a 120-Hz correction signal to the pass transistor(s). Internal collector-to-emitter resistance of the transistors then vary accordingly to turn the output voltage up and down 120 times a second, and smooth out the ripple or hum. Pretty interesting, eh?

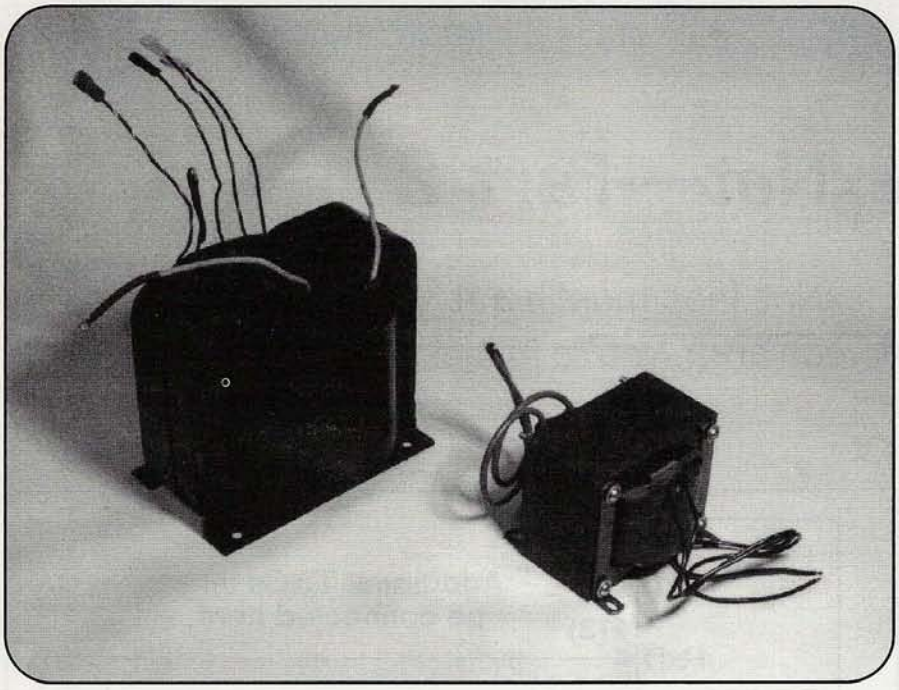


Photo D. Size comparison of transformer used in Vectronics PS30F transceiver power supply (right) and transformer used in a big Ameritron linear amplifier (left). The 3800-volt Ameritron transformer is so massive that it is shipped in a double-reinforced box. You position its mated amplifier on a desk, then (using both hands!) mount the transformer in the amplifier and connect its push-on leads. This is big-time radio for sure! (Photo courtesy David Branch, KB5VKY, of MFJ Enterprises.)

(large) Vectronics PS 30F transformer in Photo D. The large transformer delivers approximately 3800 volts at up to 1 amp, and accidentally coming in contact with such high voltage can be fatal. Realizing that fact, manufacturers include interlock switches to remove voltage when an amplifier's cover is removed. Defeating such protective devices for troubleshooting is seldom necessary, and should be approached with the utmost caution.

Wrap-up

That winds down our discussion on power supplies for now, friends, but stay tuned for some very special columns during the coming months. We plan to spotlight CTCSS and DTMF tone systems, unique OSCAR satellite activities, new designs in mobile antennas, custom mics for favorite rigs, and more. Now let's hear from you! Drop me a note on topics or items you'd like to see highlighted in this column. We aim to please—everyone! Meanwhile, check out AO27 and let's exchange brief greetings via satellite one mid-morning this month!

—Dave, K4TWJ

FlexNet—Part 2

If Don's introduction to FlexNet last month got you interested in setting up the system in your area, you're in luck. This month, he tells you how to do just that!

Welcome to Part 2 of our discussion of FlexNet networking software, continued from last month. In the June issue, we discussed some of the features of FlexNet for the PC and why this software from Germany is so wonderful (wunderbar?). However, one thing I forgot to mention last month is that FlexNet was written by Gunter Jost, DK7WJ/K7WJ, who deserves the credit and recognition. This month, we'll get into the details of setting it all up.

Before we start, a quick note on hardware and operating systems: Just about any PC will work, but for a busy node, expect to use a '386-class machine. A Pentium is overkill, but it won't hurt. Just be sure that the RS-232 serial ports are equipped with 16550 UART (Universal Asynchronous Receiver/Transmitter) chips for good performance.

"With the software in hand (well, on disk), you place the modules you want to use in their own directory somewhere, and either enter their names at the DOS prompt, or write them into a batch (.BAT) file to load them more easily."

FlexNet has been tested with MS-DOS 5.0 and 6.2 (or later) and runs well. These versions of DOS also allow you to load the drivers in the high memory area. (Remember that FlexNet is a terminate-and-stay-resident program. After loading in the software, you can go ahead and use your computer for the usual tasks, while FlexNet grinds away in the background.) Testing with DOS 6.0 has shown this version to be unstable, and there's been no real testing with DR-DOS, PC-DOS, or other versions.

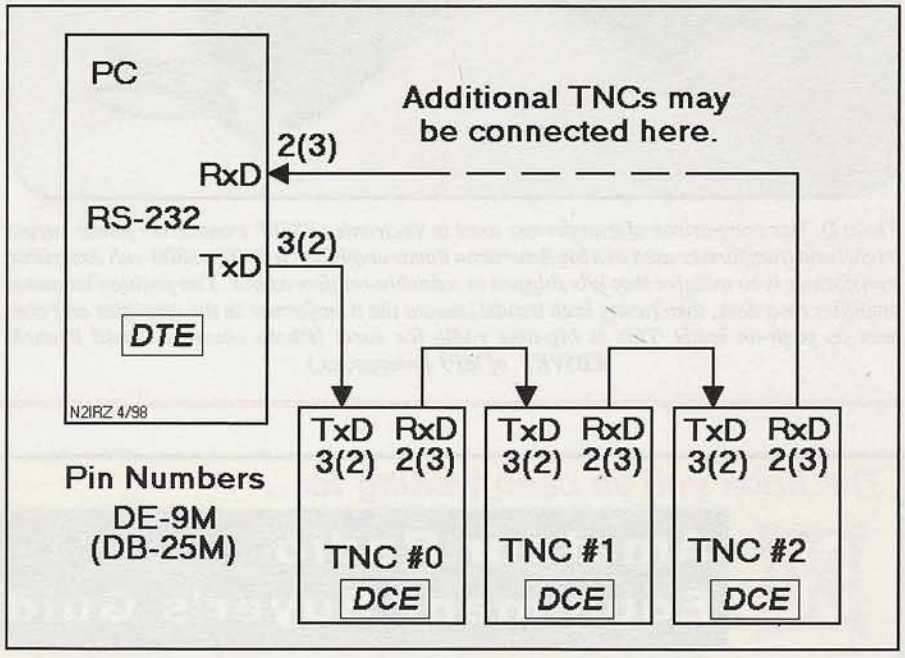


Figure 1. The 6PACK ring connection. Each TNC in the 6PACK ring (see text) is connected to its neighbors. The 6PACK driver allows existing network hardware (TNCs and related equipment) to be converted to FlexNet with minimal expense. Note that the pin numbers change, depending on whether the port is configured as DTE (Data Terminal Equipment) or DCE (Data Circuit-terminating Equipment), and on whether it uses a 9-pin or 25-pin connector.

On to the Details

The first step in setting up a FlexNet node is to get the software. Visit the FlexNet Web site, where all the various modules are available, except the networking module. Take a look through the site and get whichever modules you might want. The core module (FLEXNET.EXE, compressed as PCF.LZH) is absolutely required, of course, and you should also get any drivers and applications you think you might want. A nice user terminal program, the BayCom Terminal (BCT) is available from there, too.

The networking module (FLEXDIGI.EXE) is nearly as easy to get, but distribution is controlled to ensure that every node operator uses only the latest version. To get a copy, send an e-mail message to <flexnet@dl0td.afthd.th-darmstadt.de> stating that you would like to receive the node module. The message should contain at least:

- your amateur radio callsign
- your node's callsign
- your e-mail address for reply mail

By Don Rotolo, N2IRZ (N2IRZ@compuserve.com)

Figure 2. A screen shot of the FlexNet home page at <http://www.home.pages.de/~flexnet/>. All FlexNet software (except the networking module) may be downloaded for free from this site. See text for details on getting the networking module.

- the IARU locator (six-digit grid square) of your node
- the city/state of your node's location.

This process puts you onto their Sysop's list and ensures that you'll be notified of any future updates. The FlexNet group freely offers all this software without charge for amateur use, but asks that you follow its simple rules, and do not distribute the networking module on your own—just pass on the e-mail address, please.

With the software in hand (well, on disk), you place the modules you want to use in their own directory somewhere, and either enter their names at the DOS prompt, or write them into a batch (.BAT) file to load them more easily. All of these modules come with considerable documentation. Let's run through some examples:

Example 1: Typical User Station

Load FlexNet to use a BayCom-style 1200-baud modem on COM1 (the first serial port) and use the BayCom Terminal program as the user interface. This is a typical user station. At the DOS prompt, type the text shown in bold (the text that follows is my explanation).

FLEXNET—loads the FlexNet kernel with the default 15-kB memory reserved; this is enough for a user station, but should be increased for more demanding uses, such as network nodes.

SER12 1—loads the BayCom 1200-baud serial modem driver on COM 1.

FLEX—starts the kernel; after this command, you cannot load any more channel drivers (FlexNet supports up to 16), but now any application programs may be started.

FSET MODE 0 1200—sets the baud rate of channel 0 (the first channel) to 1200 baud.

FSET TXDELAY 0 20—sets the TX Delay of channel 0 to 20 (200 mSec.).

BCT n/ *yourcall*—starts the BayCom Terminal program; replace "*yourcall*" with your callsign.

If you want to unload any FlexNet applications, you can use either the "KILLAPPL" command (which removes the last loaded TSR application) or "FLEX/u", which unloads every FlexNet module (including the kernel, channel drivers, and applications).

Example 2: Two-Port Network Node

Load FlexNet to run as a network node, using two TNCs running off a serial port with the 6PACK driver (more on this later). This is a good configuration to try for a simple two-port network node site.

FLEXNET 60—loads the FlexNet kernel, with 60 kB memory reserved.

6PACK 1 /b=19200 /c=2—loads the 6PACK TNC driver on COM 1 at 19,200 baud and configures two RF channels (see below for details).

FLEXDIGI—loads the Network Node module, after all the channel drivers are loaded (before running this module for the first time, you should first see below for details on how to proceed).

FLEX—starts the kernel; same limitations as in previous example.

FSET MODE 0 1200—sets the baud rate of RF channel 0 (the first channel) to 1200 baud.

FSET TXDELAY 0 25—sets the TX Delay of channel 0 to 25 (250 mSec).

FSET MODE 1 9600—sets the baud rate of RF channel 1 (the second channel) to 9600 baud.

FSET TXDELAY 1 10—sets the TX Delay of channel 1 to 10 (100 mSec).

Whenever you use the 6PACK driver, it's strongly recommended that you use a Serial port equipped with 16550 FIFO UARTs (First-In, First-Out, Universal Asynchronous Receiver/Transmitter—a fancy name for a fast serial port). The 16550 chips help buffer the incoming and outgoing data with a tiny cache memory, so that no data bits are lost while the computer is doing something else.

We'll discuss the 6PACK driver in a moment. Let's try another example.

Example 3: PC-to-PC Link

Load FlexNet to allow two PCs to link over their RS-232 (COM) ports. Data rate is 115,200 baud, using COM 1 and CRC-KISS. (You would load this on both PCs and link them with a null-modem cable.)

FLEXNET 30—loads the Kernel with 30 kB memory reserved.

KISS 1—loads the KISS driver on COM 1.

FLEX—starts the Kernel.

FSET MODE 0 1152c—sets the KISS terminal rate on channel 0 (the first channel) to 115,200 baud and specifies that KISS should use CRC error-detection.

If you wanted to link two computers together to play a little with FlexNet, this would work fine. You might want to add a terminal program onto that, or it wouldn't be much fun. If you managed to

get three computers into the same room and wanted to try a three-node "Network in a box," the computer in the middle would use both of its two COM ports and load another KISS driver using the command "KISS 2". Then, use the FSET MODE command to set the baud rate for channel 1.

From these examples, and those given in the documentation, you should be able to get FlexNet running without any problems. You should try packet with the SoundBlaster driver!

6PACK, Anyone?

A very important consideration for anyone planning to convert an existing network over to FlexNet is to minimize additional hardware costs. A '286 or '386 computer with a small hard disk shouldn't cost much (maybe even nothing), so that's not a great expense. For the rest of the site, if you had to buy new channel driver cards (a function now performed by TNCs), it could get a bit costly. Since most network sites today use TNCs, one of the most important FlexNet channel drivers is 6PACK, written by Matthias Welwarsky, DG2FEF.

6PACK is used to drive up to eight TNC-2 clones on each RS-232 port. You'll have to make up a simple RS-232 cable, as shown in Figure 1, and you'll have to burn new a new EPROM for each TNC in the "ring." The EPROM code comes with the 6PACK module—it's only 4 kB, so the TNC won't need the 27512 modification (discussed in the April and May issues).

Why use 6PACK? The paper in the 14th Digital Communications Conference *Proceedings* explains that pretty well, and it also covers the details of the protocol. To summarize: KISS isn't good enough—data can get lost, and there's no good way of addressing multiple TNCs. Sure, you can get a multi-port serial card, but why bother? 6PACK takes care of everything automatically, never losing data, and controlling the data ring timing very precisely. You can even take control of the TNC's LEDs! After the driver is started, each TNC in the ring is assigned a channel number sequentially, with the first TNC getting the lowest available FlexNet channel number. Each TNC/channel's parameters are set in the usual fashion (discussed below).

The only thing you have to look out for is the baud rate. First of all, each TNC must have its terminal data rate setting adjusted properly; 19,200 baud, for example. Then, the 6PACK driver is also set to that speed. When choosing an RS-232 speed for a 6PACK ring, you should add up all the RF data rates and multiply by 2—just remember that most TNCs cannot run their terminal rates above 38,400 baud! If necessary, run two rings, one on each serial port (6PACK supports COM 1 through 4). Although you can specify the number of TNCs in the ring, if you don't, the software configures itself properly anyway.

Mode Settings

The mode settings are important for proper operation of the channel. The mode is set, and stored on hard disk in the configuration file, while in Sysop mode. The syntax for the Mode command is "MO <channel><mode>". <channel> is fairly obvious—this is the number of the FlexNet channel for which you're setting the mode. The <mode> command actually consists of two sections: the first is a number, which is the baud rate of the RF channel, followed immediately by one or more characters that completely define the channel. These are:

"d"	Full Duplex (half duplex is default, **)
"z"	NRZ mode (NRZI is default, **)
"c"	KISS: CRC mode; HDLC: Soft-DCD (**)
"m"	DAMA Master
"s"	Synchronize with other 's' channels
"u"	User port (activates for example automatic TXDelay measurement)
"y"	Auto-sysop (anyone connecting to this port is automatically Sysop)
"-"	Deactivate channel
"."	Dummy parameter, if there are no other arguments required.

(Parameters marked "**" are set according to the hardware.)

For example, to set channel 3 to 9600 baud, full duplex, use the command "MO 3 9600d". To set channel 1 to 115,200 baud, and use the CRC mode for KISS (this is a serial RS-232 connection to another nearby computer), use "MO 1 1152c". The documentation covers this point in some detail.

The First Time...

The first time you run FLEXDIGI, you have to create a configuration file, FLEXNET.FPR. This is a binary file which is not directly editable and is protected by checksums to avoid inadvertent changes. Before that, you should set the sysop password by running SYSNUM.EXE. This will create a basic config file, which we'll edit in a moment. Type in a command like "SYSNUM 54321".

Later, whenever you connect to the node remotely, you'll have to answer a challenge correctly to gain sysop privileges, using the "SY" command. (When you log on at the local console, channel 15 is set as "always sysop"). The node will return a random number, such as "12345." You then perform a calculation:

Multiply the individual coinciding random (12345) and sysop (54321) digits:

1•5=5; 2•4=8; 3•3=9; 4•2=8; 5•1=5

Then, add the products:

5+8+9+8+5=35

That means 35 is the number the node expects to receive. Now you are sysop (provided your calculation was OK). To make it more difficult for spies, you may send the SY command more than once. The calculation has to be right only once, and no message is returned. By sending wrong answers a few times, it becomes virtually impossible to determine the sysop number.

Configuring Your Node

After SYSNUM generates the basic configuration file, you can load in FLEXNET.EXE, a channel driver (say, SER12 on COM 1), and then load in the network module FLEXDIGI.EXE. Activate these with the FLEX command.

"Since most network sites today use TNCs, one of the most important FlexNet channel drivers is 6PACK, [which] is used to drive up to eight TNC-2 clones on each RS-232 port."

Here we see Klaus-Dieter Friedrich, DL2FCQ, as he tries to repair a balky FlexNet link once and for all! A good example of German engineering at its finest!

Next, invoke the TNC emulator with the command "TNC <mycall>", substituting your callsign for <mycall>. Connect to the FlexNet kernel and prepare to set all the required parameters.

It's completely beyond the scope of this column to cover every possible parameter setting. Instead, I'll refer you to the documentation for the details. We'll just cover two typical cases here...

The User Station and the Network Node

For both cases, we first connect to the kernel by typing "<Esc> C FLXNET" (press the <Esc> key, *then* C; don't press them at the same time). For a brief help file for the TNC emulator, press <Esc> H. Note that all of the TNC emulator's command begin with a press of the <ESC> key. Once you're connected to the kernel (which is acknowledged with the standard "*** Connected to <call> (xx)" (where xx is the port number), you'll get the FlexNet command prompt, which looks like this: =>

For the Network Node, you first enter Sysop mode by typing SY and correctly responding to the challenge. Next, set the callsign of the node with the MY <callsign> command. Set the SSIDs (Secondary Station IDs, the "-#" attached to the end of a callsign) of each channel with the P SSID <ssid> <channel>. Set the mode of each channel using the MO command (see "Mode Settings"). Last, define all neighboring nodes, as follows:

For each port, type in the callsign and SSID range of any other nodes reachable on that port. Ideally, there should be only one, as all backbones should be dedicated point-to-point links. Of course, one of the ports will likely be a user port, and no links should be defined there (again, just good networking practice).

For example, to configure port number 2 with a link to the N1EOW FlexNet node, which has five ports with SSIDs of 0 through 4, we'd use the command "L 2 N1EOW 0 4".

That covers a very basic configuration—not much to it, is there? Remember, all the channel settings, aside from TXDelay, are automatically adapted to the channel conditions in real time. OK, now would be a good time to set all the text files (Info, Help, Advice (current node conditions), Beacon, Connect text, and so on), using the W command. For example, to write the Help text, you enter W H (press Enter, and it will acknowledge that it's writing the Help file). Then, enter the text, just as you want it to appear. End it with a "/EX", and the file will be written to disk.

Configuring the user station is similar. The only difference from the network configuration is that only one link will have to be defined, to your local user port, and there's little sense in setting any of the text files, except maybe the Info file.

That about completes it. I recommend playing with the node or user station for a few hours to understand some of the systems and to learn more about configuration. Be sure to have a printed copy of the Sysop's manual handy for reference. I guarantee that, after a few days, you'll wonder why you never tried this before.

The nice thing about FlexNet is that it does everything so well. It simply outperforms, by a wide margin, anything else out there. Try it, really try it, and see if you don't agree.

Moving On to TCP/IP

Next month, we'll continue our networking series with a look at TCP/IP and some of the other networking systems out there. If there's enough room, we'll also summarize what we've seen these past few months, and draw some conclusions. If not, we'll push that off into September, when we'll start looking at modulation techniques. Until then, 73

—N2IRZ

Resources

FlexNet home page: <http://www.home.pages.de/~flexnet/>;

E-mail address: <flexnet@dl0td.afthd.th-darmstadt.de> (that's D L Zero T D, a German club callsign).

BayCom home page: <http://www.baycom.de>

Looking Ahead in CQ VHF Ham Radio Above 50 MHz

Here are some of the articles that we're working on for upcoming issues of *CQ VHF*:

- "Make Project Labels with Your PC...on Paper," by Raymond Schneider, W6JXW
- "Search & Rescue 'Boot Camp'," by Sam Vigil, WA6NGH
- "Further Adventures in Near Space," by Lloyd Verhage, KD4STH
- "A Repeater-Internet Interface," by John Hansen, W2FS

Plus...

- "A Wind-Powered Repeater," by Cesar Amaro, NP3H
- "*CQ VHF* Review: Kenwood TS-790 multimode," by Gordon West, WB6NOA
- "*CQ VHF* Review: Cherokee AH-50 6-Meter Handheld," by Heather Hampton, KE6HEY

If you'd like to write for *CQ VHF*, you may download our writers' guidelines from the *CQ VHF* World Wide Web site at <http://members.aol.com/cqvhf/> or FTP to <ftp://members.aol.com/cqvhf/General> and look for the file, "writguid.txt." Or, you may send a written request along with an SASE (self-addressed stamped envelope) to *CQ VHF* Writers' Guidelines, 25 Newbridge Road, Hicksville, New York 11801.

Cheap Microwave Parts

So what if it was designed as a door opener? There's a world of surplus parts out there that we can use in microwave experiments.

Two of the most common microwave goodies floating around the surplus market today are police radar detectors and the Doppler radar used to open doors down at the local supermarket. And guess what? Both of these are usable in your own microwave experiments and 10-GHz rigs!

Diode Detection in Action

Police radar detectors go back to the 1960s and S-Band (2.4-GHz) police radar units. These were switched-diode detectors and were simple yet really quite innovative for the time.

To demonstrate how they work, let's say we want to detect weak light instead of microwaves (*light, after all, is nothing more than micro-microwaves—ed.*). We hook up a photocell or solar cell to an amplifier and a detection circuit (see Figure 1). To detect a really weak light, we need a lot of gain. Great—until we put this out in the field. Temperature, battery voltage, and humidity all affect that extremely weak voltage we're looking for. Circuits drift and we get a bunch of false alarms. A simple way of getting around this gain change problem is the *chopper circuit*.

Referring to Figure 1A, let's say we have an LCD computer screen blocking the incoming light. Now let's switch the LCD screen on and off at, say, 500 times a second (yeah, I know, a pretty good trick for an LCD display, but you computer geeks can bear with me for a few seconds). Now the solar cell is just connected to a good old audio amp, and we're amplitude-modulating the light before it gets to the detector. If we hear a 500-Hz tone from the speaker, then light is hitting the solar cell. No tone, no light. And all the problems with circuit drift are eliminated.

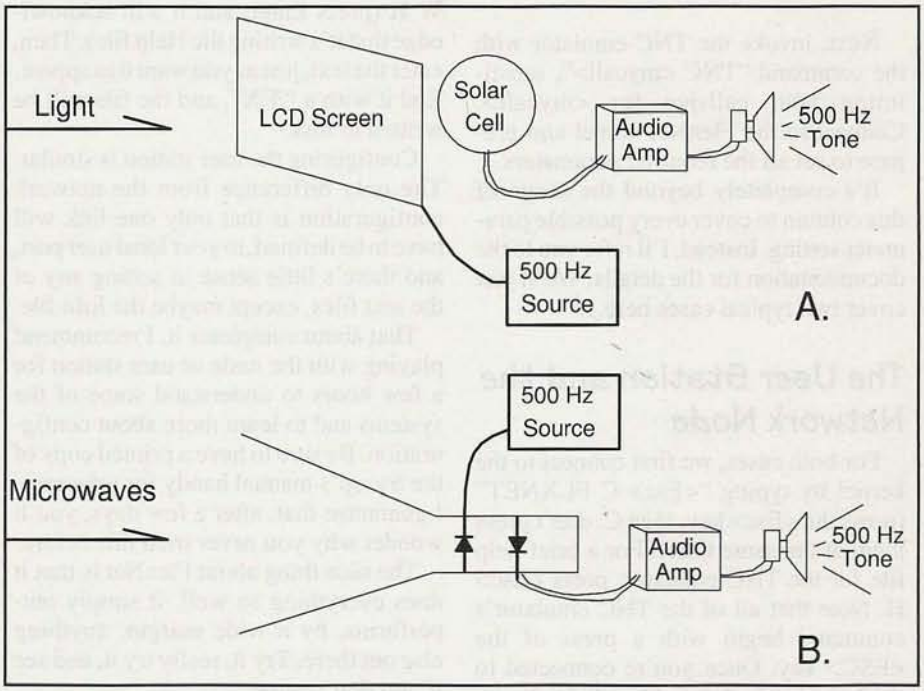


Figure 1. A simplified approach to detecting microwave signals. In Figure 1A, we're trying to detect light instead of microwaves, and turning on an LCD screen 500 times per second. The solar cell is connected to an audio amp, which produces a tone every time it "sees the light." The same concept is at work in Figure 1B, in which a microwave detector diode is switched on and off at 500 Hz, and sets off an audio tone when microwave signals are detected. See text for details.

In Figure 1B, we have the microwave equivalent of this circuit. A diode is placed ahead of the detector and switched on and off at about 500 Hz. The detector diode is connected to a high-gain audio amp. If you hear the same tone that's going into the switching diode, then microwaves are coming into the antenna. Simple! A CW signal comes in, we AM-modulate the carrier, then listen to the signal with an AM radio. (OK, for you guys who should be writing this column instead of reading it, yeah, I know, the switching diode is usually mounted behind the detector diode. When mounted in waveguide, 1/4 wavelength behind the detector diode, the reflected signal comes back out of phase. Less loss and does the same thing, but the other way is a heck of a lot easier to explain.)

This type of detector simply detects RF energy. If the signal can go down the throat of the horn antenna and the diode goes high enough in frequency to rectify the signal, you hear a tone. Many of these detectors will sound off to CW signals anywhere between 8 and 30 GHz. And yes, I have used them many times in VHF contests for quick CW QSOs. Switched-diode detectors pretty much died out in

By Kent Britain, WA5VJB

Photo A. Switched-diode radar detectors. These are some of the few that Kent hasn't already cannibalized for other microwave projects.

the early '80s, but they can be fun to play with and you get a pair of microwave diodes. I've been known to give as much as $2 for one at a flea market, but they usually go for much less.

As you can see in Photo A, I still have a few switched-diode detectors left that haven't been cannibalized. Photo B is a close-up of the horn antenna and diodes. Notice that this is very poor RF/microwave construction, but no problem, it's all audio signals.

Moving on to Superhets

Next came the superheterodyne detectors, about 30 dB more sensitive than the diode detectors and 10 dB more expensive at first. In Figure 2A, we have the typical superhet radar detector. The Gunn oscillator is used as the local oscillator (LO) and is tuned to 11.5 GHz. The mixer diode is struck by the 10.5-GHz "X-band"radar signal and the 11.5-GHz LO mixes the radar signal down to 1 GHz. The detector then has another receiver that sweeps between .8 and 1.2 GHz, looking for signals. The Gunn oscillator in the detector drifts around with voltage and temperature, as does the Gunn oscillator in the "Smokey's Camera." That's why they have to tune around quite a bit for signals.

"I've seen [superhet] radar detectors that put out as much as 1/4 watt ERP (effective radiated power)...1/4 watt ERP is about what you get when you're running a 2-meter talkie into a rubber duck antenna."

Note that there is absolutely nothing to keep the 11.5-GHz LO signal inside the detector. It just blows on by the mixer diode and keeps on going. I've seen radar detectors that put out as much as 1/4 watt ERP (effective radiated power). Now you know how some states can set up "detector detectors" (later, we're going to learn how to take advantage of this). You see, 1/4-watt ERP is about what you get when you're running a 2-meter talkie into a rubber duck antenna.

But there's one other trick in these units' "bag of tricks" as we see in Figure 2B. Gee, the 11.5-GHz energy is hitting that mixer diode pretty hard. That generates a second harmonic at 23 GHz. Well, if a 24-GHz "K-band" radar signal hits that diode, we have 24 GHz - 23 GHz = 1 GHz again. Amazing, one of the image frequencies is K-Band police radar!

These systems sing out when they detect a radar signal, but they have no idea if the signal is on X- or K-Band (*not that it made much difference in its original application...it still meant "slow down"—ed.*). The radar detectors that can tell you if it's an X- or K-Band signal have two antennas and typically cost twice as much. And the frequency-mixing schemes get real fun when you throw in the new 33-GHz "Ku-band" systems.

I've been known to cough up as much as $5 for an old superhet detector, and, as you can see from the piles in Photo C, I've collected quite a few. Nice and small,

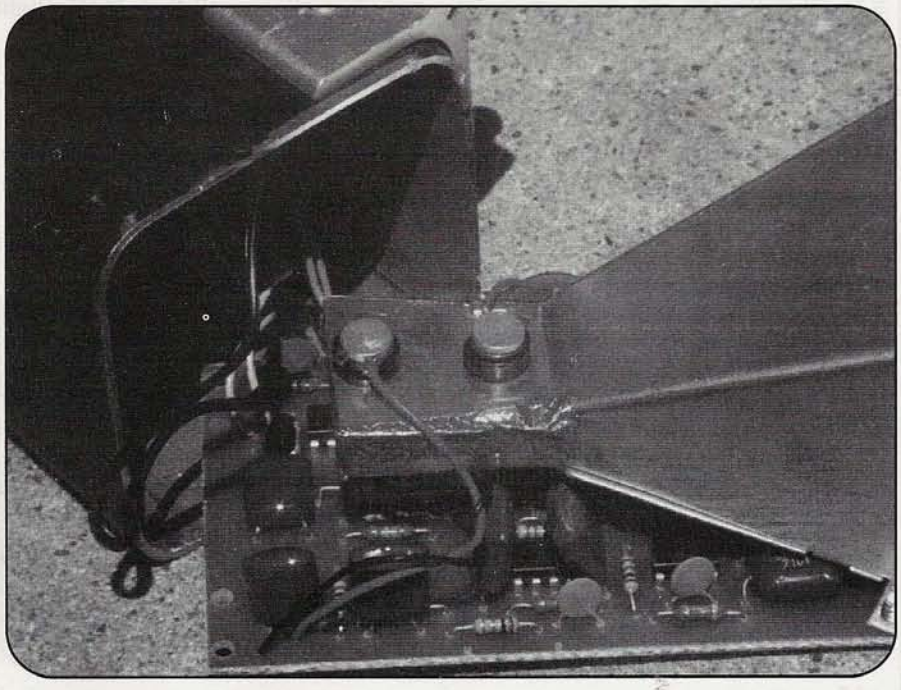


Photo B. Close-up of a switched-diode microwave (radar) detector. You can see the two diodes mounted through the top of the feedhorn. Kent notes that, once the signal is detected, everything else is just audio.

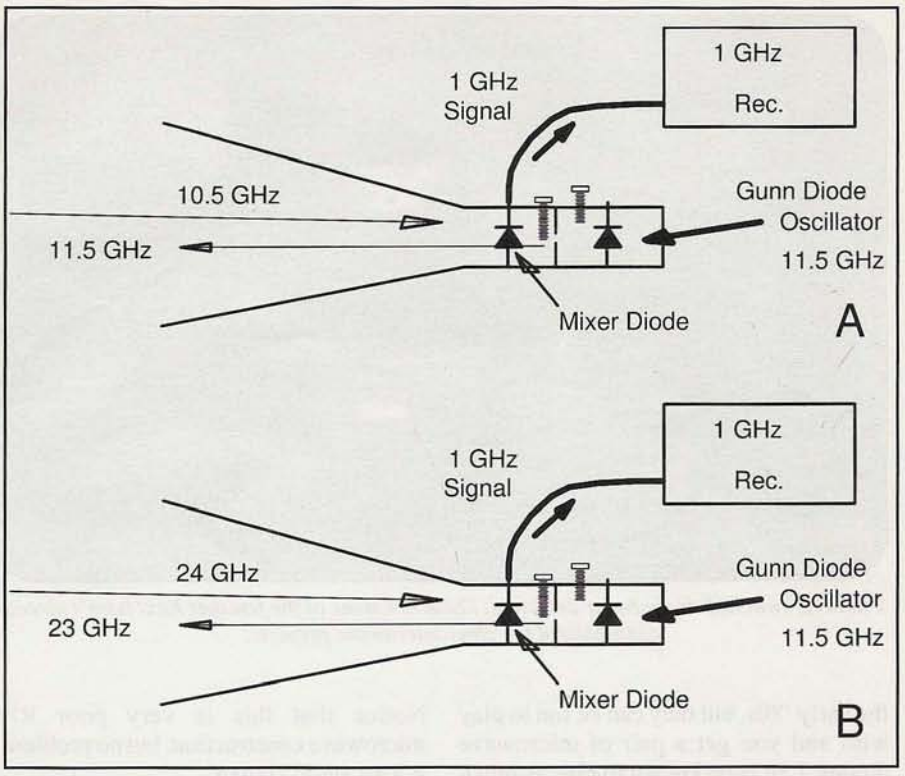


Figure 2. A typical superhet radar detector. In Figure 2A, you see the primary frequencies at work, with the Gunn diode producing an 11.5-GHz signal that mixes with an incoming 10.5-GHz (X-band) radar signal to produce a 1-GHz IF that is then fed to a receiver that tunes between 800 MHz and 1.2 GHz. In Figure 2B, we see the second harmonic of 11.5 GHz—23 GHz, mixing with an incoming K-band radar signal at 24 GHz and creating an IF signal of...1 GHz! It also sets off the detector. Note that there's up to 1/4-watt ERP going OUT on both 11.5 and 23 GHz—enough for a "detector detector" to detect, or for retuning onto amateur microwave frequencies!

5 to 10 milliwatts out, and very good mixer diodes. These can feed a lot of microwave projects. I've bought many a "bad" radar detector, but the microwave parts have always worked. In Photo D, we have a close-up of the business section from some detectors. (In upcoming columns, I'll be showing you how to build 10 GHz rigs, Doppler Radar units, and uh...well, we call them "brake light testers" out of these parts.)

At the Supermarket

In Photo E, we have two Sofan units (that's a brand name of microwave motion detectors). These come in two flavors. The larger one with the 2nd diode

Photo C. Kent hasn't made as much progress yet in cannibalizing his collection of superhet radar detectors. You can find your own at fleamarkets for $5 or less. In most cases, says Kent, the microwave part of the unit works even if the rest of it doesn't!

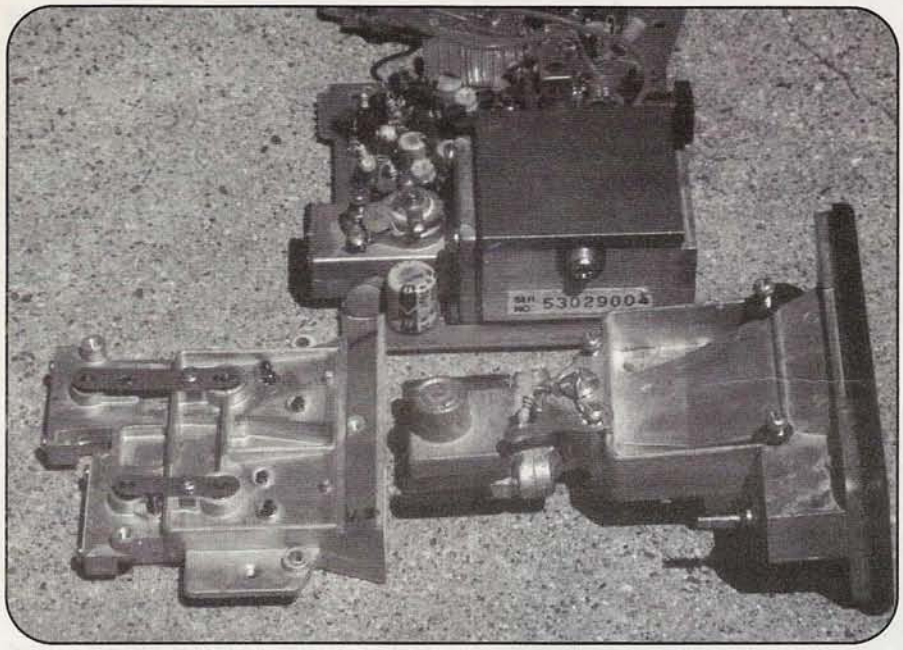


Photo D. The business end of some superhet radar detectors. Watch for projects in future columns on turning these into 10-GHz ham rigs, Doppler radar units, etc.!

is the preferred unit. But don't pass up the one with just the Gunn diode if the price is right. There are a bunch of these units out there. They are commonly used in door openers or burglar detectors and are pretuned to 10.525 GHz, just on the edge of our ham band (10.000 to 10.500 GHz).

In the smaller unit, the Gunn diode is used as both the transmitter and the receiver. A Gunn diode is a horrible receiver, but then, it only had to detect a shopping cart at six feet. The Sofans usually run 20 to 30 milliwatts out, and, again, the larger ones have a pretty good mixer diode.

So now you know what to look for the next time you're at a flea market. In September, I'll be showing you what to do with them. And while you're scrounging, look for a 30.0-MHz FM receiver that will do wideband FM. A receiver with a 50-kHz deviation detector will do; 100 kHz is better, and 200 kHz is best.

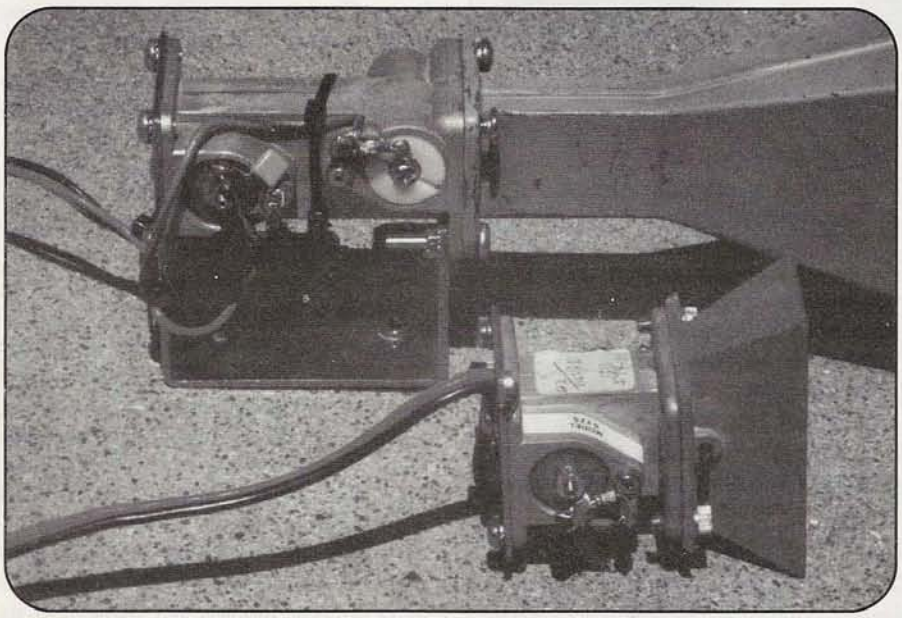


Photo E. A closeup of two Sofan microwave motion detectors. Built for opening supermarket doors and setting off burglar alarms, they operate just above the top end of our 10-GHz ham band. And of course, Kent's going to show us in coming months how to move them down so we can use them to talk!

"I've been known to cough up as much as $5 for an old superhet detector....These can feed a lot of microwave projects. I've bought many a 'bad' radar detector, but the microwave parts have always worked."

Operating News

New 78 GHz Record

As predicted, our 78-GHz operators out in California extended their U.S. distance record to 43.1 kilometers, or 26.3 miles, on March 9th. WØEOM and AA6IW are still improving their stations and had good enough signals that they are looking at even longer paths. The European record on this band is over 100 kilometers, so look for these guys to "stretch it out" even farther.

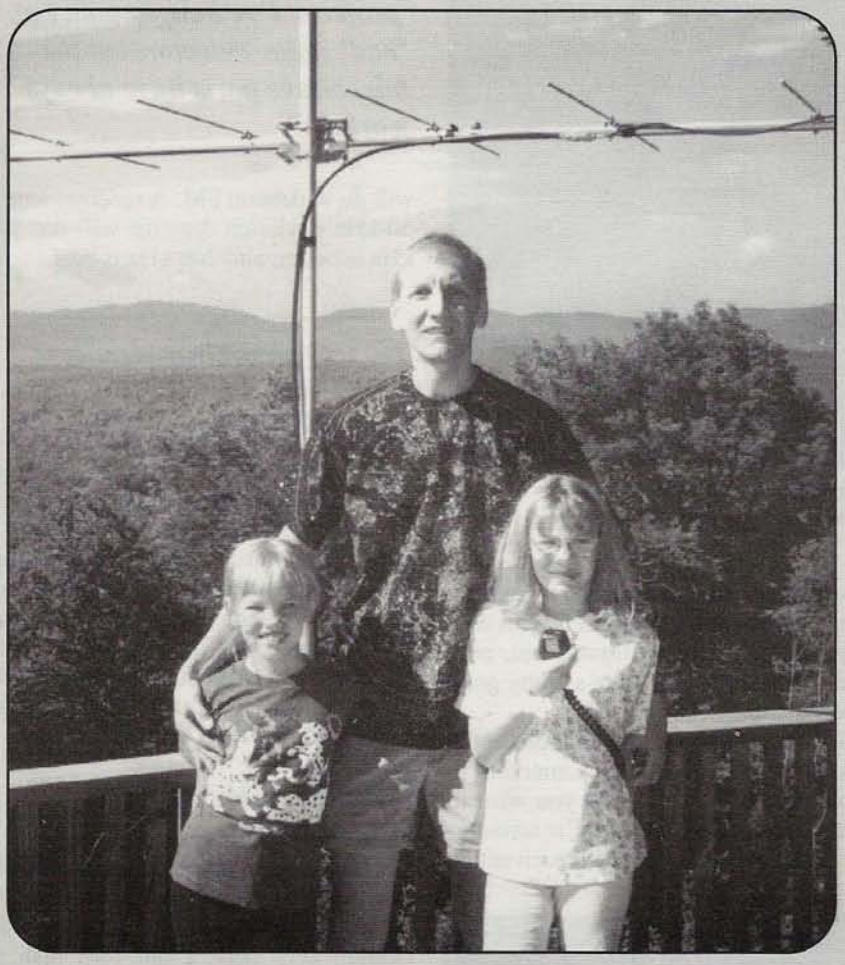
New 47-GHz Record

On April 5, Brian Justin, WA1ZMS/4, QSOed Doug Sharp, K2AD/4, on 47 GHz for a new North American record of 66.47 miles. The gear used was 100-milliwatt Gunnplexers with a one-foot dish at WA1ZMS's end, and a two-foot dish at K2AD. As Brian put it, "This is only a 'wimpy' 1.3 miles better than WA3RMX did in August of 1988. However, these were the only two hills I could find that were close, easy to get to, and did not have trees in the way." (*Tom Hill, WA3RMX, had a similar problem. His QSO, by the way, was on 47 GHz SSB.—ed.*) Brian and Doug used modulated CW (MCW) until the dishes were peaked up, then switched to WBFM (Wide Band FM, 200 kHz deviation) for a 35-minute QSO.

Beacon in the Clouds

As reported last month in "VHF News," Larry Lipitz, NY2US, has put up a 10368-MHz beacon on top of the World Trade Center in New York City. Larry has 80 milliwatts into a six-slot antenna, running on 10368.210 MHz plus or minus a few kHz, depending on temperature and line voltage. Operating at 2200

Reader Snapshot !



Meet CQ VHF Reader...Al Hanzl, W2VF (et al)

CQ VHF reader Al Hanzl, W2VF, of New Providence, New Jersey, sent us a photo of himself and his two daughters, Erin, 8 (on left in photo), and Lauryn, 10. He writes:

"I recently became active on 2-meter SSB after buying a used all-mode radio. Last summer, I operated from my brother's QTH in Barnard, Vermont, as W2VF/1, at 2,000 feet during a weekend visit in August."

"My dad was W2IOC and my brother, Ken, is studying for his ham ticket, as is Lauryn, who is studying for her Tech-Plus, while Erin is having fun learning Morse code. So, we expect to expand the ranks of ham radio (and VHFers) soon!"

If you'd like to be considered for our "Reader Snapshot" column, please tell us about yourself in 150 words or less and mail, along with a photo, to: CQ VHF *Reader Snapshot, 25 Newbridge Rd., Hicksville, NY 11801. Entries become our property and cannot be returned. If we publish your "snapshot," we'll give you a one-year gift subscription (or extension) to* CQ VHF.

feet above sea level, this beacon should be heard by hams on 10 GHz in most of New England and a lot of the mid-Atlantic region. Good work!

Technical Library on Line

I'm not in the habit of plugging Web sites, but this is one I have been helping extensively. The Six Club has a technical Web site at <http://6mt.com>. The North Texas Microwave Society has supplied the Webmasters with several hundred technical articles covering 902 MHz to 210 GHz (they already had an excellent collection of 50 to 432 MHz information). We're striving to make this the most extensive amateur radio technical collection on the Web.

"On April 5, Brian Justin, WA1ZMS/4, QSOed Doug Sharp, K2AD/4, on 47 GHz for a new North American record of 66.47 miles."

We Get Letters

Jon Valentine, KB2YUI, of Colorado Springs, Colorado, writes:

"I have a cellphone that I'd like very much to convert to a 33-centimeter transceiver. You stated in your first article that such a task was 'a considerable challenge.' Well, I think I'm up for the challenge. Could you possibly pass on some information to me on how to do this?"

OK, Jon, on the hardware side, you need to move the VCO up about 50 MHz and replace/modify the filters and diplexer. A hardware challenge, but only a tiny piece of the solution. The biggest obstacle to conversion is the microprocessor operating system.

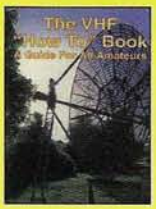
Everything is computer-controlled, so you need to download the operating system out of the memory chips, disassemble the code, then rewrite the code for new operating frequencies and new offsets, and override all the signaling controls. In short, you're writing a new DOS operating system for the cellphone. Now, load it back into the memory chips.

I expect that, someday, someone will work all this out for one of the thousands of cellphone models out there. Let us know if you have. We'd love to publish your work.

Address your questions to CQVHF@aol.com, Attention WA5VJB. ■

Books, Calendars, Pins & Cards

The VHF "How-To" Book



by Joe Lynch, N6CL

This book is the perfect operating guide for the new and experienced VHF enthusiast.

Order No. BVHF..... $15.95

The NEW Shortwave Propagation Handbook

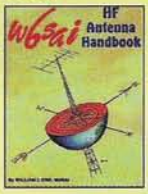
by W3ASK, N4XX & K6GKU

A comprehensive source of HF propagation principles, sunspots, ionospheric predictions, with photography, charts and tables galore!

Order No. SWP..... $19.95

W6SAI HF Antenna Handbook

by Bill Orr, W6SAI



Inexpensive, practical antenna projects that work! Guides you through the building of wire, loop, Yagi and vertical antennas.

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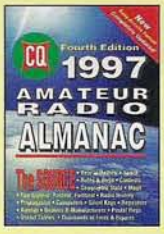
by Doug Grant, K1DG



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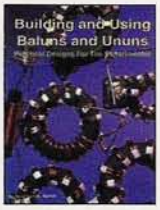

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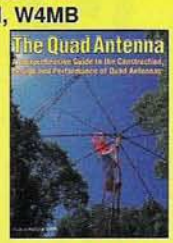

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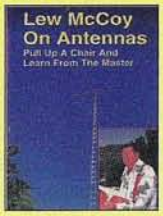

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Into the Wild Blue Yonder

It's a hobby that uses radios and encourages building, and it has local clubs and national organizations...and a few magazines, too. Ham radio? Guess again...

Charles "Sandy" Ewing picked me up before 8:00 on a beautiful April morning. Sandy and his wife, Betty, spend the winters here in Florida and summers in a Toronto suburb. Sandy is not a ham, but he knows quite a bit about ham radio because of his own hobby: flying model planes.

There are a limited number of frequencies available for radio-control (R/C) flying, and, in most areas, demand outstretches supply. Many modelers get a ham license primarily to be able to use the 18 6-meter ham frequencies commonly set aside for R/C (eight "channels" at 100-kHz intervals between 53.100 and 53.800 MHz, and 10 recently-implemented narrow-bandwidth frequencies at 20-kHz intervals between 50.800 and 50.980 MHz).

We drove about 20 miles inland to reach the remote flying field. You need an open field and tolerant neighbors to fly model planes. When a bunch of modelers get together (as they often do), it can sound like a lawnmower convention. On the way to and from the field, I conducted an informal interview with Sandy about his hobby.

Avid R/C flyer (see license plate) Sandy Ewing removes his radio/control aircraft from his car trunk for a day of flying. One consideration when you progress to larger models is whether they'll fit in your car! (Photos by the author)

A Typical Ham Question

CQ VHF: *Tell me a little bit about your equipment.*

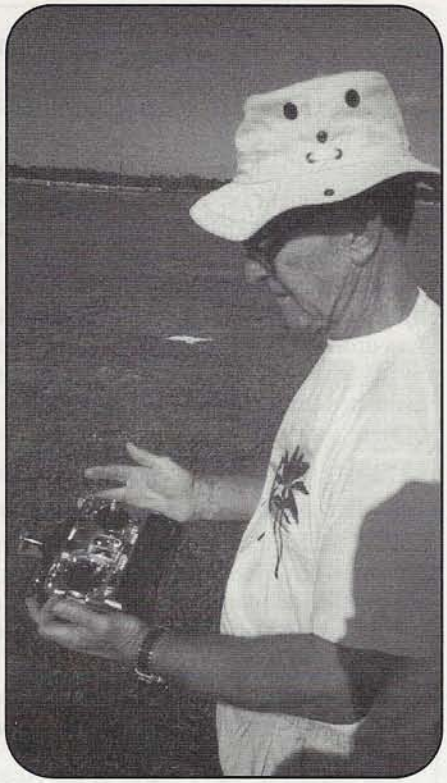
Sandy: Let's start with the radio systems. The current transmitters can operate on up to eight "channels." These are not channels in the way you normally think of them—distinct frequencies like you have on your handhelds. These are "channels" for controls. The basic four controls are rudder, elevators, ailerons, and throttle (see "Mini-Glossary" if you're unfamiliar with any of these terms). They're digitally proportional, which means that a movement on the stick on the transmitter is reflected proportionally in the movement on the servo on the aircraft and the control surface on the aircraft. In addition to those basic four, you can control things like landing gears up and down, a switch for cutting the engine, bomb drops, and flaps.

The computerized radios can be used to link the control surfaces. On banking turns, you can link the rudder and ailerons. For stunt flying, you can turn the ailerons into "flap-erons" so that they act like flaps as well as ailerons. And you can link them to the elevator. For instance, when you pull the elevator full-up, you also get lift out of the flaps. That will cause the aircraft to do a very tight loop rather than a large-radius loop. The newer radios, the computerized ones, memorize all the settings for an aircraft. And they can memorize the settings for up to 16 different aircraft—you do have to add a plug-in module to get the second eight.

An aircraft has to be "trimmed" for flight. That means that you make minor adjustments in the control settings and such things as the low-idle speed on the engine. The radio transmitter remembers all these settings for each aircraft so that they don't have to be re-entered each time you fly that airplane. The most basic non-computerized radios still have the four basic controls and the ability to do all the

By Peter O'Dell, WB2D (<success@qth.com)

The pre-flight checkup includes tests to make sure every system on the airplane is working properly and will respond to commands from the ground. While Sandy is not a ham, there are hams who enjoy R/C flying, and a portion of the 6-meter band is devoted to "radio remote control."



The R/C control unit. This transmitter, which operates at 72 MHz, sends messages containing instructions on speed, steering, etc., to a receiver on board the airplane.

trim settings that you require, but none of it is in memory and none of the linkage between control surfaces can be done.

I don't know the range of these transmitters, but it is certainly beyond sight. You can be sure that you would still have control even if you no longer knew which way your aircraft was flying. Obviously, no pilot would ever intentionally let a plane fly out of sight.

CQ VHF: *How long can you stay up?*

Sandy: With the new battery systems, the transmitter can last an hour to an hour-and-a-half before needing recharging. The on-board batteries in the receivers last probably three-quarters to a full hour of flying time. Typically, each flight would last some where between 10 and 20 minutes, depending on the type of aircraft, the size of the fuel tank, the engine, and the skill of the pilot.

CQ VHF: *How big are the models?*

The smallest airplanes that I've seen controlled with the tiniest servos have about a 15-inch wingspan. Usually, these smallest ones don't have throttle control, but they do have the other three flying surface controls. And the largest ones that they fly now, I understand, are half-scale size. These are stunt aircraft. You can see them every year in Las Vegas at the tournament of champions. One-half scale would be in the vicinity of a 12-foot wingspan for those types of aircraft. The aerobatics aircraft themselves are not really that large.

Another Typical Ham Question

CQ VHF: *What kind of price ranges are we talking about for someone who wants to get started in model flying?*

Sandy: For someone who just wants to start? You can get a simple transmitter and receiver pair for about $130. The system comes with three servos and a battery and everything you need to get it in the first airplane. A basic kit for a beginner would start at around $70. They're called "almost ready to fly." It's probably the best way for a beginner to get going. It's the least expensive, and you can anticipate that there'll be a crash or two early on. So, it's relatively inexpensive to replace and does not require more than 20 hours or so to build. A good engine for a small plane runs around $120. There are engines on the market that are in the $60 to $80 range.

But my recommendation is to get something a little bigger, which adds a little to the overall cost. A bigger plane is easier to see as you fly it, and I think you learn faster when you can see it clearly.

So, you could get started for as little as $300 or so. But once you have flown for a year, you'd find that your transmitter was not giving you the type of performance for the things you would want to do, I'm sure. It is a bit of a tough call to make. If someone was making a commitment, he would probably spend closer to $600 to $700 to start.

It can be an inexpensive or hobby or a very expensive hobby, both in terms of money and time. There are people who build planes from scratch. That's a huge investment of time. And you can spend up to $2,500 on a radio transmitter. The old transmitters were crystal controlled. Now you have the synthesized transmitters that makes it easy to switch to a different frequency. But that's just the transmitter side of it. Most people leave a receiver in the plane once it's built. It's difficult and time-consuming to take a receiver out. So, I have 10 airplanes and 10 receivers, all for the same channel.

CQ VHF: *How did you get started?*

Sandy: I started with U-control, which is standing in the center of a circle with two lines controlling the elevator. The two lines just control the elevator, and you fly in a circle with these. That was back in the '50s. I was just married then and, with all the obligations of career and family, that went by the boards. Really, it never got off the ground. I always wanted to get back into it again, especially when I saw the digitally proportional radios that came out in the '70s. But, again, it takes a fair amount of time to build. And you have to be prepared to not only build, but also spend a couple of days a week flying them. So, when the kids grew up and got on their way, that's when I had the time to start building and flying. I think it was 1991. I started out with the very basic sort of system that I mentioned.

CQ VHF: *How many planes do you have now?*

Sandy: I have three here in Florida ranging from 47 inches to six feet in wing span. Up north, I have six. And in both places, I have one being built. [laughs]. There's always one under construction and a couple in a box that you haven't

opened yet. The one that I flew today [see photos] is just about 100 hours. I have spent up to 200 hours on a single model so far. Some of the bigger, easier-to-fly aircraft actually take less time to build. There's a kit series, and I have one of them, that has an 82-inch wing span. They only take about 60 to 70 hours to build, because they have foam wings and a lot of plastic components. But they really are nice flying airplanes.

What About Clubs?

CQ VHF: *What kind of organizations are around to support modelers?*

Sandy: Both the U.S. and Canada have national associations that support modeling. I believe that both organizations date back to just before World War II. Both have worked with the government to obtain certain frequency bands to use for flying. There are local clubs...all over North America. Also, it's not just limited to flying models. There are boat and surface models, also. The national associations control where the flying fields are located so that there's at least a five-mile separation between all fields. That's so the transmitters don't interfere with each other.

At each field, every frequency is controlled through the use of a board. Each flyer puts a pin on the frequency that he's using while he's flying. For voice communications, interference is annoying, but for modelers interference can be disastrous. Not only are their money and construction time at risk, but there's the whole issue of safety to people, animals, and property. The national association provides a couple of million dollars in basic liability insurance, which is a protection for each of the flyers and spectators at the field.

In the old days, there were no deductibles, but now there are. If your airplane hits someone's car, you probably have to pay most of that damage yourself. The spectators are kept away from where the aircraft are to be flown. Only pilots and their helpers are supposed to be out on the line where the aircraft are started. The pit area, as that's called, is separated again from the runways. And there is usually 100 feet or so of taxiway from the pit area to the runways. The use of the runway is controlled with a windsock. The direction of the wind determines the landing and take off direction.

Engines are not to be broken in—run for an extended period of time—in the pits. Each pilot is taught the basics of how to keep his fingers out of the propeller [laughs]. He's taught how to keep the aircraft immobile on the ground while he's working on the engine.

CQ VHF: *You have a very elaborate preflight procedure. Can you tell us about it?*

Sandy: That's right. There's a preflight check. You make sure your batteries are fully charged before you leave the house and then again at the flying field. Without extending the antenna on the transmitter, you go 60 to 70 feet from the aircraft with the antenna pointed away from the craft to make sure that all the

R/C Frequencies and Power Levels

The FCC generally limits radio control (R/C) transmitter power levels to 750 milliwatts (mW), according to Academy of Model Aeronautics (AMA) Technical Director Steve Kaluf, who notes that most R/C transmitters operate in the 300- to 400-mW range. He says there are R/C frequencies in five frequency ranges, some exclusively for model airplanes, some exclusively for "surface users" (R/C cars and boats), and some shared. No license is required, except, of course, for the 6-meter amateur band. He notes that there's been a slight increase in the number of R/C hobbyists getting their ham licenses since the code requirement for Technician class was dropped in 1991. While he doesn't have an estimate of the number of R/C hobbyists who are hams, Kaluf says his organization has over 160,000 members, and estimates that there are over 1 million R/C hobbyists in the U.S. alone.

Here's a rundown of R/C frequency ranges, with Kaluf's notes about them:

27 MHz (CB)—Shared air and surface

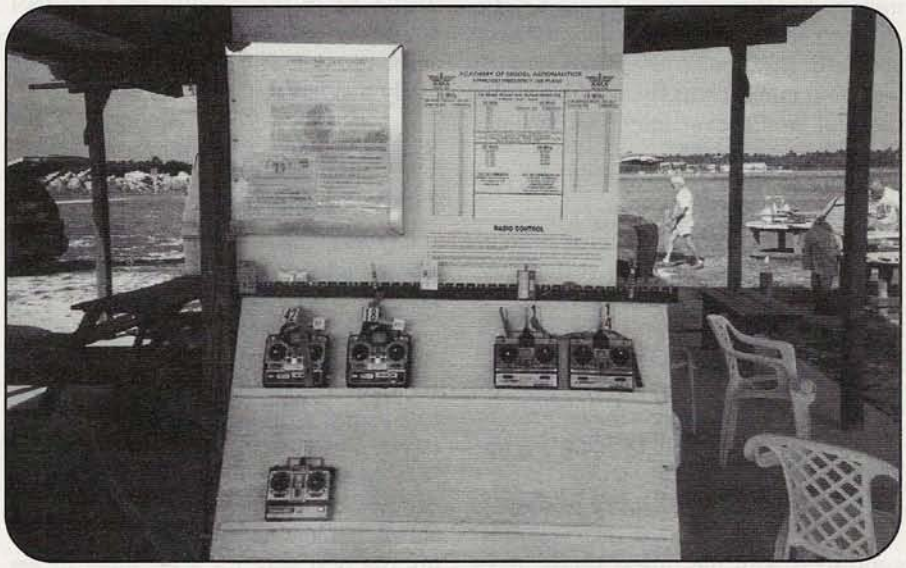
49 MHz—100 mW maximum; used mostly for telemetry

50/53 MHz (6 meters)—Ten narrow-bandwidth frequencies at 20-kHz intervals between 50.800 and 50.980 MHz; eight standard-bandwidth frequencies at 100-kHz intervals between 53.100 and 53.800 MHz (Steve wasn't sure of the bandwidth of a typical R/C control signal, or the differences between wide and narrow)

72 MHz—Primary model aircraft frequencies

75 MHz—Surface users (model cars/boats) only

Our thanks to Steve Kaluf of the Academy of Model Aeronautics for the above information. See "Resources" for how to get in touch with the AMA.



The control board. If you're not actively flying or checking out your plane, you leave your transmitter here to minimize the risk of accidental transmissions, which could result in interference and crashes. If you're flying, you clip your tag to a peg that marks which channel you are using.

Prepare for takeoff! Sandy taxis his plane across the field as it builds up speed for takeoff. R/C airfields must be sanctioned by the national association, which makes sure that no two fields are close enough to cause interference.

controls are functioning. With that check, you're pretty sure that you're not going to have a crash because of a weak transmitter or defective receiver. Before each takeoff, you stand behind the aircraft and function each and every control surface and the throttle to make sure that everything is operating in the proper direction and at the proper time.

On most fields, we're flying on rented property or something like a sod farm. The owners don't like to get the methanol-based or gasoline-based fuels on the ground. You can't see the tank as you're filling it, and you want to be sure that the tank is full, so you always fill it to overflow. So, each plane has a system to catch the overflow. When you start the airplane, you're starting it on a piece of carpet that will catch any drips and protect the ground from the muffler exhaust.

Tie downs are used to immobilize the aircraft when the engine is being started. This prevents the craft from lunging forward into the hands or body of the person starting the aircraft. On the small planes,

Post-flight cleanup and inspection. After each flight, you need to check for damage and give the plane a thorough cleaning to remove any oil, exhaust residue, and bug remains.

Mini-Glossary

Some of the terms used in this month's column may be unfamiliar to readers who aren't into the mechanics of flight or the workings of remotely controlled motors, so here's a quick mini-glossary:

Aerobatics—Aerial acrobatics or stunt flying.

Aileron—Control surfaces on the trailing edges of wings, used for turning an aircraft by increasing or reducing lift on one or the other wing.

Control surfaces—Movable parts of an aircraft's wings and tail, used to steer the aircraft in flight, both left/right and up/down.

Crystal—A precisely cut piece of quartz crystal that vibrates, or oscillates, at a specific frequency. Used as a means of frequency control in radio transmitters and receivers.

Elevators—Control surfaces on the horizontal stabilizers of an airplane's tail. They control the pitch, or up-down motion, of an airplane's nose.

Flap-erons—A combination of flaps and ailerons, used in stunt flying.

Flaps—Control surfaces on the trailing edges of wings, used during takeoff and landing to control lift. Flaps are used at low speeds while ailerons are used at higher speeds.

Lift—The upward force that allows an airplane to fly, caused by differences in air pressure below and above the surface of a wing.

RPM—Revolutions per minute.

Rudder—The movable part of the vertical stabilizer (fin) on an aircraft's tail. It moves the nose of the airplane left or right, and works with the ailerons to control turns in flight.

Servo—A remotely controlled motor.

Synthesizer—Modern means of frequency control in radio transmitters and receivers. A frequency synthesizer can produce signals at a variety of precise frequencies. Sometimes, a crystal oscillator is used to produce the reference frequency from which the synthesizer produces signals at other frequencies.

Throttle—A valve that adjusts the fuel flow into, and thus the speed of, an engine.

Trim—Making minor adjustments to the control surfaces of an airplane to balance it in flight.

Windsock—A fabric sleeve mounted on a pole that indicates wind direction and, very roughly, wind speed.

you simply hold the back of the plane, because the engines can start in reverse, which would cause the plane to back up. For the larger planes, you need a second person holding the back of the plane. If it does start up in reverse, it won't jump backwards. The larger aircraft with the gasoline engines start at a much lower RPM. Every once in a while someone leaves the throttle wide open on their transmitter and the engine starts at full RPM. That can be very startling! [laughs]

Safety First!

CQ VHF: *Would you say it's a very safety-conscious hobby?*

Sandy: It has to be. I've seen fellows without fingers. I've seen fellows who have lost the use of their fingers. And there actually have been a couple of deaths when propellers have flown off or broken while starting.

CQ VHF: *What kind of people have you met flying models?*

Sandy: It's a broad cross section. Up north, it ranges from land developers to store clerks. Down here, it's mostly retired folk who flew in WWII or Korea.

One determining factor is simply having the room to build something. You have to have a garage or a room that you can devote to the model in order to build and store or repair your airplane. That's about the biggest requirement that the hobby has. And there's the time factor. It takes time on a regular basis. Of the new people who join the hobby, about 30% seem to stay with it for the long haul. I think a lot of people are in a situation like

"There are local clubs...all over North America. Also, it's not just limited to flying models. There are boat and surface models, also."—Sandy Ewing

mine in the '50s. I wanted to stay with it then, but I just didn't have the time. But when my circumstances changed, I did come back. They'll be back, too, when circumstances permit. It is a very satisfying hobby.

Editor's Note: By now, you've probably noticed that this month's "Beginner's Corner" column really had nothing to do with ham radio. So why have it in a ham radio magazine? First and foremost, as Peter explained in the beginning, there are amateur frequencies (in the 6-meter band) set aside for R/C, and there are hams who use these frequencies for flying R/C craft. One of this magazine's goals is to cover all *aspects of VHF ham radio, of which this is one (in fact, we'd love to hear from some of you who are using 6 meters to fly planes). Secondly, if you read through Peter's interview, you'll see that the R/C folks have an awful lot in common with hams, and they are part of the much larger "radio hobby" that I discussed in last month's "Line of Sight." It will be to ham radio's benefit to build and strengthen bridges to our fellow radio hobbyists.* ■

Resources

There are local radio/control clubs all across the U.S. and Canada. The R/C equivalent of the ARRL is the *Academy of Model Aeronautics,* 5151 E. Memorial Drive, Muncie, IN 47302; Phone: (800) I-FLY-AMA (435-9262) or (765) 287-1256; Fax: (765) 289-4248; e-mail: <operator@modelaircraft.org>; WWW: <http://www.modelaircraft. org>. The AMA is also the publisher of *Model Aviation* magazine.

An independent publication is *R/C Modeler* magazine, P.O. Box 487, Sierra Madre, CA 91025; Phone: (800) 523-1736 or (818) 355-1476; Fax: (818) 355-6415; WWW: <http://www.magweb.com/rc-modeler/index.html>.

Q: I am trying to find information to help me convert a Motorola Motrac to 6 meters. I have several of these units, tech manuals, and crystals for 52.525 MHz (*the FM simplex calling frequency—ed.).*

I haven't been able to find anyone who can tell me what modifications I will have to make to the radio itself. Can you tell me who might be able to answer some of my questions? I appreciate any help you can give me. Thanks & 73,

Jim Seipel, KBØPTC
Colwich, Kansas

A: Jim—Recalling that, a few years back, some friends of mine converted a bunch of old Motorola gear to 6 meters, I forwarded your question to one of them, Bob Wilson, N2DVQ. Here's his reply:

I have worked on a couple MoComs (very nice radios) as well as a few Mitreks, but have never been inside a MoTrac. We converted MiCors to 6 meters. It was, to be concise, a pain.

Many of the transformers had to be opened and have a few turns removed. This required removing the cans surrounding them. There were also capacitors that needed to be changed—not an easy job for an inexperienced "kit builder." Of the five MiCors that were modified, only one remains in service. It is the receiver at our 6-meter repeater.

A general word of caution: these early radios typically came in two or three frequency ranges. The models centered below 40 MHz will not convert to 6 meters; the highest frequency models will, though, with results directly proportional to the time spent. It is not a project for the weak of heart.

Q (The following question was directed to "Digital Data Link" editor Don Rotolo, N2IRZ):

I am interested in setting up a packet system. I have an AEA PK-87 loaner (probably a keeper with the lack of interest in packet from this person and the general area).

I am looking for software that will run on a 286 with 512K of RAM. I originally was looking for "Packrat," but couldn't find it on the Internet. Would you have any suggestions and sources on this or other programs that will work with my configurations? Although I don't subscribe to any ham magazines, references to previous articles would be fine.

Any encouragement would also be welcomed as there is little interest in packet in my area anymore, thanks to the Internet. I am even concerned about getting out, as all of the machines I know of are down or go nowhere. I know of one person who is getting to packet through the Internet (Bloomington, Indiana) because of the lack of interest. When I mention packet to most hams, they just laugh and refer to the Internet. Is this a waste of time? It seems many hams are leaving the hobby because of the Internet!

Thank you for your time.

Mike Stephan, KB9MDQ
Tippecanoe, Indiana

A: Don's reply:

Dear Mike—I'll let you in on a secret: I enjoy helping people enjoy packet, so it's more than a pleasure to hear from you. Packet used to be a lot more popular than it is now. I see it eventually becoming just another mode of operation, like CW or RTTY. Yes, the Internet has taken a huge percentage of the hams away from packet, but, in the early days, there was no alternative, no Internet. Now, all the folks who really wanted some form of data communications have left for the Internet, which is faster/better/cheaper. The only folks left on Packet are the real pioneers—those who find packet more than just a way to move data, but a challenge. Clearly, moving data on a routine basis is best left to the wirelines.

If you enjoy learning just how a data network works, not just the theory, but the real-world problems, too, then packet is for you. If you get your fun out of doing new and exciting things, you might find something in packet.

Emergency preparedness folks like packet, too, because it's just perfect for moving lists of things and people, with no errors and quickly. Even 1200 baud is a ton faster than voice or CW. With the movement towards PCS (Personal Communications Service) and wireless data stuff in the commercial world, people who understand RF and data networks are in very high demand (maybe a career?). High-speed data is so much like black magic, that it can be fun to play with, too. It certainly isn't the Internet—but, if you can find a group of folks, all on packet, with whom you enjoy trading messages with, then Packet might be a useful addition to your enjoyment of ham radio.

Most of all, I urge you to at least try it and see what's out there. You might be disappointed, but you also might be able to form a small group with some locals that makes it fun.

On to your specific question: At home, my regular packet TNC is a PK-232 (an ancient one) running PC-PakRatt. It is copyrighted and not shareware or freeware—that's why you couldn't find it on the Internet. It is sold by Timewave (http://www.timewave.com), but the Web site there shows only PC PakRatt for Windows. Write to them, maybe they still have the DOS version in stock. Otherwise, you might be able to find a copy locally. Oh, and I run it on an 8086 machine, so it should scream on a '286. I've tried a few, and I still like it best.

Although Packratt makes packet a lot more convenient, there are other programs that are shareware or freeware that will run just fine on your 286. The simplest program would be any "terminal" program—the kind designed for use with a phone modem. ProComm, BitCom, and Crosstalk are commercial products that come to mind, but there are literally thousands out there. You might have to look at flea markets or used computer stores for a DOS version, though. I looked in CompuServe's HamNet, and found a number of programs specifically for AEA TNCs, but they were all for Windows. There were an even larger number of plain-to-not-just-plain terminal programs for DOS, but nothing specific to AEA.

You can try the BayCom terminal program from <http://www.baycom.de>, which is fairly nice shareware. GraphicPacket is a very popular program with a lot of features, and it's available on HamNet as shareware.

If that's not enough to get you started, write back.

73, Don Rotolo, N2IRZ

Do YOU have a question about any aspect of "Ham Radio Above 50 MHz"? We'll do our best to give you a clear, concise answer—or if it's not a question that has just one easy answer, then we'll invite readers to offer their solutions. Send your questions to: Q & A, *CQ VHF* magazine, 25 Newbridge Rd., Hicksville, NY 11801; via e-mail to <CQVHF@aol.com> or <72127.745@compuserve.com>; or via our Web page at <http://members.aol.com/cqvhf/>. Be sure to specify that it's a question for "Q & A."

A QRP Mod for the Yaesu FT-290 and a 2-Meter "JBeam" Antenna

Give your FT-290 a 10-watt output option for QRP operating or to drive an amplifier. Then, build a directional J-Pole antenna to give your HT more "talk-power."

Editor's Note: The process of finding a successor to Dave Ingram, K4TWJ, for the "Project Corner" column (after he took over the monthly "How It Works" column) took a little longer than expected. We hope that our new "Project Corner" columnist will be fully on-board by the September issue. Meanwhile, we've asked "Magic Band Chronicles" columnist Ken Neubeck, WB2AMU, and Ed Bathgate, N3SDO, to fill in this month with a couple of 2-meter projects.

Ken's project is for the 2-meter SSB/CW operator who owns a Yaesu FT-290 multimode radio and wants more flexibility in its power output. And Ed's "JBeam" antenna blends the classic J-Pole with a Yagi to produce a vertical antenna with considerable gain... for only about $15!

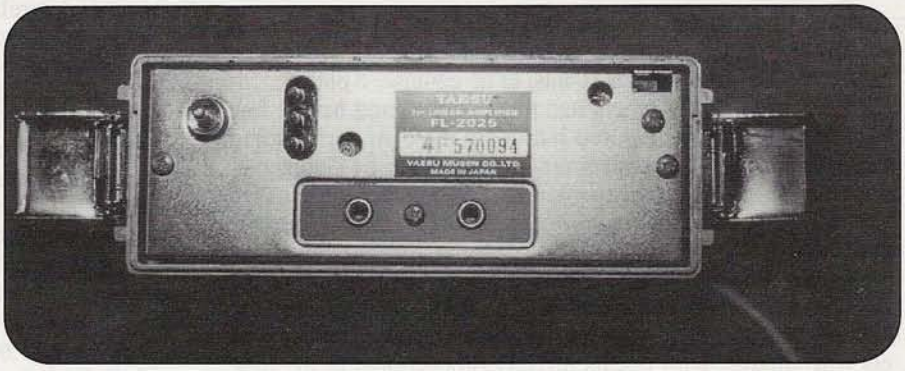


Photo A. The patient prior to surgery! This is the FL-2025, the linear amplifier attachment that connects to the front of the Yaesu FT-290 II transceiver. Output power can be reduced from 25 to 10 watts by adjusting one potentiometer—but it's not as easy as it seems. Start by removing the two Phillips head screws that hold the cover plate onto the circuit board inside. (Photos by the author)

Modifying the FT-290 2-Meter Transceiver for Low-Power Use

Whether you want to operate "QRP" in the next contest or have the right amount of power for your FT-290 to drive a "brick" amplifier, this mod will be worth the effort.

By Ken Neubeck, WB2AMU*

In the February, 1998, issue of *CQ VHF*, I wrote a 10-year review on the Yaesu VHF portable series, the FT-690 II (6 meters), FT-290 II (2 meters) and FT 790 II (70 centimeters). In this review, I pointed out that the linear amplifier attachment for both the FT-290 and FT-790 (when attached to the front end of the rig) will put out 25 watts. The only other power output setting is 2.5 watts, which you get when running in the low-power mode with the linear amplifier attached but out of line, or by attaching the front end of the rig to a battery pack.

As noted in that article, 25 watts is too high a power level for input into a number of commercially made linear amplifiers for 2 meters, which commonly accept a maximum input of only 10 watts. At the other end of the power spectrum, hams using the rig when operating in the QRP (low power) category in most VHF contests would have to run the FT-290 or FT-790 in the battery mode—with only 2.5 watts out—as the 25-watt high-power level exceeds the VHF QRP criteria of 10 watts output.

I can tell you from experience that running 2.5 watts on 2 meters during a VHF contest, even with a directional antenna, can be a *real* challenge! You can generally work the surrounding grid squares, but getting into areas two grids away is tough with just 2.5 watts! Often, you end up using CW to complete contacts.

It would really be great, I thought, if I could somehow get a 2-meter rig with 10 watts out, a gain of four times the power, or 6 dB, over my 290's 2.5-watt QRP output. My friend, Joe, W1JN, then asked me

"I can tell you from experience that running 2.5 watts on 2 meters during a VHF contest, even with a directional antenna, can be a real challenge!.... Often, you end up using CW to complete contacts."

Ken Neubeck, WB2AMU, is a CQ VHF Contributing Editor.

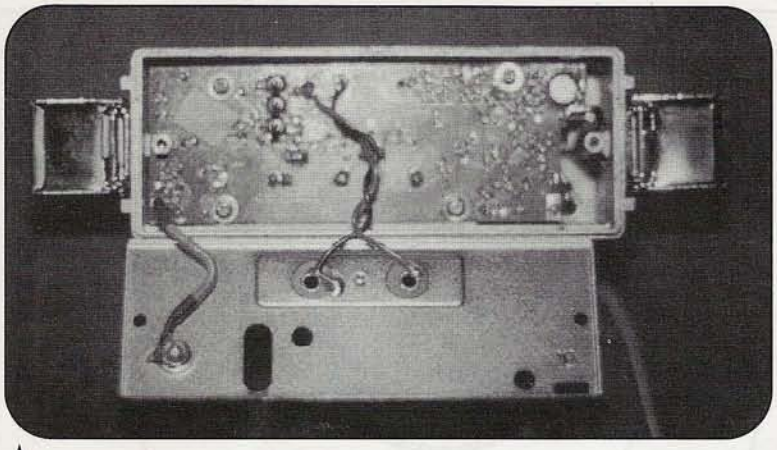


Photo B. Removing the cover plate reveals the FL-2025 PA (power amplifier) board. The part we need to adjust is on the back of this board, which cannot be completely removed from the unit. See text for details, and be careful not to stretch the wires when moving this circuit board.

Photo C. The highlighted area shows the potentiometer, VR02, that needs to be adjusted to lower the amplifier's power output. Turn it counterclockwise only 1/16th of a turn. The circuit board can't be pulled out much farther than this, and you might want to have a friend hold the board steady for you while you adjust the pot.

the obvious question: can the power output of the FT 290 be adjusted to 10 watts output in order to meet the needs described above?

Searching for Answers

In searching for answers to this problem, I contacted Chip Margelli, K7JA, from Yaesu and asked him if there was an easy way to adjust the power output on the FT-290. He said that a good place to start was with the amplifier's ALC (Auto-matic Level Control) circuit and to first try adjusting the potentiometer in this circuit (VR02 on circuit board FT-2025). This will work, but it's not as simple as it might seem at first, because VR02 is on the *bottom* (interior) side of the circuit board—and the board cannot be removed completely, so you'll have to do some careful surgery to get the desired results.

A strong word of caution: *If your rig is still under warranty and you don't have much experience in, or equipment for, working on RF circuits, you probably should not try to make this modification.* However, if you're a QRP operator, you probably have some experience in building circuits and modifying the FT-290's amplifier for 10 watts out will be worth the effort for you.

Making the Mod

To make this modification, you'll need an accurate VHF power meter and dummy load in order to measure the unit's power output when the ALC is adjusted. I was fortunate enough to have access to a combination dummy load/ power meter that's very accurate in the VHF range. You'll also need a Phillips head screwdriver, a small crescent wrench, and a small slotted screwdriver.

Referring to Photo A, remove the two screws that hold the outside plate to the linear amplifier circuit board (FT- 2025) inside. When you get to what's shown in Photo B, you'll see four Phillips head screws and one hex post that have to be removed from the circuit board. There are also two Phillips head screws that hold the chassis to the heat sink of the circuit board; remove these, too.

Before moving on, let me reiterate that the FT-2025 circuit board cannot be pulled out completely from the housing because one end is attached to an inductor (coil L08) that's soldered to the outside antenna connector. You'll be only able to lift one end of the circuit board from the housing and you must be *extremely careful* not to break coil L08. By holding the board open just far enough, you can access VR02 (a 47K-ohm pot) with a slotted screwdriver, as shown in Photo C.

You only need to turn this pot *1/16th of a turn* counterclockwise. If you turn too far, the power level will drop too much. After you turn the pot, you'll have to carefully reassemble everything and then measure the power output. It took me three rounds of disassembling and reassembling the unit before I was able to get the power level set to 10 watts. (This was before I knew that I only had to turn the pot only 1/16th of a turn, so it should be easier for you).

Now I have a radio that's compatible with the QRP rules of the VHF contests as well as with most commercial amplifier inputs for when I want to go QRO (high power) instead of QRP! Now I'm ready to go with my mighty 10 watts on 2 meters for the next VHF contest!

It Works on the 790, Too

The Yaesu FT-790 II can be also modified to yield 10 watts output by following the same procedure described above. The only difference is that the circuit board holding the pot to be adjusted (still VR02) is identified as FT-7025 instead of FT-2025. Again, caution is the word in disassembling the unit.

"You only need to turn this pot 1/16th of a turn counterclockwise. If you turn too far, the power level will drop too much. After you turn the pot, you'll have to carefully reassemble everything and then measure the power output."

The JBeam Antenna

Now you've probably heard of a beam antenna, and maybe you've heard of a J-Pole. But what's a JBeam? Read on to find out. You might want to build one!

By Ed Bathgate, N3SDO*

JBeam? What's a JBeam? Blended Scotch Whiskey? Wrong!

It's a vertical directional antenna made of copper pipe and wood or PVC. It uses a so-called "copper cactus" J-Pole antenna as the driven element and center support, with two parasitic elements—a reflector and a director—to provide directivity and gain (see Figure 1). The antenna can be easily supported by inserting the bottom of the J-pole into either a metal or non metal mast. The JBeam design is useful for a rugged, low cost, quick-setup portable beam for fixed or emergency use. I built the prototype for about $15.

There are dozens of variations on J-Pole antennas, different feed methods, J-spacings, etc. But they all have the 1/2-wave top radiating element in common. If you already have a J-Pole built, you should be able to use it as the basis for a JBeam, but you'll probably need to shorten the main 1/2-wave element by 1 to 2 inches, as the reflector and director tend to couple and lower the resonance of the 1/2-wave element in the J-Pole toward the lower part of the band. A small pruning, 1/2-inch at a time, should bring the SWR (standing wave ratio) back down in the center and upper parts of the band. You shouldn't have to adjust the matching stub, as this is not strongly affected by the parasitic elements.

Design Details and Drawbacks

The element lengths and spacings are a combination of information from the *ARRL Antenna Book* section on 2-meter Yagi antennas, and from experiments performed with a field strength meter and different length elements and spacings. The reflector and director element spacings are equal at 16 inches. You can get slightly higher gain with a reflector spacing of 18 inches from the driven element and a director spacing of 14 inches, but my copper-pipe prototype tended to lean with the unequal spacings so I sacrificed a little bit of gain for greater stability.

The antenna does have a few drawbacks, of course. The bandwidth of the JBeam is not as wide as that of the J-pole alone! The SWR tends to go up faster on the band edges. I trimmed mine to work best in the upper part of the band, but you get an estimated 7 dB gain and 20 dB F/B (front-to-back) ratio, so the compromise seems worthwhile! Finally, high wind loading could potentially break off the

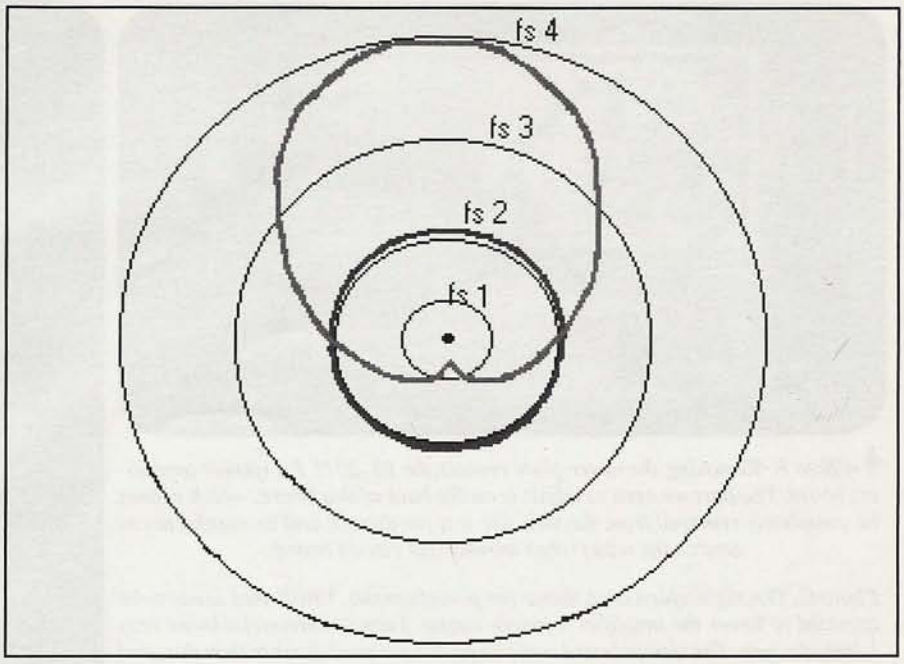


Figure 1. Radiation pattern of the JBeam antenna (looping out to the circle marked FS4) compared with that of a traditional omnidirectional J-Pole (the tight near-circle around FS2). This is based on actual measurements taken with a field strength meter.

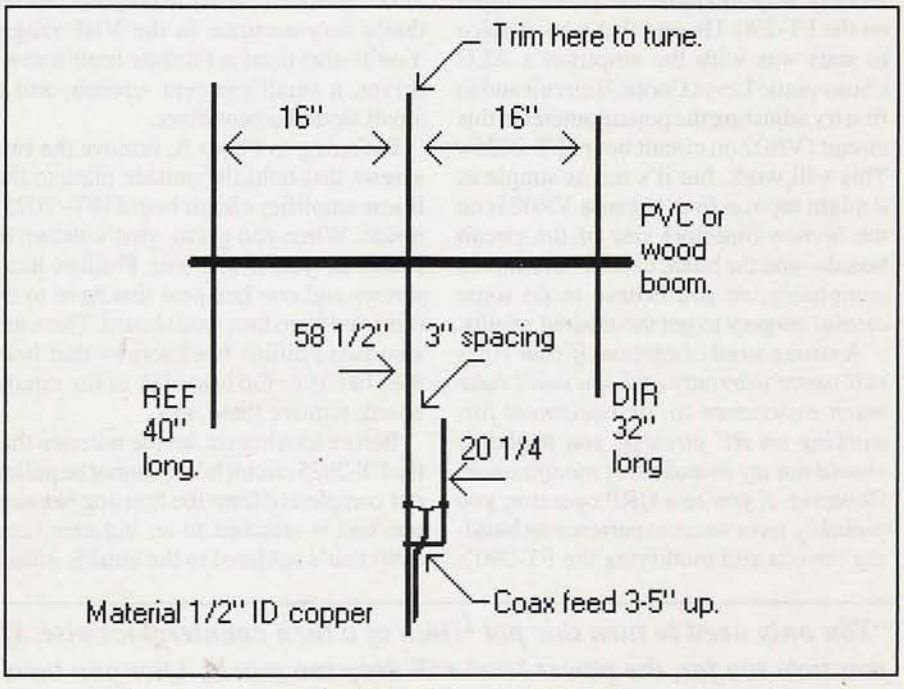


Figure 2. Dimensions and spacings for building the N3SDO JBeam antenna. These dimensions are for 1/2-inch copper pipe elements; they may vary slightly if you use other materials. See text for details.

**Ed Bathgate, N3SDO, has been an amateur radio operator since 1994. He lives in western Pennsylvania.*

JBeam at the bottom joint since the entire structure is supported by that point. You may want to consider reinforcing it.

Construction

I've included J-Pole measurements to allow you to build this antenna from 1/2-inch copper pipe, or you could add the director and reflector to that spare J-Pole sitting in the garage. I chose copper pipe for the prototype because my local hardware store didn't stock aluminum tube. I used one copper "Tee" and one 90-degree elbow. Construction is via soldered joints made with a blowtorch.

The long element of the J-Pole is 58 1/2 inches, the matching stub is 20 1/4 inches, the spacing between the two is 3 inches, and the coax feed point is between 3 and 5 inches up from the base (see Figure 2). I recommend using hose clamps to attach the feed line, as it makes adjustment/repair easier.

The center boom is a piece of 1/2-inch by 1-inch wood or PVC pipe. I drilled 5/8-inch holes in the wood boom to allow it to slide over the top of the J-Pole driven element and stop halfway down on top of a hose clamp with a screw clamped alongside the copper J-Pole element to make a "keyway" to lock the boom facing forward. I used a 1/4-inch drill bit to drill an "Egg shape" to the center hole of the wood boom to make the keyway for the screw. Two 5/8-inch holes drilled 16 inches from the center hole allow the reflector and director to drop in from the top after the boom is on the J-Pole "driven element" in the center.

"I used electrical tape around the reflector and director so I can drop them in from the top without sliding out the bottom; screw-tightened hose clamps can also be used. I can pull the pieces out of my truck and assemble the prototype in under one minute."

The reflector element is made from the same 1/2-inch copper water pipe, cut 40 inches long and spaced 16 inches from the J-Pole. The director element is also 1/2 copper pipe and is also spaced 16 inches from the J-Pole. The only difference is that it is 32 inches long. I used electrical tape around the reflector and director so I can drop them in from the top without sliding out the bottom; screw-tightened hose clamps can also be used. For portable operation, I can pull the pieces out of my truck and assemble the prototype in under one minute.

A side note: I noticed a bit of gain in the direction of the J's matching stub, so I took advantage of this natural directivity of the J-Pole by facing the stub toward the director.

Try It Your Way!

This is a "try-it-your-way" project. You could build this type of antenna out of aluminum, stainless steel rod, flexible wire, or twin lead supported by wood or PVC. You may need to adjust the element lengths for different construction methods, but once you find the correct lengths, it will work nicely.

One fellow built one with five elements—just cutting the extra directors shorter by eye—and was able to work a repeater 35 miles away, with a 5-watt HT holding the antenna, from a valley that's hard to get out of with 50 watts and an omnidirectional antenna at 30 feet! ■

A Question of Leadership at the ARRL

A longtime supporter of the American Radio Relay League says the organization's elected leadership needs to become leaders of the hobby as well as representatives of their members.

By Jim Kelly, KK3K*

First of all, I'm not an ARRL basher. Rather, I'm a longtime League member, and I want to urge you to join the ARRL if you're not already a member, or to renew your membership if you are. However, I want to outline what is wrong with the ARRL, in my view, and suggest how to fix it.

We all know by now that ham radio is under siege by interests that have their eyes on our precious frequencies. We also know that there is strength in numbers and that we need a national organization to represent hams and fight for our interests. While the ARRL represents only a fraction of licensed hams, it is our one and only viable national ham organization. Does the League always do what we'd like it to do? Of course not, but it is fighting for our frequencies and it is trying to do what is best for the future of ham radio. Also, the ARRL is a democratic organization, which means that members can have an input into League policy. These are the reasons I feel you should join or renew your ARRL membership.

Democracy and the League

I support the ARRL, but there is a serious problem at the League. I'm a political scientist by training, and here we get into a particular interest of mine, namely *democratic theory*. Since the ARRL is a democratic organization, the members elect the directors of the League, who, in turn, determine League policy. This is what is known as *representative democracy*, a form of democracy which provides an answer to the problem of how to democratically govern large entities that are too big for pure *direct democracy*, in which everyone meets, considers, and votes on each issue of concern. New England town meetings are classic examples of direct democracy. Our country's founding fathers thought representative democracy was a good idea because that's the form of government we have here in the U.S. But, here's the rub...

Representative democracy is an imperfect form of democracy. There are problems with it, particularly for elected representatives themselves. Before they vote on an issue, they often have to weigh and choose between what is good for the country as a whole and what is good for their constituents. And sometimes the two interests collide.

Here's an example: Polls might show that citizens of a tobacco-producing state are opposed to the regulation of tobacco. However, given the well-established fact that smoking is a health hazard, senators and representatives from tobacco-producing states must—when voting on tobacco-related legislation—balance the wishes of their constituents against the best interests of the whole country. If they decide that regulating tobacco is an overriding national interest, then they must have the courage to do the right thing for the country, even at the risk of incurring the ire of their constituents.

This example demonstrates that, in a representative democracy, elected representatives cannot simply vote the way the folks back home want them to, on every issue. They must also consider what is in the best interest of the nation. From time to time, elected representatives must use their own best judgment, balancing the wishes of their constituents against what is good for the country. To be sure, this is a tricky proposition, but it is the way representative democracy works. Except in Newington.

"[Most ARRL directors] think they're being democratic by following the wishes of the majority of the members in all cases; but, in doing so, they are abrogating their responsibility as leaders to balance the interest of League members against what is best for ham radio as a whole."

Followers, Not Leaders

According to the ARRL charter, the League is dedicated to all amateurs ("of, by, and for the radio amateur"), and to the health and welfare of the entire ham radio hobby, not just League members. Since the ARRL is organized along the lines of a representative democracy, when we members elect ARRL directors, we should be electing leaders capable, when necessary, of balancing the expressed wishes of the members against what is good for the hobby as a whole, and of formulating League policy using their own good judgment. Unfortunately, this is not how most ARRL directors currently function. Instead, they are followers who formulate policy and vote in lockstep

*Jim Kelly, KK3K, lives in Philadelphia, Pennsylvania, where he is an active ham and a Ph.D. candidate in political science at Temple University.

"Directors must lead, they must be independent, they must use good judgment, and have the courage to occasionally go against the wishes of the members when the good of the hobby is at stake."

with the wishes of the majority of ARRL members. They view their role as mere delegates, surrogates for the membership; as followers rather than leaders, and their job—as they see it—is simply to vote in accordance with the wishes of the majority of ARRL members in their divisions, or the majority of ARRL members as a whole.

League directors suffer from a naïve misunderstanding of their role as elected leaders in a representative democracy. They think they're being democratic by following the wishes of the majority of the members in all cases; but, in doing so, they are abrogating their responsibility as *leaders* to balance the interest of League members against what is best for ham radio as a whole.

Followers Produce Backward Policy

ARRL directors should be prepared to do what is best for the hobby, even if it occasionally means disregarding the wishes of the membership. Directors must lead, they must be independent, they must use good judgment, and have the courage to occasionally go against the wishes of the members when the good of the hobby is at stake. What is really wrong with the ARRL is that it does not function like a real representative democracy with elected representatives who lead rather than follow.

We see the result of this in terms of backward ARRL policy positions on such issues as maintaining the current code requirements, for example, which a majority of ARRL members apparently favor (according to a poll conducted by the League), but which many, if not most, astute observers within the hobby—possibly including the president of the League itself—see as an anachronism.

The Fix

This problem *can* be fixed. ARRL directors must be made to understand that they are trustees in whose hands the future of our hobby rests, at least in this country. Like our elected representatives in government, League directors are empowered to make tough decisions. However, they must have the courage to lead, and this means occasionally bucking the membership when they believe that doing so is in the best interests of the hobby. This is not undemocratic. Remember, directors must stand for re-election.

This fix can either be top-down (for example, a dynamic leader might emerge on the ARRL Board of Directors and chart a whole new progressive course for the future), or bottom-up, meaning that forward-thinking League members will have to be more active and vocal. They will have to apply pressure on the directors to act like leaders rather than followers, to be more courageous, independent and forward-thinking.

The Future

The American people respect an elected leader who does what he or she thinks is right, even if it is unpopular (consider, for example, Harry Truman). If League Directors demonstrated more courage, independence, dynamism, and real leadership, then the League might very well earn the respect of more amateurs, shed its stodgy, conservative image, attract more members and become a more powerful advocate for our hobby.

Can League members somehow make this happen and convince ARRL directors to act like leaders rather than followers? I hope so. The future of ham radio may very well depend on it.

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The opinions expressed in this column are those of the author and do not necessarily reflect the views of CQ VHF *or its publisher, CQ Communications, Inc.*

If you have an opinion on this issue or another matter of importance to the VHF ham community, we'd like to hear from you. Well-reasoned, well-written commentaries will be considered for our Op-Ed page. If we publish your Op-Ed article, we'll give you a complimentary one-year subscription (or extension of your current subscription) to CQ VHF. *Submissions not accepted for the Op-Ed page may also be considered for Letters to the Editor.* CQ VHF *reserves the right to edit all submissions for length and style.*

Hamfest Calendar

The following hamfests are scheduled for July, 1998:

July 4, 26th Annual firecracker Hamfest, Monagahan Fire Hall, **Dillsburg, PA**. Talk-in: W3UU, 145.16/76 MHz. For information, contact HRAC AnswerLine (717) 232-6087; <fabinfo@fabral.com>; N3NJB@JUNO.COM>. (exams)

July 5, Hamfest, Columbiana County Fairgrounds, **Lisbon, OH**. Talk-in: 146.70 and 146.805. For information, contact Dick Sisley, K8JKB, 1218 Northside Ave., East Liverpool, OH 43920, (330) 385-1245.

July 10–12, 35th Annual International Hamfest, International Peace Garden, **between Boissevain, Manitoba and Dunseith, ND**. For information, contact Dave Snydal, VE4XN, or Lynn Nelson, WØCQ.

July 11, 24th Annual Ontario Hamfest, Milton Fairgrounds, **Milton, Ontario, Canada**. Talk-in: VE3 RSB 147.21 & Simplex 146.52. For information, contact Burlington ARC, P.O. Box 85037, Burlington, ONT, L7R 4K3; <www.bigwave.ca/ ~ve3coj/barc/> or VA3LOR Lorne (905) 336-2999; e-mail: <ve3coj@bigwave.ca>.

July 11, Monroe County ARC Hamfest, The National Guard Armory, **Tompkinsville, KY**. Talk-in: 146.775. For information, call J. Bunch (502) 678-5784; or e-mail, David Welch, K4PL, at <dwelch@glasgow-ky.com>. (exams)

July 11, Firecracker Hamfest, Salisbury Civic Center, **Salisbury, NC**. Talk-in: 146.520 simplex. For information, contact N4KVF-Walter (Alligator) Bastow, 3045 High Rock Road, Gold Hill, NC 28071; or call (704) 279-3391. (exams)

July 11, 29th Annual Swapfest, American Legion Post #434 grounds, **Oak Creek, WI**. Talk-in: 146.52 simplex. For information, contact S.M.A.R.C., P.O. Box 102, South Milwaukee, WI 53172-0102.

July 11, Swap and Shop, Emmet County Fairgrounds, **Petoskey, MI**. Talk-in: 146.68- & 146.52. For information, contact KA8TIL (Clark) (616) 582-6455. (exams)

July 12, SweatFest '98, Brunswick, MD. For information, contact MADRA SweatFest '98, (301) 473-4151; e-mail: <madra@qsl.net>; Web: <www.qsl. net/madra>. (exams)

July 12, Valley Forge Hamfest, Kimberton, PA Fire Co. Fairgrounds, **Kimberton, PA**. Talk-in: 146.835/- and 443.80/+ CTCSS 131.8. For information, contact Bob Haase, W3SA, 674 Valley View La., Wayne, PA 19087, (610) 293-1919; or e-mail: <wb3joe@voicenet.com>; or write MARC, P.O. Box 352, Villanova, PA 19085.

July 12, 13th Annual Hamfest, Northland Public Library, **Pittsburgh, PA**. Talk-in: 147.09, W3EXW North Hills Club Repeater. For information, contact Bob Ferrey, Jr., N3DOK, at 871 Rosalind Rd., Pittsburgh, PA 15237, (412) 367-2393; e-mail: <n3dok@pgh.net>; Web: <http//nharc.pgh.pa.us>.

July 12, 20th Annual Hamfest, Sussex County Fairgrounds, **Augusta, NJ**. Talk-in: 147.300 and 224.50 repeaters and 146.52 simplex. For information, contact Daniel Carter, N2ERH, 8 Carter Lane, Branchville, NJ 07826, (973) 948-6999.

July 18, Sugar River Amateur Radio Festival, Newport Town Common, **Newport, NH**. Talk-in: 146.76 repeater and 146.52 simplex. For information, contact Rob, N1CIR (603) 863-5383 or 146.76 repeater, <N1CIR@WA1WOK.NH>. (exams)

July 18, Cleveland Hamfest, Bradley Central High School, **Cleveland, TN**. Talk-in: 147.180(+) or 146.925(-) MHz. For information, contact David Evans, WD4EZC at (423) 472-1421 or Bob Gault, KD4NEC at (423) 479-6260; write to Cleveland Amateur Radio Club, P.O. Box 2683, Cleveland, TN 37320-2683; e-mail: <carc@rocketmail.com>.

July 18, 26th Annual Cary Mid-Summer Swapfest, Cary Community Center, **Cary, NC**. Talk-in: 147.15+. For information, contact Cary Amateur Radio Club, P.O. Box 53, Cary, NC 27512. (exams)

(Continued on page 81)

Special Event

July 11, Rare VHF grid square FN40 will be activated to coincide with the July 1998 CQ World Wide VHF contest weekend. The Candlewood Amateur Radio Association, in Danbury, Connecticut, will set sail for grid FN40 located just off the eastern tip of Long Island, New York, on July 11, 1998. Operation will begin before the contest period at 1300 UTC and conclude at 2359 UTC, Saturday only.

The club call, W1QI, will operate simultaneously on the 50-, 144-, 220-, and 432-MHz bands, using SSB primarily, with some CW and FM. Output will range from 50 to 150 watts to single Yagis. Additional plans and operating details may be found on the CARA Web page at: <http://www.danbury.org/org/cara/>.

VHF Conference

July 23–26, Central States VHF Society 1998 Conference. Adam's Mark Hotel, Kansas City, MO. Featuring technical sessions, antenna gain and noise figure measurement, flea market, banquet, family and youth programs. For latest information, visit the conference Web page at: <http://www.csvhfs.org/CSVHF98.HTML> or contact CSVHFS President Denise Hagedorn, AJØE, via e-mail at <AJØE@csvhfs.org>.

Operating Notes

For late June and July, 1998:

June	
27-28	ARRL Field Day
29	Good EME conditions
July	
4-5	RSGB (Great Britain) VHF National Field Day; Various European National VHF Contests
11-12	CQ World Wide VHF Contest (see rules, this issue) Internet 6-Meter Contest (see rules, this issue)
26	Good EME Conditions
28	Delta Aquarids meteor shower peak

EME data courtesy W5LUU. More contest info is available on the CQ VHF *web page at:* <http://members.aol.com/cqvhf/navhfcon.htm>.

1-800-647-8324

July 19, Tailgate Electronics, Com-puter and Amateur Radio Fleamarket, Albany and Main St., **Cambridge, MA**. Talk-in: 146.52 & 449.725/444.725 - pl 2A - W1XM/R. For information, call (617) 253-3776.

July 19, 11th Annual Hamfest, Van Wert County Fairgrounds, **Van Wert, OH**. Talk-in: 146.850/.250. For information, contact Bob, WD9LPY (419) 238-1877 after 5:00, (after July 6, call (419) 795-5763). (exams)

July 19, Fox River Radio League Ham fest, Waubonsee Community Col-lege, **Sugar Grove, IL**. Talk-in: W9CEQ - 147.210(+600) (PL 103.5/107.2) AFAR. For information, contact James Von Olnhausen, N9UZC, c/o FRRL, P.O. Box 673, Batavia, IL 60510; (630) 879-3042; e-mail: <n9uzc@amsat.org>. (exams)

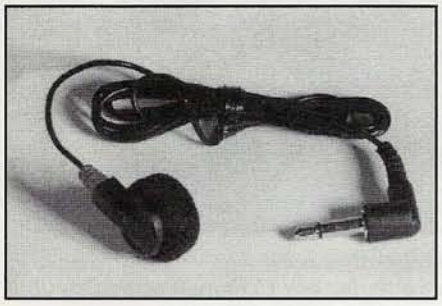
July 24–26, Fort Tuthill Hamfest/ Arizona State Convention, Coconino County Fairgrounds, **Flagstaff, AZ**. Talk-in: 146.980 (requires 100Hz PL). For information, contact ARCA of Arizona, (602) 779-2722. (exams)

July 25, 23rd Annual Hamfest, Haywood Cnty Fairgrounds, **Asheville, NC**. Talk-in: 146.76 and 146.91. For information, contact Chet Allen, KE4VXC, (828) 258-3954; e-mail: <KE4VXC@Juno.Com>. (exams)

July 25–26, Ham Holiday '98/ARRL State Convention, Oklahoma State Fair Park, **Oklahoma City, OK**. Talk-in: 146.82. For information, see CORA Web site at: <www.geocities.com/heartland/ 7332>. (exams)

July 26, 8th Annual Hamfest, Park Lane Center, Fairgrounds Rd., **Paulding, OH**. Talk-in: 146.46/46 S, 146.865/265 R. For information, contact Jerry, KB8MAF, Hamfest Chairman PCARG Inc., P.O. Box 86 or 10392 S.R. 500, Paulding, OH 45879, (419) 399-4507; or e-mail: <JLRHOD@BRIGHT.NET>.

Product Update *(from page 11)*



phone that lets you listen to your radio and still carry on a conversation with the people around you. It comes with a comfortable foam earpiece that fits securely in your ear—one size fits all.

A durable 39-inch cord with extra protective plastic at the bend points will provide years of use. The MFJ-2911 is suitable for ICOM, Yaesu, Alinco, ADI, RadioShack and other compatible transceivers. MFJ-291K is for Kenwood and compatible handheld transceivers.

Suggested retail price for the MFJ HandyPat™ Earbud Earphone is $4.95.

To order or for your nearest dealer, call (800) 647-1800; Fax: (601) 323-6551; E-mail: <mfj@mfjenterprises.com>; or check out dealer and ordering information on the MFJ Web site: <http://www.mfjenterprises.com>.

Circle 102 on reader service card

Two New Books From Prompt Publications

RadioScience Observing, Volume 1, by Joseph J. Carr, K4IPV: RadioScience observing is a phrase given to the practice of observing science with the assistance of radio frequencies. It includes such diverse topics as radio astronomy, spheric hunting, and meteor detection by radio. Author Joseph Carr, a *Popular Communications* columnist and *CQ VHF* author, has written this book to provide an introduction to the field, with more in-depth studies to follow in future volumes.

The main focus of the book is the amateur scientist who has a special interest in radio. It is also designed to appeal to amateur radio enthusiasts, shortwave listeners, scanner owners, and other radio hobbyists. The book comes with a CD-ROM containing numerous examples of radio frequencies so you can learn to identify them. It also contains detailed information about the sun, planets, and other planetary bodies so you can learn more about the natural radio signal generators of our solar system and beyond. Suggested retail price for the *RadioScience Observing Volume 1* is $29.95.

The Right Antenna, Second Edition, by Alvis J. Evans: Television, FM, CB, cellular phone, satellite, and shortwave signals are always in the air and available to anyone. However, it takes a properly selected and installed antenna to make use of them. With easy-to-understand text and clearly illustrated examples, *The Right Antenna* will help you chose and set up the antenna that meets your needs.

A separate chapter is devoted to interference and antennas used by hams for amateur band operation. The basic concepts of cellular telephone system operation are also explained and the most popular antennas are discussed. This new edition also includes informative chapters on DSS and other satellite TV antennas. Suggested retail price for *The Right Antenna, Second Edition* is $18.95.

For additional information, contact PROMPT® Publications toll-free at (800) 428-7267.

Ventronics Surface Mount Chip Inductors

A selected group of multi-layer chip bead inductors, molded ferrite wirewound chip inductors, and high-frequency wirewound chip inductors, manufactured in a variety of sizes specifically for surface-mount applications, is now being offered by Ventronics, Inc., of Kenilworth, New Jersey.

The multi-layer ferrite chip bead inductors are produced in 0603, 0805, 1206, 1210, and 1812 sizes. Inductance values range from 1.2 nH to 100 µH, with impedances from 11 Ω to 1500 Ω, measured at 100 MHz.

The molded ferrite wirewound chip inductors are available in sizes 1210 and 1812 with inductance values from 0.10 µH to 1000 µH, with minimum Q values in excess of 50, measured at 25 MHz.

The high-frequency wirewound chip inductors are available in sizes 0603, 0805, 1008, and 1210. Inductance values range from 1 µH to 3300 µH with Q values in excess of 50, measured at 1 GHz.

All items are packaged on tape, in tubes or in bulk, as well as in bulk cassettes. Operating range is generally from -40°C to +85°C (in some cases up to +100°C), while offering excellent solderability via flow soldering and reflow techniques. All shapes and dimensions conform to EIA standards for use in telecommunications, computers, computer peripherals, and digital TV/VCR equipment. Prices begin at $28.00/K. Deliveries are from stock or six to eight weeks, ARO.

For additional information, contact Ventronics Inc., 346 Monroe Ave., P.O. Box 142, Kenilworth, NJ 07033; Phone: (908) 272-9262; Fax: (908) 272-7630; e-mail: <ventronics@prodigy.net>.

Circle 104 on reader service card

Basics

What Are "Nets" All About?

Ham radio "nets" have more in common with "safety nets" than "fishing nets," so don't worry if you're caught in one!

Chances are, if you've listened to a repeater (any repeater) for more than a week or two, you've heard some reference to a *net*, or maybe even heard one in operation. Depending on the net, you may or may not have been able to follow what was going on. This introduction to net operation will try to demystify them at least a little bit.

What's a Net?

Simply stated, a net—short for network—is any on-air meeting of hams for a specific purpose. Nets may be formal or informal, "controlled" or "uncontrolled," regularly-scheduled or called up to meet a need. Let's take a look at some of the most common types of nets and some basics of net procedures.

Regularly Scheduled Nets

Traffic nets—Most of these have nothing to do with cars on the highway. Their purpose is to relay written messages ("traffic") from one place to another via ham radio. Many traffic nets are part of the American Radio Relay League (ARRL) *National Traffic System*, or *NTS*, which provides for the orderly flow of traffic from wherever it originates to wherever it's heading.

Emergency preparedness nets—These are training nets for hams involved in emergency communications. They may be sponsored by *ARES* (the ARRL's *Amateur Radio Emergency Service*), *RACES* (the *Radio Amateur Civil Emergency Service*), a local club or a "served agency," such as the Red Cross or the National Weather Service's *SKYWARN* program.

Club nets—These may be on-air club meetings, "swap 'n shop" nets, or gatherings of groups within a club who share common interests, such as technical nets, women's nets, kids' nets, and computer nets.

Most of these nets meet on a regular schedule, daily, weekly or monthly, on a specific frequency at a specific time. They're often promoted on the air by club members or recorded announcements from a repeater controller.

As-Needed Nets

Emergencies and public service events generally don't happen on a predictable schedule, so the nets required to respond to these needs are called up on an *ad-hoc* basis. Here are some of the most common types of as-needed nets:

Nets can be regularly scheduled or as-needed, such as the one conducted during this California earthquake drill. (Photo courtesy AC6EN)

Emergency nets—Something *real* has happened—a destructive storm, a chemical spill, a major accident or some other disaster. Hams respond by starting up a net to marshal resources, deploy stations to where they're needed, and provide necessary communications. This is where all the training in the regularly-scheduled emergency preparedness nets is put to the test.

Public service event nets—Your town is having a parade, a bikathon, or perhaps a swimathon. Hams have been asked to help with communications. They form a one-time net (sometimes more than one) in order to keep all the information flowing smoothly and efficiently.

Weather nets—Not quite a preparedness net, but not yet an emergency net, hams in many parts of the country help track changing weather conditions when severe weather is expected. These nets generally function under either *SKYWARN* or *ARES*.

Net Organization

The structure of a net depends in part on its size, its complexity and whether it is linked to other nets. The simplest form of net is the informal, "uncontrolled," or "non-directed" net. If your club is helping out at a small event in which only three or four stations are participating, there's not too much traffic. Then all participants monitor the same frequen-

cy and call a specific station or location whenever necessary.

If the event is any larger than this, the communication organizers will probably opt for a "directed" or "controlled" net. In a directed net, there is a *Net Control Station (NCS)* who's in charge. All other stations must follow the NCS's procedures and directions (more on this later).

Most "event" nets and many emergency nets allow unstructured, or *tactical,* messages. An example of this would be: "Checkpoint 6 needs more water." Other nets, such as traffic nets and RACES nets, require that messages follow a specific format. These are known as *formal* messages, as they often become part of the written/printed record of an event. Formats vary slightly, depending on what organization is in charge of the activity. Becoming familiar with these message formats is part of your training, along with instruction in net procedures.

Net Procedures

If you're operating in a controlled net, you must follow net procedure. While that procedure may vary slightly from net to net (again, depending on its purpose, size, and complexity), there is one basic rule that covers them all, regardless of type: *Always listen to Net Control.*

In general, all transmissions should be directed to Net Control. If you need to talk with another station, you should get permission from the NCS before calling.

Another basic rule of net operation is to transmit only when necessary and to keep all transmissions brief and concise. If Checkpoint 6 needs more water, just say so. There's no need to explain that one of the big vats that had been filled earlier by the wonderful volunteers from the local fire department had been knocked over by an out-of-control rollerblader, creating a mud pond behind the checkpoint, etc., etc. Nets are also not the place for idle chit-chat with your friends. The net is there for a *purpose* and all communications should pertain to that specific purpose.

Finally, don't leave your post or leave the net without getting permission from the NCS. If you're not there when you're needed, and no one knows where you went, an important message may not get through, and you'll harm ham radio's reputation for dependable, professional-quality communications.

Again, specific procedures may vary with different types of nets, but you'll always be in good shape if you remember the basics: Always listen to NCS, address all transmissions to NCS, wait patiently until you're recognized (unless you have a *true* emergency), transmit only when necessary, be concise, and be sure to tell the net control if you have to check out.

Give It a Try!

While some of this may sound intimidating, it's really just a matter of "learning the ropes," and most experienced hams will be happy to help you out and answer your questions. The NCS is a good person to start with. But unless you're in a training net and questions have been invited, it's usually best to hold your questions until after the net ends.

So, if you want to learn more about the world of ham radio public service and emergency communications—or just to meet some of the hams who live near you—find some of the nets in your area. Listen for a while, then check in. After you get the butterflies out of your stomach, you'll find yourself learning a lot and (hopefully) having fun. ■

Resources

The American Radio Relay League (ARRL) offers several publications that can help you learn more about nets, net operating, and public service/emergency communications. They include: *The ARRL Operating Manual*; *Public Service Communications Manual*; *Special Events Communications Manual*; and the *ARES Field Resources Manual.*

All are available from ARRL, 225 Main St., Newington, CT 06111; Phone: (860) 594-0200; Fax: (860) 594-0259; Internet: <http://www.arrl.org>

In addition, *CQ VHF* regularly covers events and activities in which net operations take center stage.

Advertisers' Index

CQ VHF Ham Link

CQ VHF Hamlink offers *free listings* of clubs, licensing classes, and exam sessions! *Plus*, for $1/month or $10/year, we also offer listings of **ham-related** *personal* Web sites (*commercial* **ham-related** Web listings are $5/month or $50/year).

Web site listings must be accompanied by payment in full in check or money order in U.S. dollars and mailed to *CQ VHF Weblink*, Attn: Bernadette Schimmel, 25 Newbridge Road, Hicksville, NY 11801. Credit card orders accepted by mail, phone (516) 681-2922, or fax (516) 681-2926. Club, class, and exam listings may be submitted to *CQ VHF Clubiink*, or by e-mail to CQVHF@aol.com. Be sure to say what it is in the subject line (e.g., Club Listing).

Club Listings

FL, Metro Dade REACT 4881: One of the few **all-ham** REACT teams in the U.S., providing public service through communications. Mtgs ev. Thurs. 8 p.m., details on 147.315 MHz (+600) repeater. For info, contact: Metro Dade REACT, 3735 SW 89 Ave., Miami, FL 33165; e-mail: <react4881@juno.com>; WWW: <http://www.geocities.com/Heartland/Ranch/4881>. For more information, contact Robert Cruz, KE4MCL, President, <react4881@juno.com>.

GA, College Park REACT 4921: Training in packet, computers, radio building, space radio, FCC. Net. ev. Mon, 8:30 p.m., MatPARC Club 145.41- repeater. Contact: Thorton Williams, 2001 Godby Road, Ste. 0-6, College Park, GA 30349.

IL, Logan Area Amateur Radio Club, Logan County: Meetings held 3rd Saturday of each month, 7 p.m., American Red Cross Bldg., 125 South Kickapoo St., Lincoln, IL. Primary repeater: 147.345+. Secondary repeater: 145.390-. Contact President, Bob Rucker, KB9JSE, at (217) 735-2506; <KB9JSE@ccaonline.com>.

IL, Olney: Olney Amateur Radio Club-Richland County. Meetings 2nd Thursday of each month, 7:30 p.m., Hardees banquet room, 912 E. Main St., Olney, IL; Repeater: 146.760-. Contact Vice President Ben Rose, KB9OTJ, <harley@wworld.com>.

IL, Skokie: Free Live Online Hamfest. Buy, sell, trade. Instant listing of all your items for sale or wanted! No charge for this classified listing of radios, antennas, computers. Open chat room to discuss the details of your purchase or sale! Sponsored by the Tri-County Radio Group, Inc.; Web site: <http://quality-enterprises.com/tcrg/ onlinefest/>.

NY, Tonawanda: Radio Association of Western New York (RAWNY). Meets 2nd Tuesday of each month from September to May, 8 p.m. at Church of the Nativity, corner of Thorncliff and Colvin Blvd., Tonawanda, NY. Web site: <http://hamgate1.sunyerie.edu/~rawny>.

CO, Bicycle Mobile Hams of America: A national non-profit club of bicyclists who use VHF ham radios for emergencies, lost riders, route information, chatting, etc. 450 members in 46 states, 6 countries. Annual Forum at Ham-Vention. Net: 14.253, 1st & 3rd Sundays, 2000 UTC. E-mail: <hartleyal@aol.com> For info, sample newsletter, send SASE to BMHA, Box 4009-CV, Boulder, CO 80306-4009.

PA, Lambda Amateur Radio Club (LARC), Philadelphia: Since 1975, the only open and visible public service-oriented ham club for gay and lesbian hams. Monthly newsletter, HF skeds, internet listserv and IRC, hamfest meetings, chapters, DXpeditions. E-mail: <LARC@net-quest.com>.

TN, Cleveland Amateur Radio Club: Meetings every 2nd and 4th Tuesday of the month (except December) at CARC Clubhouse, 560 Johnson Blvd., Cleveland, TN, at 7 p.m. EST, and 7:30 p.m. EDT. CARC operates a 2-meter repeater on 146.925 MHz (-600), and a UHF repeater at 444.275 MHz (+5 MHz). Contact W4GZX, P.O. Box 2683, Cleveland, TN 37320-2683; e-mail: <carc@rocketmail.com>; Web: <http://www.geocities.com/SiliconValley/Lab/1660>.

ONT, Canada, Muskoka Amateur Radio Club, Huntsville. Meets at Huntsville Hospital Board Room at 2 p.m. on 2nd Sunday of each month. Visitors welcome. Net at 7 p.m. Monday on 146.775. Muskoka ARC, VE3MZY, 437 Aspdin Road, Huntsville, ONT, P1H 1Y4, Canada.

OK, Tulsa Amateur Radio Club, P.O. Box 7283, Tulsa, OK 74159-4283. Repeaters 145.11, 147.045, 442.00, 443.00, 443.45, 443.75, 444.625. Autopatches on 145.11, 443.00. Net every Thursday on 145.11 @ 8 p.m. (linked to 442.00, 443.75, 444.625). Meetings 3rd Tuesday of month at 7 p.m., West Regional Library, 2224 West 51st Street, Tulsa, OK. Breakfast Meeting, 1st Saturday of month at 8 a.m., Ollie's Restaurant, 4070 Southwest Blvd., Tulsa. For more information, call (918) 446-6451, Vince Moore, N5RFW, Public Service Liaison Officer.

OH, Firelands Amateur Repeater Association (FARA): Assn. of amateur radio operators and their families in North Central Ohio, dedicated to operation and maintenance of a repeater system south of Berlin Heights. Meets monthly on 4th Tuesday at Erie County Services Cntr., 2900 Columbus Ave., Sandusky at 7 p.m. in basement cafeteria. For info, write FARA, P.O. Box 442, Huron, OH 44839. E-mail: Tim Stookey, N8AHK, President: <n8ahk@amsat.org>; Web: <http://www.fara.berlin-heights.oh.us/index.htm>.

Exam Sessions

IL, Lincoln (LAARC): Offers ARRL VEC exam sessions for Novice, Technician, and Tech Plus licenses on 2nd Saturday of every other month at Lincoln Public Library Annex Bldg., 725 Pekin St., Lincoln, IL. Pre-registration recommended but not necessary. For info, contact: Mike Roos, N9WGT, (217) 732-6323. Exam fee, $6.39.

IL, Chicago: Ham testing session 1st Thursday every month, from 7–10 p.m. We test all levels from Novice thru Extra. Reservations are NOT required. For info, contact Dennis L. Sladek, N9OZ, 4344 W. 51 St., Chicago, IL 60632; Phone: (773) 838-8088; e-mail: <n9oz@juno.com>.

IL, Chicago: VE testing, just 4 blocks from Midway Airport, 1st Thursday of every month, 7–10 p.m. Midway VE Team-W5YI affiliated, 4344 W. 51 St. (Archer & Kostner Streets), Chicago, IL 60632. Phone: (773) 838-8088; Fax: (773) 735-8469. Web: <www.megsinet.com/dsladek>; e-mail:<dsladek@megsinet.net>.

CA, Los Angeles: United Radio Amateur Club, K6AA, Los Angeles Maritime Museum (6th Street, on Main Channel of the Harbor). Contact Elvin, N6DYZ (310) 325-2965. VEC: W5YI. Cost: $6.35 (or current amount allowed); Dates: 2nd Saturday every month except December; time: 1:30 p.m.; Pre-registration: Recommended, but not required.

SC, Columbia: ARRL/VEC testing session for all license classes will be held June 20, 1998, as well as on the third Saturday of each even month (August, October, and December), at 9:00 a.m., at Heathwood Hall Episcopal School, 3000 South Beltline Blvd., Columbia, SC. For more information, visit the Web site at: <www.qsl.net/ku4qn>, e-mail: <KU4QN@juno.com>, or call (803) 779-5234. Exam fee is $6.35. Elements 2 (Novice written exam), and 1A (5 wpm code) are free of charge.

Personal Web Site Listings

Jim Bridge, KQ6BS, URL: <http://www.qsl.net/kq6bs>. Specialty: weak signal.

Robert Cruz, KE4MCL, Web: <www.geocities.com/Heartland/Estates/5281>. KE4MCL Swap Shop is a place for hams to advertise their old gear and place want ads. No dealer ads accepted.

James R. Gavlik, KF6NNX, URL: <http://members.aol.com/JGavlik/kf6nnx.html>; <JGavlik@aol.com>. Title: James Gavlik-KF6NNX's Home Page ~ DM04

Commercial Web Site Listings

Woodhouse Communication: Antennas and publications for weather satellite imaging: <www.view2earth.com>.

Teletec: Manufactures 6, 2, 1 1/4 meter and 70 cm Linear Amplifiers as well as Receive Pre-Amplifiers. <http://www.Teletec-usa.com>.

MS-Windows Software: RAC Callbook CD-ROM, Ultimeter Weather Stations and more, info <n2ckh@cybercomm.net>, <www.QTH.com/n2ckh.bytewise.org>

"The quick-release remote front panel gives you so many installation options ."

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Now a dual-bander that remotes and is easy-to-use, without sacrificing the features you want!

With its quick-release, remote front panel system, the FT-8100R combines high-performance dual-band features in a simple-to-operate rugged mobile built to the endurance standards of commercial radios. The result is installation flexibility and industry-first, "must-have" advantages!

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Yaesu's popular Omni-Glow™ display provides a wide field of view, and includes a DC voltage meter. Quickly program, or clone frequency memories with optional Windows™ PC programmable ADMS-2D.

"User-friendly" describes the streamlined front panel layout. Eight clearly-marked keys, and separate Volume/Squelch controls for each band, make operation easy. And the backlit DTMF microphone includes 3 user-programmable keys...but no awkward keypad cover!

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Features

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  - TX: 144~148 MHz
  - 430~450 MHz
- Detachable Front Panel (remotable w/optional YSK-8100)
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  - 2m 50/20/5 Watt
  - 70cm 35/20/5 Watt
- 208 Memory Channels
- Enhanced Smart Search™
- CTCSS Encode
- Built-in Duplexer
- S-Meter Squelch
- Dual Receive (V+V,U+U,V+U)
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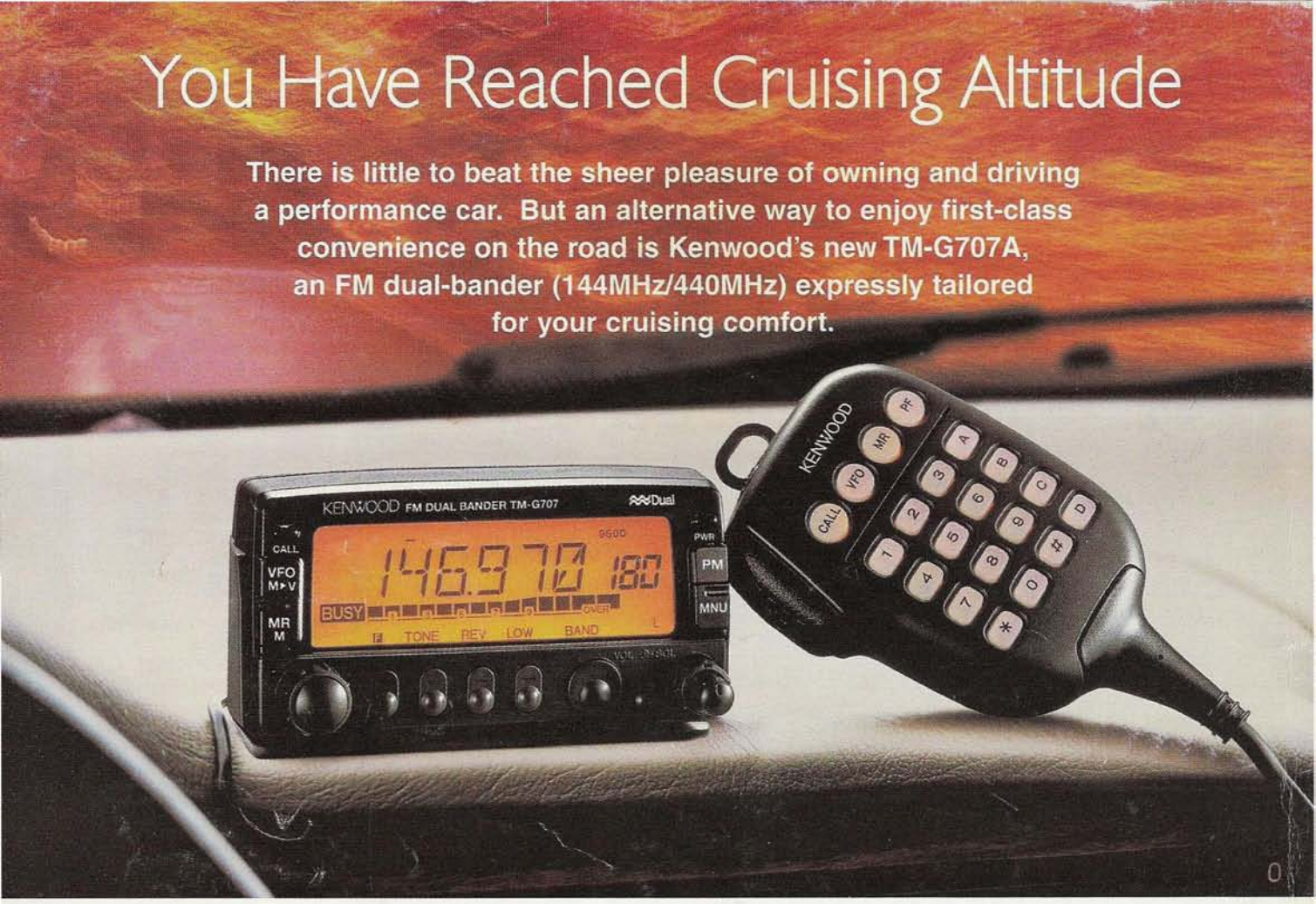
*Cellular & 900 MHz Cordless Phone frequencies blocked.

You Have Reached Cruising Altitude

There is little to beat the sheer pleasure of owning and driving a performance car. But an alternative way to enjoy first-class convenience on the road is Kenwood's new TM-G707A, an FM dual-bander (144MHz/440MHz) expressly tailored for your cruising comfort.



TM-G707A FM DUAL BANDER

Power up and you're greeted by the welcoming glow of an amber-colored LCD. You can always be sure of a friendly reception from Kenwood's TM-G707A, an FM dual-band transceiver that is a joy to use.

For some drivers, visibility is everything. That's why the TM-G707A has an extra-large display. Capable of showing up to 7 large characters, the **high-visibility amber LCD** features a 4-step dimmer control to suit all driving conditions, day or night. A convenient touch is the automatic brightness control during operation.

The TM-G707A is simple and straightforward like a car stereo, thanks to **Easy Operation** mode. You just choose a frequency and press one of the 3 quick memory keys to save it. A light touch on the same key is all that is needed for recall. And with the **Five-in-one programmable memory system,** you can store five operating profiles - complete with frequency range, dimmer level, and other details - ready for instant recall at the push of a button.

Another convenience that is especially welcome on the road is the **Memory Name** function. This allows you to identify each memory position with up to 7 alpha-numeric characters. You can also switch instantly between the frequency and Memory Name displays.

Optimized convenience goes hand in hand with polished performance and a wide range of advanced features, such as a built-in **CTCSS encoder/decoder, built-in duplexer** and **priority scan.** The front panel features a 6-pin **mini DIN connector** for either standard 1200bps or 9600bps high-speed packet or APRS communications. Also, **180 multi-function memory channels** are available for storing such data as transmit and receive frequencies independently (thus allowing split-frequency operations), frequency step, and tone frequency. Among the many options available is a **quick-release detachable front panel kit** for anti-theft protection.

There's an open road ahead for the future of mobile communications, and Kenwood's TM-G707A is showing the way.

- **Power output 50W VHF, 35W UHF**
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- **Superior intermodulation rejection characteristics**
- **Heavy-duty heat sink construction**
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- **Full band scan, program band scan, memory scan with memory channel lock-out, MHz scan and call scan with TO (time-operated) or CO (carrier-operated) resume modes**
- **CTCSS tone scan**
- **Voice Guide (requires VS-3 option)**
- **Selectable frequency step (5, 6.25, 10 12.5, 15, 20, 25 or 50kHz)**
- **Incremental MHz Key**
- **AIP (Advanced Intercept Point)**
- **Memory shift (odd splits)**
- **S-meter squelch**
- **Auto repeater offset (144MHz)**
- **Power-on message**
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