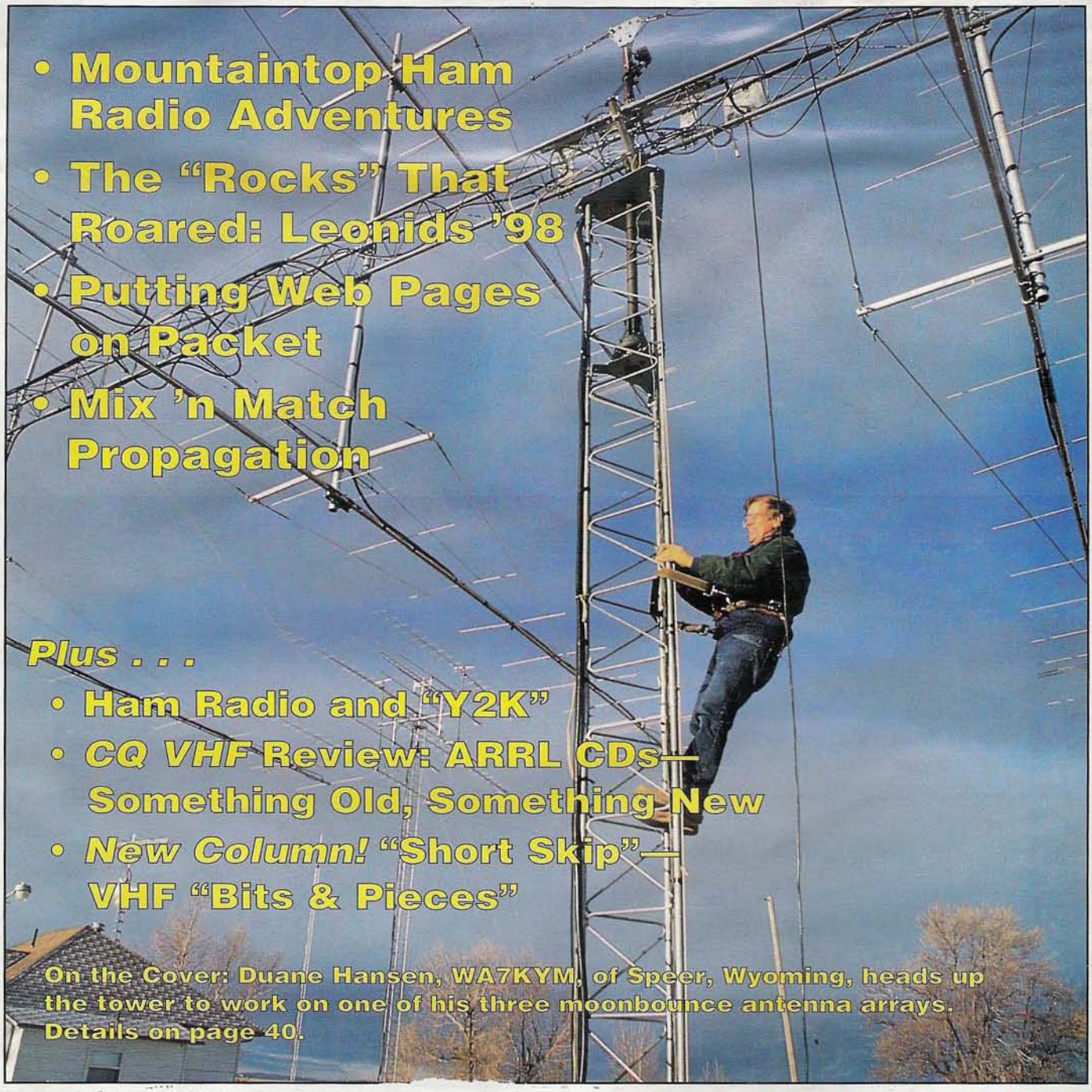
ICD 08237

CQ VHF

Ham Radio Above 50 MHz

February 1999



- **Mountaintop Ham Radio Adventures**
- **The "Rocks" That Roared: Leonids '98**
- **Putting Web Pages on Packet**
- **Mix 'n Match Propagation**

Plus . . .

- **Ham Radio and "Y2K"**
- ***CQ VHF* Review: ARRL CDs—Something Old, Something New**
- ***New Column!* "Short Skip"—VHF "Bits & Pieces"**

On the Cover: Duane Hansen, WA7KYM, of Speer, Wyoming, heads up the tower to work on one of his three moonbounce antenna arrays. Details on page 40.

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Turn your mobile, base or handheld into 160 Watt powerhouses and talk further, longer, clearer . . . All modes: FM, SSB, CW . . . Superb GaAsFET preamp . . . Overdrive, high SWR, Over-temperature protection . . . Remote controllable . . .

B-5016-G
$299
Suggested Retail

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

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, pre-amp On/Off, selects SSB/FM. With 18-ft cable.

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

More 160 Watt, 2 Meter Amplifiers . . .

B-2516-G, $299. For 10 to 35 watt mobile or base stations. 160 watts out for 25 watts in.

B-1016-G, $379. MIRAGE's most popular *dual purpose* HT *or* mobile/base amplifier. 160 watts out/10 W in. For 0.2-15 watt transceivers.

B-1016-G Great for ICOM IC-706!

B-215-G, $379. MIRAGE's most popular *handheld* amp. 150 watts out/2 watts in; 160 watts out/3½ W in. For 0.25 to 5 watt handhelds.

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*
- *FREE handheld BNC to B-310-G cable*
- *Ultra-compact 4¾x1¾x7¾ inches, 2½ pounds*
- *One year MIRAGE warranty*

***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

Read SWR directly andForward/ Reverse, Peak/Average power. Remote Coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

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CQ VHF Ham Radio Above 50 MHz

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Next Month: "Lasers to the Limit," by Eric Stroud, KB2TCQ

The Good Old Days Just Ain't What They Used to Be

So you think all the old-time hams were better than we are, right? Whizzes at code? Real technical gurus? They had to be, right? Think again...

When I was in high school, my American History teacher, Kevin Sullivan, took great delight in debunking the myths of American history that we'd all been taught over the previous decade. You know, things like George Washington and the cherry tree (never happened, pure fiction); the Civil War battle between the Monitor and the Merrimac (yes, it happened, but the Confederate ship was actually named the Virginia—it had started out as a wooden Union ship called the Merrimac, but the Navy scuttled it early in the war; the Confederates raised the ship, covered it in iron and rechristened it the Virginia. That was its name at the time of the battle, which, by the way, ended in a draw); and the myth that We the People elect the President of the United States (sorry, read your Constitution. We elect "electors," who meet every fourth December and, voting state by state, actually elect the President).

"Ham radio history is full of the same sort of myths, repeated so often that they're accepted as fact. The prime example is the several different 'true' stories of how radio amateurs came to be called 'hams.' "

Ham radio history is full of the same sort of myths, repeated so often that they're accepted as fact. The prime example is the several different "true" stories of how radio amateurs came to be called "hams." Unfortunately, not one of these stories is verifiable, and chances are we'll never know which "true" story, if any, is correct.

So, every once in a while, we need a Kevin Sullivan to come along and tell a familiar story, then slam his ruler on your desk and yell, "It's a myth!" He wasn't a ham, so I'll have to volunteer for the job. Let's go debunking...

Myth #1: Old-Time Hams Were Technical Gurus

Back in the good old days, "real hams" built their own equipment—all of it. And, because they built it, they understood how it worked. **It's a myth!** Sure, early hams built their own gear. They had no choice! And as soon as they had a choice, most of them took it, moving first to surplus military and commercial gear, which only had to be modified, not built from scratch, and then on to commercially built gear designed specifically for amateur radio. The "average ham" has been an "appliance operator" for nearly a half century.

But they still understood how everything worked and could fix their rigs when they broke, right? **It's a myth!** I recently got a review copy of the ARRL's latest collection of *QST* back issues on CD-ROM—the oldest group, going from 1929 back to Issue #1 in December, 1915 (see "A Technology Triple Play from the ARRL," elsewhere in this issue). Naturally, the first thing I did after installing the software was to start browsing through that very first issue of the magazine. A ways in, there was a half-page devoted to "The Next Issue." Here's a quote:

> The next issue of "QST" will be a wonder. There will be an article on the *oscillating audion*, and it will be written in language which no one can misunderstand. Construction, operation, what stations can be heard with one, and theory will be covered in a brief and crisp manner. The amateur will understand this newest radio development when he reads this article. Nauen and Hanover, Germany, are read easily here on a fifty-foot high aerial, using an oscillating audion.

That sounds like the sort of article we shoot for in *this* magazine: plain language, basic theory, and a focus on practical use. The article itself, by ARRL cofounder Clarence Tuska in the January, 1916, issue, delivered on its promise, starting out by saying that "It is beyond the scope of 'QST' to go into the theory of this wonderful piece of radio apparatus," then offering a one-paragraph, plain-English explanation of how the oscillating audion works. The rest of the article was devoted to guiding the reader through building and using one of these revolutionary new devices.

The oscillating audion, by the way, was the original name of the *superheterodyne receiver*, which truly did revolutionize radio receiving technology and was perhaps Edwin Armstrong's greatest contribution to the radio art. But the typical ham, even in 1915, wasn't expected to be as interested in how it worked as in how to work it. Sounds a lot like the typical ham of today.

Another note from the "good old days": in the same issue was an ad from the Institute of Radio Engineers (IRE), promoting its *Proceedings* publication and reminding hams that "In an age of progress, standing still is drifting backward." Sound familiar? Apparently, prodding hams to increase their technical

By Rich Moseson, W2VU, Editor (cqvhf@aol.com)

knowledge is a practice as old as the hobby itself.

Myth #2: Old-Time Hams Were Code Whizzes

Now, back in 1916, the cutting edge of radio technology was something called "telephony," or voice communications (you could read all about the latest developments in the IRE's *Proceedings*, according to the ad), but the typical ham wasn't on the cutting edge of radio technology and was still using a spark gap to communicate in Morse code. *These guys were speed demons at code—after all, it's only been through the "dumbing down" of amateur radio in recent years that everyone didn't have to know code at 20 words per minute.* Ready? **It's a myth!**

Hans Brakob, KØHB, a former ARRL Vice Director, did some digging and came up with the following excerpt from the "Radio Laws of the United States," published in 1912 (and reprinted recently in the *Handi-HAM World* newsletter):

122. Amateur first grade—The applicant must have a sufficient knowledge of the adjustment and operation of the apparatus which he wishes to operate and of the regulations of the International Convention and acts of Congress in so far as they relate to interference with other radio communication and impose certain duties on all grades of operators. The applicant must be able to transmit and receive in Continental Morse at a speed sufficient to enable him to recognize distress calls or the official "keep out" signals. A speed of at least five words per minute (five letters to the word) must be attained.

So let's see, the ham in 1912—a "first grade" ham with all privileges—had to know enough about how his equipment worked to prevent interference and had to know code at a speed of at least five wpm in order to receive distress calls or understand a message telling him to QSY (change frequency). The higher code speed requirements came later, in a deliberate effort to create a "filter" and place "quality" over "quantity" in new-ham recruitment.

Now here's something to think about: If the sole regulatory purpose of knowing Morse code was to assure that hams would be able to receive distress calls and understand official messages...and if hams today are virtually the only radio operators still using code (the maritime service has recently gone totally satellite, and virtually no other government or commercial service still uses code), then who's going to be sending all those messages we need to be able to receive and understand? Is there still a regulatory purpose to be served by having a code requirement? Other than keeping a lid on growth? Just something to think about.

Myth #3: Today's Tech and Tech-Plus Hams are Interested Only in FM and Packet

The FCC, in its license restructuring proposal (WT Docket 98-143), said that "*Both Technician and Technician Plus Class licensees predominantly use FM voice and digital packet technologies on the amateur VHF and UHF bands*," and used this as justification for proposing to do away with the Tech-Plus license. This perception is shared by most *CQ VHF* readers (two-thirds, according to the results of November's Reader Survey; see "What You've Told Us," elsewhere in this issue). But answers to other questions on the same survey prove that—all together now—**It's a myth!**

When we asked if the FCC's statement applied to *your own* operation, the responses were completely different *among those readers who had earned HF privileges*. Among those readers holding basic Tech licenses, the perception is correct: 69% say it describes their interests and activities. But among Tech-Plus licensees, the numbers flip-flop: only 37% say the FCC's statement describes them; and 63% say no, that's not an accurate picture of their interests. The numbers are almost identical (36% yes, 64% no) among higher class licensees, whom we asked to think back to their operation when they held a Tech or Tech-Plus license. Looking at all current Techs and Tech-Pluses combined, it was a very close 57% yes, 43% no. And if you add up all the responses, it's practically split down the middle: 52% yes, 48% no. This is hardly overwhelming.

Further proof: We asked everyone to describe their most recent amateur radio purchases (with more than one answer allowed in the case of multiple purchases). And while two-thirds had bought FM-only rigs (HTs and mobiles combined), 43% had purchased VHF rigs with multimode capability, and 40% had bought rigs that included HF coverage. Again, the majority of purchases were FM/VHF-only, but the number of radios with multimode and/or HF capability (remember, we're talking high-ticket radios here) is significant enough to make one look back at the FCC's assumption and shout, "It's a myth!"

"...forget most of what you hear and read about 'the way things were' in the good old days of ham radio, because, chances are, they really weren't."

So forget most of what you hear and read about "the way things were" in the good old days of ham radio, because, chances are, they really weren't.

Have a Heart!

February is Heart Month, and once again, we want to do our bit to get you off your derriere and out getting some exercise. Two of our articles this month offer examples of how some hams are combining good, healthy exercise with good, healthy hamming: Sam Vigil's account of the "Colorado 14er" radio event and Ed Butler's article on mountaintopping in southern California with mirrors...and 2-meter HTs.

You don't have to climb mountains to get or keep yourself in shape (in fact, if you're not in shape, hiking up a mountain is a distinctly *bad* idea). Regular exercise, such as walking, jogging, bicycling, etc., is all you need. More and more medical research is showing that sitting on your duff is hazardous to your health. So if you've become a "shack potato," talk with your doctor about the best exercise program for you, then figure out a way make ham radio a part of it!

Finally, due to a scheduling mix up, our "In Focus" amateur TV column will appear next month instead of this issue.

—W2VU

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

Restructuring Back in FCC's Hands

More than 1,900 comments on amateur license restructuring proposals were received by the Federal Communications Commission (FCC) by (or slightly after; see below) the December 1 deadline. By the time you read this, the January 15 reply comment deadline will most likely have passed as well, leaving the ball back in the FCC's court.

Fred Maia, W5YI, kept close track of the comments filed and reported in his *W5YI Report* that most comments seemed to be in line with the license classes currently held by the commenters. Extra class hams, for example, tended to favor retaining a higher code-speed requirement than did Technician and Tech-Plus hams, who tended to favor the lowest possible code speed requirement for HF operating privileges.

Maia also reported widespread problems with the FCC's new Electronic Comment Filing System (EFCS), saying he'd heard from numerous hams who were unable to successfully upload their comments or encountered other difficulties with the system. We at CQ experienced that problem first-hand. Our own comments (see page 7) were apparently spit out by the FCC computer and had to be refiled manually. FCC staffers indicated that the Secretary's office would accept all comments filed up until the reply comment deadline of January 15, 1999.

There's no deadline for the FCC to issue a decision, but it's widely expected to come sometime this spring or summer.

New FCC Wireless Chief

Thomas J. Sugrue has been named the new Chief of the FCC's Wireless Telecommunications Bureau, or WTB—the section of the FCC responsible for the amateur service (among many others). Sugrue came to the FCC staff from a private communications law firm, where he was a partner. Before that, he had served six years as Deputy Assistant Secretary of Commerce at NTIA, the National Telecommunications and Information Administration, and had twice served as NTIA Acting Administrator. The NTIA advises the White House on communications policy. This is Sugrue's second stint on the FCC staff, having previously worked as a division chief a special counsel in the Common Carrier Bureau.

Leonids Create a Storm of Excitement

Debate continues over whether the 1998 Leonids meteor shower was the "storm" that some experts had predicted, but there's no argument about the results in the ham bands. Described as perhaps the best meteor shower ever from a ham radio perspective, the event saw hundreds of amateurs shooting for the "shooting stars" and making thousands of meteor scatter (MS) contacts. For many, it was their first experience with MS. Experts feel the 1999 Leonids could be even better. For a full report, see this month's "Weak Signal News" column, beginning on page 44.

ARRL Cancels Spring Sprints

The American Radio Relay League (ARRL) has canceled its VHF/UHF "Spring Sprint" contests, citing lack of participation. The sprints were traditionally held in four-hour segments and activated a different band each week between mid-March and mid-May. According to ARRL Contest Branch Manager Dan Henderson, N1ND, "the amount of interest really didn't warrant the amount of work involved" by League staffers in processing the logs and preparing score tallies.

This is the second ARRL operating event canceled in recent years due to dwindling participation. The first victim was the Novice Roundup, which used to be a week-long event each February.

Mir SSTV Controversy

The crew of the Russian Mir space station began sending slow-scan TV pictures to hams on Earth in mid-December, but created a controversy by doing so. The SSTV signals were on 2 meters, but the coordinated frequency for SSTV activity from space is on the 70-centimeter band, specifically on 437.975 MHz. This frequency assignment was made by IARU (International Amateur Radio Union) Frequency Coordinator Graham Ratcliffe, VK5AGR, after considering the interference potential of various frequencies as a spacecraft orbited the Earth and flew over many countries with many different VHF/UHF band plans.

The Mir SSTV operation raised questions about frequencies and modes for space operations being picked out by individual countries and individual hams, as opposed to those assigned by the IARU and agreed to by the eight countries involved in planning amateur operations aboard the International Space Station.

New Satellite Available for Use

Thailand's first amateur satellite—TMSAT-1, also known as TO-31—has been opened for general amateur use, according to the AMSAT News Service (ANS). The satellite features a 9600-baud digital store-and-forward mailbox, plus an onboard camera that takes "high-resolution multispectral images" of the Earth. Control operator Chris Jackson, G7UPN/ZL2TPO, says he hopes hams will take advantage of these images and "keep other traffic to a minimum."

The online newsletter, *SpaceNews*, reports that Colin Hurst, VK5HI, has uploaded the latest version of his "CCD Display 97" program to the UO-22, KO-23, and KO-25 satellites, allowing users of *those* satellites to view and manipulate images downloaded from TMSAT.

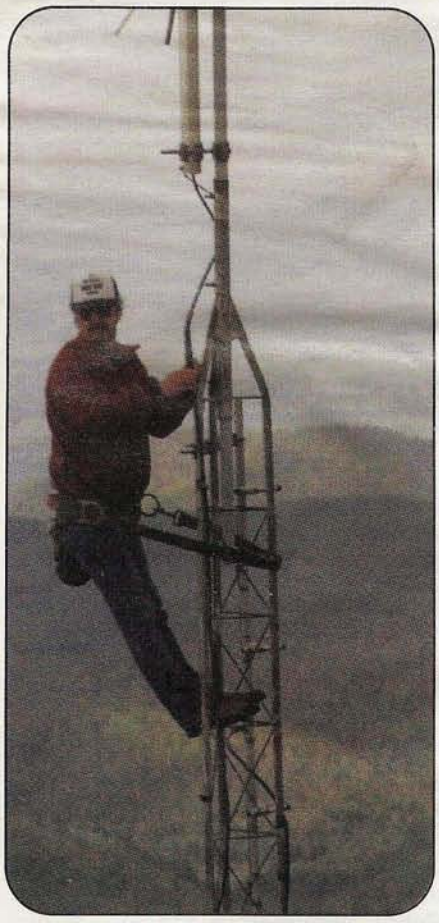
TO-31's 9600-baud FSK downlink frequency is 436.925 MHz; its 9600-baud FSK uplink is on 145.925 MHz. The satellite's BBS callsign is **TMSAT1-11**, and its broadcast callsign, for voice messages uploaded by controllers, is **TMSAT1-12**.

Hope Fades for SEDSAT

Hopes of getting the University of Alabama at Huntsville's SEDSAT satellite into operation are getting dimmer,

Compiled by the CQ VHF Staff

Picture This!



Who says you can't get out too far with only a 30-foot tower? You can if it's on top of a 4,100-foot mountain! This is Charlie Stokes, WB4PVT, of Newport News, Virginia, doing some antenna work on the Rockbridge Amateur Radio Club's KI4ZR (147.930/.330 MHz) repeater on Rocky Mountain, in Rockbridge County, Virginia. (Photo by Skip Ravenhorst, KE4AAR; courtesy of WB4PVT).

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, please tell us so and include an SASE (self-addressed, stamped envelope) with sufficient postage. Thanks!

according to former project manager Dennis Wingo, KD4ETA. Wingo told *SpaceNews* it appears that one of the spacecraft's two Mode L (1296 MHz) receivers—perhaps the main receiver—was dead when it left the ground, because a part was removed during final integration in order to fit everything into the spaceframe. In addition, Wingo says it looks like the ground controllers left out part of the initialization sequence for a second receiver, meaning it may be useless even if it is working. He says controllers may still be able to get around all of these problems but he isn't holding out much hope. Even so, he asks all hams who have been monitoring data from the satellite to please continue doing so, as the data may help controllers find a solution.

The one positive note is that controllers are receiving excellent engineering telemetry from SEDSAT, allowing NASA to evaluate the nickel metal hydride (NiMH) batteries that power the satellite.

VOXSAT-1 Nearly Ready for Launch

Argentina's VOXSAT-1 satellite is in the final stages of preparation for launch sometime this year. AMSAT-LU Vice President Gustavo Carpignano, LW2DTZ, told *SpaceNews* that VOXSAT-1 is on schedule for launch aboard a Russian booster sometime this year. The satellite will feature an AO-27-style crossband FM repeater; a "parrot" repeater in which the uplink signal is digitally recorded, then played back; broadcast voice, fax, and SSTV modes; and CW telemetry on an FM carrier. More information on VOXSAT-1 can be found on the World Wide Web at <http://members.xoom.com/Amsat_LU>.

More Space & Satellite News

Other space-related ham radio news: Shuttle mission STS-93, originally scheduled to fly in January, has had its launch date postponed until March, at the earliest. This is the only shuttle flight this year that's scheduled to carry SAREX (the Space Amateur Radio Experiment) and make ham radio contacts with schools and individual hams. The SAREX program itself celebrated its 15th birthday in November. Since 1983, SAREX has flown on 24 shuttle missions, becoming the most "frequent flyer" payload in the shuttle program, according to the AMSAT News Service.

Construction has begun on the International Space Station, with the joining of the Zarya and Unity modules in orbit last December. The first crew is expected to take up residence on the station this summer, and they'll be bringing a ham station with them!

Finally in space news, if you monitored signals from Sputnik-41 (also known as RS-18)—the mini-satellite hand-tossed into orbit by a spacewalking Mir cosmonaut—you may request a QSL card by sending your reception report, along with a self-addressed envelope and two International Reply Coupons (IRCs), available at your post office, to: AMSAT-France, RS-18 QSL Manager, 14 bis, rue des Gourlis, 92500 Rueil-Malmaison, FRANCE.

Trans-Indian Ocean DX Tests

A VHF DXpedition on Reunion Island in the Indian Ocean in mid-December was hoping to make the first-ever 2-meter contacts between the island and the African continent. According to the South African Radio League (SARL), the "TO150 Group" was planning to set up on both 6 and 2 meters, and to operate both CW/SSB and FM, hoping to work stations along the east coast of South Africa, a distance of roughly 1,800 miles. Round-the-clock operation was planned in order to take advantage of any summertime propagation enhancements that occurred. The DXpedition station was to be set up atop a mountain nearly 10,000 feet above sea level. As we went to press, this operation had not yet taken place. We will do our best to update you on the results in a future issue.

ATV "Intercom" Frequency

Frequency coordinators in Southern California have designated 144.345 MHz as the region's new simplex coordinating frequency for amateur television (ATV). According to a report on "Newsline," it is part of a continuing effort to provide a clear nationwide operating frequency for APRS (the Automatic Position Reporting System) at 144.390 MHz. ATVers often use a simplex voice frequency, generally on 2 meters, as a "talkback" or "intercom" frequency while arranging video contacts and setting up camera shots on higher frequencies.

Licensing Restructuring: The CQ View

In comments on the FCC's license restructuring plan, CQ VHF's publisher says neither the FCC's plan nor the ARRL's is best for ham radio—and offers an alternative it says will do a better job.

Ham radio publisher CQ Communications, Inc., has called on the Federal Communications Commission (FCC) to restructure amateur radio licensing with only three license classes, a single five word-per-minute Morse code exam for access to worldwide shortwave bands and experience-based requirements for upgrading. In addition, the company's comments on the FCC's restructuring proposal (WT Docket 98-143) called for creating a new type of operating authority to encourage greater use of amateur radio in schools and health care facilities.

In its FCC filing, the publisher of *CQ VHF*, *CQ—The Radio Amateur's Journal*, *Popular Communications*, and other ham radio magazines, books, and videos, criticized the Commission's own proposal as being "incomplete, inconsistent and contain(ing) many apparent errors"; said the American Radio Relay League's proposal was basically sound but did not go far enough; and called on the FCC to give due consideration to all relevant comments and proposals on license restructuring.

CQ's Proposal

The CQ proposal contains four major segments. First is a reduction in the number of license classes from six to three, equivalent to the current Technician, General, and Extra class licenses, but with either a single five-word-per-minute (wpm) code exam for both General and Extra, or five-wpm for General and 10-wpm for Extra. Current Novice and Tech-Plus licensees would be "grandfathered" to General class, and current Advanced class hams would be grandfathered to Extra, so no currently licensed amateur would lose any operating privileges.

"Part three of CQ's proposal calls for creating a 'Basic Amateur Permit (BAP)' which would authorize operation of an amateur station in a school or health care facility, under the general supervision of a licensed amateur."

The second part of the CQ plan calls for the addition of "experience requirements" as a condition of upgrading. Many amateurs have complained that the current exam structure allows hams to upgrade without actually learning anything. "Licenses would be renewable forever without any experience requirements," explained CQ President and Publisher Dick Ross, K2MGA. "But in order to qualify for an upgrade exam and greater operating privileges, you would have to show you know more than how to memorize answers to the multiple-choice questions listed in every license manual. An expanded corps of Volunteer Examiners could take care of any certification requirements, so there would be no added regulatory burden on the FCC."

Part three of CQ's proposal calls for creating a "Basic Amateur Permit," or BAP, which would authorize operation of an amateur station in a school or health care facility, under the general supervision of a licensed amateur. The station would be licensed as a club station under existing rules, with the licensed ham as station trustee, who would be responsible for the station's proper technical operation, but would not have to be physically present whenever it was on the air. The BAP holder, who would have to pass an exam on rules and operating procedures but would not be issued a callsign, would be responsible for the content of transmissions.

"The idea here," said Ross, "is to solve the problem of school-based radio groups that thrive as long as there is a teacher on staff with a ham license, but that fall apart as soon as that teacher leaves. The BAP would allow many teachers, as well as health care workers, even with little or no technical knowledge, to operate a specific amateur station as long as it was functioning properly."

Finally, CQ called on the FCC to extend to all former amateurs its own apparent proposal to grant permanent element credit to holders of certain expired Technician class licenses. This would allow anyone with an expired amateur license to reactivate that license without having to retake any exams.

Long-Term Benefits

"We believe our proposal will help amateur radio in the long run," Ross said, "by exposing more young people to the hobby, by simplifying the current license structure, by making upgrading requirements more flexible and more relevant to actual experience, and by encouraging former amateurs to reactivate expired licenses and return to the ham radio community."

The full text of CQ's comments may be viewed on the World Wide Web at <http://members.aol.com/cqmagazine/98-143.htm>. ■

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.*

Interstellar Aurora?

Dear *CQ VHF*:

I read the article on the Interstellar Aurora, in the December, 1998, *CQ VHF*. Excellent. To me, it is one of the supporting reasons for us amateurs to keep a good log, and note anything worthwhile observed, for future reference. You never know what or when something might be useful. This kind of thing is also part of the major reason supporting the existence of Amateur Radio.

For the last 26 years, I have been recording daily the WWV propagation information. I have attached some recent plots. If I look at the 27th of August, yep, we have a good geomagnetic storm, and aurora. This, plus the NASA article, certainly stirs the imagination and possibilities. Two days earlier, we had a solar flare.

Now, looking 28 days later, we had an even bigger storm, and it was associated with a solar flare two days earlier; 28 days later—one solar rotation—again, we have a solar flare and, two days later, a geomagnetic storm. Another 28 days later, another geomagnetic storm. A bit weaker. The chart shows some more activity we just had in recent days. Well, the possibilities are still quite something. Well worth investigating. Exciting, in fact.

Since we have a history of a sun-related event, the solar flare being easily tied to it, two days earlier, I would tend to discount the idea that the late-day August 27th aurora was caused by the XCTG1944+14 event. The earlier one that day, that OH1AAZ noted at 0300, quite possibly. Also, there is the possibility that it enhanced the aurora later in the day. I could be totally wrong, too. I don't know. Perhaps it would be worthwhile to look back at the other two smaller similar events, us old timers, and look at our logs. It is important to look at all the data carefully. Study it. Reach the appropriate conclusions based on the facts. This is what I have to add. 73,

Lloyd Ellsworth, NE8I
Dearborn, Michigan

Lloyd—Thank you for the interesting information. Unfortunately, we couldn't get your graphs to reproduce well in print. However, we will forward them, along with your letter, to Paul Harden at the National Radio Astronomy Laboratory.

A "Once in a Lifetime" Experience

The following letter was addressed to Ken Neubeck, WB2AMU:

Dear Ken:

Just read your article in the October issue of *CQ VHF* concerning *Es*-F_2-*Es* between VK (Australia) and the U.S. on 6 meters. I am sure you are aware of the same type opening between the southern tier states and ZL (New Zealand) this past New Year's Eve. I worked five ZLs myself (ZL3NW, 3TIC, 2TPY, 3AAU, and 3ADT) between 0033 and 0054 UTC 1-1-98. At that time, I had tremendous *Es* to the west coast and also into Mexico. Since that time frame coincides with the sporadic-*E* season "down under," it would appear that we also had F_2 in the mid path, coupled with *Es* at each end. A "once in a lifetime" occurrence for me—so early in the solar cycle, plus the fact the XYL did not want to stay out on New Year's Eve—put me in the shack at a fortuitous time! I have heard that another W5 worked a VK that same evening, but do not know the particulars. Nice article! 73,

John Butrovich, W5UWB
Orange Grove, Texas

John—The current thinking among the propagation "gurus" is that the New Year's Eve opening you describe (and were lucky enough to be part of) was most likely **Es-*TEP*-Es** *rather than* **Es-F_2-Es,** *since there was no additional* F_2 *following it. Transequatorial Propagation (TEP) is, of course, a form of* F*-layer propagation, but it is not as dependent on the sunspot cycle as is "standard"* F_2*. The feeling among the "gurus" is that there were simultaneous double-hop sporadic-*E *openings at each end of the path that ended in mid-Pacific points from which the final connection was made via TEP.*

Multiple-mode VHF propagation is a topic that needs additional study and is the subject of an article by WB2AMU in this issue of CQ VHF. *I'm sure your report will be helpful to him.*

Bigger Is Better

Dear *CQ VHF*:

I would like to see more pictures and information on phasing VHF Yagis. Also maybe some of the "big guns" on 6 and 2 meters could send in some pictures of their setups and antenna arrays. I would like to build a 6- and 2-meter array with four 6-meter Yagis and eight or so 2-meter Yagis, all on the same "H" frame. I am running a Cushcraft 617-6B six-element Yagi on six and an M^2 five-element on 2 meters. They are both great antennas but more is better, right?

I haven't had much excitement on 2 meters, but 6 meters has my interest. I started on six after some coaxing from my friend Leo, KJ6HI. And I just love the band. I started in the summer of 1995. Sold the radio in '96 and got back on the air in '97. Two hundred seventy grid squares and 15 grid blocks later, my goal is to work into Japan or Europe. I was on the air the day Mike Botchco, N5JHV, worked the JAs last year, but I just couldn't hear them well enough to try them. I wish I lived close enough to Mike to peek over his fence for some good ideas.

Well that's it. I love *CQ* and *CQ VHF*. I've tried the others and always seem to stay here. Keep up the good work.

Pete Shegas, KC6IPF
Cotton Wood, California

Pete—Glad you're enjoying our magazines. Our antenna columnist, WA5VJB, says that he's already planning a column on antenna phasing.

The F_2 *openings that are starting to happen on "the Magic Band" should*

certainly give you more than one chance to work into Japan on 6 meters. Working Europe from California will be a bit more of a challenge, probably requiring some mixed-mode propagation (see WB2AMU's "Mix and Match Propagation" article in this issue).

As for photos of "big gun" VHF stations, we're always open to submissions for "Picture This," and "Reader Snapshot," and cover photographer Larry Mulvehill, WB2ZPI (cqfotog@aol.com) is always looking for really cool stations to put on our covers. Of course, this offer is open to all, not just the "big guns." If you've got a photogenic shack, share it with us!

One More Try...

Dear *CQ VHF*:

Being absent from the amateur radio world for several years, I have decided to crawl back up and give it another shot. Having retired last May, I am going to attempt another shot at passing the 13-wpm code test and upgrade my ticket from Tech-Plus to General. Being a T-Plus for over 24 years, I have attempted this several times but to no avail. I thought one more shot at it, until I read the proposed changes in the works. I presume you know where my mind is at this time—heck with the code and let the FCC give me an upgrade to General without touching the code at all. Well I just can't give in that easily. I will give it another shot at passing the 13-wpm code. I usually become stuck at 10 wpm and that's it for me. If I don't make it this time I will accept the grandfather clause in the proposal to General, I earned it.

By the way, the first magazine I picked up at the store when I decided to become an active ham again was *CQ VHF*, November '98 issue. It made for some very interesting reading.

(Name and address withheld by request)

OM—You're in very good company. Many excellent hams have gotten stuck at 10 wpm and have thus been prevented from upgrading to General. Going back in history, the code requirement for what is now the General class used to be 10 wpm, but was increased to 13 many years ago—at the ARRL's behest—in order to limit upgrading to the "serious" ham. Don't look at the proposals as granting you something you haven't earned. As a long-time Tech-Plus, you've already passed the General written exam, so if the code requirement was reduced to 5 wpm, then you'd already have passed that, too! Newer Tech-Pluses might still have to take the Element 3B written exam in order to get General class privileges.

"I Need Communications, Not Hams"

The following letter was addressed to columnist Bob Josuweit, WA3PZO:

Dear Bob:

Thank you for the "honorable mention" in *CQ VHF* magazine ("In the Public Interest," September, 1998 issue); you did a great job writing it. Oddly enough, the Saratoga County Emergency Coordinator didn't need ham operators—he needed communications—and when I asked him, "if I can talk and you can't, then don't I have communications and you don't?" his response was, "but I need communications, not ham operators."

He got calls from all over the world on this disaster, and not once did he mention ham operators. I was the person who got the Red Cross and the Salvation Army into town with April's help (K2ZCZ); he still, to this day, doesn't know how they got here. He had cellphones that didn't work and wanted me to supply him with mine. Sorry, I'm not going to short myself, or my SAR (Search-and-Rescue) team for his inability to "provide communications" for himself.

We need to somehow educate these "uneducated people" that hams can provide communications before the next disaster hits, or we'll have a repeat situation—but we will be there again and communicating. Thanks again.

Jim Pickett, N2RXP
Mechanicville, New York

WA3PZO's reply:

Jim—Thanks for your comments. You're not the first to run into this type of problem. Education *before* the emergency hits is the key. How to do that may be the question. Meeting with the officials ahead of time is the first thing to do. I would go further and suggest informational-type letters to the emergency management director or other official with whom you may be working.

One approach is to provide a short synopsis of amateurs providing help around the country and the world. In August, I tracked about 20 stories that appeared in local newspapers around the country. You might also include copies of relevant articles from ham magazines. Some or all of this information could be sent to local township or county leaders.

Another approach is to have an active public relations program. Every time amateur radio is mentioned in the press or a disaster happens somewhere else in the country, tell your community via the newspapers that amateurs are helping in this disaster and that we're ready to assist via the Skywarn program or ARES/RACES commitment. With the large number of weather emergencies this year, it's a great opportunity. 73,

Bob, WA3PZO

Have We Lost Our Ability to Communicate?

Dear *CQ VHF*:

As usual, I was happy with the October issue of *CQ VHF*, but I did want to comment on your editorial ("Will License Restructuring Work?"). You ask, "Are we solving the right problem?" and say that "the problem is that only around half of these hams are active." Well I sorta fit into that category after being licensed for 35 years.

Here's my reason for being somewhat inactive: I do listen a good bit but am not really inclined to "get on" much. Why? HF...it's a real rat race most of the time; one can barely get in a short "contact"—signal reports and maybe a pleasantry—before a lot of others begin calling the DX on top of you. Try to have a decent conversation and some "dummy" intentionally QRMs the frequency. Listen to the nonsense on 75 and sometimes 40.

VHF...I've been on 6 meters since 1969, starting with the old Heathkit Lunchbox stuck on 50.400 AM. Today, very few people want or feel inclined to move off (the calling frequencies at) 50.125 or 144.200, and most of the time it's, once again, exchange those darned grid numbers and hit the road. The newer people on VHF are bringing their terrible operating practices from HF and implanting them on the VHF bands.

Yeah, I know they need to be educated but I challenge you to try it in a nice way!! I am also aware of the on-off switch and the VFO tuning knob!! Quite frankly I get tired and have gotten tired of fighting the whole thing and choose to stay off the air. I think a lot of the "newbies" have gotten disenchanted early on with the same garbage and feel they don't need it; after all, there is the Internet, but it too has its "dingbats."

CQ VHF Ham Radio Above 50 MHz

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U.S. Government Agencies: Subscriptions to CQ VHF are available to agencies of the United States government, including military services, only on a cash with order basis. Requests for quotations, bids, contracts, etc. will be refused and will not be returned or processed.

Printed in the United States of America.

Postmaster: Please send change of address to CQ VHF magazine, 25 Newbridge Road, Hicksville, New York 11801.

I believe that we as a society have lost the ability to communicate, carry on an intelligent conversation, call it what you may. Am I being a grumpy old guy? No, life is too short to tolerate the dumbing of ham radio. I get more enjoyment out of flying my R/C (radio control) airplanes with a bunch of truly nice people.

I need a good kick-start and so do those other 50% who are inactive or semi-inactive. Fooling around with license restructuring isn't the answer, we've already given away the boat and to what avail? On a good note, I still enjoy *CQ VHF* and the content. From day one, it's been a good publication. Thanks for listening.

Alex Kaplinsky, K5UNY
Dallas, Texas

Alex—I'm glad you're enjoying CQ VHF *despite your disenchantment with much of what you're hearing on the air. You are correct, of course, that education is the key, and that doing it "nicely" is the challenge. It's a challenge we try to meet every month here at* CQ VHF. *I think that your comments will help us meet this month's challenge! As for R/C flying, we'd love to run an article or two about using the 6-meter R/C frequencies—something many hams don't know is available to them. Know anyone interested in writing something?*

Matchmaking

Dear *CQ VHF*:

Love the magazine. At its debut, I felt it was ho-hum, but you have found the groove and become my favorite read. Specifically, I like Mr. Britain's columns. Tell us how to use 75-ohm coax on those simple Yagis! It can't be as simple as going to a full folded dipole, can it? Too much impedance. Hmm—maybe if we squeezed it closer together? Any ideas?

And now, let's toss a new twist into the reasoning for 50-ohm coax. I've heard that 75-ohm coax "listens" best, and that 50-ohm transmits best. I've heard the "water pipe" reasoning, the "economy of copper during the war" reasoning, and a few others. This may be a new one, from my military experience:

The military loves "universal"-type products. I suspect 75-ohm coax came about because its impedance was a good match to dipole antennas. When dipoles were the norm, all was fine, assuming 1/2-wave elevation, etc., for 73-ohm impedance. Tube transmitter tank circuits would match to line and aerial. The rub? The military discovered 1/4-wave verticals. Oops, lower impedance, around 34 ohms...2:1 SWR on the line, ouch. To fix this—ta dah—50-ohm cable splits the difference with a 1.5:1 or lower SWR at resonance for both systems. A "universal" cable, if you will. Sounds reasonable to me. What do you think? At least, it's a better thing to bat around than more code/no-code controversy.

Thanks, guys.

Paul J. Giacherio, KC8AQN
Clinton Township, Michigan

Paul—Interesting theory, and it probably holds as much water as any of the others floating around out there. As for using 75-ohm cable on ham antennas, I'd recommend that you check out a couple of our back issues that had some excellent articles on the topic. Specifically, in the July, 1997, issue, Arnie Coro, CO2KK, wrote "Yes, All My Coax Cables are 75 Ohms (and everything works OK!)," with additional information gleaned from the Internet in a brief article in the same issue. Then, in November, 1997, Ron Gang, 4X1MK, wrote about "A Ridiculously Simple Way to Use 75-Ohm Coax." If you've held on to your back issues, I'd suggest you go check those out. Otherwise, they may be ordered from our office for just $4 each, postage included.

Important Update

Due to the time involved with preparing CQ's comments to the FCC on license restructuring, and the space needed to report on it, we'll have to delay our contest announcement until next month at the earliest. Meanwhile, please note that, due to a conflict with ham activities in California, **the 2nd annual *CQ VHF* National Foxhunting weekend will be held on April 17 and 18, 1999, instead of the 24th and 25th, as announced last month. Please mark the new date in your calendars.**

Product Update

ICOM IC-R2 Handheld Receiver

Well, it doesn't quite cover DC to daylight, but it comes darn close! ICOM America's new IC-R2 handheld communications receiver will let you listen in on virtually everything (except cellular frequencies, of course) between 500 kHz and 1.3 GHz. That includes every ham band from 160 meters through 23 centimeters, every shortwave broadcast band, every public safety band, AM, FM, and TV broadcast bands, and whatever else is in between. It listens in AM (*but not SSB—ed.*), FM, or wide FM, features eight banks of 50 memory channels (400 total), large front panel controls for easy operation, CTCSS tone search and decode, multiple scanning functions and tuning steps, an attenuator, a noise blanker, and much more.

The IC-R2 is about half the size of most other handheld scanners, measuring only 2.3 inches wide, 3.4 inches high and 1.1 inches deep. Yet it has a relatively large 36-millimeter speaker (measured diagonally), and a loud 100-milliamp audio output. In addition, its memories are PC-programmable and/or clonable from another R2. Plus, if you purchase the FCC Master File license database software (not available from ICOM), you can quickly customize the R2 to monitor only the active channels wherever you'll be listening.

List price for the ICOM IC-R2 is $244.00 (street prices will no doubt be lower) and is available from your favorite ICOM dealer. For more information, contact ICOM America, Inc., 2380 116th Ave., NE, Bellevue, WA 98004; Phone: (425) 450-6088; Web: <http://www.icomamerica.com>.

Circle 100 on reader service card

PkTerm '99 for Windows

PkTerm '99 from Timewave Technology and Creative Services Software, a new 32-bit Windows® terminal program for Timewave TNCs, is now available for "preview." This program takes advantage of the new features in Windows 95/98 and Windows NT, and integrates these features with the "Host Mode" of the Timewave wireless modems (TNCs).

PkTerm '99 requires Windows 95, Windows 98, or Windows NT with at least 8 MB of RAM and 6 MB of free hard drive space. The program supports Com1 through Com35 and has "point and click" commands for the VHF and HF modes that the Timewave TNCs support. The program is written in robust C++, using the Microsoft Foundation Class Library.

This preview version of PkTerm '99 has been in beta test since last August. Purchasing the preview version will allow the user to upgrade to the release version at no additional cost. PkTerm '99's suggested retail price is $69.95; it is available directly from Timewave.

For more information, contact Randy Gawtry, Timewave Technology, Inc., 58 Plato Blvd. East, St. Paul, MN 55107; Phone: (651) 222-4858; Fax: (651) 222-4861; E-mail: <Sales@timewave.com>; or contact Rick Ruhl, Creative Services Software, 503 West Stare Street, Suite 4, Muscle Shoals, AL 35661, Phone: (256) 381-6100; Fax: (256) 381-6121; E-mail: <Sales@csslncorp.com>.

Circle 101 on reader service card

"ARRL Antenna Book CD"

The ARRL has added one more publication to its CD-ROM collection: *The ARRL Antenna Book CD 1.0* includes the full text of the 18th edition of the printed *Antenna Book*, along with all of the drawings, tables, illustrations, and photographs contained in the print edition. Also, the CD contains the companion software that's provided on diskette with each printed book, plus—get this—70,000 pages of propagation tables, covering propagation from 40 parts of the U.S. and more than 100 other locations around the world. For the VHFer, the *Antenna Book CD* includes the print version's chapters on VHF/UHF antennas, satellite antennas, and direction-finding antennas, among other topics of interest. The CD also includes copies of Adobe "Acrobat Reader" and the "Acrobat Search" search engine to let you quickly find what you're looking for. It's suitable for use with either Windows or Macintosh operating systems.

The ARRL Antenna Book CD 1.0 is $39.95 plus shipping, and is available from your favorite ARRL dealer or directly from the ARRL, 225 Main St., Newington, CT 06111; Phone (orders only): (888) 277-5289 or (860) 594-0355; Fax: (860) 594-0303; Web: <http://www.arrl.org>.

Circle 102 on reader service card

MFJ-414 Professional Classroom Morse Tutor

Designed for volunteer examiners, ham clubs, teachers, Elmers, schools, and individual hams alike, MFJ's new Code Tutor features include an LCD readout, printer port, audio tape recording output, loud powerful audio with true sinewave and no keyclicks, computer interface, ability to store 16 FCC exams for VEs, HF/VHF radio interface for on-the-air practice, and a full-featured memory keyer.

The MFJ-414 has everything that's in the MFJ-418 pocket-sized code tutor and more. The printer port is useful for printing correct answers for students to check copy after a code practice session. You can record high-quality code tapes for additional home study. A serial port lets

you up or download custom practice groups to or from your PC.

If a student is having trouble with certain characters, you can build and save three custom sets (16 characters each) for extra practice. You can combine these to give you 48 characters for using the KOCH method. You can customize random words for practice too. You can use your MFJ-414 with your 144/440 MHz FM handheld of HF transceiver for on-the-air Morse code practice with your buddies or an entire club. VEs can give up to 16 FCC exams. You can computer-generate actual FCC exams and download them to the MFJ-414 to test future hams and upgrades.

It is also a full-featured memory keyer, with 1,000-character memory, semi/auto modes, iambic A/B, reverse paddle, and the ability to change speed and tone on-the-fly. You can practice sending into the MFJ-414 with an Iambic paddle or straight key. Use built-in speaker or external speaker or headphones. Includes serial port cable and open-end patch cable (soldering required). Use 12 VDC or 110 VAC. Dimensions are 2 1/4 x 8 1/2 x 6 inches (HWD). It comes with a one-year limited warranty.

To order or for your nearest dealer, call (800) 647-1800; Fax: (601) 323-6551; E-mail: <mfj@mfjenterprises.com>; or you can check out dealer and ordering information on the Web at: <http://www.mfjenterprises.com>.

Circle 103 on reader service card

Hamtronics' Synthesized UHF FM Exciters & Receivers

Hamtronics' FM transmitters and receivers have long been popular for repeaters, voice and data links, control, telemetry, and other demanding applications. Now, the new T304 exciter and R304 receiver provide high-quality NBFM and FSK operation for UHF ham bands in the 420- to 450-MHz range and for adjacent bands from 400 to 470 MHz for export and government services. Features include dip-switch frequency selection, low phase-noise synthesizer for applications such as repeaters, commercial-grade TCXO for tight frequency accuracy, and fast delivery with no wait for channel crystals.

The T304 exciter uses direct FM modulation, which allows FSK transmission of data up to 9600 baud. Power output is 2 to 3 watts, and it is rated for continuous duty in demanding applications, such as repeater service. The R304 receiver has the same sensitivity, selectivity, and squelch as other Hamtronics® receivers. Both modules are designed to be easy to align and repair.

The T304 and R304 are available either in kit form or factory-wired and tested. The T304 exciter is $149 for the kit or $189 wired/tested. The R304 receiver is $179 for the kit or $209 wired/tested. Because they are designed only for use in demanding applications, both kits and factory-built units include a TCXO as standard equipment, so there are no optional extras to worry about. Since there is no wait for channel crystals, units are kept in stock for immediate delivery.

For more details, visit the Hamtronics Web site at <http://www.hamtronics.com>. For a printed catalog, contact Hamtronics, Inc., 65-V Moul Rd., Hilton, NY 14468-9535; Phone: (716) 392-9430; Fax: (716) 392-9420; E-mail: <jv@hamtronics.com>. Please tell them where you saw this announcement.

Drake Ends Factory Service for Older Ham Rigs

Vintage Drake HF radios have remained popular among VHFers as IF (Intermediate Frequency) radios for VHF and UHF transverters. If you're one of these hams, take real good care of that radio. The R. L. Drake Company says it can no longer provide factory service for most of its older ham rigs, including the venerable T-4X, T-4XB, and T-4XC transmitters; R-4 and R-4A receivers; TR-3 and TR-4 transceivers; power supplies for most of those units; and the TR-22, 22-C and 33-C 2-meter transceivers. According to the *ARRL Letter*, Drake Service Manager Bill Frost, WD8DFP, says it's getting very difficult to get replacement parts for these older units. A complete list is posted on the R. L. Drake Web site at <http://www.rldrake.com/tech/Outofservice.html>.

Frost said Drake still has some parts for these units in stock and might be able to supply individual owners with parts for do-it-yourself repairs. For more information, call Frost at (513) 746-4556, or e-mail him at <Bill_Frost@rldrake.com>. Regular mail will work, too. Write to: Bill Frost, R. L. Drake Co., Service Dept., 230 Industrial Dr., Franklin, OH 45005.

Buckmaster "HamCall" Weekly Updates

Forget the twice-a-year updates of your callsign directory software...or buying a CD in March only to discover it's six months old. Buckmaster is now updating its HamCall CD-ROM *every week*, so whenever you order your copy, it will be the most up-to-date version available. This U.S. and international directory includes over 1.5 million listings, plus old-new call cross-references, and e-mail addresses. If you run it under Windows™, you can customize the label settings to print on the labels of your choice. Plus, you can edit records, insert new addresses, add e-mail addresses, etc.

The most current HamCall CD-ROM is $50 plus shipping and may be ordered from Buckmaster, 6196 Jefferson Hwy., Mineral, VA 23117; Phone (540) 894-5777 or (800) 282-5628; Fax: (540) 894-9141; E-mail: <info@buck.com>.

Circle 104 on reader service card

Updated "Tube Substitution Handbook"

The *Tube Substitution Handbook, Revised Edition*, by Barry Buchanan and William Smith, is the most accurate, up-to-date guide available to determine direct substitutes for receiving tubes and picture tubes. The updated *Handbook* will be useful to antique radio buffs, ham operators, and collectors of vintage ham radio equipment. In addition, marine operators, microwave repair technicians, and TV and radio technicians will find the handbook to be an invaluable reference tool.

The *Handbook* is divided into three sections—vacuum tubes, picture tubes, and tube basing diagrams—each preceded by specific instructions. The tube basing diagrams provide a handy reference to pin numbers for the tubes listed in the other sections.

Authors Barry Buchanan and William Smith are engineers with Howard W. Sams & Company. They amassed the information for this book while designing PHOTOFACT® service documentation. The *Tube Substitution Handbook, Revised Edition* retails for $19.95 and may be ordered by your local bookstore using ISBN#: 0-7906-1148-1. For more information, contact Prompt Publications at (800) 428-7276.

The Colorado 14er: VHF Adventures in the Rockies

So you're looking for an operating challenge? But you don't have the bucks to outfit a big multiband, multimode contest station? No problem...just get out your HT and your hiking boots. The Colorado 14er awaits.

By Sam Vigil, WA6NGH*
(Lvengr@aol.com)

Imagine a VHF event for which you only need an HT and a backpack. Well, guess what—it exists! It's the Colorado 14er, in which the goal is to work as many of Colorado's 14,000-foot plus peaks as possible. There are no roads to most of these peaks, so most operators have to hike in and carry everything on their backs. It certainly levels the playing field! This is a radio event for fun and ham radio fellowship, not a contest. There are no points or winners, but, as a bonus, you get to camp in the wonderful Colorado Rockies.

Planning and Preparation

Although I've traveled in Colorado several times and have even backpacked in the Rockies, I really didn't know much about the geography of the Colorado 14ers, Colorado's 54 mountain peaks over 14,000 feet elevation. My first stop for information was the 14er Web site (see "Resources"), which has event rules, band plan, and latitude and longitude of the 14ers. There are also links to the Colorado Mountain Club, an excellent resource. I purchased two books from their bookstore: *Colorado's Fourteeners—From Hikes to Climbs* and *Colorado's High Thirteeners—A Climbing & Hiking Guide*. The books provide detailed information on routes, trails, and degree of difficulty. I also ordered maps of the National Forests from the Rocky Mountain Region National Forest Web site.

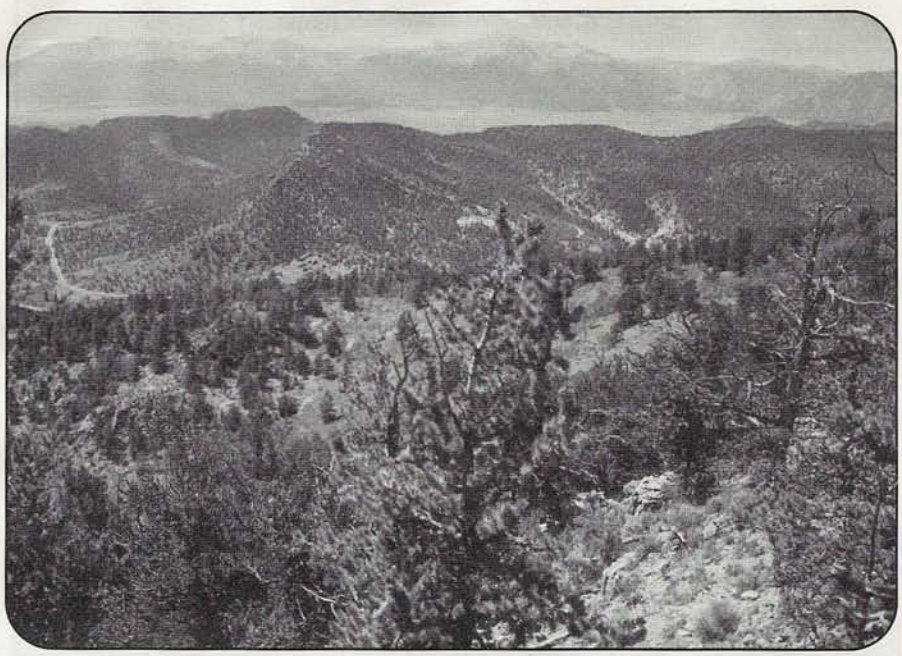


Photo A. The view from Kaufman Ridge, from which WA6NGH and KF6NEV operated the Colorado 14er event, with some of the "14er" mountains—with peaks above 14,000 feet—visible in the background. (WA6NGH photo)

On the 14er Web site, event organizer Bob Witte, KBØCY, recommends that beginners not tackle one of the 14ers if this is their first time participating in the event. So XYL Eve, KF6NEV, and I decided to set up camp at a lower elevation site with good line-of-sight propagation to the 14ers (see Photo A). Finding such a site was difficult with the maps that we had, so we purchased a raised relief map of Colorado (again, see "Resources"). From the relief map, we determined that some of the 10,000- to 12,000-foot mountains near Buena Vista, Colorado, would fit our needs. If hiking's not your thing, it's also possible to work many of the 14ers from a strategically placed mobile rig.

Sam Vigil, WA6NGH, is a professor of environmental engineering at California Polytechnic State University, and is a regular contributor to CQ VHF.

Table 1.

Freq. (MHz)	Mountain/Range
6 meters	
52.525	Primary 6-meter FM frequency
2 meters	
146.43	Longs Peak
146.46	San Juan Range
	Sangre de Cristo Range
146.49	Bierstadt, Grays, and Torreys
146.55	Coordinating Frequency (Net Control, Pikes Peak)
146.58	Mt. Evans
147.42	Elk Range and North Sawatch Range
147.45	Mosquito Range
147.48	South Sawatch Range (Huron and peaks south)
147.51	Pikes Peak (QSOs)
147.54	Reserved for mountaintop stations only
1.35 meters	
223.50	Primary 222-MHz frequency
70 centimeters	
446.000	Primary 70-centimeter frequency
446.025	Alternate 70-centimeter frequency
446.050	Alternate 70-centimeter frequency

Other bands/modes: standard calling frequencies

Table 1. Band plan for Colorado 14er event.

My equipment plan was very straightforward: a dual-band HT as my primary rig, a 2-meter-only HT as backup; AA cell battery packs and spare batteries for both rigs; rubber duck, half-wave, and Yagi antennas for both 2 meters and 70 centimeters (the Yagis were built from Kent Britain, WA5VJB's, "Cheap Yagi" articles in the August and October, 1998, issues of *CQ VHF*); and my GPS (Global Positioning System) receiver.

The plan was to have everything built and tested on weekend camping trips at least a month before the August 30 event.

Photo B. Eve Vigil, KF6NEV, sets up camp about 500 feet below the summit of Kaufman Ridge. The view isn't as good, but it's a safer place to be when thunderstorms roll through, as they often do. (WA6NGH photo)

"The plan was to have everything built and tested on weekend camping trips at least a month before the August 30 event....[but] the antennas were barely finished the night before we left!"

As luck would have it, I decided to take an intensive eight-week Emergency Medical Technician course which ended only a few days before our scheduled departure. This meant that the antennas were barely finished the night before we left! I was able to roughly check the performance of the 2-meter Yagi by working my son-in-law, John Danner, KF6NWH, across town on low-power simplex. I didn't have time to track down anybody with a 70-centimeter rig, so that Yagi wasn't tested. John also installed my mobile rig (an HF/VHF multi-multi) the night before we left while I did last minute packing ("best laid plans of mice and men...").

Making the Climb

We left our home QTH in San Luis Obispo, California, on August 20. We did a lot of sightseeing along the way and finally arrived in Buena Vista, Colorado, on the 29th, several days later than we had planned. After consulting with a local backpacking shop, we decided to camp on Kaufman Ridge, to the southeast of Buena Vista. The topographic map indicated a relatively easy hike to the summit, at 10,660 feet, and our National Forest map showed that our goal was public land inside the San Isabel National Forest. However, when we actually got out on the trail, we discovered that much of the land adjacent to the Forest Service road was fenced off and posted "No Trespassing." A review of the Forest Service map showed that, although most of the high country is public land, much of the lower elevation land (in this case, less than 9,500 feet) was privately owned ranch land.

After almost an hour of backtracking, we found public access to Kaufman Ridge and started our hike to the summit. Because of weight and size limitations, I decided to leave the 70-centimeter Yagi behind and focus on 2-meter operations. We set up camp (Photo B) about 500 feet

Table 2.

Callsign	Name	Location	Distance (mi.)
NØFMD	Steve	Mt. Princeton	17.1
KDØGD	John	Mt. Sherman	26.9
KCØAEC	Wolfgang	Mt. Antero	20.4
NØTZL	Dan	Mt Bross	33.0
KØYB	Ken	Pikes Peak	49.5
KBØUAA	Jonna	Mt. Evans	52.5
W4HXC	Walt	Gray's Peak	53.3
KBØYMT	Crawford	Mt. Lincoln	34.1
NØLHW	John	Long's Peak	97.4
N9HSW	Larry	Mt. Massive	35.1
KBØRLF	Roger	Mt. Democrat	33.7
KGØMR	Scott	Mt. Yale	18.9
KØGS	Bud	Mt. Elbert	31.0

Table 2. Log of WA6NGH for the Colorado 14er event, August 30, 1998.

Photo C. Sam Vigil, WA6NGH, uses a compass to aim his four-element "Cheap Yagi" antenna, built from WA5VJB's plans here in CQ VHF. (KF6NEV photo)

History of the Colorado 14er Radio Event

By Bob Witte, KBØCY**
(RobtWitte@aol.com)

The state of Colorado is blessed with some excellent hiking and mountain climbing. The Rocky Mountains and the Continental Divide traverse the state from north to south. Colorado has 54 mountain peaks at or above the elevation of 14,000 feet that are commonly referred to as "14ers." Climbing all 54 of these peaks is a challenging but popular accomplishment. Naturally, amateur radio operators who attempt to "bag" these peaks often bring along an HT to try contacting other hams from the tops of these mountains. The results can be quite amazing, as an HT running only a few watts can access distant repeaters and other faraway stations.

Nearly a decade ago, a group of these hiking hams came up with the idea of designating a day each summer when we all head for the hills to see how many contacts we can make and see how far our signals can propagate. So it was that the Colorado 14er Radio Event was born. The first event was held in 1991, followed by annual events since then.

During the event, these amateur radio operators set up their stations on the summits of Colorado's 14,000-foot mountains and try to work each other and any "flatland" stations they can. Most of the mountains must be hiked up and are strenuous at best and technically challenging at worst. Two of the mountains (Pike's Peak and Mount Evans) have automobile roads to the top. A couple of other peaks can be reached by 4-wheel drive vehicles.

Safety First

The biggest safety issue is the threat of lightning caused by the frequent afternoon storms that build over the mountains. The rule of thumb for climbing 14ers is to be off the summit by noon, before the storms build. Accordingly, the designated time for the event is from 9:00 a.m. until noon local time. This makes for a short but intense operating event.

Any radio amateur with experience hiking in the high country is invited to participate as a mountaintop station. However, the peaks are assigned on a first-come, first-served basis so that multiple operators don't show up at the same peak (unless they're operating together). The basic idea is to make the best use of the climbing effort and cover as many peaks as practical.

The radio operators who hike in greatly favor lightweight, portable radio gear. The typical station is an HT with a half-wave antenna (since the standard rubber duck antenna has performance similar to a wet noodle). A small Yagi antenna is very helpful and doesn't add much weight. This choice of equipment places most of the activity on 2-meter FM. With the popularity of dual-band (2-meter/70-centimeter) HTs, 440 MHz also gets used quite a bit. Most of the hiking operators carry their radio gear in a small daypack, along with their normal backcountry essentials (water, food, raingear, etc.).

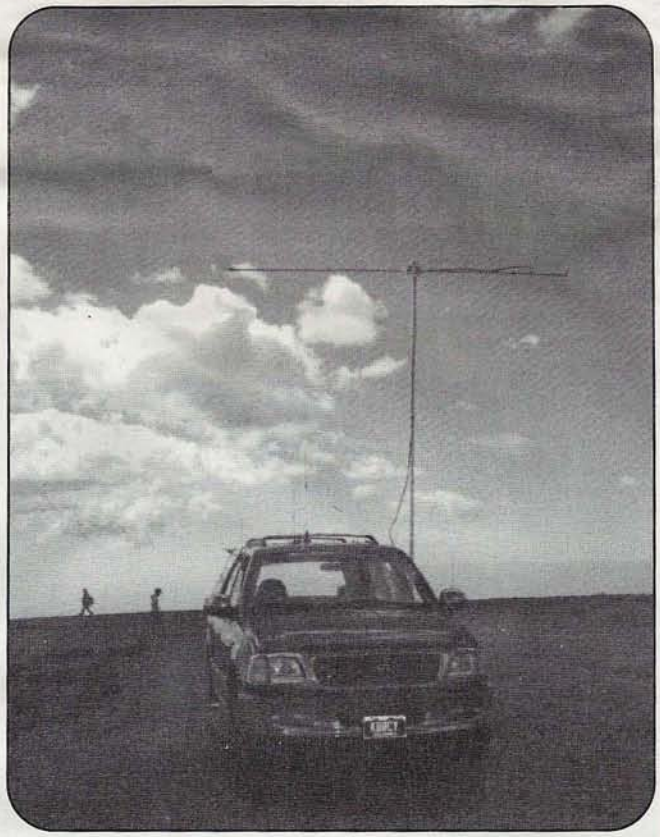


Photo E. Net control station KØYB on Pike's Peak with 11-element 2-meter beam for SSB contacts. There are two stations set up on Pike's Peak during the Colorado 14er event, one net control position and another for making contacts. (KBØCY photo)

Stations on drive-up mountains tend to bring heavier equipment and may operate all VHF/UHF bands on both FM and SSB. For example, in 1998, the Pike's Peak operation consisted of two automobiles with multiple transceivers in each one. These radios supported operation on 10-meter FM, 6-meter FM and SSB, 2-meter FM and SSB, 222-MHz FM, and 440-MHz FM. In addition, the net control station used a scanner to monitor all event frequencies to keep tabs on the level of activity.

Pike's Peak

Pike's Peak, which is centrally located in Colorado, plays a special role during the event. There are two stations on Pike's, one handling QSOs and the other acting as Net Control

***Bob Witte, KBØCY, is the founder and organizer of the Colorado 14er event.*

for the event (Photo E). The Net Control station (Photo F) keeps track of which mountains have been heard from and passes along information to interested parties, generally helping the event along.

Because the event generates considerable 2-meter FM activity, a band plan is used to spread out the action (Table 1). Basically, the idea is that mountains close to each other share the same frequency since operators located on them will tend to hear the same stations. Operators are asked to cooperate in making contacts and in keeping on-channel interference low. The band plan is not rigid, since mountaintop stations need to tune around to work the other 14er stations.

The 1998 Event

Last year (1998) was the eighth year for the event, with results similar to other years. The crew on Pike's Peak activated KØYB right at the designated start time of 9:00 a.m. The hiking operators had gotten up hours earlier to hit the trail and make their way to the tops of their respective mountains. Many had camped out overnight near the trailheads to get an early start. Right after 9 a.m., John, KDØGD, checked in from the summit of Mount Sherman, followed by Andy, AAØCM, on Snowmass Mountain and Larry, N9HSW, on Mount Massive. Chris, KBØQQW, led a group of youths from the International Association for Astronomical Studies, operating their club station KBØUAA on Mount Evans. Other stations called in as they made their respective summits and the VHF and UHF bands came alive.

In all, there were 17 peaks active that day (Table 3), which is typical for the event. Many of the peaks are remote and/or difficult climbs, so they're not often activated. The QSO station on Pikes Peak (as opposed to the net control station) made over 100 contacts during the three-hour period, for a QSO rate of about one contact every two minutes. Most mountaintop stations make contacts out to 100 miles. This year, the longest distance contact between 14er stations was between N5GIC on Mt. Sneffels and NØVMF on Mt. Lindsey, a distance of 132 miles.

Photo F. Joyce Witte, KAØDEH, operating the KØYB net control station from Pike's Peak during the 1998 Colorado 14er event. (KBØCY photo)

"The QSO station on Pikes Peak (as opposed to the net control station) made over 100 contacts during the three-hour period, for a QSO rate of about one contact every two minutes."

Distance Records

The longest distance contact *ever* made during the event was completed by Ron, NØIVN, in 1996 from Mount Evans. Using 25 watts and a beam antenna, Ron worked NØYKR in Great Bend, Kansas, on 2-meter SSB at a distance of approximately 388 miles. SSB offers an efficiency advantage over FM, but Ron also worked KAØVNV in Ogallala, Nebraska, on 2-meter FM, a distance of 232 miles.

The longest distance contact between two 14er summits occurred in 1995 between Andy, AAØCM (assisted by Paul, KGØCZ), on Longs Peak, and Jan, W3GEY, on Sunshine, 188 miles away. Both of these mountains must be hiked to, so these operators were using compact portable equipment running only a few watts of RF power. What a difference altitude makes! Longer distance 14er-to-14er contacts are possible between Longs Peak and 10 other peaks, but these contacts have not yet been achieved.

Benefits of the Event

The number one benefit of participating in the 14er event is *fun*. It's a great way to get out and enjoy the outdoors while using amateur radio. There's also considerable challenge involved with choosing a summit, finding the route, organizing your equipment, and making it to the summit. Just climbing a 14er is considerable physical challenge without the complications of operating in the event (for this reason, we recommend that radio amateurs not use the 14er event for their first climb).

Another benefit of the event is that it generates activity on the VHF/UHF bands. More to the point, it generates simplex activity (as opposed to repeater contacts), which gets people thinking about the capabilities of their stations *without the use of repeaters*. In addition, this activity spreads out over multiple bands, including 50, 222, and 440 MHz.

The event also encourages operation that is truly portable, with human power carrying the equipment. Participants learn how to operate from remote locations under challenging conditions, which encourages preparedness for emergency operation. In fact, many 14er event operators have been involved with emergency communications in the backcountry, either during the event or on other hikes.

So if you're planning to be in Colorado at the end of August, if you enjoy hiking and climbing in the crisp, clear, air, and if you enjoy operating ham radio from out-of-the-way places with incredible views, mark off August 29 on your calendar and let me hear from you about participating in the 1999 Colorado 14er event.

Table 3.

Mountain	Call	Name	Other operators
Antero	KFØWF	Frank	KCØAEC
Bierstadt	KCØCAV	Eric	
Bross	NØTZL	Dan	NØXDW and others
Democrat	NØUVR	Dave	KBØRLF, NØRQV
Elbert	KØGS	Bud	
Evans	KBØUAA	Chris	KBØQQW and IAAS team
Grays	W4HXC	Walt	
Lindsey	NØVMF	Leith	
Lincoln	KBØYMT	Crawford	
Longs	NØLHW	John	NØEC
Massive	N9HSW	Larry	
Pikes	KØYB	Pikes Pk	WA6TTY, NØIPQ, KAØDEH, KBØCY
Princeton	NØFMD	Steve	KBØWFL, KBØVUU, KBØREF, KCØAEB
Sherman	KDØGD	John	
Sneffels	N5GIC	Allyn	
Snowmass	AAØCM	Andy	
Yale	KGØMR	Scott	

Table 3. 1998 Colorado 14er event summary. Seventeen 14ers were manned. The furthest QSO was between N5GIC on Mt. Sneffels and NØVMF on Mt. Lindsey, 132 miles apart.

The Mt. Yale Ascent

One participant in the 1998 Colorado 14er event discovered that the benefits went beyond ham radio, and hiking:

As in past years, I was joined by my (now 16-year-old) son, David. We managed to open up the time slot at the last minute and signed on for 14,196-foot Mt. Yale. But squeezing in the climb involved some serious burning of the candle at both ends: a couple of hours' sleep on Friday night, and *no* sleep on Saturday night—not a good recipe for a climb. If I seemed a bit groggy when I talked to some of you, well, now you know why.

We left Greeley, Colorado at 0200 Sunday morning and arrived at the Denny Creek trailhead at around 0530. After struggling with gear in the dark, we started up the trail by headlamp at roughly 0555, with great will, but little energy. We summited at 0925, got set up, made a few contacts and checked in with control on Pike's Peak.

We shut down the radio at about 1145 and, after a leisurely lunch, departed the summit at 1230. With absolutely no energy (sleep really does matter I guess), we took lots of breaks on the way down, and we didn't arrive back at the trailhead until almost 1500. And then the endless drive home...

Highlights

There were many highlights...lots of good contacts. The incredibly beautiful weather coupled with the fabulous views into the Collegiate Peaks Wilderness and beyond. We spent three hours on the summit, rather than my more typical "peak bagging" time of 15 to 20 minutes. Perhaps the best part, though, was spending "quality time," in the truest sense of the phrase, with my son. We don't get to hike and climb together nearly as much as we'd like as he gets older and busier, and we both really enjoyed the time.

—Scott Turner, KGØMR

"As we hiked the last five minutes, we heard Bob Witte announcing the start of the event from the Pike's Peak net control station. We were just in time, without a moment to spare!"

below the summit to avoid the evening thunderstorms. Being the high point on an exposed ridge is not a good idea.

The next morning, we hiked to the ridge, carrying only our radio gear, antennas, water, and lunch. As we hiked the last five minutes, we heard Bob Witte announcing the start of the event from the Pike's Peak net control station. We were just in time, without a moment to spare!

The Event

The stations on the 14ers (the mountains, that is) operate on preassigned FM simplex frequencies (see Table 1) on 6 meters, 2 meters, 135 centimeters (222 MHz), and 70 centimeters (there are also assigned SSB frequencies on these bands). I decided to work the close-in stations first, using a telescoping 2-meter half-wave vertical, and to set up the four-element Yagi later on to bag the distant stations. My first contact was Steve, NØFMD, who was on nearby Mt. Princeton, only 17.1 miles away. In rapid succession, I worked John, KDØGD, on Mt. Sherman; Wolfgang, KØAEC, on Mt. Antero; and Dan, NØTZL, on Mt. Bross. All of these early contacts were less than 33 miles away.

Eve and I then took about a 15-minute break to assemble my "Cheap Yagi" (Photo C). My version was made from 1/4-inch copper tubing, which is easy to work with but, in retrospect, too soft. I kept snagging it on trees on the way up and bending the elements. The Yagi was mounted on a two-piece, 10-foot PVC mast and taped to a small tree. When not in use as an antenna mast, the PVC pipe sections made excellent hiking sticks.

While I finished assembling the Yagi, Eve finished entering the latitude and longitude coordinates of the 14er mountains into our GPS receiver (Photo D). We used the GPS to find compass bearings from our site to the desired 14er. This made it easy to aim the Yagi.

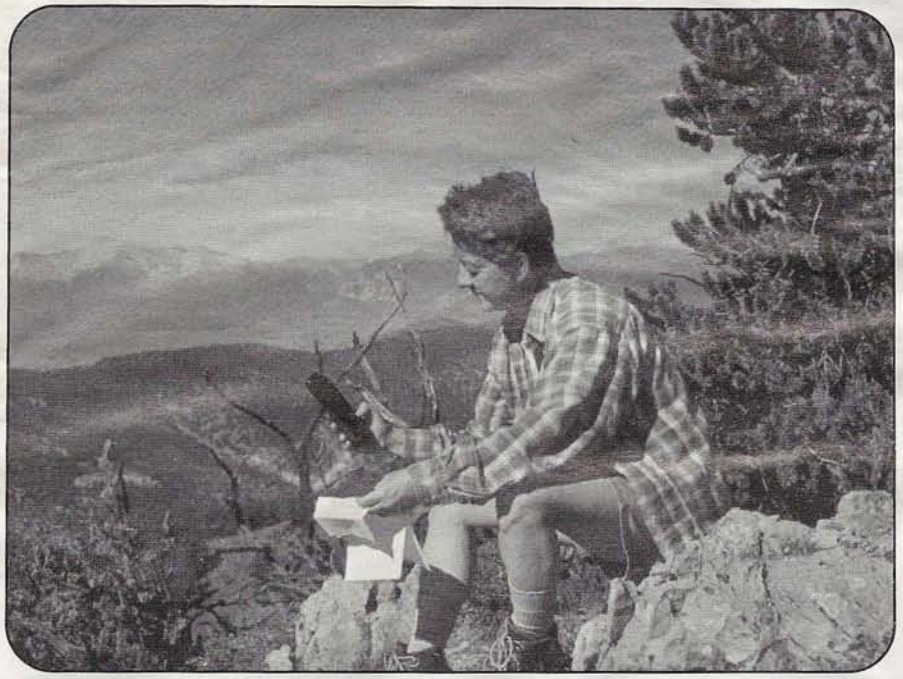


Photo D. Eve Vigil, KF6NEV, enters latitude and longitude data for the active 14er peaks into a GPS receiver, making it easy to find compass bearings for aiming the "Cheap Yagi" antenna at specific mountaintops. (WA6NGH photo)

Resources

Web sites

Colorado 14er Event Home Page: <http://members.aol.com/RobtWitte/colo14.html>

Colorado Mountain Club Home Page: <http://www.cmc.org/cmc/index.html>

Maps Unlimited (topographic and relief maps of area): <http://www.coloradomaps.com>

U.S. Forest Service Rocky Mountain Region: <http://www.fs.fed.us/r2/>

Articles

Britain, Kent, WA5VJB, "Some Really Cheap Antennas," *CQ VHF*, August 1998, pp 57–61.

Britain, Kent, WA5VJB, "More Really Cheap Antennas," *CQ VHF*, October 1998, pp 46–50.

Witte, Bob, KBØCY, "1998 Colorado 14er Radio event," *CQ VHF*, August 1998, p 73.

Books

Garratt, Mike, and Martin, Bob, *Colorado's High Thirteeners—A Climbing & Hiking Guide, Third Edition*, Cordillera Press, Evergreen, Colorado, 1992 (available from the Colorado Mountain Club, 710 10th St., #200, Golden, CO 80401; Phone: (303) 279-3080; Fax: (303) 279-9690).

Roach, Gerry, *Colorado's Fourteeners—From Hikes to Climbs*, Fulcrum Publish-ing, Golden, Colorado, 1996 (also available from the Colorado Mountain Club).

"I was able to work 13 of the 17 14ers manned in the event.... The pace of operations is a lot like Field Day, with the added attraction of trying to work 14er 'DX' with a QRP (low-power) VHF rig. This is the most fun I've had in a ham radio event in many years!"

Our strategy seemed to work. I was able to work 13 of the 17 14ers manned in the event (Table 2 for my log and Table 3 for a list of the peaks activated in the 1998 event). The pace of operations is a lot like Field Day, with the added attraction of trying to work 14er "DX" with a QRP (low-power) VHF rig. This is the most fun I've had in a ham radio event in many years! Next time I hope to be on a 14er summit myself.

A Modest Proposal

Start planning for the August 29, 1999, Colorado 14er event. If you can't make it to Colorado, why not start a 14er type event in your state? You don't need to be in the Rockies to have fun on VHF simplex. Consider what is special about your area and create an operating event around that theme. You'd be amazed at what you can do with an HT, a simple antenna like a telescoping half wave, and even a few hundred feet of elevation! ■

2-Meter Mountaintopping with Mirrors

How far can YOU project a beam of light? How's 80-plus miles? Two-meter FM simplex provides coordination and confirmation for this band of "light-headed" hams.

By Edward Butler, KF6DXX*
(ebbutler@juno.com)

I first became intrigued with the idea of sending light signals about 10 years ago, while on a solo winter camping trip in California's Anza-Borrego Desert, east of San Diego. From my primitive campsite that night, I could see lights on what I later learned was the then-active Mount Laguna FAA (Federal Aviation Administration) radar site, about seven miles from my camp and thousands of feet higher in elevation.

It occurred to me that it would be interesting to send some kind of signal to the source of those distant lights and maybe even get an answering signal in return. Maybe that was the seed of my interest in amateur radio. Anyway, I got my license in May, 1996, and, last summer, I made a pilgrimage to the site of those distant lights I'd seen years ago.

Our radio club, the Palomar ARC, provides time on its repeaters for a number of special interest nets; one of the nets I participate in is the Hikers' Net. This is a net where hams with an interest in hiking can exchange information and plan hikes in the San Diego area and beyond. One of the hikes last year was our mirror signaling hike, which has become something of an annual event for our hiking group. The hike was on August 2, 1998, and it combined hiking with 2-meter mountaintopping and mirror signaling between Southern California peaks (see Photo A).

Photo A. The author (standing) and Mert Taylor, KF6KCE, send mirror signals 65 miles from Monument Peak to Mount San Jacinto, both in southern California. Mert is holding a small 3 x 5-inch signaling mirror in front of his face. (All photos by the author)

For this hike, we selected Mount San Jacinto, the second-highest peak in southern California at 10,804 feet, as the northern signal site. The southern site was Monument Peak (6,272 feet) in the Laguna Mountain Recreation Area, east of San Diego. These two peaks are roughly on a north-south line and are high above the smog and most atmospheric haze. Monument Peak forms part of the escarpment where the Laguna Mountains drop away thousands of feet to the western edge of the Anza-Borrego Desert. Ttrees along the ridge line of the escarpment are windblown and bent from the winter storms and snow, but, on August 2nd, the temperature there was well up into the 90s.

Hitting the Trail

The main San Jacinto hiking group reached its destination at the summit by first riding the Palm Springs Aerial Tramway to the upper tram station at 8,500 feet. There they began a six-mile hike to the summit, with a 2,300-foot elevation gain along the way. Even in the middle of July, the upper parts of the trail are still under several feet of snow and a few patches of snow still remained at the summit on the day of our August hike.

**Ed Butler, KF6DXX, enjoys combining hamming with hiking and camping in the mountains of Southern California.*

Photo B. Basic ham radio mirror signaling gear: a 3 x 5-inch "Survival Signalling Mirror, Air Force Type" (note the hole in the center for aiming) and a handheld radio. These signaling mirrors are available from hiking and outdoor stores for about $8 each.

Perhaps wanting more of a challenge, one of the group members, John Lee, KT6E, hiked up a 7.25-mile trail while gaining 4,000 vertical feet to the summit. John arrived there ahead of the main party and was the first to exchange mirror signals with my group on Monument Peak to the south.

For the sake of clarity, let me explain that, as of now, we're not exchanging any real messages via the light beams, as we have no way to "modulate" them. We consider a "contact" to be a sighting of the light signal by a group member at each end of the path, confirmed by radio on 2 meters. I'm in the process of building a solenoid-activated mirror mount which will allow us to send Morse code and make direct "contacts" via light beams.

Before setting up our station on Monument Peak that morning, we had first scouted nearby Mount Laguna, location of the now-abandoned FAA site mentioned earlier. This site is now populated by numerous antennas for cellphones and other users, along with one intact radome. We found that this location did not offer a clear view to the north, so went instead to Monument Peak, 1.25 miles to the north.

Earlier that morning, we had signaled back and forth to Mike Doyle, AB6QT, who was atop the dome of the Hale Telescope on Palomar Mountain about 40 miles away, using small 2 x 3-inch and 3 x 5-inch mirrors. These mirrors, labeled "Survival Signalling Mirror Air Force Type," were purchased from a hiking equipment store and cost about $8 each (Photo B).

The mirrors have a clear unsilvered area in the center to sight through. Within this clear area is a fine mesh or grid with a hole at its center (Photo C). The grid is coated with tiny reflective spheres which, when struck by sunlight, produce a small bright spot in the clear area. This spot looks like a tiny image of the sun and indicates where the mirror is being pointed. By sighting through the mirror until this bright spot is superimposed on a distant object, the beam of reflected light can be aimed quite accurately after only a few minutes of practice.

Setting Up Radios and Mirrors

After a 45-minute walk, we arrived at the high point on Monument Peak and began setting up our radio and mirror station. After a scan of the horizon, an almost 360-degree array of mountains,

Update

On a September 12th hike, I sent a one-way mirror signal from Cuyamaca Peak to Lorraine Aubert, AC6XK, on Mount San Gorgonio (11,499 feet), where she was participating in the Top of the World Contest (*Lorraine wrote about the Top of the World contest in the November, 1998, issue of* CQ VHF.—*ed.*). She confirmed seeing several of my signals at a distance of 80.5 miles—the longest distance we have reached so far—but did not have a signaling mirror of her own, so she could not respond in kind.

I'm now nearly done with the mirror mount for sending code (*see main text—ed.*) and am building up a unit for Lorraine, as well, so we can send actual messages via our beams of light on future hikes.

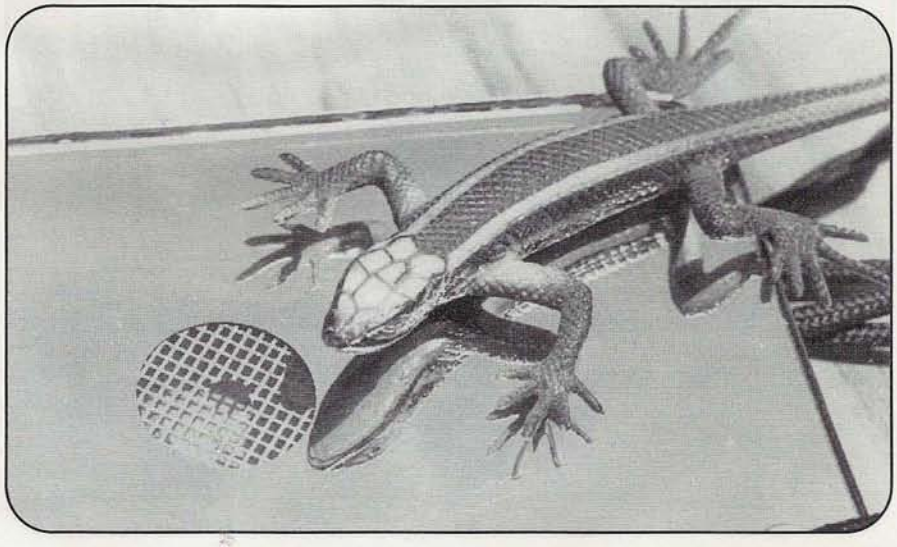


Photo C. Close-up view of the small signaling mirror and the non-reflective grid used for aiming. Ed says "the lizard is fake, but I added it for scale."

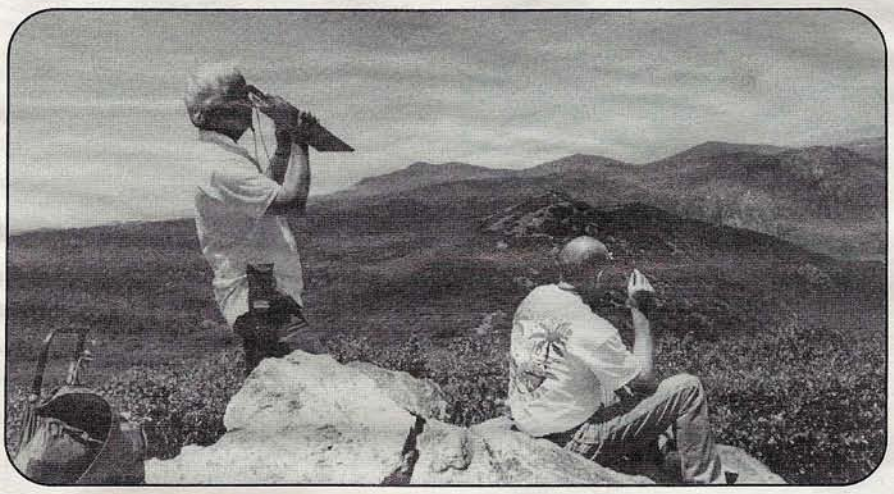


Photo D. Getting out the "big guns." The author uses his "linear amplifier mirror," a 12-inch-square mirrored tile, to send stronger light signals to Mt. San Jacinto, while Mert Taylor continues to use the smaller mirror. Also on Monument Peak with Ed and Mert was Glenn Paden, KE6ZLY; the team on Mt. San Jacinto included Bob Gonsett, W6VR; Stan Rohrer, W9FQN; Nirmal Velayudhan, KF6RAC; John Lee, KT6E; and Ted Wilcox, KF6BFI.

we were able to pick out Mount San Jacinto. A radio call to the group there revealed that they were still en route to the summit and were taking a lunch stop. While we waited, we briefly explored our site, then sat back to enjoy the view.

By early afternoon, the San Jacinto hikers were all in position and we were ready to begin our 65-mile attempt. We first used the small 3 x 5-inch mirrors (look closely at Photo A), and were just barely able to see the flashes without using binoculars. Next, out came what I've dubbed our "linear amplifier" mirrors (Photo D). These are considerably larger in size than the pocket size sighting mirrors and are easier to spot, especially through the haze. Mine is just a 12-inch-square mirror tile mounted on a sheet of clear acrylic with a pocket to hold the sighting mirror so that both mirrors can be used together (Photo E). The brilliant orange light reflected from the large mirrors was easy to see with the unaided eye.

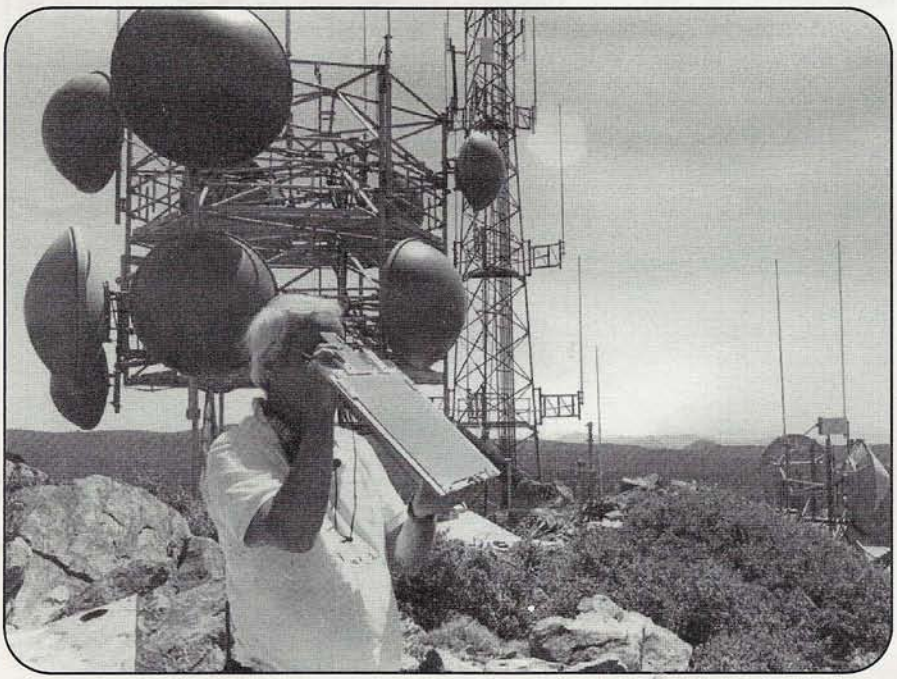


Photo E. The author using his "linear amplifier mirror" on Monument Peak. Note the pocket at the top in which he's placed the smaller signaling mirror for aiming the larger one.

Beaming In

Sending light signals over long distances with mirrors takes a bit of tuning in by those at each end of the proposed light path, to narrow in on the area to sweep with the light beam. This process is largely based on feedback from those on the opposite peak, so our 2-meter handheld radios are essential at this stage.

Once the right mountain is spotted, we sweep our mirrors in arcs across it while waiting to hear an "I got it" over the radio. Once this is heard, we sweep smaller arcs, punctuated with additional "got it" reports, trying to focus in on the exact location of the group on the opposite peak. This usually continues until we're able to send a more or less steady beam of light in both directions and everyone has had a chance to participate in the fun.

The August expedition set a new 65-mile mirror signal record for our group. We had an exceptional day in the outdoors and were ready to start planning for the next hike, perhaps in the fall, when the skies are clearer and we might be able to better our distance record. By then I hope to perfect my little solenoid-activated mirror mount for sending Morse code.

Practical Value...and Fun

Our light signaling exercise provides us with some experience in practical field communications, but its main purpose is to have fun. The mirror contacts made on our hikes seem to generate a lot of interest from other hikers, and most of them enjoy looking with us for the distant light flashes. People at our sites are usually enthusiastic about what we're doing, especially when they realize that the light flashes they're seeing are coming all the way from another county.

There's another practical value to this exercise, of course. It's called exercise! Ham radio—especially VHF ham radio—doesn't have to be a sit-at-home or sit-in-your-car activity. Today's radios are small enough and pack enough punch to let you go practically anywhere and keep in contact on the ham bands. And all the better when other hams join in your activity. So grab your radio, get moving, and *have fun!* ■

Reader FEEDBACK!

Mobile Installations—Another Option

If you're concerned about damaging your new car in the process of installing your mobile ham equipment, W2NJS says you ought to consider letting the pros do it for you—and it could cost less than you expect.

I enjoyed reading Phil Salas's story about the mobile installation he did for his wife's new Mustang (November, 1998, *CQ VHF*, p. 38), and I have a few thoughts to add which some may find interesting.

I recently acquired a two-year-old Honda Accord wagon, at which time I gave up a similar car that was seven years old. Having lived with the older wagon for a few years, and never having gotten around to doing the mobile radio installation properly, I resolved that I would do this one the right way. As things turned out, I ended up mostly having it done for me, but it was done in commercial style and method, and the results were very satisfying.

First of all, as Phil noted in his story, the idea of "ripping apart" the trim inside a new car is a bad one. You need help for the same reason that you don't fill your own teeth, even though you do own a small drill! Get help from the experts; they're usually closer, more accessible, and less expensive than you think. In my case, I wanted a good alarm system added to the car. It cost me very little when the job was done to have the electronics mechanic who installed the alarm to add a fused, properly sized power supply wire to a location in the console (for my ham radio), and in the rear package well (for the cellular phone main unit). It was also interesting to note that Honda runs its unfused primary 12-VDC power cable to a distribution point which is part of the underhood fuse box, and making the extra radio power connection from that point was much easier than trying to make the wire connect physically to the battery (inline fuse holders which accept standard automobile blade fuses are available.) Electrically, it was the same thing as going directly to the battery terminals, and I figured that if the short unfused 12-volt run didn't affect Honda's electronics, it probably wouldn't hurt my two radios. As it turned out, I was right.

Recent Honda Accords provide a natural radio space in the console, below the broadcast radio, which is sometimes used for an equalizer (as it was on my previous Honda wagon), or else it's just left as package space with a plastic filler (as it was on the Honda I had just purchased). The space accepts most small 2-meter or dual-band transceivers, but the unit must be relatively shallow, up to about five or six inches deep at most. The old ICOM IC-28As fit nicely, but the deep heatsink on an IC-28H would probably not work. Many of today's newer mobile radios will fit into these spaces. The height is usually just about perfect, and the radios are usually narrower than the opening, so a small amount of gray sponge foam rubber fills in the sides nicely. The external speaker goes in the glove box, where the muffling effect serves to properly equalize the audio signal, eliminating most of the "highs" and making the sound more like you'd want for mobile work. The microphone ends up attached to the handset cradle for the cellular phone, or some other convenient point.

Well, back to the installation work, which at this point had me with a ham radio in the front of the car, a cellular radio in the back, the power wires in place, but no antennas and nothing connected or operating. The next step was to call my friendly commercial two-way dealer's shop and see if they were particularly busy. These businesses will often accommodate a ham who needs help, at a reasonable cost, if they do the work when they don't have anything else to do, or when they are not super busy. In my case, the shop drilled the roof, ran the coax to the front console, then provided, wired, and installed a quarter-wave antenna, terminated the coax at the front radio, and finally connected and dressed all of the power and antenna wires, including the cellphone, for less than $100! I had already installed a glass antenna for the cellphone and the shop hid the cable almost completely.

One particular word of advice on having these shops work on your systems and wiring. You must tell them exactly what it is you want done. They have the tools and knowledge to do the job, and most of the time they'll do it the way you want it done on their own, but it pays to go over the details with the person who's actually doing the work before the work starts.

Summing up, by paying an extra $50 to the alarm shop, and less than $100 more to the two-way shop, I had a professionally installed radio setup for both the amateur radio and the cellphone. No wires show, the power connections are all safely and properly fused, and I can relax in the fairly certain knowledge that nothing is going to go bad on me at the wrong time because of some shortcut I took to save time. The quarter wave antenna on the roof can be heard a bazillion miles away (just kidding!) due to its low angle of radiation, and, if things ever get rough, I can just pop on the $^{5}/_{8}$-wave Larsen gain antenna in its place for the really long-haul stuff (I have a Larsen Shadow antenna, the new stubby design, on order, and it will be interesting to see how it works, but I suppose that will be another story).

—Tom Donohoe, W2NJS

CQ VHF Ham Radio Above 50 MHz

Reader Survey—February 1999

We'd like to know more about you...about who you are and where you live, about the kinds(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 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).

As an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to CQ VHF. *This month, we continue repeating last year's questions to see how our readership has changed in the past year.*

	Circle Reader Service #
1. Please indicate your highest level of education:	
currently in elementary, middle, or high school	1
out of school (did not finish high school)	2
high school graduate	3
currently in college or technical school	4
technical school graduate	5
college graduate	6
currently in graduate school	7
completed graduate school	8
2. Please indicate highest college degree held:	
Associate	9
Bachelors	10
Masters	11
Doctoral	12
3. Please indicate the job category that most closely describes your work:	
student	13
homemaker	14
professional/executive	15
educator/writer/creative	16
technical	17
service industry worker	18
government worker	19
factory worker	20
disabled/not working	21
unemployed	22
retired	23
4. Do you plan to upgrade your ham license in the next two years?	
yes	24
no	25
Extra class, can't upgrade	26
5. Please indicate all modes on which you are active on VHF/UHF.	
If you are active on...	
APRS	27
ATV	28
FM	29
Packet	30
SSB	31
None	32

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

What You've Told Us...

Your responses to our November survey became part of our comments to the FCC on license restructuring. If you read our comments, you'll see that the numbers there are slightly different from the ones here. These are more recent and represent more replies.

The makeup of our respondents was 46% Technician, 28% Tech-Plus, and 26% higher class. Overall, 41% of you say you operate only on 50 MHz and above, while the majority (57%) operate some mix of VHF/UHF and HF (23% say about half and half).

Two-thirds of you agree with the FCC's assertion that Technician and Tech-Plus hams are interested mainly in FM and packet, but reports of your own activity tell a different story. Among Technicians, 69% feel the FCC description accurately describes them (and 31% don't); but among Tech-Plus and higher class hams, only 37% say the FCC's statement applies to them or did when they held a Tech or Tech-Plus license (63% say "not me").

Recent equipment purchases back up these numbers. FM handhelds are still number 1, with 37% reporting a recent purchase; followed by FM mobile rigs (30%); then by HF+VHF multimode rigs (27%); VHF/UHF-only multimode rigs (16%), and HF-only multimode rigs (13%). It looks to us like FM and packet are far from the only interests among today's Tech and Tech-Plus hams.

Thank you, as always, for your responses to our survey. This month's winner of a free one-year subscription to *CQ VHF* is Daniel Owen of Lexington, NC.

Hamfest Calendar

The following hamfests are scheduled for February, 1999:

Feb. 1, Radio Equipment Auction, Clement of Rome Catholic Church Social Hall, **Sun City, AZ**. Talk-in: 147.30+. For information, contact WVARC, P.O. Box 1573, Sun City, AZ; Phone: (602) 582-8208; E-mail: <wødno@worldnet.att.net>.

Feb. 6, First Hamfair Ever, Eugene Woods Civic Center, **West Memphis, AR**. Talk-in: 147.150+ and 444.775+. For information, contact Kellye Farris, KB5RCE, 432 Ross Ave., AR 72301; Phone: (870) 732-8724; Fax: (870) 732-5540; E-mail: <dixiefest@media-two.com>; Web: <http://www.media-two.com/DARG>. (exams)

Feb. 6, 26th Annual Hamfest, Stall High School, **North Charleston, SC**. Talk-in: WA4USN linked repeater system (146.79- repeater aboard *USS Yorktown* and 145.25- repeater near Summerville), others area 147.18+, 146.835-, 147.27+, 147.345+, 146.76-, 147.15+, and 443.8+. For information, contact Jenny Myers, WA4NGV, 2630 Dellwood Ave., Charleston, SC 29405-6814; Phone: (843) 747-2324; E-mail: <brycemyers@aol.com>. (exams)

Feb. 7, 5th Annual WinterFest Hamfest/Fleamarket, Latrobe American Legion, **St. Latrobe, PA**. Talk-in: 145.150 (-600). For information, contact Chris Weiss, K3JDU, at (724) 537-6068 or write to CRARC, P.O. Box 175, Loyalhanna, PA 15661-0175.

Feb. 13, Hamfest/Computerfest, Westfield Exempt Volunteer Fireman's Assn., **Westfield, NY**. Talk-in: 145.350 (-). For information, contact Eric Kroon at: <ekroon@netsync.net> or (716) 595-3220. (exams)

Feb. 13, Club Fleamarket, Marlborough Middle School, **Marlborough, MA**. For information, contact Ann Weldon, KA1PON, before 9 p.m. at (508) 481-4988 or AARC Box 258, Marlborough, MA 01752.

Feb. 13, 20th Annual Swap & Shop, Negaunee Township Hall, **Negaunee, MI**. For information, contact Bob Serfas, N8PKN, at (906) 226-9782, or John Veiht, N8RSE, at (908) 228-9417.

Feb. 13, 26th Annual Swap & Shop, Immaculate Conception Middle School, **Traverse City, MI**. Talk-in: 146.86. For information, contact Joe, W8TVT, at (616) 947-8555 or Chuck, W8SGR, at (616) 946-5312.

Feb. 13, Valentine Hamfest, Oberlin Fire Company **(location to be announced)**. Talk-in: 146.76. For information, contact N3NJB, 2501 S. 2nd St., Steelton, PA 17113-3009. (exams)

Feb. 14, Mid*Winter Hamfest/Computer Show, Richland County Fairgrounds, **Mansfield, OH**. Talk-in: W8WE on 146.34/94. For information, send SASE to Pat Ackerman, N8YOB, 63 N. Illinois Ave., Mansfield, OH 44905, or call (419) 589-7133 after 2 p.m. EST.

Feb. 14, Annual SwapFest, Adams County Fairgrounds, **Brighton, CO**. For information, contact Wayne NØPOH, P.O. Box 473411, Aurora, CO 80047-3411; Phone: (303) 699-6335; or E-mail: <nrclog@aol.com>. (exams)

Feb. 14, 28th Annual Hamfest/Computer Show, QCCA Expo Center, **Rock Island, IL**. Talk-in: WØBXR, 146.28/.88 and 146.04/.64. For information, send SASE to Kent Williams, K9UQI, 4245 10th St., East Moline, IL 61244-4154; Phone: (309) 796-0718 (4–9 p.m. only); Fax: (796-0629 (24-hour); E-mail: <k9uqi@arcsupport.com>.

Feb. 20, Annual Salem Hamfair, Polk County Fairgrounds, **Rickreall, OR**. Talk-in: 146.86. For information, visit: <http://sra.goldcom.com/sraflyer.htm>.

Feb. 20, 17th Annual Hamfest, Spring Hill VFW Post 10209. Talk-in: 146.715. For information, contact HCARA, P.O. Box 1721, Brooksville, FL 34606, or Ralph Wilson, AF4FC, at (352) 754-9653, Jim Angello, KE4SZP, at (352) 688-5214; E-mail: <iangello@fiber-net.com>.

Feb. 21, Indoor Winter Hamfest, Freeport Armory, **Freeport, NY**. Talk-in: W2VL, 146.85 (136.5 PL). For information, call LIMARC 24 hr. infoline: (516) 520-9311, or write: LIMARC Hamfest, P.O. Box 392, Levittown, NY 11756; Web: <http://www.limarc.org>; E-mail: <hamfest@limarc.org>. (exams)

Feb. 21, 11th Annual Fleamarket, New Westminster Armories, **New Westminster, BC, Canada**. Talk-in: VE7RBY, 145.35 (-) or 442.85. For information, call Harry, VE7HNC, at (604) 530-3962 (please between 7 and 9 p.m. PR).

Feb. 21, Swap'n Shop, William M. Costick Activities Center, **Farmington Hills, MI**. Talk-in: 144.75/5.35 and 146.52 simplex. For information, write Neil Coffin, WA8GWL, Livonia ARC, P.O. Box 51532, Livonia, MI 48151 (SASE), or call (734) 261-5486; Web: <www.larc.mi.org>; E-mail: <swap@larc.mi.org>.

Feb. 27, Winter Hamfest/ARRL State Convention, Milton High School, **Milton, VT**. Talk-in: 145.15. For information, call W1SJ, (802) 879-6589; E-mail: <w1sj@vbimail.champlain.edu>; Web: <http://www.ranvtogether.com>. (exams)

Feb. 28, 4th Annual Hamfest, Castle Shannon VFD Memorial Hall, **Castle Shannon, PA**. Talk-in: 146.955(-). For information, call Steve Lane, W3SRL, at (412) 341-1043; E-mail: <slane@adelphia.net>; Web: <http://www.hky.com/~sanfordb/index.htm>.

Feb. 28, 23rd Winterfest, Annadale, Virginia, campus of Northern Virginia Community College, in gym of Ernst Cultural Center, **Vienna, VA**. Talk-in: 146.31/91. For information, call Jim Parsons, WA4LTO, at (703) 392-0150; E-mail: <k3mt@erols.com>; Web: <http://www.erols.com/k3mt/vws>. (exams)

Feb. 28, 21st Annual Hamfest, Fayetteville HS, **Fayetteville, WV**. Talk-in: 146.790-, 147.075- & 443.300+. For information, write PARA Hamfest Committee, P.O. Box 96, Fayetteville, WV 25840, or call Mike Skaggs (304) 658-5789. (exams)

Feb. 28, 45th Annual Hamfest Electronic/Computer Show, Emidio & Sons Party Center, **Cuyahoga Falls, OH**. Talk-in: 147.87/27. For information, contact Carl Hervol, N8JLQ, 11192 Cottingham Circle, Uniontown, OH 44685-9185, (330) 497-7047.

Operating Notes

For January, February, and early March 1999:

January

23–25	ARRL January VHF Sweepstakes (see rules in last month's issue)
31	Very good EME conditions

February

28	Very Good EME conditions

March

6–7	IARU Region 1 (Europe/Africa) VHF Contest
6–7	DUBUS (European) EME Contest, 144/1296 MHz

Note: The ARRL Spring Sprints have been cancelled (see "VHF News").

EME data courtesy W5LUU. More contest info is available on the CQ VHF *Web page at:* <http://members.aol.com/cqvhf/navhfcon.htm>.

Mix 'n Match Propagation

It's time to put on your DX detective hat and join WB2AMU on his search for clues about whether more than one propagation mode may be responsible for some really long distance 6-meter contacts, in... the Multiple Mode Mystery!

By Ken Neubeck, WB2AMU*
(kneubeck@suffolk.lib.ny.us)

As we approach the peak of sunspot Cycle 23, F_2 layer propagation will appear more often on 6 meters and it will soon be possible to make some very long range DX contacts—on the order of several thousand miles—on the Magic Band. What many of us may not realize is that some of these contacts require the presence of other propagation modes besides F_2 layer propagation. We will need to put on our propagation detective's hats when sifting through the evidence and exploring specific cases of extreme 6-meter DX contacts made in the past to try to come up with the probable propagation modes that made up the various links involved.

Hams are not the only ones trying to figure out the different propagation modes that may be involved in super-long range 6-meter contacts. Over the years, this has also been a topic of discussion for scientists who study the ionosphere and radio waves. In Ken Davies' book, *Ionospheric Radio Propagation*, when discussing long-distance transmission path identification, he states, "When the distance of transmission is much greater than 4000 kilometers (2500 miles), considerable difficulties arise in the identification of the propagation paths." He discusses various F_2 openings with sporadic-*E* (*Es*) link combinations that not only help extend long-range transmission, but can also alter range in certain cases where the signal coming down from the *F* layer hits the *top* of an *Es* formation and bounces back to the *F* layer.

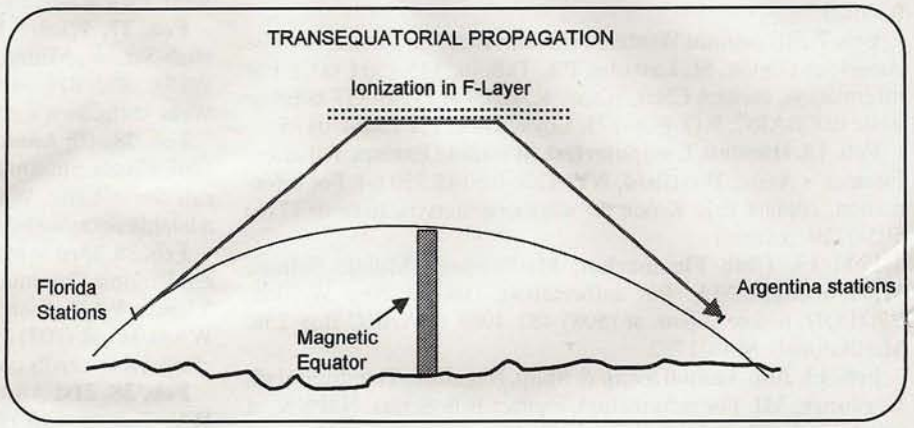


Figure 1. A kind of sideways view of the Earth, showing a signal being refracted by Transequatorial Propagation (TE). Note the extension along the bottom of the ionized layer before the signal is bent back toward the Earth. This is a feature unique to TE.

Recall that the *E* layer is about 70 miles above the Earth and that the F_2 layer is some 200 miles up.

Davies's statement is certainly true when it comes to long-range 6-meter DX, although certain combinations, such as an F_2 plus *Es* link, can be identified with relative certainty. For example, 6-meter activity between the midwestern states and western Europe during the winter months of the sunspot peak—covering a distance of 5,000 miles—would be an example of F_2 with *Es*. Another example is an Alaska-to-central and southern U.S. event, such as the one experienced by Howard Sine, WB4WXE, during his November, 1979, stay in Alaska. It can even be possible to determine which side the *Es* link is on, based on date and time and what other stations are heard. Quite often many of these F_2/*Es* combinations fall in one hemisphere in the form of an east/west path.

However, with the case of truly long DX on 6 meters, such as a New York-to-Argentina QSO or a northeast U.S. opening to Australia, determination of the different modes becomes an exercise of probability. The conclusions in the following case studies are "best guesses" and are in no way 100% conclusive. Let's begin with a north-south example:

Case 1: New York to Argentina, November, 1991

From my home QTH on Long Island, New York (grid FN30) at latitude 41 degrees north, with a vertical antenna and my Swan 250 transceiver, I worked LU3DCA (GF05) on 6 meters on November 2, 1991, at 1852 Z. A week later, on

**Ken Neubeck, WB2AMU, is* CQ VHF*'s "Magic Band" columnist.*

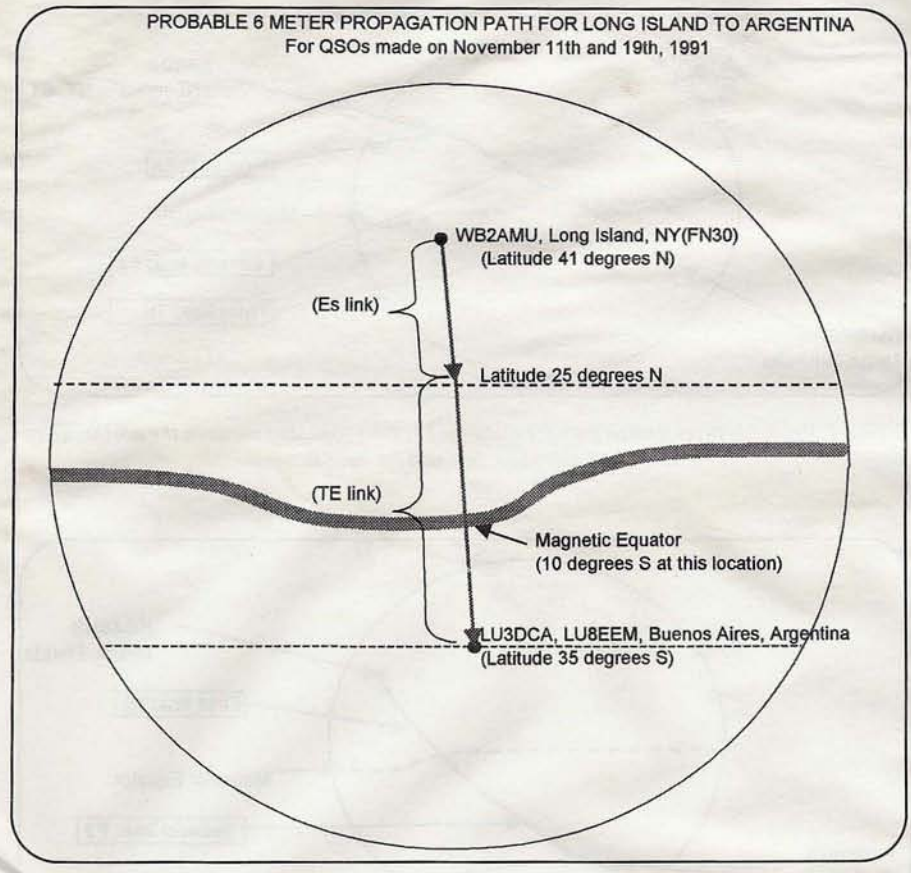


Figure 2. Probable propagation path for 6-meter contact between Long Island, New York, and Buenos Aires, Argentina, on November 11 and 19, 1991

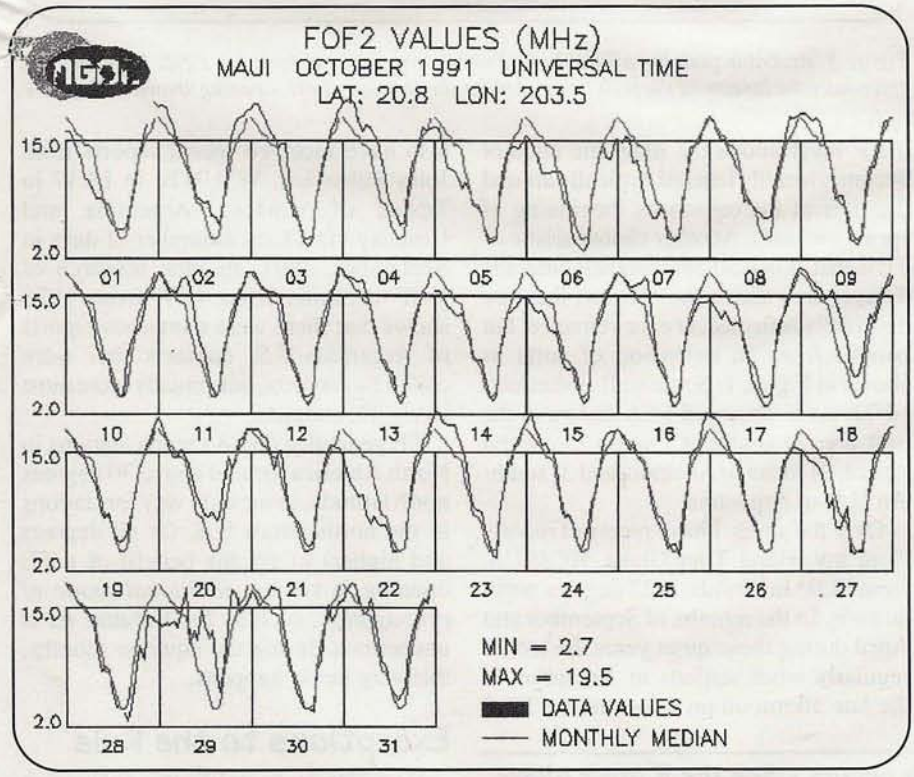


Figure 3. Ionosonde data from Maui, Hawaii, for October, 1991. On the 29th, you can see that the critical frequency for F_2 propagation shot up to nearly 20 MHz, equating to a maximum usable frequency (MUF) above 50 MHz. (Graph courtesy of NOAA; see "Resources" for additional information)

Table.

Propagation Mode	Typical 1-Hop Range
Es	800 to 1,200 miles
F2	2,000 to 3,000 miles
TE	5,000 to 6,000 miles

Table. Typical distances covered on 6 meters by a single hop of each propagation mode discussed in this article. Using these distances versus the distance of a long-range DX contact, you can often determine if more than one propagation mode was used in the contact and, if so, which ones.

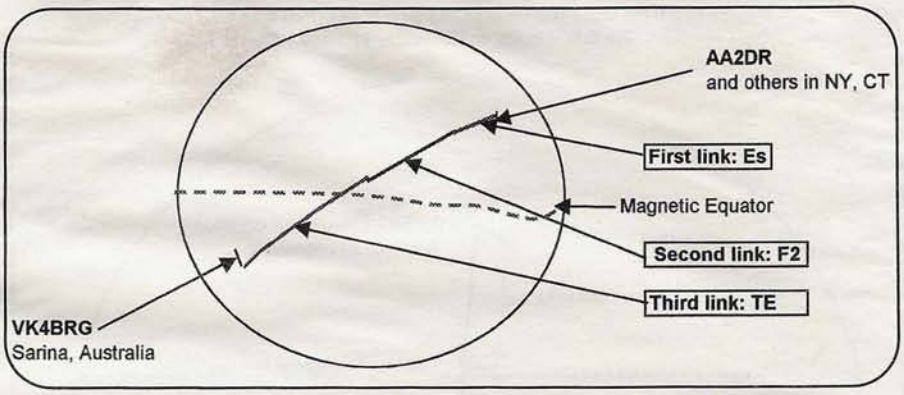


Figure 4. Probable propagation path for October 29, 1991, opening between the northeastern U.S. and Australia. See text for details.

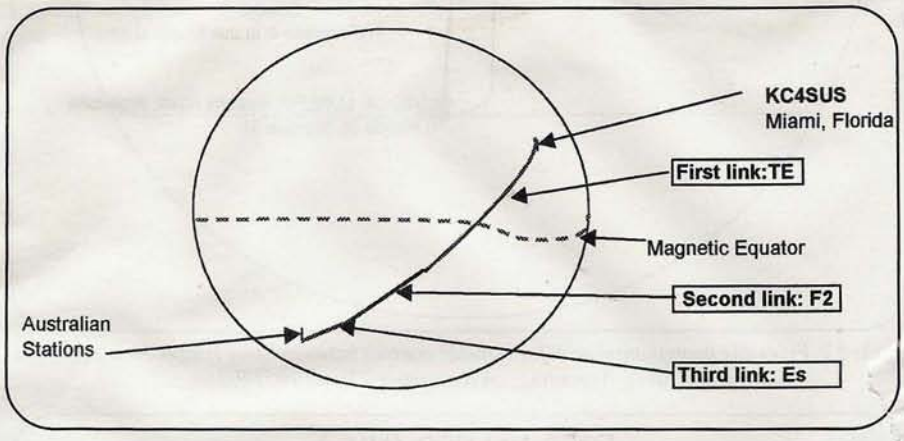


Figure 5. Probable path for a Florida-to-Australia opening on April 17, 1992. Note that it is essentially the inverse of the path calculated for the October, 1991, opening shown in Figure 4.

November 9, 1991 at 1621 Z, I worked LU8EEM (FF95). Both were at approximately 35 degrees south latitude. On the surface, this looks like a probable multiple-hop F_2 opening between Argentina and the northeast U.S. But wait! Even though F_2 propagation is more likely during sunspot peak years, it does have a seasonal pattern for stations in the northern and southern hemispheres.

Davies states in his book that the critical frequency of the F_2 layer is higher in the winter than in the summer, so that higher frequency contacts can be made in winter. So in November, while enhanced F_2 conditions are noted in the Northern Hemisphere, Argentina in the Southern Hemisphere is in its summer season, and F2 conditions on six are generally much poorer. So could this contact still have been the result of a multiple-hop F_2 opening?

Believe it or not, the answer to this question actually came after several years of observations of the 6-meter band during the subsequent *quiet* years surrounding the sunspot minimum (1993 through 1997), and not from observations made during the active sunspot years! These observations have produced a significant amount of new information about *Transequatorial Propagation* (TE or TEP), a special form of *F*-layer propagation that occurs on 6 meters *throughout* the sunspot cycle.

This mode supports contacts between stations located at equal distances from the *magnetic* equator, generally in the late afternoon. TE propagation occurs when the *F* layer above the magnetic equator becomes heavily ionized, typically around the time of the equinoxes (beginning of spring and fall). Another characteristic of TE is that, when 50-MHz signals enter the *F* layer area above the equator, they are not simply reflected, or even refracted, but benefit from an extension of sorts as shown in Figure 1. Some well-documented TE paths observed on 6 meters in the past are: 1) southern Europe to central Africa, 2) Japan to Australia and 3) southern U.S. to Argentina.

Over the years, I have received reports from my friend Tom Glaze, KC4SUS, from EL95 in Florida, at 25 degrees north latitude. In the months of September and April during these quiet years, he would regularly work stations in Argentina in the late afternoon on 6 meters via TE. I also have received recent reports from John Butrovich, W5UWB, in EL17 in Texas, of working Argentina and Uruguay via TE on a number of days in September, 1997. In fact, research of VHF columns from *QST* from 1978 shows that there were numerous reports of Argentina/U.S. contacts that were called F_2 contacts, but actually were most likely TE contacts.

TE generally doesn't reach stations in North America located above 30 degrees north latitude, so the only way for stations in the northeastern U.S. (at 40 degrees and higher) to get the benefit of a TE opening is *via an additional mode of propagation*, such as *Es*. Because *Es* is uncommon during the equinox months, this very rarely happens.

"TE [Transequatorial] propagation occurs when the F layer above the magnetic equator becomes heavily ionized, typically around the time of the equinoxes [beginning of spring and fall]."

Exceptions to the Rule

However, an event like this *did* happen when a TE opening occurred on November 26, 1997, and PY5CC and other stations in southern Brazil worked

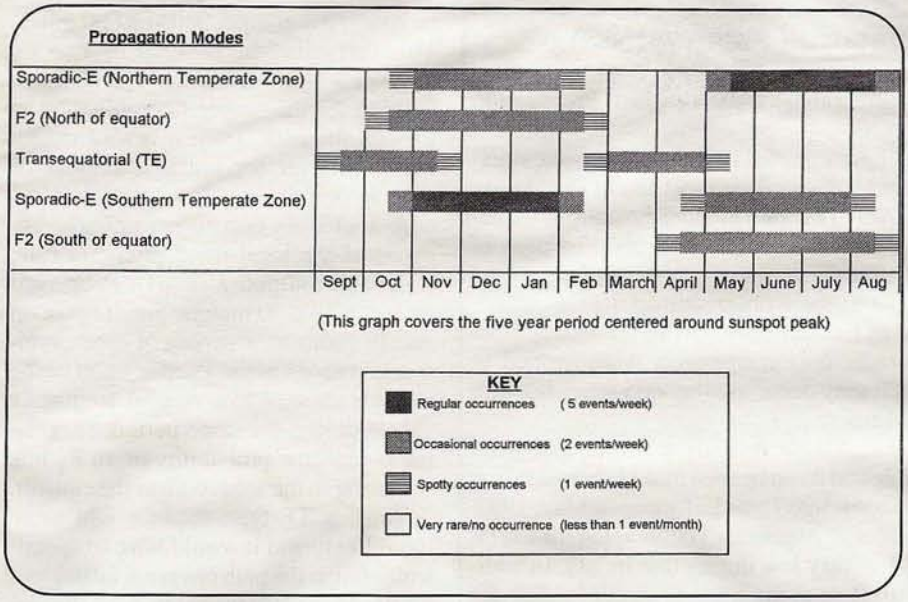


Figure 6. General guide to long-distance propagation modes found on 6 meters, showing the times of the year in which they are most likely to occur.

a number of stations in Connecticut, Massachusetts, and New York in the early evening via a TE-*Es* link. It's well known that *Es* is more common during November than in September. However, it was not known until recent years that TE openings could take place as late as November. The beauty of the November 26 event was that it occurred at a time when the sunspot count was still not high enough to support a conventional F_2 opening on 50 MHz. This shows that, even during the quiet years of the sunspot cycle, relevant data regarding F_2 and TE propagation can still be collected. This particular event in 1997 filled in the missing information required to solve the problem posed in the first case stated in this article.

But since that 1991 contact was made during a peak sunspot year, should we necessarily rule out double-hop F_2 propagation instead of TE? As stated before, November is late spring—nearly summer—in Argentina, and F_2 propagation tends to peak in the winter months. It is possible, but unlikely, that conventional F_2 skip requiring more than one hop was the vehicle here.

In addition, while *Es* is common in the southern hemisphere in November, it would take at least two *Es* links to bring a signal to the area of the Caribbean where an F_2 link could then bring the signal to the northeastern U.S. The odds of this, or a triple-hop *Es* event, happening twice in one week are extremely low. It would seem that the simplest explanation is a probable TE path between Argentina and around 25 degrees north latitude, followed by an *Es* link north to Long Island (see Figure 2). The distance from Buenos Aires to Long Island is on the order of 6,500 miles, so the miles covered by a TE plus *Es* link (see Table) add up just right. Now let's look at a longer distance contact that's harder to solve.

"In addition to working Long Island, Ron [VK4BRG, in Australia] worked hams in Connecticut, Massachusetts, upstate New York, and Canada. A week later, Ron had a similar opening to the U.S., only this time to the western states."

Case 2: Australia to Northeast U.S., October, 1991

On October 29, 1991, at 2000 Z, Ron Graham, VK4BRG, from Sarina, Queensland (Grid QG48 at 22 Degrees south) experienced an opening into Florida and other southern states. Then, after about an hour, he started hearing stations in the northeastern U.S. and proceeded to work 35 stations from the area. One of these was my friend, Frank

More about Transequatorial Propagation

As more hams get on 6 meters, more is learned about Transequatorial Propagation (TE) through observations of various contacts.

As mentioned in the main article, when long-range contacts occur across the equator during the quiet years of the sunspot cycle, the mode is most likely TE. During these quieter years, TE appears to be confined to the two months during and immediately after each equinox (March, April, September, and October). The peak of each "season" seems to be several weeks after the equinox.

However, what is becoming more evident as more observational data is collected is that the TE season seems to spread as the sunspots start to climb. As mentioned in the main article, TE plus sporadic-*E* (*Es*) openings were spotted in November of 1997. Also, it appears that TE may occur at other odd times because of unusual things happening in the ionosphere.

For example, Lefty Clement, K1TOL, from Maine, recently sent me some of his observations from the previous sunspot cycle and it can be seen that TE-based events can occur as late as May and, in some rare cases, into June. Lefty cites a May, 1982, opening in which he worked into Uruguay and Argentina via an apparent *Es*/TE combination. He notes that the solar flux was very low during that month. In addition, he heard stations in Florida and Puerto Rico at the same time, confirming the *Es* portion of the link and leaving the rest to be accounted for as TE.

Lefty also mentions an unusual opening into Argentina in July, 1983, at 10:00 a.m. local time. However, he heard Caribbean stations coming in at the same time via apparent double-hop S*Es* skip, leaving the rest of the path to be some sort of TE situation. The day before, Lefty notes, there was an intense aurora opening, so it may be that the aurora may have some connection with *F*-layer ionization over the magnetic equator, making the Maine-to-Argentina contact on 6 meters possible at 10:00 in the morning in July.

All of this shows that there is still much more to learn about multi-propagation paths and that various observations made on 6 meters by operators will help contribute to determining the causes of these events!

Moorhus, AA2DR, on Long Island, who was surprised to hear a VK station coming in at 5:00 p.m. local time. Frank worked Ron both from his base station and from his truck (see the "Magic Band Chronicles" in the October, 1998 issue of *CQ VHF* for complete details). In addition to working Long Island, Ron worked hams in Connecticut, Massachusetts, upstate New York, and Canada. A week later, Ron had a similar opening to the U.S., only this time to the western states. Certainly these are two openings for the ages, but how did the signals travel this great distance?

In order to trace the path of these signals, we have to work our way from the U.S. side. For the first link, we can see from the stations Ron worked that the northeast-to-southeast link was an *Es* opening, both because of the distance involved (1,200 miles) and the moderate probability of *Es* events in late October. The *Es* link points us in the right direction for a direct path going over the Pacific Ocean, as opposed to one going over the poles. Now, for the second link, from the southern states into the Pacific ocean, we have to recall some practical amateur radio experience as well examining scientific data.

VHF expert Emil Pocock, W3EP, has stated in numerous articles that the prime time for east-west oriented F_2 contacts on 6 meters is when local noon (when the sun is directly overhead) is at the midpoint between the two stations involved. Thus the midpoint for this particular F_2 would be in an area of the Pacific Ocean not far from Hawaii.

Fortunately for us, there's data available on the Internet from a NOAA (National Oceanic and Atmospheric Administration) ionosonde station in Maui, Hawaii. This data, shown in Figure 3, indicates that on the day and time in question, there was high F_2 activity, with the vertical critical frequency rising to between 15 and 17 MHz (this will result in an MUF, or Maximum Usable Frequency, exceeding 40 MHz). So it seems likely that the second link was an F_2 path that brought our signal from the southeastern U.S. into an area of the Pacific Ocean near the equator.

What about the rest of the signal's journey to Australia? This is where it gets really tough. The rest of the distance to be covered is about 5,000 to 6,000 miles. This can either be covered by two F_2 links or a single TE link. Again, we're looking for the simplest combination to explain the path, since it is statistically more difficult for higher numbers of links to occur.

A double F_2 hop seems unlikely because of the local noon midpoint rule, and, while multiple F_2 hops are observed on bands like 20 meters, they're rare on six. In addition, a survey of other ionosonde stations in the Pacific south of the equator showed low critical frequency values during the same period, suggesting a very low probability of an F_2 link occurring in the area south of the equator.

Thus, a TE-type mode might seem more likely and it would have to specifically fall in the path covering 20 degrees north and 20 degrees south, with the signal slanted over the equator on a southwest/northeast path. Things can get pretty interesting in the area of the equator! Thus the simplest explanation for this contact is an Es/F_2/TE path, although an $Es/TE/F_2$ combination cannot be ruled out entirely—even though the ionosonde data does not seems to support this. See Figure 4 for a graphical representation of the most likely explanation.

Case 3: Florida to Australia, April, 1992

On April 17, 1992, beginning at 2211 Z, Tom, KC4SUS, worked eight Australian stations, six from grid QF56, one from QF47, and one from PF94. This case is identical to Case 2, except that the arrangement of the different propagation modes for this path is in reverse order. Using the same reasoning developed to solve Case 2, we can see that there was most likely a TE path from Tom's location in Florida (at 23 degrees north) to take his signal across the equator. From there, the next link was probably an F_2 path over the Pacific Ocean to an area around 10 degrees south latitude and 170 degrees west longitude, bringing this signal relatively close to Australia.

Data collected from ionosonde stations in the general area show very high critical frequency values for F_2 on that date. And since April in the southern hemisphere is like October in the north, when *Es* begins to return from its seasonal lull at the equinoxes, it also seems likely that there was an additional *Es* link to take the signal the rest of the way to southern

"...TE or similar type F_2 ionization at the equator is one of the more likely links involved in any long-distance contacts on 6-meters between stations on either side of the magnetic equator."

Australia. The math works out to be roughly 5,500 miles for the TE link, 3,000 miles for the F_2 link, and 1,200 miles for the *Es* link. This is essentially a reciprocal event of the October 29 event described in Case 2. This path is shown in Figure 5.

Lessons from the Past

What have we learned from working on these examples? Well first and foremost, it appears that there are certain times of the year when these types of contacts are possible on 6 meters and it would be worth our time to monitor then. It would also appear that TE or similar type F_2 ionization at the equator is one of the more likely links involved in any long-distance contacts on 6 meters between stations on either side of the magnetic equator.

From the first example provided above and from other observations, mid-October through November and late March through April appear to be good times for *Es*/TE combinations for northeastern U.S. to southern South America contacts on 6 meters. Something else these past events has taught us is that if a very long-range opening is experienced on one day, it pays to monitor the band for another week or so, since the path may sometimes be repeated.

For a really long DX path on 6 meters, such as the ones described in Cases 2 and 3, the same time period of mid-October through November and late March through April appears to be best yet again. However, for Australia-to-U.S. contacts, stations in the U.S. should be looking to the southwest during the afternoon, typically after 3:00 p.m. local time, during April and October.

Figure 6 is a simple chart that shows which of the major propagation modes that can result in long distance contacts is most likely to be encountered at various times during the year. When two or three of these modes overlap and line up vertically on the chart, and physically occur within close proximity to each other, the potential is there for some major 6-meter DX. Each case described in this article can be traced this way.

Other Factors

While this article has primarily covered the possible interactions between F_2, TE, and *Es* propagation, other combinations are possible (though unproven) and other considerations should also be kept in mind by the 6-meter operator. Here are a few:

1) Note the asymmetry between the TE seasons and the *Es* seasons in Figure 6. The latter are centered around the solstices, whereas TE appears to be centered in the weeks following the equinoxes.

2) Remember that the TE path between South and North America is based on signals going through *F*-layer ionization over the *magnetic* equator, which is 10 degrees south of the geographic equator in the zone of the Americas. The annual *Es* and F_2 seasons are symmetrical with respect to the normal geographic equator at zero degrees as the Earth orbits around the sun. This fact is important in understanding why there appears to be significantly less long range DX on 6 meters during months on the "summer side" of the TE season, such as May or August (although as veteran 6-meter operators know, anything is possible on the Magic Band).

3) Even though we haven't discussed this possibility here, many hams also suspect that tropospheric propagation (tropo) can sometimes extend the distances of *Es* signals. Likewise, it would not be impossible for a long-distance contact to take place involving an aurora opening, but this has yet to be observed or confirmed.

Closing Thoughts

Six meters, like 10 meters, is one of the great bands on which different propagation modes can occur at the same time. By knowing how 6 meters behaves, including the general rarity of signals coming in from several directions at once, it becomes reasonably possible to trace out these signal paths as we did in this article. While there's never 100% certainty with this type of exercise, our conclusions are fairly good educated guesses based on the available data and previous 6-meter experience.

There is also a potential for super-long distance DX to occur at other times of the year on 6 meters during the peak years of the sunspot cycle, given the right combination of propagation modes. As we enter into this exciting time, keeping our minds and ears open will yield some fantastic results.

The author wishes to thank George Talarski from NOAA's National Geophysical Data Center in Boulder, Colorado, for his help on using the NOAA ionospheric Web page. ■

Resources

Ionospheric observations from NOAA weather stations around the U.S. may be accessed on the World Wide Web at <http://spidr.ngdc.gov:8080/production/html/IONO/iono_home.html>. (If you find the information there useful, you may want to bookmark the address so you don't have to type all that in more than once!)

For a detailed description of ionosondes and how they measure ionospheric activity, see WB2AMU's article, "Rockets into the Ionosphere," in the December, 1997, issue of *CQ VHF*.

An Antenna from Yesteryear—The Trusty, All-Purpose Saturn 6

It had to be one of the strangest-looking antennas ever made. But, boy, did it work! And if you still have one, chances are it STILL works. WA6ITF takes a look back at a classic VHF antenna.

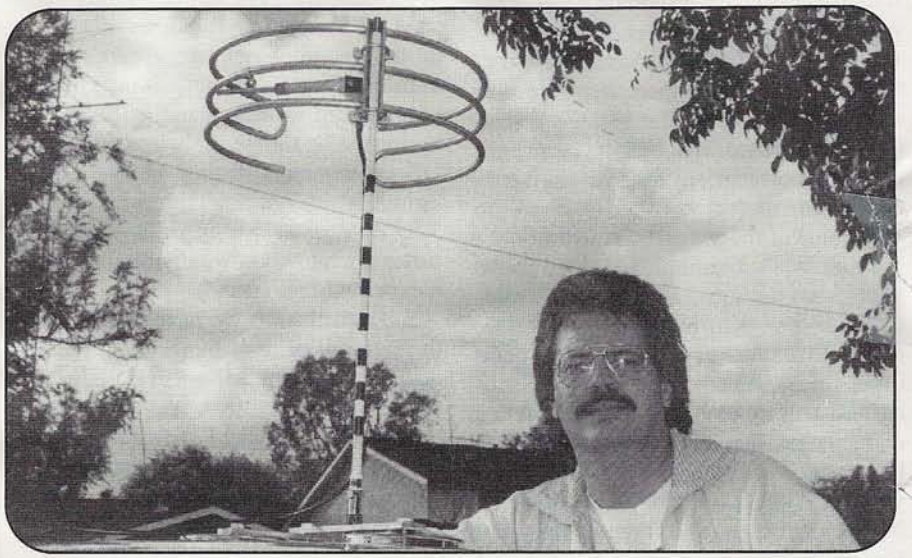
By Bill Pasternak, WA6ITF*

If there is one 6-meter antenna that I can say I love, it is the old Saturn 6, a 6-meter halo. The Saturn 6 was manufactured by Hi-Par Products Company of Fitchburg, Massachusetts, from the mid-1950s to the early 1970s, and its unique design and excellent performance made it a classic. It was unique in that it used three concentric rings, rather than the more common single loop element, for what the company claimed was a broadband approach to this type of antenna design.

"The Saturn 6 was built to take abuse and keep a signal on the air. You might say it was the classic 'inner city survival antenna.' "

I saw my first Saturn 6 in early 1959 at a mid-winter T-Hunt (hidden transmitter hunt) in Brooklyn, New York. It was attached to the rear bumper of a number of cars driven by those out for the hunt. My first impression: "...Gawd! Those are ugly! There's *no way* I will be caught dead with one of those on my car." Two years later, I had my first car...with a Saturn 6 firmly mounted to it.

Why a Saturn 6 when there were less conspicuous single loop halos and even less conspicuous 56-inch vertical whips available? The latter were not used because the conventional wisdom of 6-meter AM mobileers (yes, everyone used AM in those days) east of California was to use horizontal polarization. Hams believed (with some good technical grounds) that most ignition noise was vertically polarized and that, by tying their radio to a horizontally-polarized antenna, they could achieve better noise immunity. Also, most 6-meter home stations used three- to eight-element horizontally polarized directional antennas. If you wanted to talk to home stations as well as other mobiles, you needed to be horizontally polarized. Nobody (except the City of New York RACES stations and the hams in California) used vertical polarization.



We couldn't put our hands on a photo of a Saturn 6, but we did have this shot of Chip Margelli, K7JA, jealously guarding his 2-meter Hi-Par halo. Just imagine this three times larger and you'll have a mental picture of the 6-meter version! (WB6NOA photo)

"It Took a Licking and Kept On..."

The Saturn 6 was built to take abuse and keep a signal on the air. You might say it was the classic "inner city survival antenna." Its three rings made it a very

Bill Pasternak, WA6ITF, is Executive Producer of "Newsline," a weekly ham radio audio news service. He is a frequent contributor to CQ VHF.

rigid albeit heavy antenna. I think it weighed in at almost three times that of any competitor's single-ring halo, and back then weight was what the public equated with overall quality. On that score alone, the Saturn 6 beat the competition hands down.

Because of its design, the Saturn 6 also had greater surface area than its competition, and hence greater wind resistance. Those people who opted to use the supplied mast and optional mount assembly usually found themselves running guy wires to their auto's rear door handles or securing them into the trunk to keep from having to stop and pick up the remnants of their Saturn 6. As such, the Saturn 6 also did its share to keep automobiles carrying them from breaking the local speed limit.

The "correct" way to install a Saturn 6 (the way the ham community developed) was to do away with the supplied thin-wall mast and mount the Saturn 6 to a five-foot length of heavy-wall Dural™ aluminum TV pipe, then clamp it securely to a trailer hitch mounted on the rear bumper of your car. (In those days, automobile bumpers were made of steel and they could hold many pounds of ham radio antenna.) Then, every two weeks, out came a crescent wrench to tighten all the mounting hardware. Such was life running mobile with the Saturn 6.

Hi-Par claimed that the Saturn 6 was designed for broadband operation, and it was. At least, mine was. If tuned up at 50.5 MHz and used with the recommended matching stub or balun transformer, I would have a 1.1:1 match from about 49.5 to 52.0 MHz. Rain and snow did not detune it very much, either. As such, for the 6-meter AM mobileer, it was *the* antenna of its day.

A Base Antenna, too

The Saturn 6's broadbanded operation and seeming immunity to the ravages of harsh weather also made it a favorite *home* antenna among hams involved in community service and emergency communications. For amateurs who served as net control stations, it was a Saturn 6 mounted on the roof that would be pressed into service when net time came around—much the same as 1/4-wave or 5/8-wave vertical ground-planes are used by 2-meter FMers today.

I left my Saturn 6 on the roof of my last apartment in Brooklyn when I moved out to Los Angeles more than a quarter of a century ago. On a recent trip back, I passed the place and looked up. The Saturn 6 was still sitting there as a tribute to its structural integrity and my stupidity in leaving it behind.

"Those people who opted to use the supplied mast and optional mount assembly usually found themselves running guy wires to their auto's rear door handles or securing them into the trunk to keep from having to stop and pick up the remnants of their Saturn 6."

And I must not forget the T-Hunting ability of a Saturn 6. Its front-mounted capacitor match provided several degrees of sharp null in front of and behind the antenna. And I do mean sharp—as in being able to take an S9 signal right down into the noise. To T-Hunt with a Saturn 6, you drove in a circle until you found the null. Then you drove in that direction. If the null got steeper (and the signal got weaker), it meant the signal was behind you and you reversed your course. As you got closer to your hunt target, the overall signal strength would overpower the null until you got to a point where it was a matter of using your eyes to spot another car—the "bunny" or "fox" transmitter—with *its* Saturn 6 standing tall from its bumper.

Where Are They Now?

In retrospect, from the mid '50s until the early '70s, the Saturn 6 was the premier all-purpose antenna for the 6-meter AM and SSB enthusiast. It cost less than $40 and its "forgiving nature," for lack of a better term, made it extremely popular in its time.

Why did this antenna disappear? Mainly because its manufacturer, Hi-Par, closed its doors. For a long time, I figured that some day another manufacturer would realize the potential market for such a mass-produced antenna and would reintroduce it—and I would be first in line to buy one. As the years passed, I came to wonder why this never happened. Only recently, I was told that the surviving heirs of Hi-Par's owners have kept up the patent on the antenna, although they seem to have no intention of going back into business to make it. So, for all intents and purposes, bringing back the Saturn 6 is a dead issue.

This is unfortunate since, in my view, the Saturn 6 would be an even bigger seller in today's growing 6-meter SSB/CW community than it was in the last heyday of 6 meters back in the '50s and '60s. It is the perfect antenna for beacon operation. Its compact but heavy-duty design still makes for a great mobile antenna. Plus, it's ideal for monitoring 6 meters with its ability to listen in all directions for signs of a band opening. I can think of so many uses that it still comes across to me as the ideal 6-meter utility antenna—and I wish I had one.

Don't Despair...

Thankfully, several companies still offer halo-type antennas for 6 meters. Two good ones that come to mind are the AEA Halo-6 and a great line of 6-meter (and up) loops from KB6KQ. Both are single loop designs and both perform quite well (See January 1997, *CQ VHF*, pg. 41 for a photo of this author with the KB6KQ design).

If you're interested in playing with an antenna that closely resembles the Saturn 6, then David Clingerman, W6OAL has what you're looking for. David is the Chief Engineer at the Olde Antenna Lab in Parker, Colorado, and has developed what he says is "not quite a clone," called the OAL Mobile 6. David also offers a special open-air matching transformer that does away with the need for the original Saturn 6's ugly coaxial matching stub or the now-unavailable low-power-only Hi-Par matching device. David's open air transformer will handle 500 watts or more, making it a natural for those who run a "brick" amplifier following their transceiver.

"The Saturn 6 was still sitting there as a tribute to its structural integrity and my stupidity in leaving it behind."

The Olde Antenna Labs Mobile 6 antenna is priced at $159.95, including the matching transformer. It may sound like a lot of money but when you take inflation into account, it's actually a lower price in today's dollar than it was in 1959 dollars. And if, by chance, you already have an original Hi-Par Saturn 6 sitting in your garage or attic (and probably a 1 x 3 non-vanity call to go with it), you can add David's transformer for a mere $25. Both are plus shipping.

Plus, M^2 Antennas has just introduced a new line of "HO" loop antennas for 6 meters, 2 meters, and 222 or 432 MHz. At press time, a final decision hadn't been made on pricing, but you can give them a call or visit their Web site for an update. Please see "Resources" for ordering information on this and other halo antennas for 6 meters.

Hamfest Advisory

The Saturn 6 was the classic 6-meter mobile antenna of the '50s and '60s. It would make a great conversation piece today and would still be an excellent antenna besides. So keep your eyes open at hamfests for those three distinctive rings. If you see one, buy it. And if you can't wait, pick up one of today's modern counterparts and hit the road on 6-meter SSB! ■

Resources

For more information on the antennas discussed in this article, contact:

AEA—A division of Tempo Research Corporation, 1221 Liberty Way, Vista, CA 92803; Phone: (760) 598-9677 or (800) 258-7805; Fax: (760) 598-4898; Internet: <http://www.aea-wireless.com>. Halo-6 priced at $69.95 plus $7.50 shipping.

KB6KQ Antennas, Attn: Norm Pedersen, 70 Arrowhead Drive, Carson City, Nevada, 89706; Phone: (702) 886-7885; Fax: (702) 841-1880; E-mail: <kb6kqnorm@aol.com>. 6-meter halo priced at $95 plus shipping.

M^2 Antenna Systems, Inc., 7560 N. Del Mar Ave., Fresno, CA 93711; Phone: (209) 432-8873; Fax: (209) 432-3059; E-mail: <m2sales@aol.com>; Internet: <http://www.m2inc.com>. New 6-meter "HO" loop, pricing not available at press time.

The Olde Antenna Lab, 41541 Dublin Drive, Parker, CO 80134; Phone: (303) 841-1735; Fax: (303) 841-1354; E-mail: <w6oal@aol.com>. Mobile 6 antenna priced at $159.95 plus shipping; includes matching transformer.

Origins of VHF FM and Repeaters

Why do 2-meter repeaters have a "split" of 600 kHz? Why is the 6-meter FM simplex frequency on 52.525 MHz? Here are some recollections from a ham who helped usher in the age of FM and repeaters.

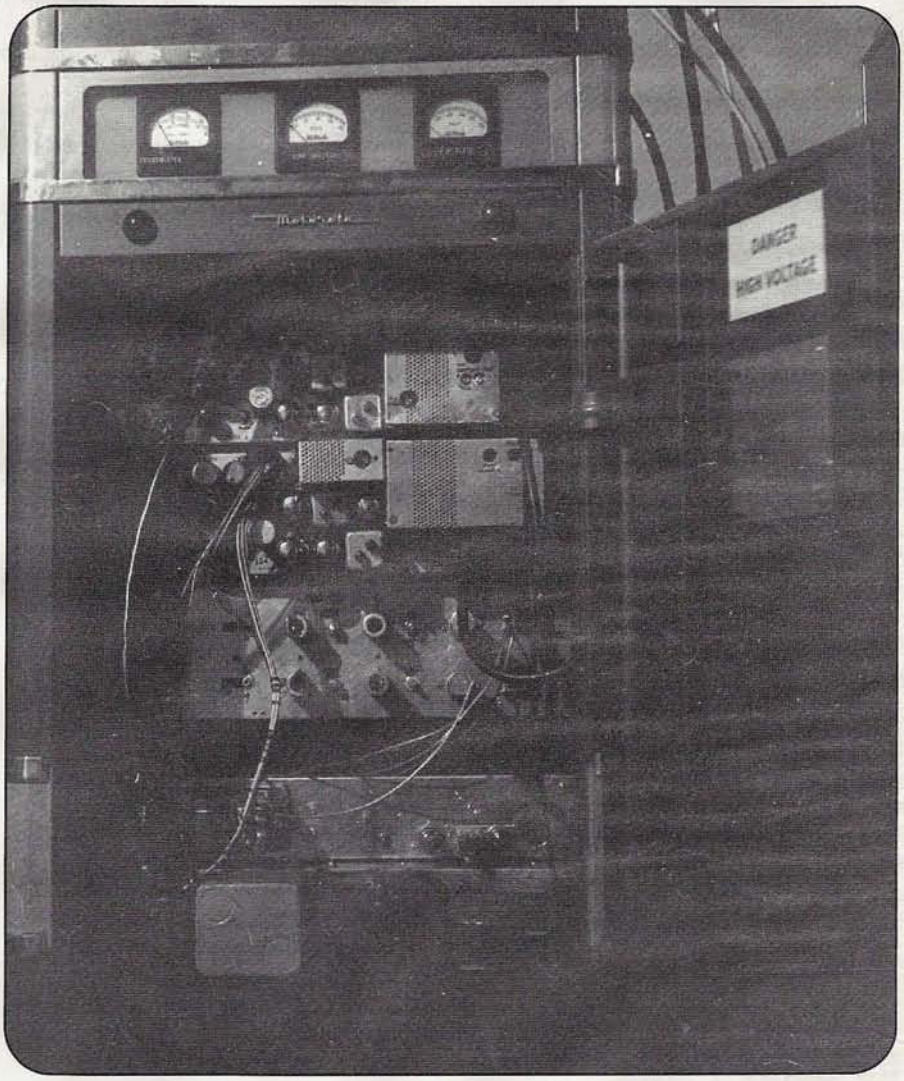
By Van R. Field, W2OQI*
(wreck_and_rescue@juno.com)

Editor's Note: There's a variety of stories about how FM and repeaters first came into use in ham radio. This is probably because the use of FM and repeaters was developing simultaneously in different parts of the country, and people's recollections are based on what happened where they were at the time. This is the northeastern-U.S. perspective. We welcome other recollections from other areas.

FM—frequency modulation—was an innovative way of putting audio on a carrier that was developed and patented by Major Edwin Armstrong, one of radio's truly great innovators. Around 1939, Armstrong himself started experimenting with FM broadcasting. He constructed a large tower at Alpine, New Jersey, which is still being used today, and got an experimental license (W2XMN) to transmit high-fidelity music and programming in the range of 42 to 50 MHz.

"Calling All Cars..."

Soon thereafter, GE and Motorola started to use FM for two-way police radio in the 30- to 40-MHz range, with the Connecticut State Police being the

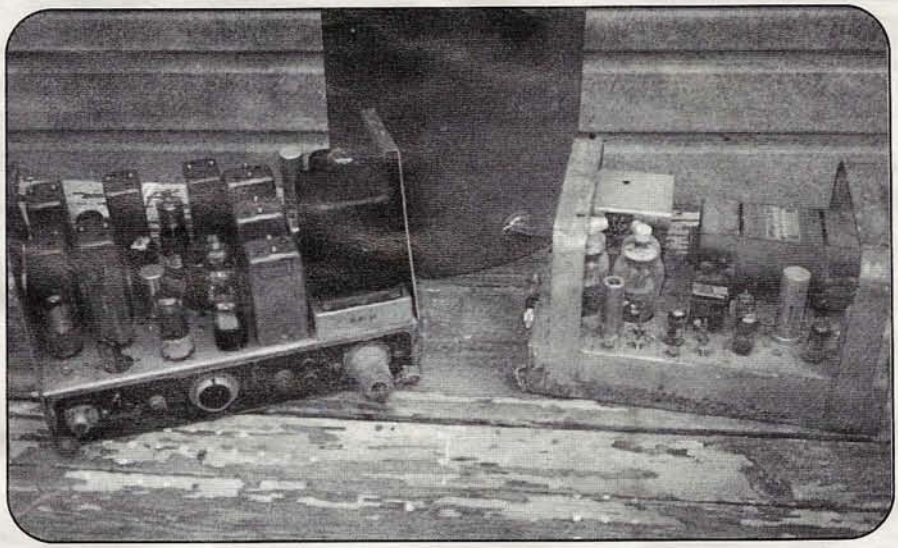


The transmitter side of the W2OQI repeater system, photographed sometime in the 1960s. At the top are two converted Motorola transmitters, one on 6 meters, the other on 2 meters. Below them are a homebrew audio mixer and a homebrew CTCSS encoder/decoder. The receivers were in a separate rack. (Photos courtesy of the author)

**Van R. Field, W2OQI, has written several articles for* CQ VHF. *He lives in Center Moriches, New York, where he enjoys hamming on VHF and UHF and chronicling the history of the United States Life Saving Service, a predecessor of the U.S. Coast Guard.*

222: The Forgotten Band

Ever wonder why 222 MHz never became popular? Simple: there was no commercial surplus gear in that frequency range, only some military AM equipment. Because there weren't enough of us to build gear and go there, the overseas manufacturers weren't willing to go out on a limb and manufacture very much gear in that range. (*In addition, 222 isn't a ham band all over the world, so potential sales in foreign markets are limited.—ed.*) This helps to explain how we lost 2 MHz of very usable spectrum (220 to 222 MHz). There is a fair amount of 222 gear out there, however—and the band has a distinct character of its own. I encourage you to give it a try...before we lose the rest of the band!



Radios were typically purchased surplus and converted into early ham repeaters. On the left is a pre-WW II 30- to 40-MHz receiver with an AC power supply. On the right is a GE transmitter for the same frequency range, circa 1946. Transceivers, combined transmitters and receivers in a single case, didn't appear until the mid-1950s.

first in the northeast to use it. Until then, police radio systems consisted of AM equipment. The New York State Police used a frequency just above the AM broadcast band for one-way dispatch (the cars couldn't talk back). On Long Island, New York, Nassau County and Brookhaven Town talked out on 2490 kHz and the cars talked back in Brookhaven on 37,780 kHz, all AM. Western Electric made a 30- to 40-MHz system that transmitted and received AM in this range. But ignition noise was a major problem, which was why everyone eventually switched over to FM.

GE, Motorola, and Link were the big three manufacturers of FM police equipment going into World War II. In addition, all three made equipment for the military in the 20- to 50-MHz range. My first job was working for Fred M. Link at 225 W. 17th St. in New York City, who was packaging his 30-MHz equipment into a coffin-shaped box that fit the contour of the Army tank for which it was designed. The noise reducing qualities of FM helped in the tanks. At around this time, the Suffolk County, New York, Sheriff's office installed Link units on 39.18 MHz.

Moving to VHF

After World War II, the first VHF (152 to 162 MHz) FM equipment was marketed. I was working for the Brookhaven Town Police at the time and we evaluated both Link and Motorola equipment. The Motorola equipment was much better. At my instigation, Brookhaven installed a system with the base station located on Telescope Hill, the second highest spot in the county (next to where WALK FM is today, for those of you familiar with the area). The equipment had a 60-kHz bandwidth and was controlled by a remote link on the 72- to 76-MHz police band. And it was hell on the TV sets just coming into use. Neighboring Smithtown, New York used an RCA system on 150 MHz.

Eventually, this first generation of FM equipment entered the surplus market—just as the surplus World War II equipment started to dry up. Only a tiny portion of hamdom seemed to be interested in crystal-controlled receiving equipment, it being alien to the tunable ham gear of the day.

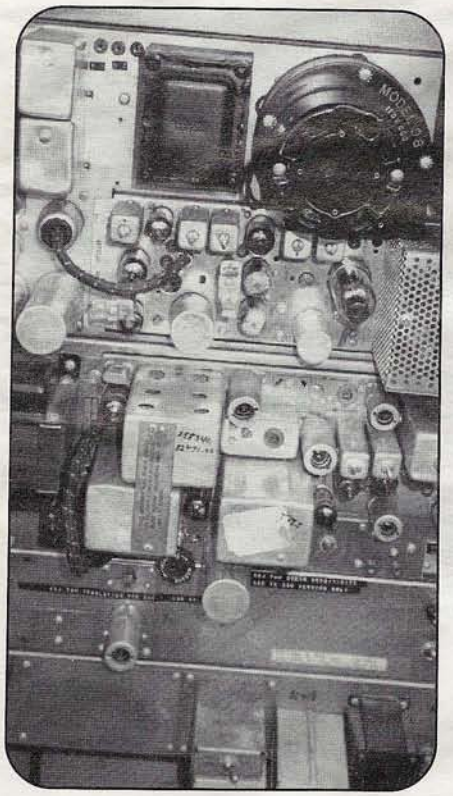
In Angola, Indiana, the hams fell heir to the Indiana State Police FM system near 6 meters. They found that by making the last doubler stage a tripler, the equipment—along with the state police crystal—came out on a frequency of 52.525 MHz. And that, boys and girls, is how that became the 6-meter FM calling frequency. It also launched hams into the world of VHF FM.

Hams and FM

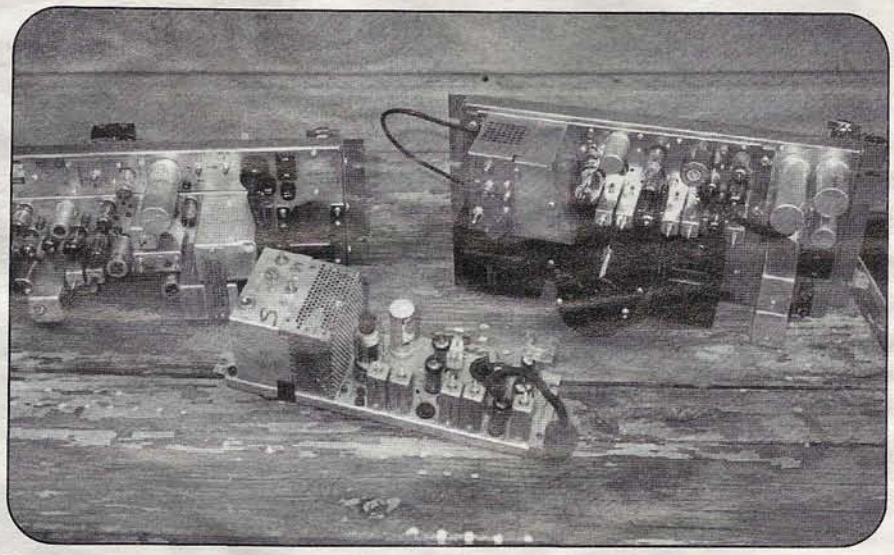
Soon, FM usage spread to large metropolitan areas on both coasts. Some police departments were using repeater systems to be able to talk car-to-car over large distances. Hams tried this out as well, and repeaters started springing up on both 6 and 2 meters. Under the FCC rules of the day, repeaters were technically remote bases and were restricted to 146 to 147 MHz. The FCC hadn't caught up...and, when it did, it overshot the mark and made licensing requirements tough on both hams and the Commission staff. The new rules required siting information like the commercial stations had to present, complete with contour maps. But that didn't prevent chaos and confusion on the bands.

"...hams fell heir to the Indiana State Police FM system near 6 meters. They found that by making the last doubler stage a tripler, the equipment—along with the state police crystal—came out on a frequency of 52.525 MHz."

Inputs and outputs were whatever the repeater owners chose. Repeater-to-repeater interference quickly became a problem. So, in the late '60s, all the repeater owners had a big meeting in Newtown Square, Pennsylvania, and decided on a 600-kHz spread between input and output frequencies. Just about



A GE Progress Line repeater modified for 2 meters. This is all "stock" equipment, with no homebrewed components.



Receiver and transmitter strips from a GE Progress Line repeater removed from racks. The two strips in the rear are each connected to AC power supplies. The transmitter strip in front is disconnected from its supply. Note the "S" marked on it—that was GE's designation for "scrap," which is how it was sold.

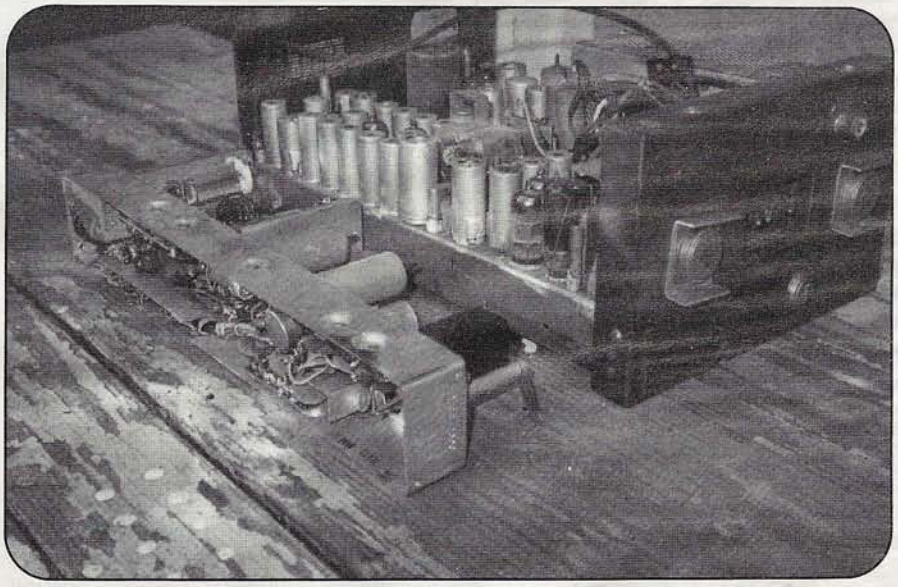
everyone agreed to the split, even though it meant purchasing a lot of new crystals (there were no synthesized FM radios on the ham market in those days; and, even today, crystal control is the rule for repeaters themselves). For example, Bridgeport, Connecticut, had a big repeater on (146.) 22/76, and our eastern Long Island group was on (146.) 34/82. The Bridgeport folks moved their input to 146.16, we went to 146.22, and others did likewise. There were a few holdouts, but it all worked out fairly well.

Movin' on Up...

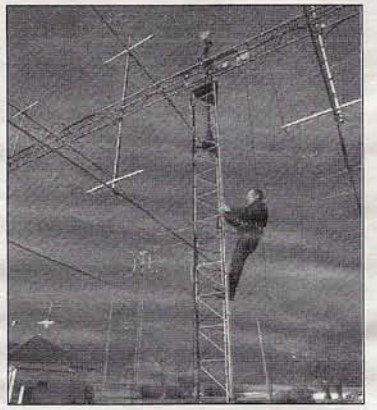
Next, when 450- to 470-MHz FM gear started showing up on the surplus market, some hams moved up out of the "crowded" 2-meter band. Modification was still the way to go. The bandwidths on each succeeding generation of commercial UHF FM equipment went from 120-kHz to 60- to 30- and, finally, to 15-kHz channels, and hams kept pace (*to a point...in most parts of the country, 30-kHz separation on 440 MHz is still the rule—ed.*).

There were modification kits put out by the manufacturers to keep commercial gear from becoming obsolete (one of their selling points). Hams used these kits to modify the radios for amateur use. Rolloff audio filters were also required, and much of the available equipment needed a little front-end boosting and modification. Pre-amps were added, multi-channel modifications were made. Some rigs could actually work on four repeater pairs! But FM and repeaters had arrived on 70 centimeters as well.

As more and more repeaters came on the air, it became desirable—necessary, sometimes—to limit access to a repeater's input in order to keep it from being keyed up all the time by someone using another repeater. This led to hams slowly adopting the commercial trick of using CTCSS (Continuous Tone Coded Squelch System) to access the repeater. Before going to this extreme, a tone burst (whistle up) system was tried. Unfortunately, it allowed the repeater to lock up and time out on a distant signal accessing another repeater. This system is still used in Europe and can be found

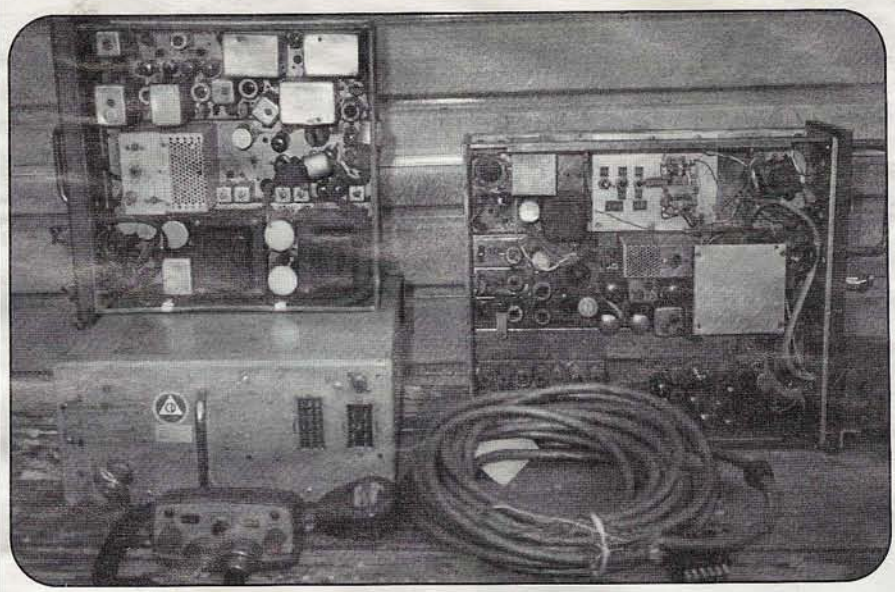


Right: A Motorola FMTRU 41V transmitter retuned for the 2-meter band and with power supply converted to transistors. On the left is a 6-meter version, removed from its "drawer," the enclosure on which it would be mounted for sliding into or out of an equipment rack.

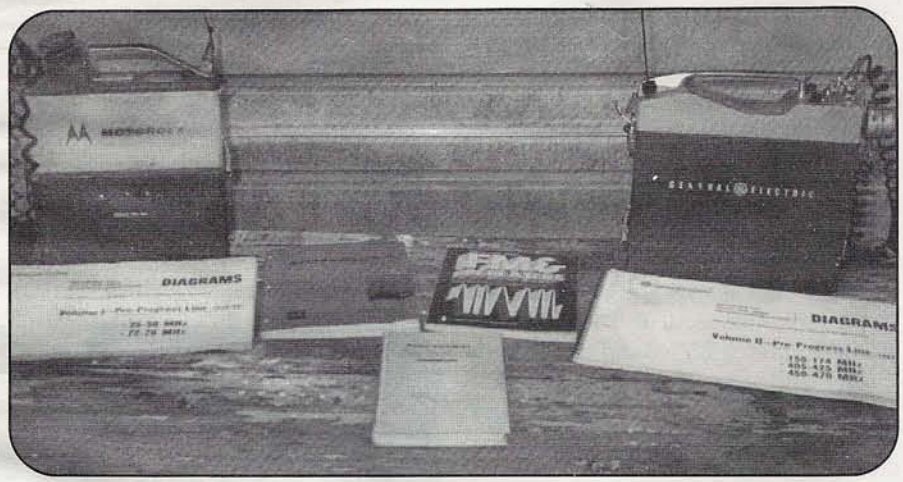


On the Cover

When you live in Wyoming, most of your fellow hams are so far away that they may as well be on the moon! So, for Duane Hansen, WA7KYM, of Speer, Wyoming, it only makes sense to concentrate his VHF/UHF setup on Earth-Moon-Earth, or EME, communication. In this month's cover photo, we see Duane on one of his two EME towers: one supports an array of eight 17-element Yagis on 2 meters (for a total of 136 elements), and the other holds multiple long-boom antennas for similar "talk power" to the moon and back on 432 and 1296 MHz. For a wider view, with more of Duane's antennas visible, see the March, 2000, page of the CQ 1999-2000 Amateur Radio Calendar. (Cover photo by Larry Mulvehill, WB2ZPI)



A 1960s FM mobile station! On the left is a GE Progress Line trunk-mount unit with one of its "drawers" on top. In front is a modified control head and connecting cable (the control head was mounted in the front of the vehicle, with the actual radio in the trunk). On the right is a Motorola 140D with the dynamoter removed and a transistor power supply added. At the left-hand end of the center transmitter strip, note the three crystals, meaning this radio was capable of operating on three different frequencies.



A couple of 1960s "handhelds"! A Motorola P33 and a GE HN31, along with the books used to convert and repair them. Both transceivers included tube transmitters and solid-state receivers. The Motorola unit put out 7 watts; the GE put out 2.

in most imported VHF ham gear (*it's slowly being replaced there by CTCSS as well—ed.*).

Commercial Ham Gear Arrives

There were eventually enough people on 2 meters to interest equipment manufacturers. This was coupled with the fact that marine radio for recreational boating was changing over from 2 MHz AM to VHF FM. In my opinion, that was the principal market and the ham market was just gravy. Open up some 1970s' ham magazines and the ads are there—U.S. manufacturers like Drake and Gladding and a few overseas radios, such as Standard and Midland. All were still crystal-controlled. Soon, crystalplexing (using a limited number of crystals to generate a variety of frequencies) made it up from CB, soon followed by the synthesized radios of today.

And that's the story, as I remember it, of how FM and repeaters got started in amateur radio and how we got to where we are today. ■

A Technology Triple Play from the ARRL

Take a trip through time with three new products from the ARRL—the early years of "QST" and the 1999 "ARRL Handbook" on CD-ROM, and "The ARRL RFI Book" (on paper).

By Rich Moseson, W2VU*
(cqvhf@aol.com)

Technology has the interesting ability to propel us forward while also helping us look backward. For example, ever-more sophisticated telescopes are allowing astronomers to see farther back in time than ever before. Archaeologists use state-of-the-art science to see more clearly into Earth's history. And we hams can now use CD-ROM technology to get easy access to our own history (although not quite as far back as the beginning of the universe) while, at the same time, adding new dimensions to "reading" current-day books.

Two examples of the ham radio variety arrived on my desk recently, in one envelope from the ARRL: the newest installment in the League's "*QST* View" CD collection, and the 1999 *ARRL Handbook* CD. And just a couple of weeks earlier, I got a copy of the League's new *ARRL RFI Book*, which, while available only in paper, deserves your attention as much as the other two publications. So, in the interest of telling you about all three before the end of the century, I'm going to review them all together, right now.

"QST View" CD 1915-1929

Raise your hand if you own a copy of the very first issue of *QST* magazine, from all the way back in December, 1915. Perhaps there are one or two of you out there, perhaps not. I know I certainly couldn't have raised my hand—until I got the newest (and oldest) "*QST* View" CD set from the ARRL. The three compact discs include every page of every issue of the League's membership journal, from that December, 1915, inaugural issue, to the final issue of 1929. The set completes the ARRL's CD-ROM collection of *QST* back issues, which now extends from 1915 to 1994.

Who Needs Old Magazines?

Now some of you may be asking, "Why would I want to spend 1999 dollars on a virtual stack of 80-year-old magazines?" Why? Because ham radio is more than a hobby, more than a service—it is a mini-society, with its own culture, language, and history. If you want to understand where we're going in the future, it's important to understand where we've been and how we got to where we are today. Looking back, you can see how far our technology has advanced since 1915, and how some other aspects of ham radio have changed very little, if at all.

What makes this CD-ROM collection truly valuable, though, is its indexing and search capabilities. When you install any of the sets on your computer, the software sets up a master index, which is updated whenever you add a set to your collection. Using this index, you can look at a complete issue (cover to cover, ads and all), or search the entire set—or your entire collection—for a specific article or author. I know this feature would have come in very handy five years ago, when we were working on the 50th anniversary issue of *CQ* magazine. Bill Orr, W6SAI, and Joe Lynch, N6CL, wrote excellent articles on ham radio's history from 1945 to 1994, and they did most of their research using microfiche collections of both *CQ* and *QST*. Their jobs would have been much easier had these CDs been available at the time. My only complaint is that "navigating" through the issues is not very intuitive, and I'm still trying to learn how to easily switch between articles and issues.

But even if you're not researching an article, this window on our past provides you with a fascinating view of our hobby's earliest days. And finally, on a more practical level, having those

Rich Moseson,W2VU, is Editor of CQ VHF *magazine.*

back issues in CD form makes them much more accessible and much more usable than the paper originals. My own collection of *QST*s goes back to the early 1970s, and most of them are in cartons in the attic. Not very accessible. As my budget allows, I'm planning to replace the magazines in my attic with CDs in my office. Not only will the information be more accessible, but the clutter in my attic will be reduced. And that will make my wife very happy! In fact, if you look at buying these CDs as an investment in marital harmony, they're really, really inexpensive! ("*QST* View" CD sets, $39.95 each, plus shipping; 11 sets in the complete collection. See "Resources" for ordering information.)

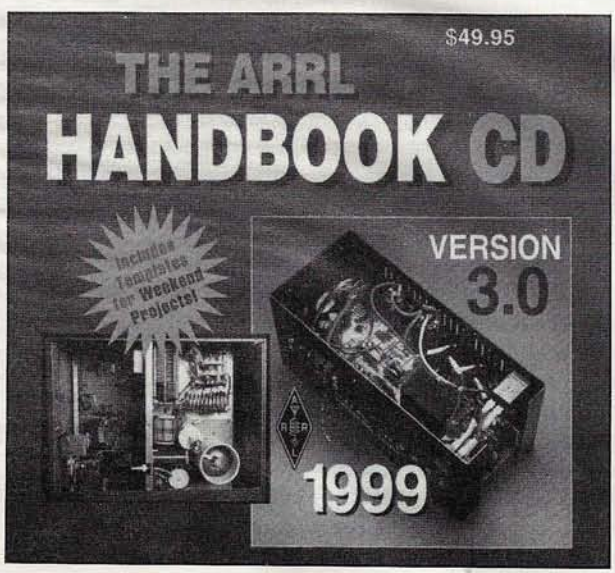
The 1999 "ARRL Handbook" CD

Fast forward from 1929 to 1999, from black-and-white scanned images of old magazine pages to a colorful, interactive, information source. The 1999 "*ARRL Handbook*" CD takes full advantage of the medium by offering much more than a less-than-4-ounce digital version of its more-than-5-pound print companion. In addition to the full text and all illustrations from the print version of the '99 *Handbook*, the CD includes a search engine to let you look for information by entering key words or phrases; audio clips (want to hear the beacon on OSCAR-10, so you know what to listen for?); bookmarks for easily returning to favorite topics; Windows™ copy-and-paste capability; and all of the print version's pc board templates in Adobe Acrobat® PDF files (the CD includes an Acrobat reader if you don't already have one on your computer).

Looking things up is a major part of my job as an editor, whether I'm fact-checking an article or trying to answer a "Q&A" question. *The ARRL Handbook* has always been one of my most often-used references. Having it on CD-ROM makes it even more useful to me, not to mention freeing up space on my bookshelf.

CD or Book? Your Pick

However, being tied to a computer with a CD drive may be limiting for some people. If you need to look up formulas or other data while working on a circuit board at your test bench, for example, your computer may not be handy. Or if you're using the computer to design a circuit, you may want to keep your design program on the screen while looking up something. It's even possible that you don't have a computer at all—or you're using a Macintosh, which as far as this CD is concerned, is like having no computer at all. Don't despair. The *Handbook* is still available in print form as well as on CD. So take your pick and choose whichever format works best for you.



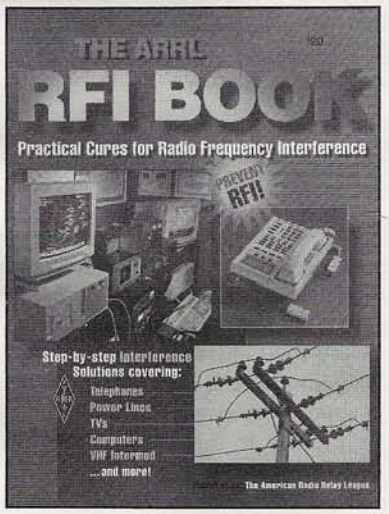
One final note: If you're new to ham radio, *The ARRL Handbook for Radio Amateurs* is the standard reference on nearly all things technical relating to amateur radio and to radio communication in general. Every active ham should have one as a reference book. And while you probably don't need to buy a new one every year, I'd recommend updating at least every three to five years, as your budget permits, to keep current with advances in technology. (1999 *ARRL Handbook*, print edition $32; CD-ROM $49.95; both plus shipping)

The ARRL RFI Book

The ARRL RFI Book, edited by Ed Hare, W1RFI, is available only in print form. But that's probably a good idea, since most folks won't be lugging their computers around with them as they try to track down and resolve radio frequency interference (RFI) problems. Besides, this book is not only for you...it's for your neighbors, for "the cable guy," and for anyone else who's truly interested in working cooperatively to reduce or eliminate RFI.

The new book is a rewritten, updated and expanded follow-up to the League's 1991 book, *Radio Frequency Interference: How to Find and Fix It*, with three entirely new chapters, on cable TV interference, VCRs and intermod—topics of particular interest to VHF operators.

The book contains plain-English explanations of how RFI happens (as well as more technical details for those who want them) and straightforward suggestions for specific fixes to specific problems. In addition, the chapter on cable TVI includes a reprint of a three-part series of articles written by W1RFI for *Communications Technology* magazine in 1993, titled "Electromagnetic Interference and the Cable Operator." *Communications Technology* is a cable industry magazine and, according to Hare, the reprints were included in the book so hams with CATVI problems could simply hand the book to their cable technician and provide information written specifically for cable operators and published in a respected cable industry journal.



VHF Emphasis

The chapter on CATVI is a particularly important one for VHFers, since much cable/amateur interference occurs on the 2-meter and 1.35-meter (222-MHz) bands. This is because cable channel 18 (sometimes called Channel "E") is on 145.25

"...every amateur ought to read the chapter on 'EMC Fundamentals.' EMC is* electromagnetic compatibility, *and this chapter provides the best-written, easiest-to-understand summary of RFI causes and cures that I have ever seen."

MHz, and cable channel 24 ("K") is on 223.25 MHz. Normally, there's no problem because cable systems are supposed to be "closed," and not send out signals over the air. But if there are leaks in the closed system, interference on the amateur bands (and amateur interference to the cable system) become distinctly possible. This book details ways of identifying and dealing with these problems.

The other "VHF-specific" chapter is the one on *intermod*, or *intermodulation distortion (IMD)*. This is one of the most common interference problems to plague amateur repeater systems. The chapter explains how intermod occurs, how to track down the source(s), and how to eliminate it.

Other extremely valuable chapters include those on minimizing interference from and to computers and in automobile installations (radio installation guidelines from Chrysler, Ford, and General Motors are reprinted). In addition, telephones, stereos, and just about every other interference scenario is covered in this excellent reference.

Finally, every amateur ought to read the chapter on "EMC Fundamentals." EMC is *electromagnetic compatibility*, and this chapter provides the best-written, easiest-to-understand summary of RFI causes and cures that I have ever seen.

In summary, if you have a radio, and if you have neighbors, you should have *The ARRL RFI Book* on your bookshelf. (*The ARRL RFI Book*, $20 plus shipping.) ■

Resources

All of these publications are available from most amateur radio dealers, or may be ordered directly from the ARRL, 225 Main St., Newington, CT 06111; Sales phone: (888) 277-5289; Fax: (860) 594-0303; E-mail: <pubsales@arrl.org>; WWW: <http://www.arrl.org/catalog>

"Artist in resonance."

Leonids '98: The Rocks That Roared

Last November's Leonids meteor shower may have been the best ever for making ham radio contacts and for introducing many hams to this exciting facet of our hobby. And this year's may be even better...

"WOW! NØLL EM09 Kansas just worked W1AIM in Vermont on 2 meters for terrestrial state #47. Anyone in Maine want to run? What will tomorrow be like?"

That Internet posting from Larry Lambert, NØLL, on the morning of November 16, offered a quick glimpse of the 1998 Leonids, possibly the best meteor shower ever, from a ham radio perspective. The shower, forecast by some to possibly be a meteor storm, was supposed to peak on November 17th. What really peaked, though, was the number of hams on 6 meters, 2 meters, and even 222 and 432 MHz who successfully made huge numbers of meteor scatter (MS) contacts. For many, such as Brad Pioveson, W9FX, it was their first experience with "working the rocks."

I hate to admit it, but, after 35 years in ham radio, this is my first-ever attempt at meteor scatter. After this morning, I can honestly say that it's a blast. Thanks to N1BUG for being my first QSO—and to all the rest of the stations in the DM-, FN-, and EN- grids I worked this morning. Ran only about 80 watts output to a single 13-element Yagi at 75 feet and worked a baker's dozen randoms.

Other hams had similar introductions...

From Jim Worsham, W4KXY:

I agree, Brad. I have been a ham for over 20 years and have been doing VHF weak signal for only 2 or 3 years. As far as I am concerned, this is it! Everything else is for "sissy boys"....Worked over 2 dozen stations this morning this way for quite a few new grids and several new states. I could have worked more but the QRM was even heavy on .205.

"Signals kept popping in from all over the place, and often were in there for 20 seconds or more. I never thought 2 meters could ever be like this. It was great!"—Steve Berg, WA9JML

From Ron Marosko, Jr. NN5DX/0, Colorado DM79rh:

First time I ever played on the rocks. Everything was random. Everything was between 0800 Z and 1100 Z, and all on 2 meters. Boy, was I wasted at work today. Stuff I worked: WW2R EM13; WB4LXD EM55; WA8WZG EN81—best DX; WØRRY EM26; K5CM EM25; K5LLL EL29—My father!; NØLL EM09; NØUK EN34; NN9K EN41; VE5UF DO61. Stuff I heard but didn't complete: AB5SS, WA5VJB, W5LUA, K5IUA, KØMQS, K7ICW, KF7NP, AG4Y. And the locals who put up with my newbieness: W1XE, KØRI, KØGU, NØPOH, KØKHZ. 73.

From Steve Berg, WA9JML, De Kalb, Illinois EN51:

I had a great time! This was the first time I have successfully worked meteor scatter. I stayed on 2 meters, and tried to stay off 144.2 if at all possible. I started at 1007 Z, and should have been on earlier. I worked: KØGU DN70 CO new state & grid; WA1T FN43 NH new state; K8ZES FN02 NY; WA1OUB FN43 NH; NØIPL DM76 NM new state & grid; K4MRW EM64 AL new state & grid; K4TO EM77 KY; WA3DRC FN20 PA; N3YGA FN10 PA; KØMQS EN31 IA (tropo)—thanked Dick (MQS) for turning me on to meteor scatter; W5AAW EL29 TX new state & grid....All of the above contacts were on SSB, and were random....Signals kept popping in from all over the place, and often were in there for 20 seconds or more. I never thought 2 meters could ever be like this. It was great!

From Ron Johnson, K7UV, Brigham City, Utah DN31:

This was my first ever MS and needless to say I'll be back. This, coupled with my first aurora QSOs last week, has kindled my fire...after being licensed for over 40 years. Contacts, all 11/17: 144 MHz: VE6MK DO33 (sked); N7EPD CN87 (CW sked); N6ZE DM04 (sked); KA7GUX DN17 (sked); K7CW CN97 (random). 50 MHz (ALL random, SSB): K7RAT CN85 (sounded more like *Es*); K6SYW DM03; W6FM CM95; N6TEB DM03; W7GJ DN27 (What state? He was laughing at my excitement & confusion when I got tongue tied!) (*If he was at home, it was Montana—ed.*); WD6E CM96; NØXX CN84; NI6G DM06; WD6HDY CN85; VE7BEE DN09; N7SKT DM33; K6UM CM88. Thanks to all for a great first time experience!

Not Just for Newbies

The shower was impressive to veteran MS ops as well as the "newbies." Here's a sampling:

From Del Schier, K1UHF FN31:

I have never experienced a shower like this one. If it wasn't a storm, I can't imagine what that sounds like. I was on for the first round from about 11:00 p.m. local till 3:00 a.m., got up again at 6:45 a.m. and stayed on till about 9:00 a.m. and had to go to work. I think the

By Rich Moseson, W2VU (cqvhf@aol.com)

Table.

Date	Period (UT)	ZHR	+-
Nov 15	1800-0150	12	8
Nov 16	0813-1028	16	6
Nov 16	1915-2319	64	12
Nov 17	0000-0200	460	180
Nov 17	0200-0330	510	220
Nov 17	0300-0420	360	210
Nov 17	0400-0630	255	124
Nov 17	0700-1000	242	37
Nov 17	1000-1200	256	18
Nov 17	1500-1700	100	16
Nov 17	1700-1840	86	18
Nov 17	1800-1940	102	19
Nov 17	1900-2050	130	35
Nov 17	2000-2100	180	48
Nov 17	2145-0040	62	15
Nov 18	0000-0200	47	5
Nov 18	0130-0240	38	14
Nov 18	0220-0500	33	11
Nov 18	0430-0650	36	22

1998 Leonid Meteor Counts—Initial Results from the International Meteor Organization, as posted on the Internet by Jon Jones, NØJK, along with the following explanation and comment: "From this table, the 1998 Leonids peak appears to have been around 0200–0330 UTC on Nov. 17. The radiant (point in the sky from which the meteors appear to originate) was not visible from North America at this time. ZHRs (meteor-per-hour rates) over 200 occurred from 0700 to 1200 UTC, when the radiant was visible. After 1700 UTC, the number of meteors dropped off significantly, which was what I personally observed."

peak was around 0700 Z though I may have slept through it. The activity dropped before I went to sleep but I don't think the meteors did. The meteors definitely were less before I went to work at 1400 Z.

This shower, I decided that the stations come in from the direction that they actually are, not some oblique reflected path, but in the direction of the burn and the station. Some burns were so long I was able to peak my antenna on them and work a few stations. On several occasions while working zeros, I heard fours come in on another meteor and turned my antenna to work them. For hours, it seemed that there was almost constant scatter propagation and I actually worked six stations on one meteor, a lot of very long burns several over three minutes.

My totals were: 58 QSOs, 56 on 144 and 2 on 222; 38 grids on 2, 4 new ones; and 2 new grids and at least one new state on 222. Didn't tally the states worked. I did hear DM93 but did not copy the call as he got covered up by QRM. I think most of the long-haul stuff got lost in the QRM. I was only working stations that were on top of the clutter on .200, .205, .210, .195, .190. Someone said it sounded like a sea of voices, I would agree.

Here is the list: 0502 KF9WM EN70; 0526 AA9D EN52; 0527 W7XU EN13; 0550 W7XU EN13 222; 0554 KBØPYO EN24; 0554 WA2VOI EN35; 0554 WØVB EN34; 0605 KA9CFD EN40; 0605 K5UR EN35; 0608 N8HTV EN82; 0610 WB2QLP EL96; 0625 WA8CLT EN80; 0625 W9ZIH EN51; 0625 WØOHU EN34; 0625 W9YF EN51; 0627 KØMQS EN31; 0635 WB2WIH EL96; 0635 K9KNW EL95; 0642 W4WDH EM83; 0718 NØQJM EN13; 0719 WØUC EN44; 0725 K2RTH EL95; 0725 WD4MGB EL87; 0727 WA1EHL EL95; 0727 WA5RT EL49; 0734 KB4DFO EL89; 0754 KWØA EM48; 0754 WØRRY EM26; 0755 KØETC EM27; 0755 WB4LHD EM55; 0757 N8WMU EN63; 0758 W5FU EN41; 0804 N9BJG EM26; 0805 N5LJL EM26; 0806 K9KJM EN64; 0806 N8WXS EN80; 1204 WØPW EM26; 1207 KC8CD EM79; 1209 N4LGY EM55; 1217 W4FF S2; 1220 KØMVJ EN36; 1222 W5FYZ EM32; 1223 KD4ESV EL87; 1237 W9JN S2 222; 1242 W9JN S2; 1243 K5YY EM26; 1246 WØVD EM27; 1252 NØBPE EM39; 1253 KØDAS EN32; 1257 N2BJ EN61; 1259 W9FX EM57; 1300 KAØPQW EN33; 1300 NØARC EN44; 1311 KY4SA EM78; 1310 KE9ZAP EN61; 1316 KD4JLE EM75; 1317 KØWLU EN13.

One last comment. I think we blew it by not working the day before and the day after the peak. The day after, I observed lots of good burns, better than most showers, but no activity. 73.

From Kevin Clark, WA2AEY, Watertown, New York FN23bx:

WOW! What a fun time! This was my all-time best at MS since I got the "VHF bug" six years ago! I had started to become quite jaded after the Perseids shower last year, when I had just a few burns and lots of QRM and rudeness on 144.200. What a big difference this time around!! Finally, everyone spread out...heard lots of activity from 144.190 to 144.210 and the sheer number and length of burns here was awesome!! One thing though, what was all the fuss about this being the big *storm*?? Since the last big storm was 1966, *next year* should be the big one. Even CNN was expecting the "big one" this year. They, like a lot of other people, got fooled. No storm, but certainly a fantastic shower!! I'm glad I had the foresight to get on early Monday morning (wish I had gotten up earlier).

From 1122 Z until 1646, I worked the following stations: WØPW EM26; W5RCI EM44; W8WN EM77; WA4HFN EM55; K8TQK EM89; K5YY EM26; N5FAC EM35; N9BJG EM57; K9IMX EM38; K4MRW EM64; WB4LXD EM81(?); WØDQY EM48; KØWLU EN13; W4FZV EM65; K5SW EM25; WB5ABD EM84; WB9Z EN60; KAØWLU EN13. Needless to say I was quite happy with all this since they were *all randoms*, but the best was yet to come...

I knew this shower was going to be something special, so I called in to work (they can live without me for one night—hi) and got ready for the next morning....Starting at 0425 Z this time, the burns were long and plentiful, including many multiple burns at once—MS heaven! Here is the list of what I snagged that morning, again *all randoms*: AA9D EN52; WAØTXK EN41; WA1EHL EM95; KA9CFD EN40; WBØDGF EN10; W9ZIH EN51; K4KXL EM79; WØOHU EN34; W4KXY EM84; KA9FOX EN43; W7XU EN13; WØVB EN34; K4GO FM17; W4FSO FM14; KAØPQW EN33; KBØPYO EN24; N8IEZ EN82; KBØIKP EN25; WB4LHO EM55; KE4JLE EM75; K9OYD/4 FM18; K4YA EM25; WØFY EM48; K9PW EN52; WAØDXZ EN41; W9JN EN54; WØVD EM27; WB4PLS EM95; WA9WOA EM69; KA9RZZ EM59; WØDFK EM47; WBØVGF EN10; my best DX—NØKQY DM98!!!; KF4WE EM56; K4MRW EM64; and my last contact with N4ION EM66, at 1735 Z. WOW!!! And just think, this year we might actually see a *storm* instead of a shower.

Just so the newcomers to MS don't think I have a superstation or something, my setup is quite modest compared to some. All of the above contacts were on 2 meters and were all randoms, no skeds! I am using a Kenwood TR751A with an ARR SP144VDG preamp into a Mirage A-1016 amplifier, with 160 watts into an old Cushcraft 4218XL boomer fed with 75 feet of 9913 coax. My antenna is only 40 feet up, no big tower, no high power

"For hours, it seemed that there was almost constant scatter propagation and I actually worked six stations on one meteor, a lot of very long burns several over three minutes."
—Del Schier, K1UHF

(I wish). I probably missed at least another 15 to 20 grids due to QRM and fatigue near the end. Wish I could have worked all the guys I heard in Florida and the gulf coast, but there is always *next year*! Was really excited when I caught a burn and heard as guy give his grid as DL88 (Mexico)!! Boy, that was one I really wish I could have gotten...oh well...73.

From Russ Pillsbury, K2TXB:

Well it wasn't a storm here, but it sure was fantastic just the same! I guess the highlight for me was working Oscar, CO2OJ, in Cuba for a new country (and my only new grid on 2 meters in years!). It was also fun working John, K5IUA in EL29 *twice* (once each day). He is 1,401 miles from me and the signals were quite strong both times (I worked him back on the 3rd on random rocks—no shower enhancement—and it took us five days of skedding and our contact took one and a half hours to complete, the last 45 minutes waiting for me to hear the RRRs confirming his receipt of my info). But, try as I would, I could not work anyone who was farther away, tried three times with N5XU (1450 miles) and only partial calls exchanged. Still, it was a blast. I know some contacts greater than 1,400 miles were made—wonder who has the best DX for the shower???

Here's my list, all on 2 meters: K5YY EM55; K4MRW EM64; K4TO EM77; NS4W EM76; NØLL EM09; NØQJM EN13; KØWLU EN13; KA8CCD EM79; KM5PO EM23; W4WDH EM83; WØKRP EM27; N4LGY EM55; K5IUA EL29; WA5RT EL49; WØRRY EM26; N5FAC EM35; W4HP EM75; CO2OJ EL83; N5PIP EL96; WB2QLP EL96; WB2WIH EL96; KD4ESV EL87; K5SW EM25; KØMQS EN31; KØKD EN31; KY4SA EM78; WØFY EM48; KFØM EM17; KØVXM EL98; W7XU EN13; KØFF EM49; KØCJ EN34.

Wonder what Wednesday morning will bring? Based upon experience I'd have to agree with the people who think it's basically over. But this shower is anything but "normal," and experience may not be relevant! 73.

From Kent Tiburski, WA6TBO, San Diego, California DM12:

Well, just when you thought there might not be anything...it happens! Went into the house after I erected my makeshift antenna mast and set up the station. Sent a message to the VHF reflector, went into the shack and listened to 144.200. Nothing. Thought I'd swing the antenna ("armstrong" type) to the northwest and see what the LA guys were doing and heard several stations chatting. But wait, these guys have "7" calls? *No way*! Dropped my call, my pencil, and kicked my floor switch when five to seven of these guys began calling me! I couldn't copy everyone and told them to QSY to .180, which made a big difference. Worked W7KK, K7ZL, KI7WB, and K6AAW! All randoms and they were S-9 +20 or better for about three minutes. Sure made taking the day off worthwhile! Thanks guys!

From Chuck Griggs, W6KGF, Fresno, California DM06:

The phrase "the early bird gets the worm" certainly was the case for me. I started operating at 1200 Z (4 a.m. local) on the 16th and 17th, with results that were outstanding. The "predicted" peak Tuesday didn't happen... [but] this was the best I have heard in 40 years of operating. As the amp isn't quite ready yet, I ran barefoot—160 watts (TR-6) to stacked 3-element YO-designed Yagis and had a field day! The kW boys locally slept in? For me, Monday was the best, Tuesday almost as good. I was pointed north about 40 degrees most of the time.

From Dave Clingerman, W6OAL, DM79:

Had a ball during the shower here in DM79, 35 miles southeast of Denver....During the two days I had 126 QSOs on 6 meters and 79 Qs on 2 meters. My skeds were a bust on 222 and 432....It was like the ionization was coming in waves, almost like the Colorado 7-minute roll during a good *E* opening, and as 6 meters would get hot, a couple of minutes, later 2 meters would go off and sound like 20 meters during a DX phone contest. For the most part, I kept the antennas pointed north (330–030 degrees). As far as new grids, I'm really not interested. My bag is trying to Work All States every year on 6 meters. I just like working people and will QSL 100% of QSLs received. Best DX on 6 was probably FN02 (New York) and EN91 (NE Ohio) on 2 meters. Sure would have liked to work some of those elusive New England states. Enjoyed it, looking forward to the next big one. CU all, 73.

From Doug Beck, W7MQY/K6ZX CN82gm Merlin, Oregon:

Thanks to all the folks who took the time to work me in the shower. Thanks to all who heard me, called and had the path go away. The QRM on 144.2 was at times glorious. After 50 years as a ham, it takes a lot to shake the processes here, and this did it. By the way, there were a number of very short (in distance) bursts heard as well, including N9JIM, W6OMF, and K6KLY in the San Francisco Bay Area (about 350 miles from me). Quite amazing. 73 and see you all next year, I hope.

The DX Report

Thanks to the Internet, we now can get reports from around the world as quickly as from around the corner. As great as the shower/storm was here in North America, folks in other parts of the world had the benefit of seeing as well as hearing the meteors, and down in South Africa, several new MS distance records were set. Let's see what was up (or coming down) "across the pond":

From Conrad Farlow, GØRUZ:

I only had limited time and a very small station by my standards, but I managed some new ones. I had lots of semi QSOs but completed 37 to my satisfaction. I was QRV (*on the air—ed.*) between 05:45 and 09:45 UTC on the 17th. Equipment was a single 14-element MET antenna at 15 meters, 250 watts and an IC-746. Locator was IO93fr, I was operating from North Wakefield Radio Club's site, which is a good site and I will probably do most of my operating from there in the future. The best thing is that there is no TVI! I was driving from my home 12 kilometers south to the site at 05:00 and the visible display was incredible. I, for one, will remember this shower for a long time. I have not been on 2 meters for nearly four years and it was a great welcome back! 73.

From Graham Daubney, F/G8MBI, France JN04ft:

It's not over 'til it's over, but can't see it getting any better than it has been. Having lived through over 25 years of these "it's gonna be mega" predictions, I was skeptical, but managed to drag myself out of my pit anyway. Visually impressive here at 0500 UTC; many fireballs capable of casting shadows and reflecting light from light coloured walls here in the dark countryside. Got on the radio at 0600 UTC; from 0600 to 0800, made 101 random QSOs; from 0800 to 1330, added some more for a total of 168 QSOs (a few dupes and a few "did they get rogers?" type deals...but around 160 different callsigns), all SSB, all random, best DX...dunno but half a dozen LYs (Lithuania) were in there which, from here in JN04, must be it, I guess. 73.

From Rytis Zumbakis, LY2BIL/LY2WR, Vilnius, Lithuania:

I was very busy before the Leonids and didn't manage any skeds so had to arrange "on-go." During a long burst on 2 meters, I exchanged sked details for 432 MHz with Alex, DL1KDA, and in 35 minutes he was in the log with 26/49 reports; on my side, five bursts, no pings, max 25 seconds, S9++, 17 Nov, 02:50 UT. The only other sked on Nov 17 was with Enrico, I5WBE. I received 40 seconds of 59+20 reflection up to switchover time; I replied immediately with "599 BK" in slow CW; hearing nothing in some five seconds, I transmitted "I5WBE DE LY2WR 599 BK" in slow CW again. No reply, so I resumed 2000 lpm (lines per minute) high-speed CW MS procedure. I was told later by Enrico that he had received both transmissions. I assume the reflection lasted at least 100 seconds. Unfortunately, the sked was not completed. I called many CQs on 432.200, hoping for random one-burst QSOs between

0000–0700 UT on Nov 17, but was only once heard by PAØRDY, who was so surprised he didn't call me.

This experience proved me that MS-432 one-burst contacts were *absolutely possible* with a ZHR (number of meteors/hour) around 200, having Leonids trails, there had to be some 10–15 stations making noise at the same time on the same frequency. Why 10–15? Simply because 432-MHz antennas illuminate a much narrower part of the possible reflection area than on 2 meters. Hope we can do better here in Europe in 1999 Leonids.

I would repeat what I wrote before the 1998 shower: 1.) This may be the only lifetime chance to work some areas like F (France), I (Italy), S5 (Slovenia), LZ (Bulgaria), or SV (Greece) from LY (Lithuania) on 432-MHz meteor scatter; same for all of you, without using any special MS procedures or high speed CW, simply 59-roger 59-roger 73! Just be QRV on same frequency (432.200?) at the same time (frequent 3-5-minute-long reflections on 2 meters is a good indicator). EME-ers welcome! 2.) Remember, Leonids radiant is over horizon between approx. 22–12 hours local time here in Europe. (*The* radiant *is the point in the heavens from which a meteor shower appears to originate. In a separate posting, British VHF authority Geoff Grayer, G3NAQ, noted that contacts are possible even with the radiant as much as 10 degrees* below *the observer's horizon, since the ionized meteor trails are in the* E-*layer, some 100 miles up.—ed.*)

Broken Records in South Africa

The South African Radio League (SARL) reported that 2-meter DX records for that country were repeatedly set and broken during the 1998 Leonids. The following is from an SARL bulletin:

In South Africa, two-metre records were established and smashed minutes later. Mike Bosch, ZS2FM, reports that he established an historic meteor scatter record at 03:00 SAST with Paul, ZS6PJS, in Pietersburg some 1178 kilometers (707 miles) away. This was followed by contacts with ZS6PT and ZS6HS. The record lasted only some two hours, until ZS6PT made a contact with Shaun, ZR1EV, in Cape Town. Again, this record was short lived when ZR1EV made a contact with ZS6PJS. He later also worked ZR5ADQ, ZS2JA, ZS5DJ, and ZS6LP. The new record is well over 1,500 kilometers (900 miles).

And What about Next Time?

Finally, Jon Jones, NØJK, who kept the Internet VHF reflector updated with predictions from meteor physics experts, posted the following predictions for the 1999 Leonids, a true meteor storm, which hold out the promise of being even better than in 1998:

The experts' consensus for the next Leonids peak is November 19,1999 at 0150 UTC. With the 14-hour offset (from the predicted peak) this year, my prediction is for 1200 UTC on Nov. 18, with a "meteor per hour" rate of 2,200 to 5,000. The Earth crosses the orbit of P/Temple Tuttle 622.5 days after the comet goes by. In any case, I will be taking off the day *before* the peak next time.

So, even if you missed out on last year's Leonids extravaganza, don't despair—you've got plenty of time to plan ahead for this year's meeting between the Earth and the orbit of comet P/Temple Tuttle, the source of all these meteors. As you can see from the comments we've shared with you here—and there were many, many more that we just didn't have room for—if you've never tried operating MS, the '99 Leonids will be the perfect time to get your feet wet. But be careful—you might end up diving in headfirst! ■

Still More Cheap Yagis—This Time, for FM and ATV

Looks like you folks just can't get enough of WA5VJB's Cheap Yagis, so here are two more designs—for 440-MHz FM and 421-MHz ATV—plus a look at a really wideband radar antenna that'll work on a variety of amateur microwave bands.

Way back last August, I introduced my "Cheap Yagi" designs here in *CQ VHF*. The response has been so tremendous that all I've been able to do for the last six months is try to fill your requests for "Cheap Yagi" dimensions on a variety of bands and subbands. That first column last August provided data for building two 70-centimeter versions: one for 432-MHz single sideband (SSB) work, and the other for 435-MHz satellite use. In October, we covered 2 meters and 222 MHz, and December's designs were for 902 and 1296 MHz. Now we're back to 70 centimeters, and this time we'll cover "Cheap Yagi" designs for FM (446 MHz) and amateur television, or ATV (421 MHz).

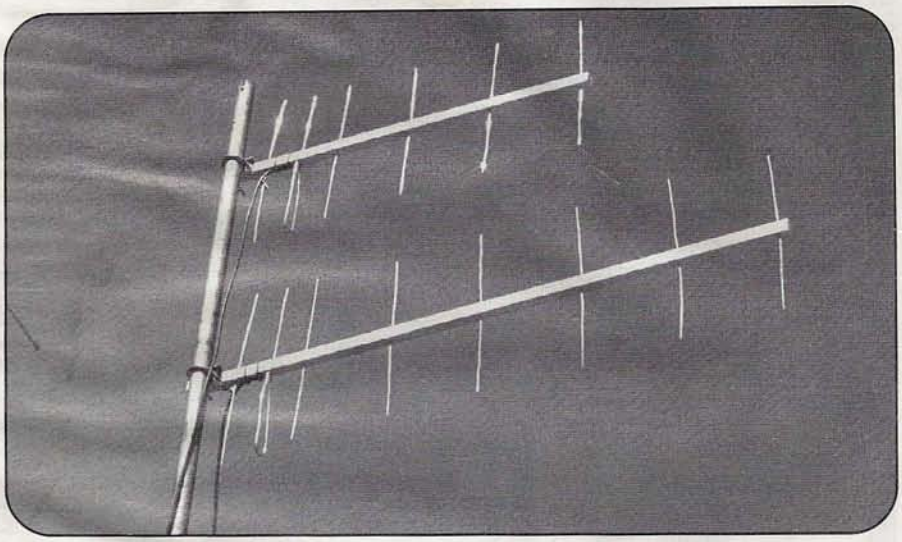


Photo A. The two versions of the vertically polarized 70-centimeter Cheap Yagi. The six-element antenna on top has a gain figure of about 11 dBi, while the eight-element model offers 12.5 dBi. Both have a front-to-back ratio of 30 dB.

Begin with the Boom

The booms for all of these antennas are cut from 1/2- by 3/4-inch wood. You'll need to drill the mounting holes so that the antennas mount with the elements in a vertical position. I realize this is a major trauma for many of us, but after several deep breaths and with a steady hand, you *can* drill a boom for vertical polarization (446.0-MHz contest simplex operation for me, of course! You rarely find me on a repeater). A coating of varnish or even house paint will waterproof the antenna if you mount it outside.

To keep these really cheap, I used RadioShack 1/8-inch diameter aluminum ground wire (catalog #15-035) for all elements except the driven element (bare #10 copper wire). About $4 gets you enough aluminum wire to make eight of these antennas. Other 1/8-inch diameter material can also be used. I've made elements with equal success from silicon bronze welding rod, copper hobby tubing, and brass hobby tubing.

There's a six-element and an eight-element version of each antenna (see Photo A). Dimensions for the driven element are in Figure 1 (Photo B shows details on connecting the feedline to the driven element), and the dimensions and spacing of the other elements are found in Table 1. The six-element Cheap Yagi should give you about 11 dBi gain with a 30-dB front-to-back ratio; the eight-element version should have a gain figure of about 12.5 dBi, again with a 30-dB front to back ratio.

How about Ham TV?

While we're on the 70-centimeter band, here are several ATV (amateur television) receive antennas:

As explained in detail last August, we control the impedance of the driven element in these antennas by changing the spacing between elements. So by making the first few elements just a little farther

By Kent Britain, WA5VJB (wa5vjb@flash.net)

Table 1.

	Ref	DE	D1	D2	D3	D4	D5	D6
Six-Element Version								
Length	13.0	*	12.0	11.75	11.75	10.75		
Position	0	2.5	5.5	11.0	18.0	23.5		
Eight-Element Version								
Length	13.0	*	12.0	11.5	11.5	11.5	11.5	10.5
Position	0	2.5	5.5	11.0	18.0	23.5	29.5	35.5

*See Figure 1 for driven element details

Table 1. Element dimensions and spacing for 450-MHz FM repeater version of the Cheap Yagi. All dimensions are in inches. Spacing (position) measurements are cumulative from the "O" at the reflector.

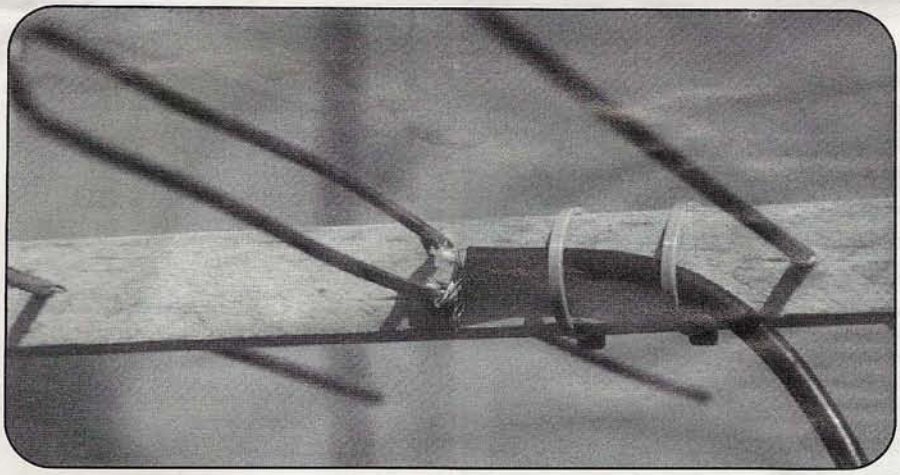


Photo B. Close-up of the Cheap Yagi's driven element—made from bare #10 copper wire—and details of the feedline connections. The center conductor of the coax is soldered to the end of the "J," while the shield is attached at the center of the element. See Figures 1 and 2 for dimensions.

apart, the impedance goes from 50 to 75 ohms—just the thing for connecting up to a "cable-ready" TV and watching ATV.

The two most popular ATV frequencies in my part of the world (Texas) are 421.25 MHz and 427.25 MHz. These just happen to be the same frequencies as cable channels 57 and 58. So all we have to do is build up one of these antennas, run the coax down to a "cable-ready" TV, put the TV in CATV mode, then punch up the remote to Channel 57 or 58. Presto, ATV. No expensive converters needed. (In some parts of the country, 434 MHz is also a popular ATV frequency. But because 434-MHz ATV signals can interfere with the international amateur satellite "window" at 435 to 438 MHz, the Texas VHF FM Society, which coordinates over 1,000 repeaters and ATV systems in Texas, does not coordinate 434-MHz ATV systems, so I've never developed a 434-MHz version of this antenna.)

You'll find the dimensions for the driven element in Figure 2 and data for the other elements in Table 2. For this antenna, we offer dimensions for six-, nine- and 11-element versions. At the request of a chap who lived quite some distance from the Dallas, Texas, ATV system, I also worked up a special 13-element "monster" (well, as Cheap Yagis go, it was a monster). Just use all the dimensions for the 11-element antenna, but lengthen D9 from 11.5 to 11.75 inches, then add two more elements, as shown in Table 3. Obviously, your boom will have to be longer, too.

The gain on these antennas won't be as good as that on their 446-MHz FM counterparts. That's because ATV is a wideband mode (a standard TV signal has a 6-MHz bandwidth), and some gain had to be traded for a wider bandwidth. But you can still expect pretty good performance. The computer predicts 10.9 dBi gain with 35 dB front-to-back for the six-element version; 12.8 dBi gain with 40 dB front-to-back for the nine-element model; and 13.7 dBi gain with 35 dB front-to-back for the 11-element antenna. The guy who requested the 13-element version wanted it tweaked for best gain, so you can expect 14.6-dBi gain with 25-dB front-to-back on the "monster."

Moving to Microwaves

In Photo C, we have the 18-inch antenna from a UWB (Ultra Wide Band) radar. Most pulse radars have bandwidths of a

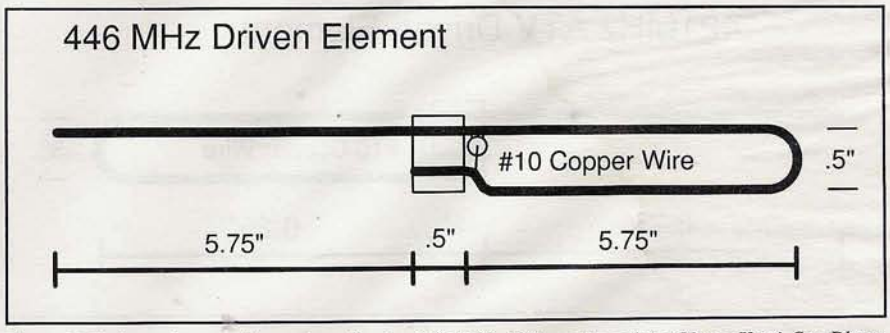


Figure 1. Driven element dimensions for the 446-MHz FM version of the Cheap Yagi. See Photo B for details of feedline connections and Table 1 for dimensions and spacing of other elements.

Table 2.

	Ref	DE	D1	D2	D3	D4	D5	D6	D7	D8	D 9
Six-Element Length	14.0	**	12.5	12.25	12.25	11.0					
Nine-Element Length	14.0	**	12.5	12.25	12.25	12.0	12.0	11.25			
11-Element Length	14.0	**	12.5	12.25	12.25	12.0	12.0	12.0	11.75	11.75	11.5
Spacing for All Versions	0	3.0	6.5	12.25	17.75	24.5	30.5	36.0	43.0	50.25	57.25

** See Figure 2 for driven element details.

Table 2. Element dimensions and spacing for 421-MHz ATV version of the Cheap Yagi. All dimensions are in inches. Spacing (position) measurements are cumulative from the "O" at the reflector. All element diameters 1/8 or .125 inch.

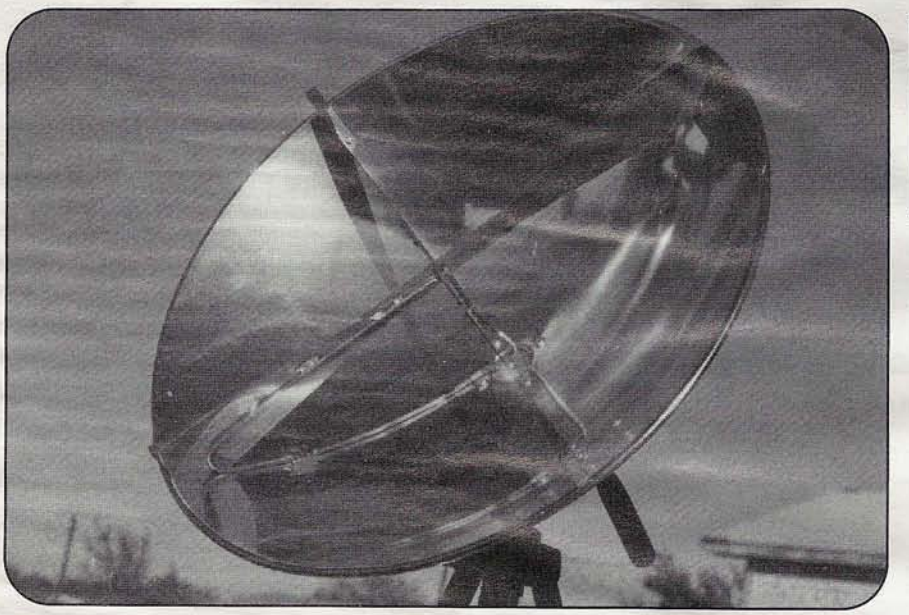


Photo C. The UWB, or Ultra Wide Band, radar antenna. This dish works from 800 MHz to 20 GHz, a span of frequencies that contains six or seven microwave ham bands. I'll tell you more about it after I have the chance to put it through its paces on the antenna range.

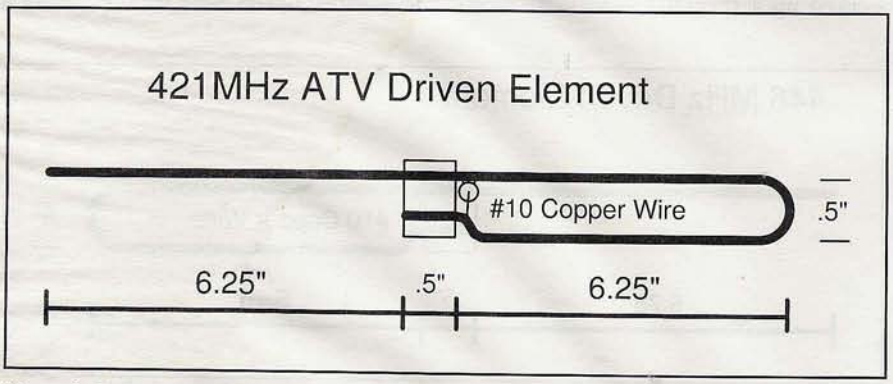


Figure 2. Driven element dimensions for the 421-MHz ATV Cheap Yagi. Feedline connections are the same as for the FM version. See Table 2 for dimensions and spacing of other elements.

Table 3.

	D10	D11
Spacing	64.5	71.0
Length	11.75	11.5

Table 3. Element length and spacing dimensions for making a 13-element "monster" antenna for 421-MHz ATV use. See text for additional details and Table 1 for dimensions of the other elements

few MHz up to 100 MHz. The bandwidth of a UWB is dozens of GHz! The antenna shown starts radiating at 800 MHz. The upper bandwidth is somewhere near 20 GHz. So this is the antenna for a 1- to 20-GHz radar! The interesting optical effects are because they used a polished dish; the optical surface is not necessary for the proper use of the UWB, it's just the dish that was used.

Photo D and Figures 3 and 4 show how the feed elements are connected. This is a bit like a turnstile antenna with the feed elements tapering to a point at the coax. By running the coax along the feed element, and soldering the .141-inch coax to the element, the coax becomes part of the feed. And the feed becomes the balun for the coax cable. The folks who built this antenna used a pretty deep dish, so even though it may not look like it, the elements really do meet at the focus of the dish.

OK, I know this UWB antenna works on six, maybe seven, microwave ham bands. So how much gain does it have? I don't know yet—the weather's been a bit poor for working out on the antenna

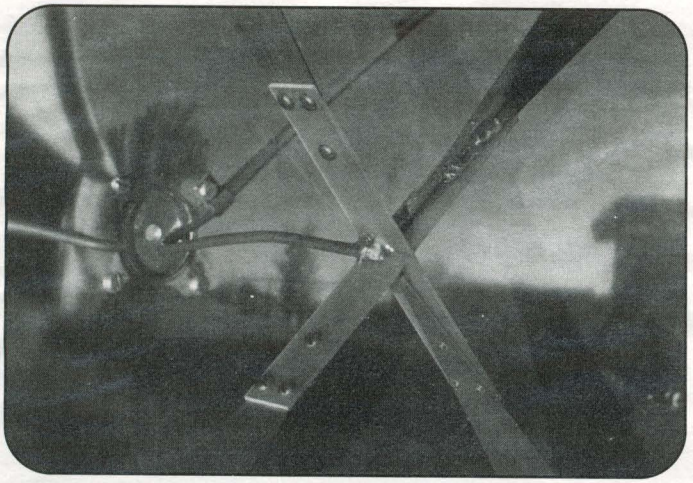


Photo D. Close-up of the feedpoint of the UWB dish antenna. The elements are similar to a turnstile antenna and taper down in size as they approach the center.

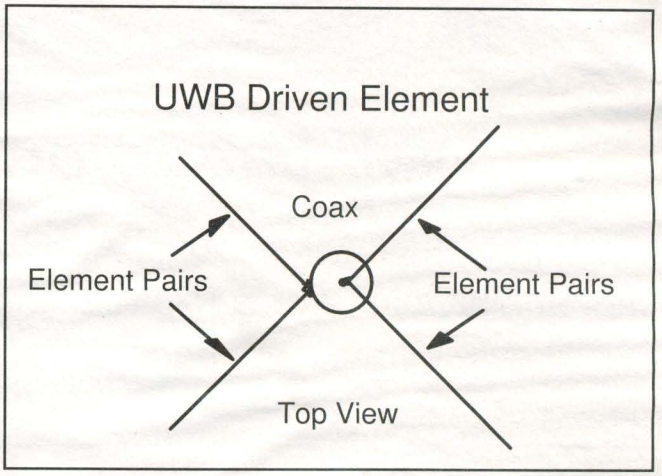


Figure 3. Top view of the UWB (Ultra Wide Band) dish antenna feed system. The feed is similar to that of a turnstile antenna (described in detail in last month's "Orbital Elements" column).

Operating the Leonids Meteors

This has nothing to do with antennas, but it was so much fun I just have to tell you about it. Back in mid-November, I stayed up all night playing with the Leonids meteor shower/storm. It was certainly the best meteor shower I've ever operated, picking up two full log pages of QSOs on 144 MHz. All contacts were random, and from Texas, I worked stations spread out from Arizona to South Carolina and even up to Canada. A few days later I spoke with a chief engineer at USSB, a satellite company. He was unaware of any satellites taking a meteor hit, despite all the dire predictions in the news media of billions of dollars of damage to satellites. See this month's "Weak Signal News" column for more on the Leonids.

"The antenna shown starts radiating at 800 MHz. The upper bandwidth is somewhere near 20 GHz. So this is the antenna for a 1- to 20-GHz radar!...I know this UWB antenna works on six, maybe seven, microwave ham bands."

range—but I can assure you I will be finding out. And, of course, I'll let you know. Still a very interesting antenna.

Administrivia

A few months ago, I starting writing this column on a different computer. I continued using the same CAD (computer-aided design) package for the drawings, but on the new computer. We still don't know why, but the drawings were coming out as series of hollow tubes (as seen in my October and December columns). I'm back to doing the drawings on the old computer now, so my solid lines should be solid again.

One other note: My old e-mail provider finally gave up the ghost after being out of commission for several months after incurring major storm damage. You can now reach me at <wa5vjb@flash.net>, hopefully with better reliability. And if you can't get through, you can always send a note to the main *CQ VHF* e-mail address of <cqvhf@aol.com> and just mark it "Attn: WA5VJB." They'll forward it to me wherever I am.

Finally, I plan to have my AMSAT 435-MHz Circular Polarization antennas finished in time for the next antenna column (April issue), and we'll devote that column to talking about 435-MHz antennas. If you can't wait until April to build a 435-MHz satellite antenna, you'll find the dimensions for the 435-MHz Cheap Yagi back in the August, 1998, issue. ■

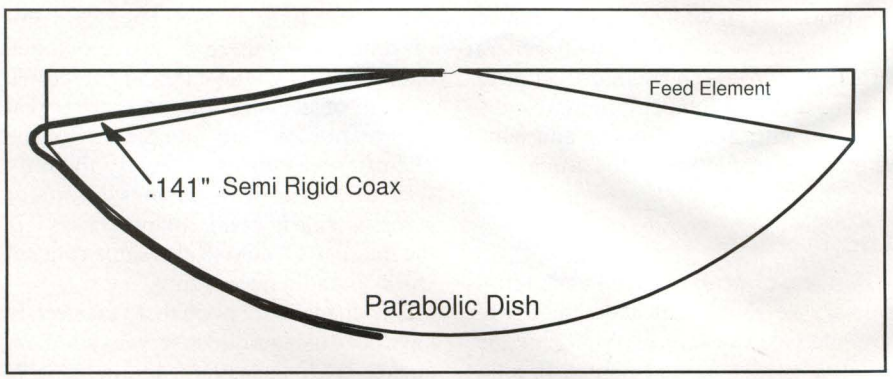


Figure 4. Side view of the UWB dish antenna. The feed elements taper in size as they approach the center, where the feedline is attached.

Resources

Back issues of *CQ VHF* may be ordered for $4 each, postpaid (to U.S. addresses), from our office at 25 Newbridge Rd., Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926.

Web Pages on Packet Radio?

Yes, folks—it CAN be done! And better than that, it is BEING done in Wisconsin. Join us on a trip to "America's Dairyland" to learn how they're sending Web pages via packet, and how you can, too!

In my first "Digital Data Link" column (March, 1996, *CQ VHF*, p. 50), I wrote about delivering Web pages via packet. I didn't explain how to do it—I didn't know how—but I knew that some hams had done it, and I promised to find one who could tell the rest of us what to do.

That was nearly three years ago, and I might have forgotten it, except I remained quite eager to actually see it happen. You see, I believe that doing something like distributing HTML content via packet is a reasonable concept and that users will actually find it useful. No, they wouldn't find it overwhelmingly fast, especially at 1200 baud (1k2), but using it might just drive a desire for greater speed. HTML works well at 9k6, and a speed of 76k8 is not only reasonable, it is *way* faster than most of us are used to. Dreaming? I don't think so.

This month, we are graced with a guest columnist, Andy Nemec, KB9ALN. Andy wrote this article as editor of *The Wisconsin Packeteer*, the newsletter of the Wisconsin Amateur Packet Radio Association, and it is republished here with permission. The newsletter takes up a few pages of the August, 1998, issue of the *Badger State Smoke Signals*, a non-profit cooperative newspaper containing a number of different clubs' newsletters, along with information of general interest to hams in the upper midwest. Refer to the "Resources" box for further information. The article has been modified slightly for *CQ VHF*. Now, over to Andy.

Many hams are on the Internet these days and have become accustomed to the many conveniences and resources available there. One of the most popular Internet activities for hams and the general population is "Web surfing," or looking for information and/or entertainment on the World Wide Web. In fact, WWW has nearly become part of our language, and we see it in magazine advertisements and TV commercials. These days, "the Web is hot" is nearly an understatement.

How does packet radio fit into this? After all, you can't send Web pages over packet—or can you? The answer is, "Oh, yes you can," and I have done it.

We in Green Bay have been able to route TCP/IP packet radio as well as the more conventional AX.25 packet radio traffic for quite some time now. Many of us have been operating TCP/IP stations (known as *hosts* in Internet terms) and have been having quite a good time at it. For those of you who may not know, TCP/IP is the protocol set (the method computers use to talk among themselves) used on the Internet. It seemed logical to a number of folks that it should be possible to send Web pages out over the packet radio network using TCP/IP. I had heard that it has been done out in the eastern part of the country, so I set out to try it myself. That is the subject of this article: what was done and how it was done. For those of you who are less technically oriented, we'll look at it in general terms. For those who are more technically minded, we'll look at it in more depth as well, with an equipment and setup summary near the end of the article.

The Basics

Before we get all wrapped up in terminology, we should get acquainted with how the basic system of Web page distribution works on the Internet. In looking at the general layout of the system, we'll also explain some of the terminology used to describe it.

One important concept you will need to understand is that of a *client/server system*. You also need to understand the idea of *distributed resources*. Simply put, a *server* is a computer running a specific program that allows it to provide a service on behalf of a user or another computer. On the World Wide Web, a computer that stores and dispenses copies of Web pages is known as a *Web server*.

At the other end of the system is the *client*. Just as lawyers have clients, a Web server has clients, too. A client is a computer running software designed to collect and display (or store) information provided by the server. When you connect to the Internet and view Web pages, your computer is the "client." The software that allows your computer to become the client is your Web browser, plus the software that allows you to connect to the Internet.

When you use the client/server system, you are said to be on a network of *distributed resources*. The resources required to transfer and view Web pages (or other information) are distributed across many computers, not just a single computer. It is literally impossible to store every Internet Web page on a single computer—there is just too much data. Plus, it would take an incredible amount of network time to transfer that information to your computer. So, the client/server concept is really the only way to go, as it distributes resources across a wide network. In most cases it is the Internet. Of course, this same concept works in radio networking.

The chances are good that you already have been using a client/server system on packet, perhaps without realizing it. If

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

For the "Techies"

Here are the specifics of what we're running on our packet "Web server" in Green Bay. If you understand this, we encourage you to try it on your own, make your own improvements, and then let all of us know how it's working!

Server Side: 486DX-33 computer running Caldera OpenLinux Lite, kernel 2.0.29; Apache Web server v. 1.1.1-11, with a 10-Mbps wired network port.

Server Side Radio Interface: 386SX-16 running MS-DOS 6.22; WNOS 4 (DAMA slave custom version, a variant of KA9Q NOS); 10-Mbps Ethernet wired network port; PacComm Tiny-2 TNC at 1200 bps; Motorola Moxie VHF radio, converted to the 2-meter amateur band.

The Client Side: 486DX-100 computer running Red hat 5.0 Linux; Lynx 2.4.2-4 Text-based Web browser; Pseudo-SLIP (UNIX "Pipe") connection to the radio interface program.

Client radio Interface: JNOS v1.11b (Linux) software, running on the above Client computer under Linux; Pseudo-SLIP (UNIX "Pipe") connection to the Linux-operated browser; PacComm Spirit-2 TNC at 9600 bps in KISS mode; Motorola Mitrek UHF radio converted to the 70-centimeter amateur band.

Radio Network Nodes: PacComm Tiny-2 1200-bps TNC running TheNET X1J firmware; Motorola Syntor-X VHF radio converted to 2 meters; PacComm Spirit-2 TNC at 9600 bps running TheNET X1J firmware; Motorola Mitrek UHF radio converted to 70 centimeters.

Notes: The "server side" may also be configured like our "client side" is configured, perhaps running a NOS program such as JNOS or TNOS. This would mean only one computer would be used, and it could be set up as both the server and the radio interface computer. We did not do it this way for convenience—the wired Ethernet network was already in place. As a side benefit, we are able to demonstrate the concept of distributed resources in a small network.

The same can be said of the 1200-bps "speed limit." At present, there is no 9600-bps capability at the server site (which just happens to be my house!). The 1200-bps system was already in place and is workable as a test bed when the LAN is not being used for other purposes. This is a limited-run test, and we do not wish to congest the LAN by offering this as a full-time service until a 9600-bps (or faster) TNC is installed.

you use a packet BBS, you are essentially using an e-mail server of sorts. When you connect to a BBS and read messages, your computer becomes the client. On the other hand, when someone connects to your TNC mailbox, your TNC (terminal node controller) becomes the server and the person connected to your mailbox becomes the client. This is an example of how the concept already applies to packet radio.

In the world of the Web, we need a server to store and distribute the Web pages on demand and suitable client software to interpret and display the pages. There is no commonly available Web server and Web client software (that I know of) written specifically for packet radio, but we can use other existing software to perform these functions. However, we do need a radio network capable of operating with this software.

Network Interconnection

In amateur packet radio, our computers communicate with each other using a standardized method known as the *AX.25 protocol*. Other protocols, such as TCP/IP and NetROM, may be sent via packet radio, but they must first be "wrapped up" or encapsulated into an AX.25 packet. (If you are unfamiliar with this concept, it is discussed, among other places, in the "Using the Wisconsin Network" series, parts 10, 23, and 24. If you have access to the World Wide Web, you can find these on the Wisconsin Amateur Packet Radio Association Web page. Again, see "Resources.")

Once we have the ability to send these TCP/IP packets, we must have the ability to carry the packets to their destination. When all of these pieces (server, radio interface, and radio network) are put together, we have something that looks like this on the "server" side of things:

Web Server Computer → Radio Interface → Radio Network (nodes, etc.)

When we add the client into the picture, the "other half" looks like this:

Radio Network → Radio Interface → Client Computer

The "Badger State Smoke Signals"

I have had the privilege of receiving the *Badger State Smoke Signals* newsletter for nearly 15 years now. As far as I know, this is a unique publication in the world of amateur radio: it combines statewide coverage of ham radio news stories and *is* the club newsletter for various radio clubs around Wisconsin.

Participating clubs submit monthly columns about their activities, meeting notices, etc., and all subscribers receive the *Smoke Signals*. This allows clubs not only to communicate with their own members, but with members of other clubs in the state as well. It also saves the individual clubs from the time and expense involved in laying out, printing, and mailing a newsletter each month. Expenses are shared and per club costs are no doubt lower, due to reduced duplication and economies of scale. Newsletter editors and publishers in other parts of the country could benefit from taking a look at the *Badger State Smoke Signals*, and perhaps it can serve as an inspiration to do something similar where you live.

—W2VU

The *radio interface* is one term that might be a little vague, because there's more than just a TNC and a radio required to couple a computer running TCP/IP to the AX.25 computer network. I mentioned earlier that we need to "wrap" (encapsulate) the TCP/IP packets in AX.25 packets, so the TNC can send them to the radio and out on the airwaves. We can use one of a couple of methods to do this:

1) We can have another computer intervene and perform this function. This computer sits between the server and the TNC and accepts incoming TCP/IP packets. It then wraps them in AX.25 packets and sends them out to the TNC, which in turn sends them to the radio and out into the packet network. This is another example of "distributed resources." This has its appeal for reasons I will not go into right now, but it also has the disadvantage of requiring more hardware—two computers instead of one—and a wire network connecting them together.

2) We could also program the server to do the "encapsulation." The Web server would not only serve up the pages, but would also do the encapsulation and hook to the TNC. This is a little tidier, but also requires the use of an operating system that will support multitasking.

Specifics of Our Test Setup

What we did to test our Web page server incorporated both of the concepts discussed above. The server uses *Linux* as an operating system (see "Using the Wisconsin Network"—Part 40). Linux is a multi-tasking system, and is able to run the Web server software as a program that runs in the background. It listens for incoming connection requests and accepts and processes them. This server computer connects to a wired network.

The radio interface computer serves the function of a gateway to the radio network. Aside from the Web server computer, this radio interface computer provides gateway service to the radio network for three other computers on the wired network. In a sense, it is a "radio interface server." It wraps the TCP/IP packets into AX.25 packets for any computer on the wire network that needs this service. This computer runs an amateur radio TCP/IP *NOS* (Network Operating System) program set up for this purpose.

The radio interface computer is also connected to a TNC running on VHF at 1200 bps. The local LAN (local area network) and "backbone" nodes are able to route the AX.25-encapsulated TCP/IP packets to the client computer. (*A packet "backbone" node is a high-speed link between user-accessible nodes, or connection points, on a packet network—ed.*) The server-side LAN node is a 1200-bps VHF node. It is on the same node stack as the client-side LAN node, which is on UHF at 9600 bps.

The client side uses the second "unified" approach, but without the server software running. It uses client software and is set up to do the radio interfacing with a conventional TCP/IP NOS program. Because we are using more than one program at a time, a multi-tasking operating system is again needed. Linux is used here as well, because it easily supports a Web browser as well as the radio NOS program.

The radio NOS program links the Web browser to the radio network. It runs on the same computer and sends the AX.25-wrapped TCP/IP packets to the TNC and then to the radio, where they are sent out to the radio network. Naturally, it also does the reverse, so that commands can be sent to the server.

The Web pages themselves are written in HTML (HyperText Markup Language), the language of the Web. They are simple text in content, with no graphics. The system operates just as usual—it supports linking to other pages and other sites. Our server side was not set up to link to other sites, but it does support this feature.

Graphics can be sent as well, but it was decided that the heavy download time needed would not be suitable for a radio path that is using 1200 bps in part of the radio link. As it was, this 1200 bps limiting factor did make itself known—those folks who are used to lightning-fast speeds will most certainly yawn while waiting for the full page to appear. However, a Web page with mostly text content would be far more practical even at 9600 bps.

Are There Other Ways to Do This?

Linux is the best choice for a server operating system, as it was born to do server work. Setting up a DOS-based server would be very difficult and probably would limit its utility. That is, assuming you could find something that can run effectively under DOS.

The client side is a little more flexible, however. There are two programs that have been written that will allow Windows 3.11 and Windows 95 to operate their TCP/IP systems with a TNC. What these programs do is wrap the TCP/IP packets from your browser into AX.25 packets and send them to your TNC through your serial port. You would need a TCP/IP address in order to use this system, but it is possible to use a specially configured Windows computer to see Web pages served over the amateur packet radio network. Both of these programs are available at the following Web site: <http://hambox1.cqu.edu/au>. The files also include setup instructions, and this site has a lot of other neat information on it as well.

The Future

We plan to offer this as a full-time service to users of the 9600-bps LAN on UHF here in Green Bay. Graphic content will be light, and other area hams will eventually be invited to have their own Web pages for all to see.

N2IRZ here again. Just a brief note to thank Andy for taking the time to write all that down in a form that is understandable for most everyone. Also, the usual note to encourage *you* to write down what you know and send it in—I'd like to hear about it, and I'm sure others would, too! Don't worry if you can't write well, that's what editors are for...(*gee, thanks, Don!—ed.*)

Next month, we'll have a look at higher speed and what we can do about it. Until then, get cracking on putting up that Web server!

—N2IRZ

There has been talk of implementing some system or Web server using solely the AX.25 protocol. It is possible to transfer at least text pages via AX.25. They are, after all, written in HTML, which is a text-based "programming language." So far, though, there are no firm plans to implement AX.25 Web serving—just ideas floating around. If it ever comes to pass, it will not be able to implement all of the features one will find with the Internet Web server implementation, but it may prove intriguing for those people with limited computer resources.

In closing, this was an especially fun project that I recommend to technically minded packeteers for duplication. I also recommend a good radio network for the task, and at least 9600-bps speed. It is also especially important to consider the content and size of the Web pages and the time of day you decide to test. Other users of the packet radio network in your area will be glad you did.

I welcome your questions and comments on this. Refer to the info below for this. If you do decide to undertake this test, good luck! ■

Resources

Wisconsin Amateur Packet Radio Association. Bob Gedemer, KA9JAC, 609 Wilson St., Neenah WI 54956. Web: <http://netnet.net/~ke9lz>. Membership is $20/year, or $15 without the *Smoke Signals* subscription. Write for details.

Badger State Smoke Signals, Kenneth A. Ebneter, K9EN, Chairman, 822 Wauona Trail, Portage WI 53901. A one-year subscription is $13.95, or included with WAPR membership (above).

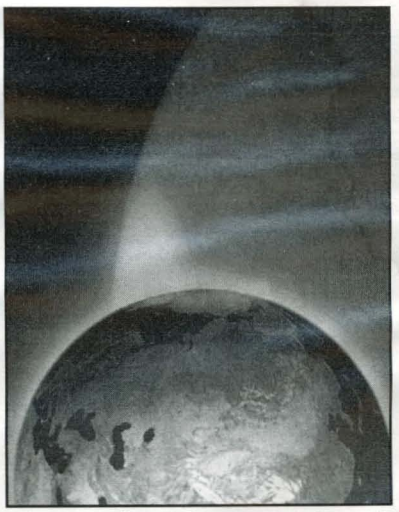
Andy Nemec, KB9ALN, 433 Cottage Grove Ave., Green Bay WI 54304. E-Mail <kb9aln@kb9byq.ampr.org>

Radio Science

Putting the Squeeze on Earth's Atmosphere

Researchers using NASA's Polar spacecraft have found the first direct evidence that bursts of energy from the sun can cause oxygen and other gases to gush from Earth's ionosphere into space, and that these gases then return to touch off auroras.

According to a NASA news release, scientists first saw this effect last September 24 and 25, when a storm from the sun hit the Earth. Using particle detectors on Polar, they found that the flow of "polar wind" out of Earth's upper atmosphere increased substantially when the storm hit. In effect, pressure from the solar ejection squeezed gas out of the ionosphere. But those same gases get caught in the Earth's "wake" and are pulled back into the atmosphere after being heated and excited by the solar wind, and it appears to be these supercharged gases that are responsible for causing aurora.



A two-way flow of gases at the poles. The "plasma fountain" seen in this NASA image is both spewing oxygen and other gases from the ionosphere into space and simultaneously pulling in plasma energy that causes auroras to form. (Courtesy NASA)

A Leaky Ionosphere

According to NASA, scientists have known since the early 1980s that the Earth's upper atmosphere leaks oxygen, helium, and hydrogen ions (atoms that have gained or lost an electron) into space from regions near the poles. But it was not until the Polar spacecraft actually flew through this fountain of ionized gas last September that scientists confirmed that the flow of ions was caused by solar activity.

On September 22, 1998, the sun ejected a mass of hot, ionized gas (known as plasma) toward Earth. NASA says this magnetic cloud of plasma (called a coronal mass ejection) increased the density and pressure of the solar wind and produced a shock wave similar to a sonic boom. When that shock wave arrived at the Earth late on September 24, it rammed into and compressed the Earth's magnetic shell in space (the magnetosphere). This shock to the magnetosphere excited the plasma trapped in Earth's ionosphere to a point where some ions gained enough energy to escape the planet's gravity and flow downwind of Earth. The amount of oxygen and other gases lost from the ionosphere amounted to a few hundred tons, roughly equivalent to the mass of oxygen inside the Louisiana Superdome.

"This is the supply of plasma that makes things interesting in space," said Dr. Thomas E. Moore of NASA's Goddard Space Flight Center, Greenbelt, Maryland, principal investigator for Polar's Thermal Ion Dynamics Experiment (TIDE). "Much of the gas ejected from the ionosphere is caught in Earth's wake. It then flows back toward the Earth while being heated and accelerated by the same processes that create auroral particles and the radiation belts."

Year 2000: Maintaining Emergency Response Communications

You've probably heard all sorts of dire warnings about computer systems crashing on New Year's Day, 2000. What's it have to do with ham radio? And how can you be prepared to help?

Eleven months and counting. Unless you've been in a vacuum for the past year, you must have heard of the "Y2K Bug," the "Millennium Bug," or the "Year 2000 Bug." Yes, we're on final approach to the year 2000. As a refresher, the Y2K Bug has to do with the way dates are processed by computers. Early computer programmers decided to conserve data space by having computers "read" only the last two digits of a year, and automatically add a "19" at the beginning. This means that "00" will be read as 1900 instead of 2000.

There have been all sorts of dire predictions of potential chaos when the computers that run so much of our world today suddenly lose track of time. Programmers, information technology specialists, and computer consultants are taking the threat seriously, and have been busily reviewing and testing millions of lines of computer programs and equipment that includes computer chips that respond to a date figure.

This spring and summer, public service agencies around the country will be conducting tests to make sure that they have identified and fixed all of the problems which some say will affect us all. Many agencies have been working on the problem since 1996. The key for local communities, neighborhoods, and individuals is to have contingency plans in place if there is no power, no traffic lights, and no gas pumps working. Also keep in mind that you may not be able to run to the next town or next state because they might be having the same problems.

K6CHE is the command post used in the Long Beach area for ham radio communications during the annual California Coastal Cleanup Day. The trailer provides HF, VHF, and UHF communications as needed. (See sidebar for details.)

For hams, "being ready" means not only working with public service providers such as police and fire departments, but also with utility companies, including electric and water. Let's take a look at how public service agencies are dealing with this problem and how local ham radio groups might be able to serve in the Public Interest.

The FCC and Y2K

Late last year, the Federal Communications Commission (FCC) conducted a forum on "Maintaining Emergency Response Communications in the Year

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

Table 1.

Communication Alternatives

Service	Potential Problem	Alternative
"911"	Emergency response may be delayed or prevented	Alternate phone numbers, cellphones, radio
PBX	Loss of internal and external communication lines	Use radio, pagers, cellphones, or couriers
Cellphones	Missed and erroneous calls	Use radios or face-to-face communication
Radio	Loss of police patrol communication, increasing danger for police who cannot call for backup	Use cellphones if possible. Double up patrol assignments
Pagers	Missed and erroneous pages.	Use cellphones, if possible; otherwise, use periodic call-ins or face-to-face communications

Table 1. Communication services likely to encounter problems with the "Y2K Bug," and recommended backup approaches to keep communication flowing. Source: Texas Guidebook 2000 <*http://www.dir.state.tx.us/y2k/resources/Y2KGuide06.htm*>.

2000." The forum stressed the importance of making sure that all links in the emergency communications chain are working properly. This includes the telephone system, emergency operations centers, police and fire units, warning devices, and the Emergency Alert System.

During many natural disasters, there's an increased reliance on wireless communications. This includes radios, cellphones, and pagers to name a few. If the traditional telephone circuits didn't work, there would be an even heavier reliance on wireless communications. Many dispatch centers are considering scenarios that will have special tasks forces on duty to deal with disruptions caused by the Y2K Bug as well as the regular staff to handle the routine calls. Let's take a look at what some of the experts are saying:

One speaker explained that most planning and worrying that's done in emergency scenarios usually involves only one event occurring at a time—one earthquake, one hurricane, or one something else—and assumes that resources from neighboring communities will be available to help. But January 1, 2000, may produce similar problems all over. Certainly, communications and fuel supplies will be among the first necessities to be restored. Ed Becker, a project manager with Plant Equipment, Inc., a provider of 911 equipment, said his company "wholeheartedly agree(s) with the FCC's position that there is a lack of awareness out there in the community about how significant the threat is posed by the year 2000 problems."

Robert Miller, technical director of the National Emergency Number Association explained that

> ...every link in the processing of a 911 call involves a complex independent array of processing equipment. Any equipment incorporating a time-date clock must be considered a problem until confirmed otherwise. This complex starts with the public switching telephone network which routes a 911 call from the local central telephone office through a computerized 911-selected router so computerized equipment...will integrate [yet another] computer to retrieve the caller's location. The dated phase resides on a computer which is derived in part from the telephone company's database computer.

Miller continued,

> This system is a complex database involving several interface computers. The call takers and the dispatcher positions receive the calls. These positions are assisted by recorders which are computer driven. All of this happens before the calls are even dispatched. Few places depend on computers more than the public safety dispatch center to safeguard citizens across the country. The corrective action program could be the largest and most complex project ever undertaken....

Illustrating the scope of this effort, Lisa Thomison of the Arlington County (Virginia) Emergency Communications

Center described the county's radio system as having 2,000 components. Each one has to be tested. She commented that not only does her department have to find the equipment that is not compliant, but then it has to be fixed. "Everyone knows we have to do this," she said. "We have the utmost responsibility to make this right. This has to work. This can't fail." Her main concern is the cost of fixing those systems that are not compliant.

The U.S. Fire Administration conducted an informal survey at the National Fire Academy. Out of 600 students representing 431 fire departments in all 50 states, 98 indicated that they were aware of the Y2K issues. Of those, 77 indicated they were working to get their systems operational and 20 said they were fully ready and compliant.

A Global Event

Barbara Reagor of Bellcore, a communications networking company, recently emphasized,

> We are looking at a global event. All of our methods that we use for disaster recovery are built on the ability, as the event grows, to bring in shared resources to a single point or nucleus. We have to now step back and look at year 2000 at the point that the nucleus will not be there. Our normal recovery planning cannot call on shared resources....We have a global scenario to deal with and we have to identify how we can approach that.

She also expressed concern that any computer-related failure that occurs from April on may mistakenly be blamed on the Y2K problem.

Interior view of the command vehicle for the Los Angeles International Airport (LAX) Police/Security force. It has ham gear as well as cellphone and law enforcement radios available. Los Angeles ARES was able to arrange for its use during the coast cleanup. Ham gear includes two IC-901s plus packet and ATV receive capability.

The Gardener Group, an authority on Year 2000 problems, reports that by the end of 1999, approximately 30 percent of mission-critical systems will end up having a failure on that date.

Donald Appleby, from the Commonwealth of Pennsylvania, said his state has over 22,000 radios, some of which are in use 24 hours a day, seven days a week. Others shift to county dispatch at night and you have to make sure they don't "go to sleep" when the year 2000 arrives. "There won't be a lot of generators out in the backyard and the power will go quickly," Appleby said. "We have a lot of reliance in Pennsylvania on cellphones and this backup will not be there."

The Madison, Wisconsin, *Journal Sentinel* newspaper reported that the Wisconsin National Guard is prepared to mobilize on December 31 to deal with potential power failures, water system shutdowns, and other problems that could occur as computer clocks click over to the

Table 2.

Date	Importance/Potential Problem
July 1, 1999	Start of the IRS Fiscal Year 2000
August 22, 1999	GPS (Global Positioning System) rollover (reset to zero) used in paging operations and provides accurate date and time for recording and synchronization.
September 9, 1999	"Nines end-of-file problem" in certain systems using 9999 in the date field to denote "end-of-file" (EOF). Most of these programs are mainframe-based, written in high-level computer languages such as COBOL. Pubic safety applications include large criminal justice information systems and motor vehicle/drivers license systems.
Feb. 29, 2000	Not a normal leap year. (Century years normally are not leap years. Rule: if the year is divisible by four but not divisible by 100, *or* if the year is divisible by 400, it is a leap year). Many computer programs perform the first two tests (divisible by four, but not divisible by 100) but do not include the last test. Those that do not will be off by one day from March 1 through Dec. 31, 2000.

Table 2. January 1, 2000, is not the only date that threatens to disrupt computer systems in the coming year. Other key dates to watch for stretch from July 1, 1999, to February 29, 2000. Source: Dealing With the Y2K Millennium Bug, *by John Powell and David Buchanan*

Origins of the Y2K Bug

At last fall's AMSAT conference, Roy Welch, WØSL, presented a forum on "Y2K, Your PC and AMSAT Software." As a general introduction, Roy explained the origins of the Y2K "bug" and outlined procedures for testing your computer and software for Y2K "compliance," or ability to tell one century from another. Here are some highlights:

The problem dates back to the earliest computers that had on-board memory. There was very little memory and programmers saved every possible byte in writing programs. As a result, the earliest programs and operating systems used only a two-digit date code (the last two digits), with the computer having a single instruction to put a "19" before every year. Remnants of those early operating systems have survived many upgrades and improvements, and may still be present, particularly in older computers.

Your computer's date information comes from the "Real-Time Clock," in the CMOS memory (special memory that contains the computer's basic startup instructions and that is not "forgotten" when the power is turned off). The computer's BIOS (Basic In/Out System) attaches the century value to the year figure and passes it on to the operating system and software. Newer BIOSes have an option of appending either a 19 or a 20; older ones will automatically attach a 19.

Y2K Tests You Can Do

Roy recommended that everyone perform the following simple tests on their own computers and date-dependent software:

1) Set the system clock to 11:59 p.m., December 31, 1999. Wait a minute. Will the date change to 2000? If not, you've got a problem. If yes, move on to the next step.

2) Power down the computer (without resetting the date), then start it up again. Does it boot up with the correct date and time? If yes, move on to number 3.

3) Now, set the date manually to a date in 2000. Power down and restart. Does it boot with the right date and time? If no, you've still got a problem; if yes, there's still one more test to do.

4) Finally, try to set a date of February 29, 2000. Will the computer accept it? (See Table 2 for the significance). If yes, you're cool! If no, you'll have to manually reset the date on March 1, and the system may still have the day wrong.

—W2VU

year 2000. After a hearing by an Assembly committee on the Y2K problem, the newspaper reported it was clear that no one really knows exactly what will happen at 12:01 a.m. January 1, 2000. "The only thing we do know is that there will be problems," said Rep. Sheryl Alberts (R-Loganville), the chairwoman of the committee. "We don't know what will fail. It could affect a small area or a big area or the entire state." She said National Guard members could be called upon, for example, to help evacuate hospitals that lose power and heat or to help haul water to communities whose water systems have shut down.

What Can We Do?

We've covered what the experts think might happen, but what can we as hams do to be prepared to serve in the Public Interest? Erik Dyce, WØERX, of Denver, Colorado, is involved with Denver's Y2K process. In an Internet posting, Dyce says the majority of communication systems utilized by municipal police, fire, and paramedic groups are *not* Y2K compliant. He says our ability to assist when normal communications fail will be paramount to a nationally required resource. "All too often, ARES and RACES groups have become stagnant, or worse, unknown to city officials," says Dyce, "*Now* is the time to reconnect and re-establish a rapport with those persons charged with responding to local emergencies."

A bittersweet flipside to this is that, if we are called upon to serve, will we have the resources to respond? Paul Cavnar, NN7B, says his group is "focusing on the things we can do something about ahead of time and preparing defensively for the things we cannot."

It's time to take stock of your own ARES/RACES group's inventory. Here are some questions you may want to ask...

Equipment

- Do you use a computer in your shack? If so is it Y2K compliant?
- Do you use other gear (radios, TNCs, etc.) in your radio shack that relies on a date calculation?
- Do you have emergency power available if needed?
- Does your repeater system depend on date calculations?

Staff Readiness

- Many people will be welcoming in the new millennium. What alerting procedure will you use should your group be needed by any of the served agencies?
- Have you met with your local emergency management or National Weather Service office to determine whether there is a need for amateur radio to provide backup communications if there is a problem?
- Is your group capable of supporting local government during a holiday weekend when many people are away?

Flying Blind

No one is really sure what will happen as we start the new millennium. Virtually every government and company has been spending time looking at how or whether Y2K will affect them. Many businesses have been past the Y2K problem for several years. Long-term credit and financing plans are well into the next century. All we really know is this: we won't really know what, if any, amateur radio response will be needed until 12:01 a.m., January 1, 2000.

Resources

For further information on Y2K preparedness, visit the following Web sites:

Federal Communications Commission: <http://www.fcc.gov/year2000/>
Federal Emergency Management Agency (FEMA): <http://www.usfa.fema.gov/y2kcom.htm>
International Assn. of Emergency Managers: <http://www.emassociation.org>
The President's Council on Year 2000 Conversion: <http://www.y2k.gov>

California Hams Help in Cleanup

An article in the *Los Angeles Times* described how a group of ham radio operators operating from a Caribbean island had left their operating area full of graffiti. Here's a story of California hams helping to clean up the environment and serve in the public interest.

Each year for the past four years, ham radio operators have pitched in to help support the California Coastal Commission's Beach Cleanup Day, an annual event that coincides with International Beach Cleanup Day around the world. Robert W. Sanford, WB6NYC, says tens of thousands of volunteers take to the beaches from San Diego to the Oregon border and to the shorelines of Lake Tahoe and the inland creeks and rivers of California. In 1997, nearly 50,000 Californians picked up over 1,000,000 pieces of debris that weighed in at 700,000 pounds. The collected data is a powerful voice for conservation and is used to influence governmental and corporate policy (see "A Few Stats of Interest" for a rundown of what was picked up).

Ham Participation

Since it is a statewide event, the beach cleanup offers an excellent opportunity for hams to drill together and to provide local VHF and statewide HF communication circuits. An operator was assigned to each beach cleanup brigade. The operator was able to keep in contact with neighboring beaches using an HT, and with a regional command post or net control station. Each net control station coordinated between five and 10 beaches. The net control stations were linked via a 222-MHz repeater. In the Los Angeles, Orange, and San Diego County areas, operators were able to exchange information at the county level (see Figure).

According to Dennis Smith, KA6GSE, the purpose of using hams for communications is threefold:

1) To provide for safety of those volunteers picking up trash along the beach.

2) At or near the end of the event, hams give their net controls the totals of the number of participants as well as the amount of stuff picked up—this allows for some real good message handling practice.

3) Using various mobile communications setups provided by different groups allows for great coverage along the beach and an exercise in making everything work together. There was also one operator on Catalina Island—able to see the entire coast from Point Dume to San Diego—who was standing by to relay if needed.

Internet and Ham Radio

Smith says the hams tried to interface the Internet into the operation as well. This was done by using an Internet chat room to pass traffic up to the Coastal Commission Headquarters in San Francisco. The main plan was to use packet radio at each net control location, fill out a form with the information required from each beach, and then send this information to a station with chat room access who could relay the beach information to San Francisco either via HF or the chat room, depending on which was working at the time. Previous experience had shown that HF was not always dependable from all sections of the state.

Why use the Internet for a ham radio event? "Due to the size of this event and the amount of information that is generated," Smith said, "it is quite close to a large disaster situation that would require us to incorporate different modes in an overall communications plan." Smith hopes to get Internet-savvy youth involved in ham radio/community events. He explains,

> ...the easiest way to do that, as far as I can see, is to get them involved in some of our community service projects and let them see what is going on. Since they would be co-located with the ham station and be hearing what is going on, they might be more inclined to look into it as a way of communicating with their friends as well.

Is California the Only State?

According to Smith, California is the only state using ham radio for this event. If you're interested in setting something up in your own state, Dennis has some contacts in other states who might be interested in communication support. You can contact Dennis via e-mail at <dsmith@smartlink.net>.

A Few Stats of Interest

The Center for Marine Conservation tabulates most items that are picked up on Coastal Cleanup Day. Here are the totals of litter picked up along the beaches during the most recent effort:

Cigarette Butts	237,709
Foam plastic pieces	91,115
Plastic pieces	64,507
Paper Pieces	61,014
Food bags/Wrappers	59,224
Pieces of Glass	46,891
Caps/Lids	43,631
Straws	35,876
Cups	25,682
Bottle Caps	21,702
Packaging Material	21,683
Beverage Bottles	18,811
Total	**328,824**

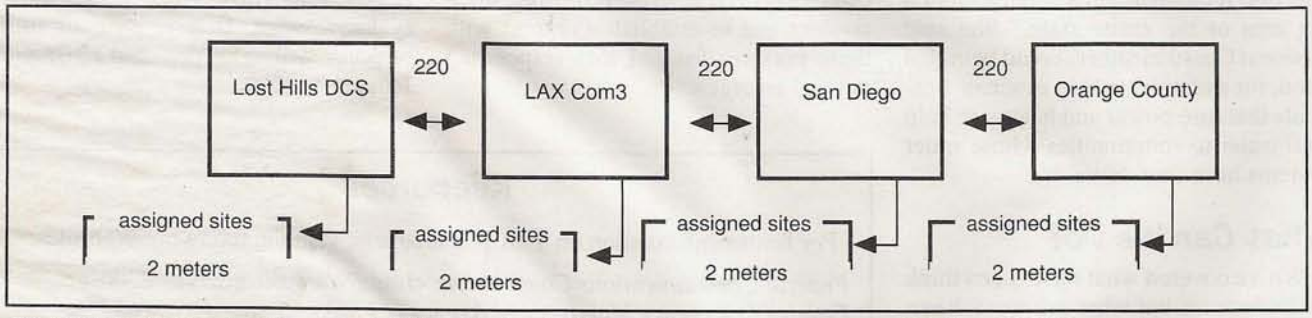


Figure. Organization chart for part of California's Beach Cleanup Net shows extensive use of VHF and UHF frequencies to coordinate the cleanup. Hams with cleanup crews communicated with their net controls via 2-meter handhelds, while the net controls kept in touch with each other on 222 MHz.

The Shape of Things to Come for the Magic Band

The new sunspot cycle is upon us and worldwide DX, as well as all kinds of activity throughout the year, is beginning to appear on 6 meters. This month, we'll review the types of propagation that occur on the band and when they'll most likely be present.

Long-distance communication on 6 meters may be related to a greater variety of propagation phenomena than the communications on any other band. Here's a brief look at the major causes of 6-meter DX openings.

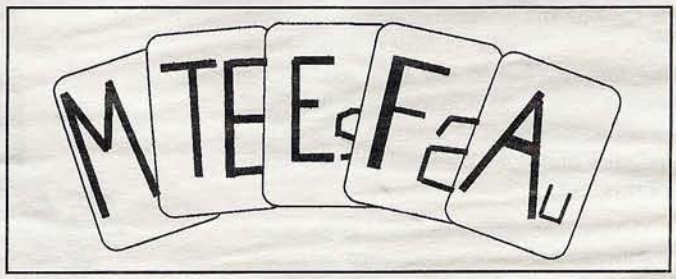
Sporadic-E and Aurora

The sporadic-*E* (*Es*) phenomenon will continue in the same fashion as it has during the low sunspot count years, with a strong summer season and a minor winter season. As before, there will be a slight drop-off in activity during the in-between months of the spring and fall equinoxes, when *Es* occurs very rarely. The beauty of *Es* still being present during the winter season is that it's often part of multiple skip links into exotic DX, i.e., mix 'n match propagation, in which a long path may involve both links of F_2 and *Es*.

With increasing solar activity, there will be a corresponding increase in geomagnetic activity that will result in more *aurora* (Au) activity during these years, as compared to the quieter years of solar activity. There will be more Au openings during both the spring and fall equinoxes, as some very strong Au activity can take place with a few days of exceptionally high fidelity. The appearance of major Au openings for this new cycle may already have begun, with some strong Au signals heard in the Northeast during the end of August, 1998.

The Coming of F_2

Of course, the big event during the peak years is the arrival of F_2 skip. F_2 is primarily a wintertime event, occurring from the middle of the fall through the early spring. It is also primarily a daytime phenomenon that can occur between 8 a.m. and 5 p.m. local time. The skip tends to be on a north-south path during the early and latter parts of the F_2 season, with east-west paths being predominant during the winter months (November through January for the Northern Hemisphere). The rule of thumb is that it must be local noontime at the midpoint of the path being worked. Keep in mind that F_2 on frequencies as high as 50 MHz is not going to be a daily occurrence as it is on 28 MHz during peak years, but there will be some significant stretches lasting several days at a time.



Pick a card, any card. Six meters hosts a wide variety of both HF and VHF propagation modes, and the "hand" that you're dealt on any given day will determine just how far you can talk—that day—on the Magic Band.

Transequatorial Propagation

One form of F_2 propagation is *Transequatorial Propagation* (TEP). TEP is generally prevalent during the equinox months, between two stations located at roughly equal distances on either side of the *magnetic* equator.

During the higher sunspot years, this form of propagation will occur more often and will extend deeper into the season, sometimes into November and May. When this extension occurs, and another propagation mode such as *Es* appears simultaneously, stations as far north as New England will be able to work into Argentina. This combination of modes is discussed further in the article on "mix 'n match" propagation elsewhere in this issue.

You may ask why so much fuss is made in detailing these modes when not much thought is given to them on HF bands, such as 10 and 15 meters. This is probably because they are present more often, and for longer periods, on those bands. It's important to realize that on 6 meters, many of these modes, particularly combination modes, may only appear for short periods of time (less than one hour) and that vigilant monitoring is generally required to catch that "rare one." In addition, six also has the benefit of "VHF" propagation modes such as Au, and the combination of all of these propagation possibilities is what makes it truly the Magic Band!

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 (kneubeck@suffolk.lib.ny.us)

Charlie and the Wizard

The wizards who bring out the magic of ham radio usually don't wear fancy robes or pointy hats. It may be hard to find them, says WB2D, but always worth the effort.

Yesterday, I received an e-mail from a ham I knew 15 years ago. We'd lost touch, but he noticed my name in *CQ VHF* and wondered if I was the same person he knew then. I've met a lot of famous and interesting people through ham radio. Charlie Helmick, W8JZN, is not famous, but to say he's interesting would be a gross understatement. There is something almost magical about him. When I think of Charlie, I always think of this story:

A long time ago on an island in the South Pacific, an evil monkey bedeviled the people of the village. During the most sacred of ceremonies, the monkey would show up chattering and hurling things at the high priest. When the women were preparing the village meals, the monkey would suddenly show up, steal food, and deposit decaying matter into the community stew pot. Their lives were in shambles because of one bantam, but seemingly unstoppable, monkey.

The men of the village had done their best to trap the monkey, but he was small, fast, and smart. Nothing they tried had worked, and they had resigned themselves to live under the oppression of the monkey forever. But that would change.

One day, a powerful wizard showed up on the island. No one knew where he came from or how he got there, but they all instantly recognized his wisdom and special powers. The wizard simply asked for food and shelter. As mealtime neared, the monkey made his appearance and again ruined much of the meal the women had prepared in honor of the wizard's visit.

"Why do you put up with this?" asked the wizard of the villagers.

"It is the will of the Gods," said the king. "He has been sent to punish us because we have obviously offended Them in some way. We have tried to rid ourselves of this pest, but we are helpless against him. He is evil, and there is nothing that we can do about it."

"That is true," smiled the wizard, "there is *nothing* that you can do about him. Tell me, what is the monkey's favorite food?"

"He loves these nuts above all else. Probably, because they are so rare on our island."

"Go get me a large quantity of these nuts."

And so the king sent his best soldiers into the forest to retrieve as many of the rare nuts as the men could find. Soon they returned with a small bowl of these nuts and presented them to the wizard.

Slowly, the wizard held the bowl up to the sky and then began walking around the village until he found a tree with a knot hole a few inches above the ground. Very carefully, he poured all the nuts into the hole as the king and villagers gasped at the waste. But the wizard simply shook his head and motioned the people away from the tree.

The monkey, which had been watching from the trees above, began working its way closer to the tree with the prized nuts. When he was sure that no one was near, he stuck his hand into the tree and grabbed a big handful of the nuts. But he could not remove his hand from the tree without letting go of the nuts. The monkey chattered and screeched as he tried to remove his hand from the tree, but he refused to let go of the prize nuts. Suffice it to say that, that night, the wizard and the villagers dined on monkey stew. The monkey had not realized that whatever it is that you hold onto is what holds you back.

There are those who see with their eyes only, and then there are those who *perceive*. There are those who resign themselves to a second-rate existence when the conventional rules do not work, and there are those who find solutions in the problem itself. There are those so busy holding onto an idea that they would risk annihilation rather than let go.

Charlie and the Wizard

To me, the wizard embodies the spirit of ham radio. Charlie could very well be that wizard. No, Charlie never entered a contest, and he never bothered to pass the Extra—even though I'm sure it would be a piece of cake for him. As far as I know, he has never checked into an official traffic net. Nor has he held an ARRL appointment. I can't think of any of the conventional yardsticks that we use to measure our "ham worthiness" that apply to Charlie.

When I first met Charlie, he was the Chief Engineer at a small under-capital-

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

ized TV station. Management was frugal, to say the least, but Charlie and his crew kept things running in pretty good order. However, there was one video amplifier that constantly malfunctioned. Each technician got a turn at it. But nothing helped, and the symptoms were strange and seemingly unpredictable. After several months, Charlie called one of the technicians aside and said, "We've replaced everything in that amplifier except the chassis. Call the manufacturer and see if we can get a new chassis."

At first the technician didn't believe him. How could a chassis be "bad"? A chassis is just a sheet of metal bent into shape with holes in the right places. But Charlie was serious. So, the staffer contacted the company and ordered a new chassis. All the circuitry was moved to the new chassis, and all the problems went away. How could that be? I don't know, and I doubt that Charlie knew, either. But for him it was simple—you just step back and look at the problem. Let go of what you think is or isn't possible. If you have eliminated all the other possibilities, what you are left with is the solution, no matter how much it defies your belief system.

Digging In

When synthesized scanners first appeared on the market, Charlie made no secret that he wanted one. So his wife bought him the top-of-the-line model for Christmas. She told me that he had a classic Cheshire cat smile on his face when he unwrapped the package and pulled out the scanner. Charlie grabbed the new toy and headed for the basement. His wife thought that he had gone down there to try out the radio and looked in on him to see how it played. But what she saw startled her. Without so much as even turning it on, Charlie had sat down at the work bench and disassembled the radio, just to see what it was like inside. What an incredible sense of curiosity! By the way, he did put it back together quite easily and used it for years.

Then there was the apartment fire in a building down the street from the TV station. Charlie went along with the news crew to cover the smoky fire. The firemen soon had the occupants out of the building and made sure that all were OK. Except, there was a large black Labrador retriever that was not breathing. "What about the dog?" Charlie yelled at one of the firemen. The only response was a shrug of the shoulders as if to say, "It's only a dog. What can I do? These things happen, you know."

"How is it possible that when all other forms of communication fail, ham radio gets through? What is it that's so magical about ham radio?"

Charlie grabbed the dog and began giving it CPR—chest compressions and mouth-to-mouth. Even some of the firemen stopped to watch his efforts. Within a few seconds, the dog began to stir. Charlie continued until the dog was breathing easily on his own. One of the firemen came over with an oxygen mask, and soon the dog appeared to make a full recovery. Charlie made the front page of the local paper that day. His 15 minutes of fame said that he was a hero, but his friends knew that it went much deeper than that.

Always Listening, Always Helpful

Charlie was always listening in on the repeater. If you called him, he answered. If someone needed assistance, he was there in a flash. And if something funny happened, he could always give you the details. But he had no interest in jumping into the gab sessions.

The only times I recall hearing Charlie come on the air and look for someone to talk to were those times when he was testing a piece of equipment that he had just built. Even then, the conversations would be short. Once he was satisfied that it was working, Charlie "drifted back into the woodwork" and went on with his life. To Charlie, the wonder of ham radio is in your ability to do something different. You know one way works;OK, fine, let's see if you can find another way to do it.

That attitude applied to more than just equipment. Charlie learned enough CW to pass the 13-wpm code test, made some contacts to prove that he could do it, and moved on. Over the years, he has owned some HF gear from time to time, but his love has always been VHF and UHF.

In his note to me, Charlie mentioned that he likes the articles on antennas that run in *CQ VHF*. He says that in his entire life, the only antennas he ever bought were two five-element beams for 6 meters. Why pay "mega bucks" for an antenna? Charlie asks. All you need is something metal and the know-how to configure it. Charlie adds, "And the guy on the other end never knows the difference." This has nothing to do with frugality. This is about taking what life gives you and getting the job done. It's about the difference between "just looking" and "really perceiving." This is about the magic of ham radio.

The Spirit of Ham Radio

The spirit of ham radio is something that carries over into all aspects of your life. A few years back, a new company purchased the TV station where Charlie worked, and "cleaned house," as they say in the corporate world. Charlie and the other staff members found themselves on the street. There is not much demand these days for RF engineers in Small Town America.

Charlie didn't want to move, which is what the other staff members did. But in no time, he had lined up a job with the local cable TV company—producing commercials. It wasn't his cup of tea... too little contact with the equipment, the toys. No problem. As time went by, Charlie worked his way into more and more technical aspects of the job. Now he's in charge of servicing much of the microwave equipment and links that stretch over several hundred miles and four states. Charlie is just quietly going about living his life, taking care of his family, and playing around with 10-GHz construction projects.

What is it that makes ham radio so special? What is it that creates that sense of connections that we all seem to have to each other? How is it possible that when all other forms of communication fail, ham radio gets through? What is it that's so magical about ham radio?

Personally, I think that Charlie is a walking embodiment of the spirit of ham radio. As you continue along in the hobby, look around for the other Charlies. Chances are, they will *not* be the ones on the repeater day and night. Nor will they be the ones pontificating about how lousy the club leadership is. And they may not even be all that visible in the club. Nonetheless, they are there. Just look for them.

When you find someone like Charlie, just hang around and watch for a while. You'll learn a lot that way. ■

Understanding Signal Levels, Frequencies, and Modes—Part 2

Part 1 of our series looked at amplitude, or signal levels. This month, we move on to a closer look at frequency, along with a little more practice on working with metric measurements.

Last month's discussion of frequently used technical terms and units of measurement, plus our mini-tour of the full electromagnetic spectrum, contained such a wealth of information that it overflowed available space. So we continue this month with Part 2 and more notes, tales, and always-beneficial information. Let's begin with some "carried-over-from-Part 1" comments on the radio spectrum, then finish our study of the metric system, and wrap up with a quick look at signals and decibels (dB). The information promises to be interesting in a dozen ways and it also represents knowledge you can use for an entire lifetime, so let's get started!

Some Notes on the Electromagnetic Spectrum

In Part 1, I pointed out that signals in the HF range of 3 to 30 MHz can reflect off the ionosphere and cover long distances. Speaking more precisely, signals between approximately 500 kHz and 10 MHz tend to bounce off the ionosphere during hours of darkness, and signals between 10 and 30 MHz tend to skip off the ionosphere during daytime hours. The ionosphere's signal-reflecting abilities also vary with photon energy, which, in turn, varies with the number of sunspots and the sun's 11-year sunspot cycle.

Signals at VHF and higher frequencies are more likely to go through the ionosphere rather than reflect off of it. Thus they're especially good for local area coverage, space and satellite-type communications. UHF and microwave signals also exhibit characteristics similar to light, whereas signals at lower frequencies act more like radio waves. As an example, at UHF and higher frequencies, signals are attenuated more by foliage and nonmetallic structures more than at VHF; but UHF and microwave signals "bounce around" rooms or buildings and leak through barely open doors, much like light. The higher the frequency, the more radio signals act like light. Eventually, as frequencies get well up into the Terahertz (THz) range—above 1000 GHz—signals do more than act like light: they *are* light. Beams of light are nothing more than very, very, very high-frequency radio waves. Interesting, eh? Now let's squeeze in one more quick tidbit of information.

During the early days of wireless communications (and before frequencies could be accurately measured), folks assumed that ultra-low frequencies were best for long range communications (a very low number of wavelengths would span between the U.S. and Europe, for example). Frequencies above 200 meters were considered insignificant, so amateurs enjoyed relatively open access to them. After our forefathers proved that shorter wavelength signals could cover long distances by reflecting off the ionosphere, government agencies reclaimed the HF range and allocated narrow bands of frequencies for amateur radio use.

In many ways, today's views of upper microwave ranges like 10 GHz and higher seem similar to yesteryear's opinions of HF. This is our modern communication frontier—and it is wide open to exploration and development by creatively minded amateur radio pioneers. True, life on these incredibly high-frequency bands may be somewhat lonely at present, but even 2 meters was sparsely populated 30 years ago.

The high volume of sound produced by a jet plane during take off is approximately 90 dB—more than a loud crowd, but less than a rock concert. The Table lists the decibel value of other commonplace sounds.

That's enough radio philosophy for this time. Now let's take another detailed look at the metric system.

More Metric Measurements

Last month, we examined metric terms used to measure large quantities or numbers greater than one. This month, let's

By Dave Ingram, K4TWJ

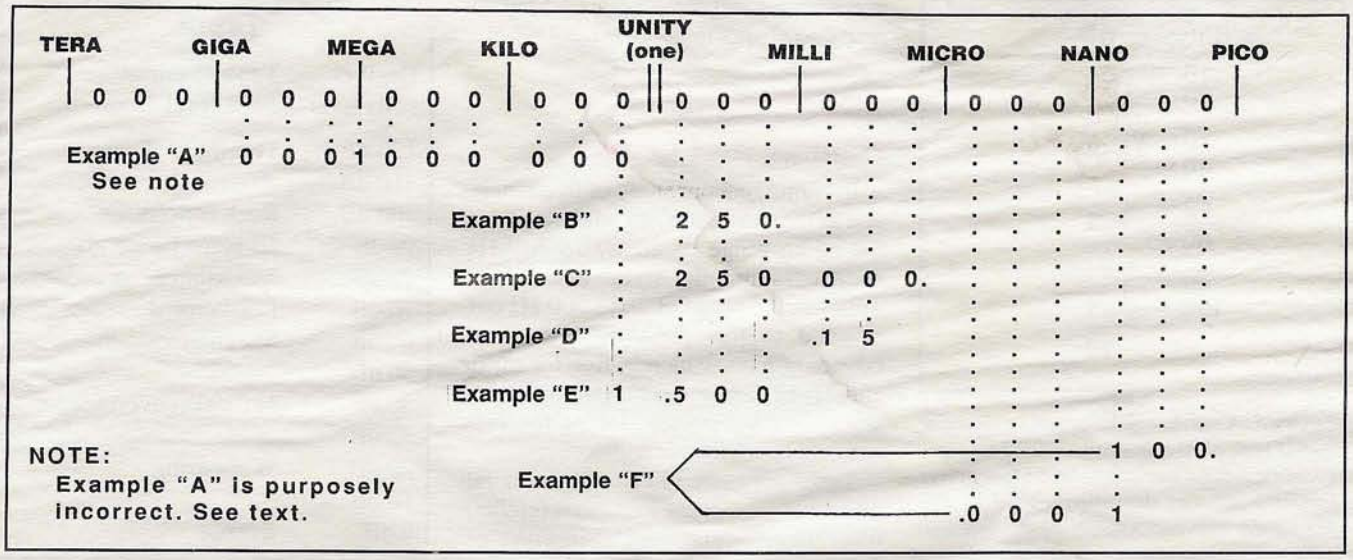


Figure 1. Outline of the metric system and related units of measurement used in electronics. This month, we're focusing on parts of whole numbers or "zero slots" on the right side of unity/one. See text for discussion plus explanation of examples.

turn our attention to quantities of *less* than one, or numbers on the right side of *unity*. Another copy of the metric chart (which, hopefully, you can now draw and label from memory) is shown in Figure 1. Let's begin with a quick review of proper chart use (the old practice-makes-perfect philosophy still works!).

Experience has proven that the most common error using a metric chart involves misaligned numbers. Placing a "1" (or other number) right *at* the "Meg marker" rather than in its first "zero spot" to the left of Meg, as shown in Example A of Figure 1, illustrates this (improper!) step. The number might read correctly as 1,000,000 Hz, etc. to the right, but can be incorrectly interpreted as .0001 (GHz, etc.) when read to the left. The solution? Whether working on the left or right side of unity/one, remember there are only three slots for zeroes or numbers in each section. Every number or zero inserted on the left or right side of unity must fit in a "zero slot." It's that simple. In Example A, the "1" should have been placed in the first "zero slot" to the left of Meg to signify 1.0, or one whole Meg. Get the idea?

Now let's focus on electronic quantities of less than one, such as milliamps (mA), microvolts (μV) microfarad (μF), picofarad (pF), etc. These tiny amounts are used in measurements of input power of linear amplifiers, front-end sensitivity of receivers, output levels of microphones, values of capacitors, etc. The terms are also included in questions on all classes of radio exams, so time invested learning about them is time well spent.

We will start by entering an often encountered value, like 250 milliamps, into the chart and then converting it to amps. Since we are talking in terms of milliamps, we place the decimal at "milli," write "250" to the decimal's left, then read the quantity as "250" whole milliamps (Example B in Figure 1). Think back to last month's explanations and it will make sense. The decimal point is always placed at the term's marker under consideration. Digits or "zero slots" to a decimal's left indicate whole numbers while "zero slots" to a decimal's right indicate parts or fractions of a whole number.

If we now wish to read the value in amps, we simply move the decimal to unity or "whole amps" and read .250 or 1/4 of an amp. Do that again, you say? OK, let's read the value in microamps. Since we're considering microamps, we place the decimal at "micro" and "fill in" to its marker with zeros, as shown in Example C of Figure 1. One-quarter amp or 250 mA is thus the same value as 250,000 microamps. Did you follow that? 250,000 microamps, 250 milliamps, and .250 amps are all the same value!

"Real-Life" Examples

Next, suppose a microphone is specified as having an output level of 0.15 millivolts and answer this question. Is that output level more or less than an AA/1.5-volt battery? First we place a decimal at "milli" and write 15, as shown in Example D. Then we place another decimal at unity/volts and write 1.5, like Example E in Figure 1. Now compare the two and you see that 1.5 volts is more than 1500 times greater than .15 mV!

Now, let's say we need a 100-pF capacitor for an antenna tuner or linear amplifier, but all the capacitors we find are marked in μF. How do we convert pF to μF? First we place a decimal at "pico,"

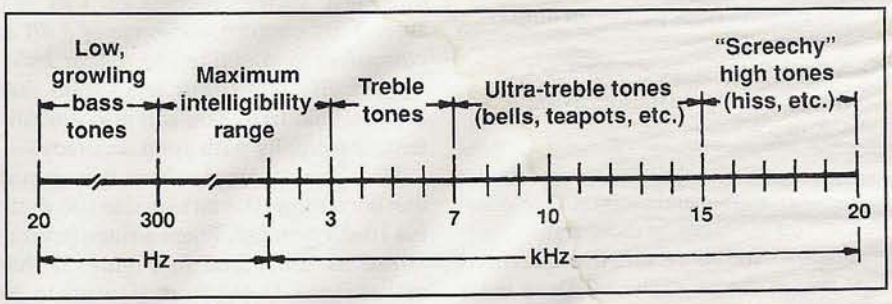


Figure 2. Imaginary "slide rule dial" presentation of the audio frequency spectrum. Bass tones are on the left, treble is on the right. Articulation and maximum intelligibility are in the near-middle 1000- to 3000-Hz range.

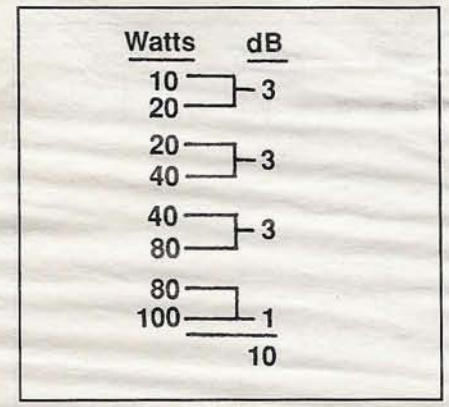


Figure 3. A quick and easy way to visualize signal gain or loss in decibels (dB) involves counting from a starting to an ending power level in 3-dB steps, then tallying total dB. The final 3-dB step can usually be divided into quarters with reasonable accuracy. If you have one, the attenuator on your receiver can be switched in/out to establish how many dB equal one S unit on your receiver.

then enter "100 whole picos" in the three "zero slots" to the decimal's left. We then move the decimal to "micro," fill in the three open slots with zeroes, and read .0001 µF, as shown in Example F of Figure 1. Some manufacturers have begun marking surface mount capacitors in *nano*farads (nF). Can you convert 100 pF to nF? That's right, you move the decimal to nF and read .1 nF.

Think you have the technique mastered? Terrific! Try your hand at the following practice/exam questions to confirm that:

1) A microphone has an output of 270 microvolts. How much would that be in millivolts?
2) A receiver's sensitivity is listed as .25 µV for 10-dB SINAD (a .25-µV signal will produce a 10-dB change in signal, noise, and distortion). What portion of a volt is .25 µV?
3) Which is larger: 0.25 µV or .25 mV?
4) A linear amplifier draws 1000 mA at full output. What part of an amp is 1000 mA?
5) An oscillator stage draws 7 mA of current during operation. What is 7 mA in µA?

Look near this column's end for the correct answers—and congratulate yourself if you got three or more right.

Want to see more practice questions like this in future columns? Drop me a note at 4941 Scenic View Drive, Birmingham, AL 35210. Include a self-addressed stamped envelope (SASE) if you wish a direct reply. Now let's put our new knowledge to good use.

More Details on AF Signals and Levels

In continuing our study of frequencies and amplitude levels, let's take a look at the audio range of 20 Hz to 20 kHz, shown "tuning-dial style" in Figure 2. Tones in the range of 20 to 300 Hz correspond to low growling and chest-pounding bass, which is fine for music and Hi-Fi (*Dave, you're dating yourself!—ed.*), but power robbing for SSB-type voice communications.

Tones between 300 and 3000 Hz fall into what we call the *maximum intelligibility range*. Sounds consistent with most daily conversations and voice communications are conveyed in this range, and a good communications grade microphone exhibits a slightly peaked response here for high "talk power" or audio "punch." Higher-pitched voices and mild treble sounds fall in the 3000-Hz to 5000- or 7000-Hz range, which some folks describe as exhibiting a "tin can sound." Tones between 7000 and 15000 Hz are *ultra-treble* sounds akin to small bells ringing, teapots whistling, etc. If you can hear the "sing" of a horizontal output (flyback) transformer in a TV, you're hearing 15.7 kHz (or, to reinforce what we've just covered, 15700 Hz). The sound of a mosquito in flight is also near 15 kHz. If you can hear a mosquito near your ear, but not 10 feet away, it's probably because the frequency response curve of your ears drops off 10 dB or more at the high end.

Strength or amplitude of audio tones and/or signals is usually measured in dB or in microvolts (µV) for microphones, and in watts for large sound systems. Generally speaking, 1 dB is the minimum discernible level of change you can hear (occasionally described as "did that volume just increase/decrease? I'm not sure."). By contrast, *a change of 3 dB is equivalent to doubling (+3 dB) or halving (-3 dB) a previous level*—and that effect is additive. You can also guesstimate it mentally with good accuracy.

Here's an example: You may heard that boosting a 10-watt signal to 100 watts is a 10-dB increase. When written or visualized as illustrated in Figure 3, that makes sense. Going from 10 watts to 20 watts is 3 dB, 20 watts to 40 watts is another 3 dB, and 40 watts to 80 watts is another 3 dB (9 dB total so far). Now another 3 dB would push our 80 watts to 160 watts—too much (oops!). What about plus 1.5 dB? That's 120 watts, still more than we've got. But now, if we whack off 20 watts (and .5 dB), then our increase from 80 to 100 watts equals 1 dB. Added to 9 dB, that's 10 dB total—and this technique works without using fancy formulas. Remember it!

Also remember another point of interest: We do not hear linearly, that is, each 3 dB does not always sound like double or half the volume to our ears. If you've ever replaced a linear taper potentiometer in an oscilloscope with an audio taper pot, or perhaps installed a linear taper pot in an audio circuit, you're aware of this. One will "squeeze" movement of a CRT's dot or trace line into a fraction of pot rotation; the other requires excessive turning for even a mild volume increase. Finally, some familiar sounds are listed by dB level in the Table for your general knowledge.

If you find decibels interesting and would like more information on the subject, incidentally, check out "You Don't Have to Be Einstein...to Understand Decibels" by Ron Hranac, NØIVN, on page 40 of the December, 1997, *CQ VHF*. It's a superb article.

Table.

Decibel (dB) level	Typical sound/ noise level
120 dB	Threshold of pain
110 dB	
100 dB	Rock concert
90 dB	Jet plane taking off
80 dB	Jackhammer on concrete
70 dB	Loud crowd
60 dB	Shouting
50 dB	
40 dB	Normal conversation
30 dB	
20 dB	Whispering
10 dB	
0 dB	Silence

Table. How loud are various sounds we hear daily? Some often-experienced samples are listed here.

Another Application of Decibels

While on the subject of frequencies and dB, and since receiver sensitivity was

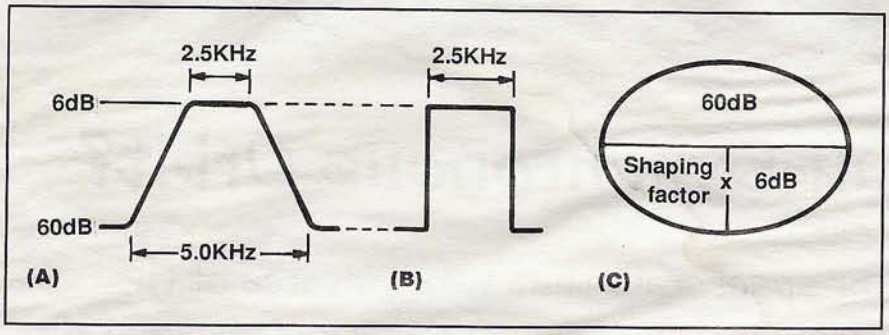


Figure 4. Decibels and frequencies are also used in specifying a receiver's bandwidth and selectivity, as well as the shaping factor of its IF filter. "A" is a typical receiver with a 2.5-kHz bandwidth for a 6-dB signal and 5.0 kHz for a higher power 60-dB signal. "B" is an impossible-to-attain 2.5 kHz/6 dB, 2.5 kHz/60-dB bandwidth, or 1:1 ratio. "C" is the formula used to calculate bandwidth.

briefly introduced in our practice questions, this is an ideal time to bring in another technical specification: *receiver selectivity*. In plain language, a receiver's intermediate frequency (IF) bandwidth should be only wide enough to pass a tuned-in signal and reject or ignore an adjacent-frequency signal. If a desired and an undesired signal are both weak or of normal strength (up to 6 dB), an "economy" filter can handle this requirement. If an undesired/off-frequency signal is stronger, a more elaborate IF filter can help prevent the strong signal from bulldozing its way into the receiver.

"...a receiver's intermediate frequency (IF) bandwidth should be only wide enough to pass a tuned-in signal and reject or ignore an adjacent-frequency signal."

How can we determine a receiver's on/off frequency selectivity? Usually it's listed in the radio's technical specifications, at 6 and 60 dB bandwidth points. Using SSB as an example, a receiver's bandwidth might be 2.5 kHz for a 6-dB (average strength) signal, but 5.0 kHz for a 60-dB (strong!) signal. This bandwidth curve and the "circle formula" for determining the sloping angle of curve skirts or *shaping factor*, is shown in Figure 4A and C.

This circle formula, incidentally, works just like the one you learned for Ohm's Law: Divide the top number by a bottom number or multiply the two bottom numbers to determine the top number. Applied here, 60 dB/6 dB is 5.0 kHz/2.5 kHz: a 2 to 1 shaping factor—acceptable, but not blowout great. A shaping factor of 1.6 or 1.7 would be much better. In other words, low ratios are terrific (also expensive!) and higher ratios are less selective (and less costly). A shaping factor of 1:1 (Figure 5B) would yield optimum selectivity, but coils and capacitors in filters cause signal delays that widen curve skirts at 60 dB points and make such a tight shaping factor impossible.

Wrap-Up

Gracious goodness, gang—we're once again down to the closing wire and still need to squeeze in a discussion of communications modes (which, even condensed, is lengthy). Obviously, that discussion (and some terrific "support info") must be shifted into next month's column. Stay tuned!

Meanwhile, here are the answers to this month's test questions:

1) .270 millivolt; 2) .000,00025 volt; 3) .25 millivolt; 4) 1.0 amp; 5) 7000 microamps. If you answered three of the five correctly, congratulate yourself on good technical knowledge.

73, and may the force of good signals be with you!

—Dave, K4TWJ

What's a Sun-Synchronous Orbit?

While traditionally used for spacecraft that take pictures of the Earth's surface, these orbits are also becoming popular for amateur radio payloads because it's easy to predict when a satellite will fly over your location.

Sun-synchronous orbits are special because the plane in which the satellite orbits stays oriented at a constant angle to the sun throughout the year. If you're not the type of person who likes to study orbits, you may be thinking either, "what's so special about that?" or maybe "so what?"

This article will answer both of these questions by first explaining what's unique about maintaining a constant sun angle and then explaining how it's useful. As part of explaining how constant sun angles are useful, I will also tell you why sun-synchronous orbits are in an exclusive group of orbits in which it's easy to estimate when the satellite will fly over your location.

The Earth's Orbit

Since we live on the Earth's surface, it's easy to forget that the Earth orbits the sun (and not vice versa). This distinction is more important than you might think. The reason comes from how we as dwellers of the Earth's surface define the length of the day. The length of a day (i.e., 24 hours) is defined by the average time from noon to noon—noon being when the sun is at its maximum elevation above the horizon (astronomers define noon or maximum solar elevation as the "upper transit" of the sun). The average time interval from noon to noon (or between successive upper transits of the sun) is called a *mean solar day*.

You may be asking yourself, *wouldn't it be easier just to define the length of the day as the time it takes the Earth to make one complete 360-degree rotation?* That definition describes what astronomers call a *sidereal day*. A sidereal day is shorter than a solar day—it has a length of 23 hours, 56 minutes, and 4.09054 seconds.

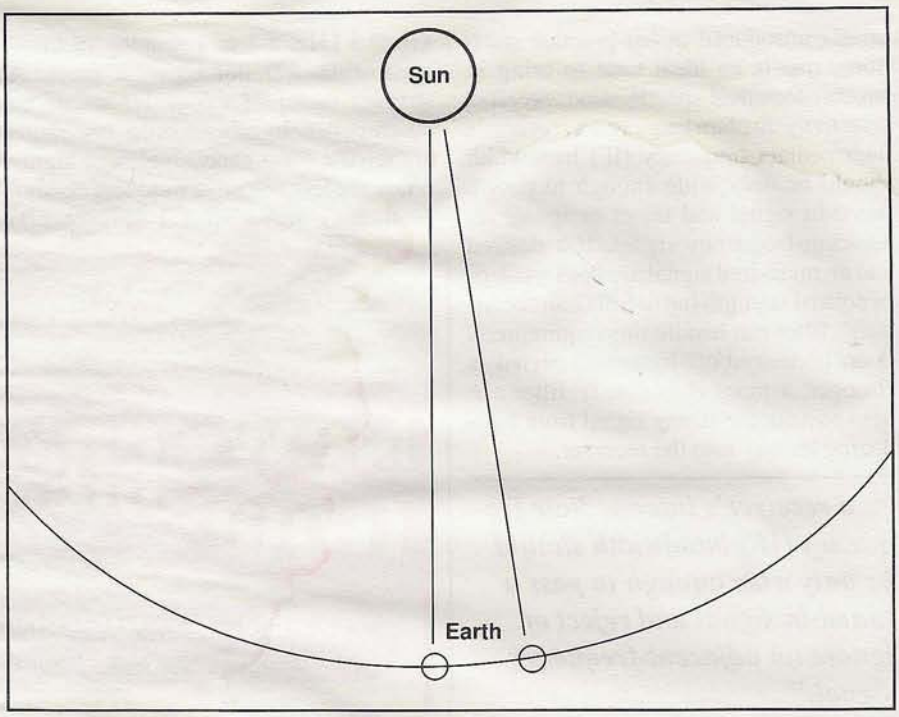


Figure 1. A solar day, defined as the time from one noon to the next, requires approximately 361 degrees of Earth rotation. So a satellite whose orbit covers 360 degrees in one day would appear to move by 1 degree each day.

Figure 1 illustrates why the length of a solar day is nearly four minutes longer than that of a sidereal day. Since the Earth orbits the sun once per year (approximately 365.25 days), the Earth's orbital rate is roughly 1 degree per day. Therefore, the Earth must rotate approximately 361 degrees to go from one noon to the next. Because of this, each year has one more sidereal day than it has solar days. Figure 2 shows that a non-drifting orbit aligned with the sun will have its plane perpendicular to the sun's direction three months later because of the way the Earth orbits around the sun. *The sun angle of a non-drifting orbit changes by about 1 degree per day because the Earth orbits the sun.*

So What's a Sun-Synchronous Orbit?

The plane of a sun-synchronous orbit keeps a *constant sun angle* throughout the

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

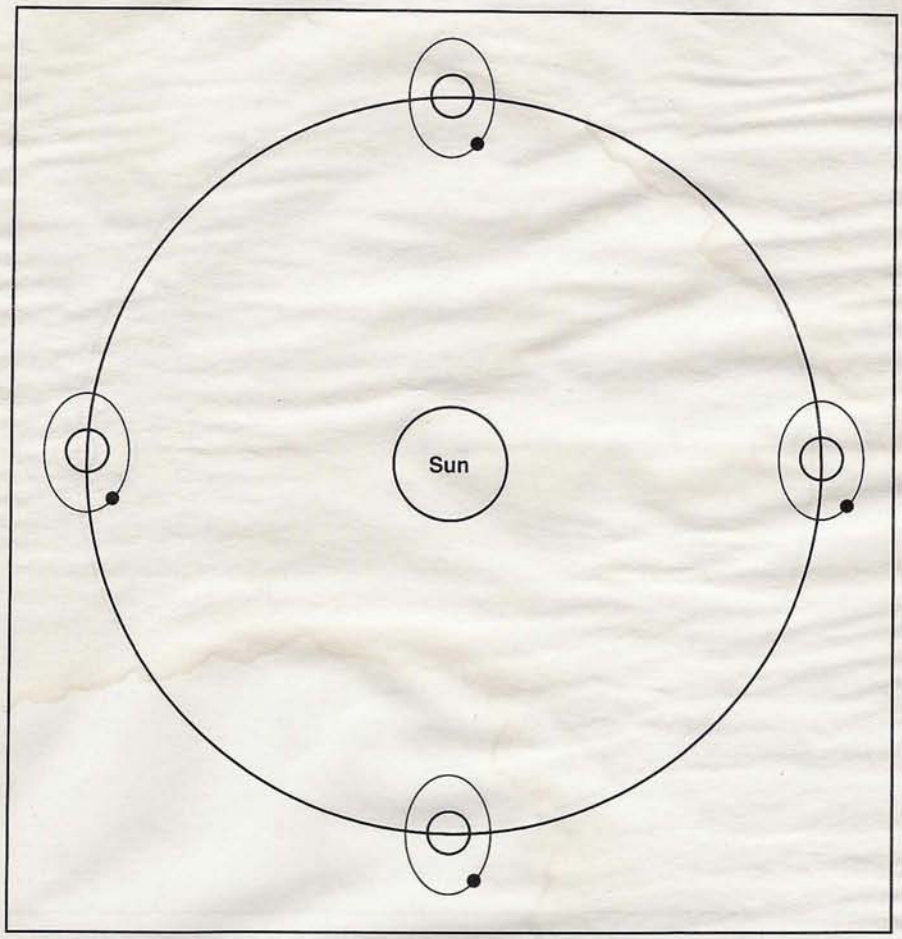


Figure 2. A stable orbital plane will have its sun angle constantly changing at about 1 degree per day as the Earth orbits the sun—just as the Earth's sun angle constantly changes, producing the changing seasons.

year. Figure 3 is a revision of Figure 2, illustrating a sun-synchronous orbit by drifting the orbit's plane at a rate of about 1 degree per day, correcting for the Earth's orbital motion around the sun. *If the orbital plane is aligned with the sun, it will then remain aligned with the sun throughout the year.* Likewise, if the orbital plane is perpendicular to the sun it will remain perpendicular (as will any other orientation) and will keep a constant sun angle throughout the year.

Orbital Plane Precession

Now that we know what a sun-synchronous orbit is, you may be wondering *how* we might get the orbital plane to accommodate us by drifting 1 degree per day to hold a constant sun angle. We do this by taking advantage of a natural imperfection in the Earth: the *equatorial bulge*. The concentration of extra mass around the equator applies a continuous rotational force (i.e., a torque) on the orbit that causes the orbital plane to *precess*, or slowly shift.

I'll avoid all the mathematics and just tell you that you can control both the rate and the direction of the precession by selecting the appropriate orbital inclination (degrees above horizontal) for your orbit's altitude range. Depending on altitude, the appropriate inclination varies between 95 degrees and 105 degrees. The 95-degree inclination works for very low altitudes; the 105-degree inclination works for the highest altitudes.

Mission Types

The sun-synchronous orbit's constant sun angle makes it ideal for photographic satellite missions. For example, the National Oceanic and Atmospheric Administration (NOAA) weather satellites are in sun-synchronous orbits so their cameras get consistent scene illuminations throughout the year. This allows the camera to continuously pho-

tograph the Earth's surface under the same lighting conditions, giving pictures to weather forecasters that help them detect changing weather patterns.

But a constant sun angle is advantageous not just for spacecraft that photograph the Earth's surface. The University of Toronto Institute of Aerospace Studies (UTIAS) will be flying its Microvariability and Oscillation of STars (MOST) astronomical satellite in a sun-synchronous orbit in order to keep its telescope directed toward deep space (darkness) while, at the same time, keeping the solar panels on the opposite side of the spacecraft pointed at the sun for maximum light collection. One other feature of the MOST satellite that you may find interesting is that, in addition to its primary astronomical payload, it will be flying an *amateur radio payload*.

As of this writing, there are 12 amateur radio satellites already in sun-synchronous orbits (with South Africa's SUNSAT to follow sometime in the near future). These include the University of Surrey satellites (UOSATs) UO-11 and UO-22, the Korean KITSAT-B (KO-25), and the packet radio microsats—PACSAT (AO-16), DOVE (DO-17), WEBERSAT (WO-18), LUSAT (LO-19), ITAMSAT-A (IO-26), and EYESAT-A (AO-27). In addition, there are the recently launched POSAT (PO-28), TMSAT (TO-31), and TECHSAT (GO-32). These amateur spacecraft were launched as secondary satellites on missions for which the primary satellite needed a sun-synchronous orbit.

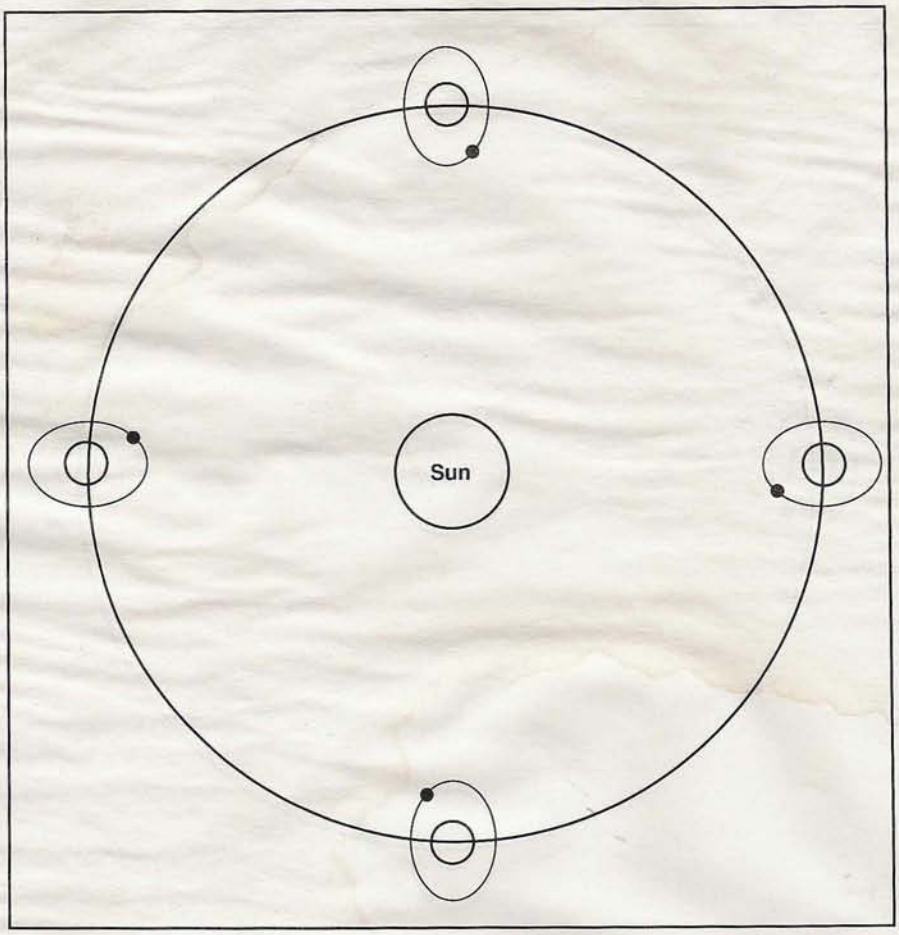


Figure 3. A sun-synchronous orbit has a 1-degree per day drift on the orbital plane that compensates for the Earth's orbital motion. This provides a constant sun angle throughout the year.

Attention all you would-be cover models: CQ's roaming Staff Photographer Larry Mulvehill, WB2ZPI, is currently in the early planning stages of his next photo tour. He will be visiting several areas throughout the USA, Canada, and possibly Mexico shooting cover photos for *CQ*, *CQ VHF*, and *Popular Communications* for use over the next year. In addition, Larry will be shooting photos for the CQ Year 2000 Amateur Radio calendar. If you have or know of a particularly photogenic shack, QTH, or antenna system, get in touch with Larry at <CQFOTOG@aol.com> with the details. Who knows...it could be your face smiling back at you from the cover of one of the CQ Communications magazines. Our magazines are read in 146 countries throughout the world. You could be famous!

Pass Predictions

One of the unique features of sun-synchronous orbits is that pass times can be easily predicted. This is no accident. Recall that solar time—the 24-hour day our clocks use to tell time—is defined from a constant sun angle at noon. The extra rotation the Earth has to make for the sun to be at its highest point in the sky is the same as the drift we cause to form a sun-synchronous orbit. What does this mean? Basically, the satellite will pass *your location* every day at about the same time, give or take an hour or so.

Once you learn the approximate times that particular sun-synchronous spacecraft pass by your location, you can depend on them almost "like clockwork." At equatorial and middle latitudes, you usually get two passes per day, one north-to-south and one south-to-north, separated by approximately 12 hours. These *ascending* and *descending* passes occur at the same time (within an hour) every day. This can be very convenient for planning purposes.

Summary

Sun-synchronous orbits maintain constant sun angles throughout the year. These orbits use the Earth's equatorial bulge to provide a controlled torque, which causes a drift rate that compensates for the Earth's orbital motion around the sun. A natural consequence of this synchronized drift rate is that satellite passes are quite predictable within about an hour. Thus, rough operating times are known for satellites in sun-synchronous orbits without needing to do complex computations. ■

Q & A

Questions and Answers About Ham Radio Above 50 MHz

Q: I once asked about the RadioShack simplex repeater. You mentioned that it operates via remote control and that it could be in violation of FCC rules if used improperly. I *know* I should have the rulebook, but I don't. My question pertains to remote control itself. I'm considering the Standard C5900 6m/2m/70cm rig for my car. It, as well as many popular dual-banders, allows crossband duplexing. It also allows access from an HT's DTMF pad. Both of these operations sound like remote operations to me. Can you explain the thin lines between legal and illegal remote operations?

Scott Farrell, KE4WMF
Buzzards Bay, Massachusetts

A: Scott—The line is very thin, but a couple of things are quite clear:

1) Auxiliary operation (control links, etc.) is not permitted on 6 or 2 meters, so any control transmissions must be made on 70 centimeters. In cross-band repeat mode, you may use a 440 HT to talk through the 5900 on 2 meters or 6 meters, but not the other way around.

2) This is the thorny one that puts most of these units technically afoul of Part 97: there must be a capability for your station to identify on both legs of the link. Let's say you're on your 440 HT, crosslinking through your mobile rig onto a 2-meter repeater. You ID when you transmit, and that covers both the 440 HT-to-mobile link and the mobile rig-to-repeater link. The repeater IDs on the return side, but the 440 link from your mobile rig back to your HT will be unidentified (it needs your callsign, not the repeater's). It transmits only when you're listening, and never retransmits your signal on 440. So you have a consistent unidentified transmission on the final return leg of the path. This, technically, is illegal. And so far, none of the manufacturers has seen fit to include any sort of automatic ID feature in a radio capable of cross-band repeat.

That said, let's get real. When was the last time you heard of a ham being cited by the FCC for failure to identify on one leg of a cross-band link if everything else about the transmission was legal and no interference was being caused? I don't think I've ever heard of one. The return link transmissions should be at low power (no point in them reaching farther than the reach of your HT) and are unlikely to cause interference unless you choose a repeater input as your link frequency. Crossband repeat capability can be very valuable, so you'd have to weigh the risk of getting cited against the benefits of the crossband repeat.

The manufacturers really should include a feature in these radios that would permit you to program in your callsign and to enable an automatic CW or 1200-baud packet ID every 10 minutes when the radio is in crossband repeat mode. It should be very simple to build into the radio, but is very difficult to add on afterwards.

Q: I am a CAP commander. I have a small place to put an antenna for 4582.0/4585.0 kHz. I have a 102-foot longwire. Can I put a longwire on top of a metal building? Will it hurt my radio?

Russell Garretson, KB8YQM
Seth, West Virginia

A: Russell—We normally limit our content to questions about VHF and higher frequencies, but since the Civil Air Patrol uses both VHF and HF, and provides all of us with a valuable volunteer service, I'll do my best to answer your question. A metal roof will definitely have some impact on your antenna pattern, acting somewhat like a reflector in a two-element beam. But if you want mostly to communicate with CAP aircraft in the air, it could be a benefit, since it'll send most of your signal straight up. There should still be enough signal getting out to the sides to make it useful even when the plane you want to contact is not directly overhead. You don't say how high above this metal roof you can go. My advice would be to mount the antenna as high above the roof as possible.

The following question was sent to "Antennas, etc." columnist Kent Britain, WA5VJB:

Q: Thanks for the great article on Yagi antennas that appeared in the June, 1998 issue. However it left me with two questions: 1. If the mast is *non*-resonant, such as wood or PVC pipe, does it matter how it is mounted? And, if so, what would be best? 2. Does it make much difference how you route the coax on *non*-circularly polarized antennas, bearing in mind that I intend to use a non-resonant mast if possible or practical. Thanks again,

Jim Schellin K6JPS
Alta Loma, California

A: If the mast is *non*-resonant, it has little effect on the Yagi. You don't want the non-metallic mast touching an element, but if it's a few inches away, there shouldn't be any detuning effects.

The coax is a conductor. It has just as much effect as a metal mast. You never want the coax leaving the Yagi in the same plane as the elements; that is, you want the coax leaving at as close to a 90-degree angle from the elements as possible. (My 144-MHz EME array has the feedline leaving at about a 60-degree angle, the best I could do at the time.)

Now, you have three choices if you want the antenna vertically polarized. First is to route the coax out the back and bring it back to the mast in a big loop. This is often done with AMSAT (satellite) stations. Messy and a lot of coax, but it works.

The second choice is to end-mount the antenna, which is OK as long as you don't have too many elements. And the third way is offset the antenna from the mast. I have a five-foot horizontal section of mast "T'd" to the vertical mast. A 222-MHz vertical Yagi is on one end of the T, and a pair of 445 MHz Yagis is attached to the other end. Now I have vertically polarized Yagis mounted on a horizontal mast.

The biggest consideration: Ya really want to keep that coax away from the Yagi elements.

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, 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 Technological Imperative

Introducing young people to amateur radio isn't only a good idea for the future of our hobby, says KF5WT, but may well be essential for the future of our nation's ever-more-wireless telecommunications network.

There have been many debates lately about the future of amateur radio. With commercial interests vying for our frequencies and governments eager to gobble up money by auctioning off spectrum, our valuable ham bands are threatened as never before. In just the past year, we have twice had to mobilize to counter threats to our VHF and UHF frequencies.

Though we seem to have "won" for now, there are some troubling storm clouds on the horizon for amateur radio. New licensing numbers are down almost 50% as compared to this time last year. Unfortunately, not enough people (especially young people) are seeing amateur radio as a hobby they are interested in being a part of.

It's easy to blame the decline in ham radio's popularity on the Internet, but I think basically amateur radio simply dropped from public visibility. Plus, I wonder how many new hams have just dropped out of the hobby after realizing that for the most part, repeaters are dull places to hang out. I wonder how many scanner enthusiasts have come to the same conclusion after monitoring our bands.

Fighting Obsolescence

The old standby reason we have relied upon to justify our existence, and our occupancy of the bands, has been that hams traditionally help with communications during times of emergency when normal means of communications go down. However, I can see that even this role is diminishing. I work for a leading telecommunications company in the two-way radio industry, and I see how most major public safety radio systems have many layers of redundancy, making an outage extremely unlikely. In fact, even relief agencies (such as the Red Cross) are relying more heavily on means of communications other than amateur radio. For us, this trend means we have less visibility and credibility in the eyes of the public and governmental decision-makers.

Today we are fighting one of the most formidable enemies of all—*obsolescence!* Frankly, amateur radio isn't "high tech" anymore when compared to sophisticated communications methods that are readily available and highly reliable. We once held a virtual monopoly here, but that isn't the case anymore.

RF "Brain Drain"

For years, ham radio also provided a training ground for kids who grew up to work in the electronics and radio industry. But, in the last few years, the company I work for has a very hard time recruiting workers with even a basic knowledge of radio. It used to be that practically everybody in the two-way radio industry was a ham. Now maybe one in 10 has a callsign. With the wireless industry poised for explosive growth in the next century, I wonder where these companies will find the thousands of new workers they will require.

Education Is Our Future

But enough about the problems! I believe there is a way for ham radio to survive, and actually even thrive, well into the next century even against such great odds. There is one major benefit that amateur radio has always provided to the country: I'm talking about the *educational benefits* of amateur radio.

"For years, ham radio also provided a training ground for kids who grew up to work in the electronics and radio industry. But in the last few years, the company I work for has a very hard time recruiting workers with even a basic knowledge of radio."

Instead of publicizing amateur radio in the same old ways, I believe we should "market" the hobby as an educational tool. In partnership with local Elmers, many schools all over America are already integrating amateur radio into their science curricula. ATV repeaters are carrying live NASA TV coverage of shuttle missions, hams are launching amateur balloons carrying students' experiments to the edge of space, and HF school club nets are linking classrooms all over the nation. Sometimes, scientists and celebrities are interviewed by students on these HF nets.

If every club had an active outreach to the local schools, the benefits to the community and to the ham fraternity would be immeasurable. Amateurs would be challenged to learn new skills and become more adept at communicating that knowledge to others.

Plus, schools would get a wide range of benefits *for free*—after all, amateur radio can be a valuable tool in many different areas of classroom study, not just

By James G. Alderman, KF5WT (james.alderman@ericsson.com)*

James Alderman, KF5WT, lives in Carrollton, Texas. He's working to put his ideas into practice in the local schools and is writing a handbook for his club on launching amateur radio balloons.

electronics. Since schools are struggling just to fill teaching positions, volunteer guest speakers (especially those who can demonstrate something technical) are always in high demand.

The increased public (and media) exposure from having ham radio activities in the schools would generate more interest in our hobby and certainly increase our ranks, our lobbying power, and our voting power. Even adults who aren't hams would support amateur radio in principle if their kids were benefiting academically and getting excited about learning. And think about it, what Congressman would vote to take away frequencies so important to the education of "the children"?

"Even adults who aren't hams would support amateur radio in principle if their kids were benefiting academically and getting excited about learning."

Reinventing Our Image

But in order to do all these grand things, we must first transform ourselves in the eyes of the public into a fraternity that people would want to be a part of. We must get ourselves informed and motivated, and we must start communicating what we know. (Why can't morning drive time on every major repeater be as exciting to listen to as the most interesting and, yes, controversial, talk show you've ever heard?) Ham radio must be "marketed" as the "adventure" it is—an adventure for the whole family, not just a clique for old timers.

How about offering families a hobby that can help springboard the kids into a great career, or offering teachers the ability to bring the space program down to earth? How about helping a room full of grade-schoolers send a film camera up to the edge of space? Or teaching a room full of high-school students about satellites, then letting them talk on one? How about teaching a scout troop the fine art of mountaintopping?

Do we really want to save our hobby from the forces that would put us off the air permanently? The threats to our existence are very real. I believe that if ham radio is to have a future, that future must start where all foundations for future achievement are laid—in the classroom.

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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.*

A Balanced Coaxial Feedline—"The Best of Both Worlds"

Imagine a feedline that combines the best virtues of both twinlead and coaxial cable. CO2KK says don't imagine it—do it!

Welcome to "Short Skip," CQ VHF's newest column and your newest opportunity to share interesting stories or informative tips with your fellow VHFers. "Short Skip" will feature stories too brief to be used as full-scale feature articles, and they may go off in all different directions. Authors will vary, from some of our regular columnists and authors to...who knows? Maybe... you! We'll start out with a couple of tidbits from our always interesting friend in Havana, Arnie Coro, CO2KK.

—W2VU

Many years ago, while I was working at a TV station, the chief engineer there showed me his pride and joy—a rigid, pressurized, balanced 3 1/8-inch coaxial feedline from his 10-kilowatt transmitter up to the beautiful hi-gain antenna at the top of the tower. He proudly switched the reflectometer back and forth, from forward to reverse, showing less than 1.01 to 1 VSWR.

Balanced coaxial feedline. Uhhh! Is that possible? Yes it is and, when properly installed, it provides the VHF/UHF operator with what could be described as the "best of both worlds," because one ends up with a shielded transmission line that can be dealt with as "coax" while—at the same time—it behaves like a balanced line of roughly twice the impedance of each separate coaxial feeder that forms it.

Let's be clear here: This is no fancy cable. The twin balanced coaxial line is easier to implement than you may think. I simply use a pair of 75-ohm TV type foam coax cables to feed a wideband upper HF and VHF antenna (already published in *CQ VHF*; see the October,1997, issue for "The VBW-1 Antenna," the VHF version of a TTFD, or Terminated Tilted Folded Dipole). The two cables are tied together with plastic cable clamps, but a much better and elegant solution is to use the newer dual 75-ohm CATV cable, which has two coaxial lines in a single polyethylene jacket.

Now back to the twin coaxial line.

Building Your Balanced Coax Feed

If you have 50-ohm cable, then your balanced coax line's impedance is going to be around 100 ohms, while a pair of 90-ohm cables will produce a nearly 200-ohm impedance line. As you see, these are really practical values to deal with in many actual antenna situations.

If you calculate the losses of the twin balanced coaxial line, the numbers will tell you that it has slightly lower losses than the same length of a single coaxial cable, but that is not really all that important. What really matters is that, when properly installed, the twin balanced coax line shows absolutely no "antenna currents" circulating down the shield of the cable and thus distorting the antenna pattern. Once the two coax cables reach your antenna tuner, treat them as lines from a standard balanced feeder. So, just connect them via an appropriate balun to the antenna tuner's input and that's it.

"...one ends up with a shielded transmission line that can be dealt with as 'coax' while—at the same time—it behaves like a balanced line of roughly twice the impedance of each separate coaxial feeder that forms it."

Unexpected Pleasures

At VHF frequencies, especially on the 50-MHz band, using the twin balanced coax line to feed a five-element Yagi via a standard T match has added another unexpected advantage: The Yagi is very easy to match to the 150-ohm impedance of the 2 x 75 coax balanced line, just by moving the short circuit bars in the matching section back and forth.

But wait, this is not the only advantage. There are two more. One is that I no longer need to use a balun at the antenna terminal; the second is that TVI to channels 2 and 3 in my immediate vicinity is substantially reduced, due to not only a better match, but to the complete disappearance of the so called " antenna currents" coming down the single coax feedline that I used with that Yagi before installing the twin coax balanced feeder system. By using really low-loss coaxial lines to form the balanced shielded feeder, this system can be used all the way up to 1296 MHz with excellent results.

By Arnie Coro, CO2KK*

Arnie Coro, CO2KK, is a professor at the University of Havana, an internationally known host of two shortwave programs on Radio Havana, and a regular contributor to CQ VHF.

Havana's Odd-Frequency Repeater

Yes, you can work into Cuba on 2-meter FM from Florida...if conditions are right, AND if you know what frequency to use. The secret, courtesy of CO2KK...

Not too long ago, while enjoying a nice tropo-duct opening all around the Caribbean, a ham in Florida asked me, "Arnie, why do the Cuban amateurs have a repeater way up the band, on 145.600?"

I took a little time to explain in detail... after all, the temperature inversion was very stable, and the 2-meter FM signals from 400 miles away were pinning the S-meter on the old FT-221.

"The fact is that those crystals came from Europe," I answered. "A group of Spanish hams upgraded their repeater site with a new synthesized machine, and one of them—traveling to Cuba on a vacation trip—brought the crystals just in case they could be useful. Well, it happened that we had obtained an old, very much abused 2-meter commercial repeater that used exactly the same frequency multiplication system for the transmitter and local oscillator as the one they had replaced in Spain. It took just a few hours to tune up the machine to European repeater channel 'R0,' 145.600 minus 600. Later we found a duplexer for it and installed the repeater on a nice hilltop!"

No DX "QRM"

As an added bonus, we've found that when the band opens, the 145.600 machine is QRM-free...while the other local repeaters, on 145.190 and 145.110, share their frequency pairs with many other machines in the region and do suffer from co-channel interference. After my explanation, the American ham was pretty satisfied, and during the next tropo opening, about a week later, while CO2KG and I discussed the upcoming summer VHF contests, guess who was keying the repeater from 400 miles away to say hello? My friend from Florida, "dropping in" on Havana's "odd-frequency" repeater!

What Is "Short Skip"?

Virtually all forms of ionospheric propagation have a predictable range over which you can communicate, depending on your frequency and the *angle of incidence* at which your signal strikes the refractive layer (the lower the angle, the greater the range—a reason many HF antennas promote their "low angle of radiation"—you can talk farther).

But sporadic-*E* propagation has an additional feature which, if you learn to recognize it, can help you be in the right place at the right time for big-time band openings. The typical range for sporadic-*E* contacts on 10 meters, for example, is about 1,500 to 2,000 miles, while on 6 meters, it's typically somewhere between 900 and 1,200 miles.

The interesting thing is this: as the Maximum Usable Frequency (MUF) climbs, the distances you can cover via sporadic-*E* decrease. This closer-than-usual *E*-skip is called *short skip*, and it's good—for two reasons: 1) it lets you work close-in stations (beyond your ground wave range) that your signal would normally skip over; and 2) it's an alarm bell to watch for an opening on the next band up in frequency.

So...when you start working stations under 1,000 miles on 10 meters, that means it's time to start checking for a band opening on six. Likewise, when you start hearing stations in the 200- to 300-mile range on 6 meters, it means there's a good chance that the *E*-skip opening is about to reach as high as 2 meters, and, on rare occasions, all the way up to 222 MHz. So it's always a good idea to keep your eyes and ears open for "short skip."

—W2VU

Color Your QSLs

Your QSL card is an extension of your personality. So why not make it as colorful as you are?

By Gordon West, WB6NOA*

Every ham is proud of his or her callsign. Some calls might be original issue; others may be a chosen vanity callsign. Or maybe you just lucked out and ended up with a random callsign that fit you a tee (I like the water and boating, so WB6NOA—as in Noah's ark—was a lucky catch for me!).

The QSL card is a fun way to express yourself and that callsign when confirming radio communications or an "eyeball meeting" with another ham (Photo A is one example). Or maybe it's a shortwave listener or scanner enthusiast who's writing you confirming reception of your signal and a request for a QSL card. "I QSL 100 percent," says Bob Davis, K7IY, Nevada Section Manager for the American Radio Relay League. "I QSL listening reports, too, because this is a great way to reach out and attract hobby radio listeners into our amateur radio service," adds Davis.

There's great variety in QSL cards. Postcard-sized QSLs are relatively inexpensive—at a few pennies apiece, you can make a big, bold, glossy statement of your callsign. Some QSLs, such as the WØORE card in Photo B, are particularly special.

Brand new to the art of QSLing? Then see "QSLing" in the "Basics" section at the back of this issue for some general information, and see the box at the end of this article for a list of several of the better-known QSL printers. They'll all be happy to send you free samples if you send them an SASE (self-addressed stamped envelope).

Photo A. QSL cards come in an endless variety of designs—but in only a couple of standard sizes, which is why it's better (cheaper) to use a specialized QSL printer for your cards than the print shop down the street.

In Living Color...

Let's take a closer look at one QSL maker on that list, Rich Halstead, WX9X. He offers a customized starter pack of QSLs for under $19. But, more importantly, he's one of a few QSL printers that offers you *color* QSLs.

"We will customize a color QSL card that will really get attention," says Halstead. But the quality of the photo on the card can only be as good as the original photo that you send in. For a color QSL card showing you at your shack, or you on a horse, or you operating aboard a sailboat out on the ocean, or you halfway up an antenna tower, the submitted color photo must be sharp as a tack. "The better the color print or transparency, the more resolution and snap we can get with the finished product," explains Halstead.

Advice from a Pro

"A 35-millimeter slide can achieve good color separation (*part of the color printing process—ed.*) as long as the photographer uses a relatively big lens," comments ham photographer Julian Frost, N3JF. "A relatively inexpensive 35-mm 'point and shoot' fixed internal lens camera will do okay, but a bigger 35-mm camera with a big lens will do infinitely better."

"The ultimate color QSL will achieve exceptional clarity and resolution if the submitted photo can be taken with a larger format camera, such as 6 x 4.5."

In other words, start off with a good camera for this once in a lifetime shot before you send it off to WX9X or another color

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

Photo B. Some QSL cards identify not only a station, but a special event as well. This card from Astronaut Tony England, WØORE, was issued for QSOs made during his Spacelab 2 mission aboard the shuttle Challenger.

QSL card printer. While Halstead says that he can work from color prints, he agrees that you'll probably get better results from color slides or a larger format color film transparency.

"We take great efforts to work with the color separations in order to provide just the right balance for your color QSL," Halstead explains, but notes that "we can only do as good as the original photography that is provided to us."

"Postcard-sized QSLs are relatively inexpensive. At a few pennies apiece, you can make a big, bold, glossy statement of your callsign...."

Halstead says he also takes great care in the placement of your callsign on the front of the card. He would not want to strip in (*another printing term—ed.*) the callsign and accidentally cover up that vintage Gonset radio that's seen in the back of your radio room. Nor would he want to strip in your callsign and accidentally cover up your significant other, or other person, pet, or object that you really want to display in the photo.

"I love my cat, so I made sure that the WX9X QSL card wouldn't accidentally have my call letters covering up his little furry face," adds Bob Davis, K7IY.

"So when you take your photo to go on the QSL, work in an area where the QSL card designer can place your callsign without covering up something that you want to show in the photo," adds Frost, N3JF. "And take a complete roll of film—a good photographer will usually end up with one or two acceptable shots out of a roll of 36 exposures."

Dotting the "i's"

It's a good idea to look over other QSL cards that you've received to get ideas. You'll find hams include things like MARS membership, an ARRL or QCWA (Quarter Century Wireless Assn.) logo, operating achievements, such as VUCC or DXCC, and the like.

I also suggest that you ask for a sample of your completed card before it goes into 500 quantity print. Let everyone take a look at it to make sure you didn't accidentally leave something out, or make an error in a little thing like your Zip code number.

And once you have your new custom color QSL cards, use them regularly. This will help maintain our sparkling image of "I QSL 100%." You never want to receive a QSL and not have one to send out in return.

For our readers who would like a WB6NOA-signed QSL card specifically with their callsign, send a self-addressed, single-stamped envelope to Gordon West, 2414 College Drive, Costa Mesa, California 92626. I QSL 100%! ■

A QSL Card Printers' Sampler

Here are a few of the better-known QSL printers. For some free samples, send a self-addressed envelope with five first-class stamps affixed:

Brownies QSL Cards, 3035 Lehigh Street, Allentown, PA 18103
Doc's QSLs, 8208 Broken Arrow Trail, Knoxville, TN 37923
W4MPY QSLs, P.O. Box 73, Monetta, SC 29105-0073
Rusprint QSL Cards, 12730 Stateline Road, Leawood, KS 66209
Old Press, P.O. Box 1252, Kankakee, IL 60901
WX9X Color QSLs, 354 West Street, Valparaiso, IN 46383
X-Pressions, 11184 Antioch Rd., #399, Overland Park, KS 66210

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*:

- "Lasers to the Limit," by Eric Stroud, KB2TCQ
- "SATERN: A Different Kind of Radio Club," by Ann Shaver, WH2E
- "Understanding the Computer in Your Ham Shack," by Lew Ozimek, N2OZ

Plus...

- "Hollywood Ham Watch," by Bill Tracy, KE6EJQ
- "Make Your HT Talk Forever," by Ken Collier, KO6UX
- "Build Your Own Battery Pack," by Dennis Wilkison, KE6UZQ
- "*CQ VHF* Review: ICOM IC-746," by Rich Moseson, W2VU

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 Rd., Hicksville, NY 11801.

Basics

QSLing

There's an old saying that "A QSL is the final courtesy of a QSO." This is a courtesy that is all-too-often ignored nowadays, especially on VHF, where there's some confusion about what QSOs are and aren't "proper" to QSL. So let's start at the very beginning...

First of all, a QSO is shorthand for a radio contact. QSL is another bit of shorthand, basically meaning a confirmation. On the air, someone might say or send QSL to confirm receipt of a transmission or message. Off the air, the term QSL refers to postcards that hams exchange to confirm that they actually made contact (some hams also exchange them for in-person, or "eyeball" contacts). These postcards generally contain each ham's callsign, the sender's mailing address, and other relevant information (see below). Then, there's a space where you can fill in the details of the QSO, including date, time, frequency, and mode (FM, SSB, CW, etc.), plus optional information such as a signal report and the equipment you were using when you made the contact.

Why Bother?

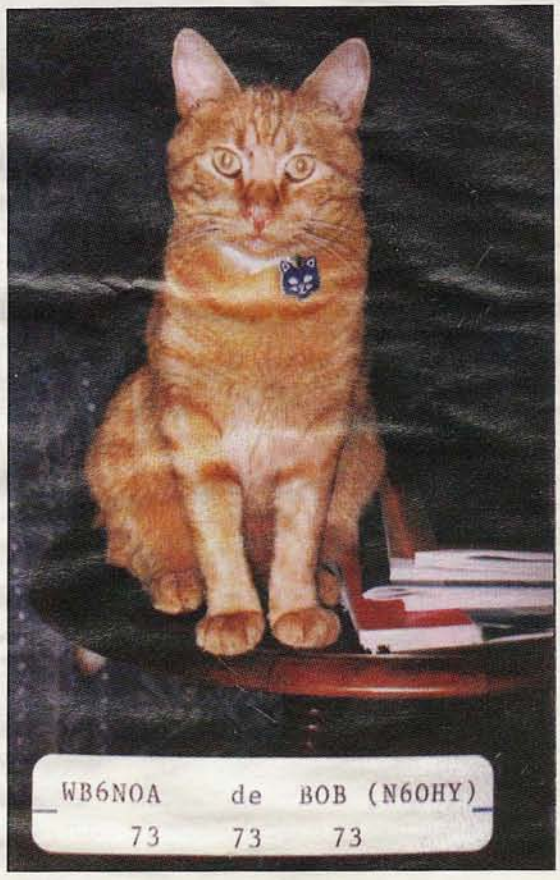
There are two reasons why radio amateurs exchange QSL cards:

1. It's cool to be able to put them on a wall and show off all the different people and places you've contacted; and

2. QSL cards are ham radio "currency" for earning all sorts of operating awards, such as the ARRL's VUCC (VHF/UHF Century Club—for contacting stations in a given number of grid squares) or the Central States VHF Society's States Above 50 MHz Award. Properly completed QSLs are proof of making contact with the states, grids, etc., that the award rules may require. And it's under this area that questions arise about what is and isn't a "proper" QSL.

First of all, while printed QSLs look nice and are convenient to use, a homemade card is just as valid when it comes to "proof" of making a contact.

So let's take a quick look at the cards themselves and how to fill them out "properly." First of all, while printed QSLs look nice and are convenient to use, a homemade card (see Photos) is just as valid when it comes to "proof" of making a contact. Essential information includes your callsign, name and station location (generally including county, country, and grid square for the benefit of folks who "collect" any or all of those), plus any information you want to add, such as the logos of organizations to which you belong. Next, there needs to be space to fill out the information about the QSO (the back of the card will

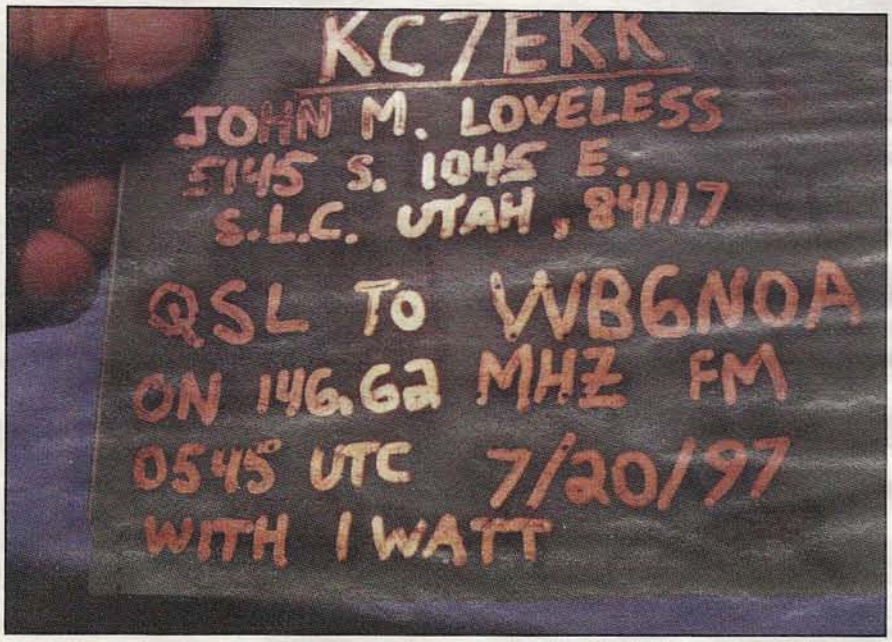


While commercially printed cards look nice and are convenient to use, they're not required. This homemade QSL card "works" just fine, as long as the details of the QSO are written on the back and the card is signed. (Photos courtesy WB6NOA)

do fine on a homemade one). This needs to include the callsign of the station you contacted, the date and time (generally in UTC) of the QSO, the band or frequency on which the contact was made, the mode of the contact, and a signal report. Optional info includes a station description and a notation of whether you still need the other guy's QSL ("PSE QSL") or whether you've received his card and are responding in kind ("TNX QSL"). Finally, you must *sign the card*. This doesn't need to be your "official" signature, like you'd put on a check, but some indication that you actually filled out the card and are saying "yes, this was a real QSO." Of course, it's also perfectly fine to add comments as space permits.

"Valid QSLs"

In order to "count" for credit, most awards require that all contacts be direct; that is, without help from manmade relay devices, such as repeaters or packet networks (exception: satellites, but there are generally special award categories for satellite contacts).



Taking the concept of the homebrew QSL to new heights—this perfectly valid "card" is etched on circuit-board material.

Does this mean that you should never QSL repeater- or packet-relayed contacts? Of course not. What you *should* do, though, is make a note on the card such as "146.70 Rpt" in the frequency box, or "Packet, via network" under mode. This way, the recipient won't accidentally submit your card (months or years later) for some award, thinking that the contact was direct when it wasn't. Are these "valid QSLs?" Absolutely, you contacted each other. Are they valid for award credit? Probably not, which is why they should be noted as such, to avoid possible confusion.

The Cost Question

Make no mistake about it, sending out lots of QSL cards can get expensive. Not only is there the generally reasonable cost of printing the cards, but also postage: 20 cents per card if you're willing to risk having a postmark cover up essential information or a cool photo; 32 cents if you're not.

Now, imagine that you live in a "rare" state or grid square and that everyone who contacts you "needs" your card. If you're very active, this can run up the postage bill *really* fast. So...since a QSL is "the last courtesy" of a QSO, be considerate of the ham in the rare grid or state whose card you need, and give him or her the courtesy of including an SASE (self-addressed stamped envelope) for your reply card. Not only does this keep the other guy from going broke, it generally speeds things up as well, since all he has to do is fill out a card, pop it into your pre-addressed, pre-stamped envelope, and drop it in the mailbox. Will it cost you a few extra cents? Sure. But unless you're in a rare location yourself, you probably don't have 1,000 people a year asking you for QSL cards.

Don't Have QSLs?

What's that? You don't have QSL cards? Not a problem; we've listed contact information for several of the better-known QSL printers in Gordon West's "Color Your QSLs" article elsewhere in this issue. Or, once again, you can make your own. But if you're going to be active on bands and modes where QSLing is expected (basically, anything other than FM repeaters and packet via networks), then you really should make an effort to buy or make some QSL cards and be ready to respond when someone asks you to "PSE QSL." ■

CQ VHF Hamlink

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 are accepted by mail, phone (516) 681-2922, or fax (516) 681-2926. Club, class, and exam listings may be submitted to *CQ VHF* "Clublink," 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

CA, Fortuna, Redwood Amateur Radio Club: Meets 1st Tuesday of every month at 7 p.m., CDF building, 118 Fortuna Blvd., Fortuna, CA. Repeater at 147.090+.6. Info e-mail: <KE6JQW@aol.com>.

CA, Santa Barbara Amateur Radio Club, Inc.: Meets 3rd Friday of September–May at 7:30 p.m., County Schools Auditorium, 4400 Cathedral Oaks Rd., Santa Barbara. For more information about SBARC, see club Web site: <http://www.sbarc.org>; or call (805) 569-5700.

CA, South Orange Amateur Radio Association (SOARA): Meets 3rd Monday, Monthly, 7:30 p.m., Norman P. Murray Community Center, Mission Viejo, CA. Visitors welcome. Primary Repeater: 147.645(-). For information write: SOARA at P.O. Box 2545, Mission Viejo, CA 92690, call (949) 249-1373, or e-mail: <soara@cahaba.com>.

CA, Ventura County Amateur Radio Club: Meets 2nd Friday of each month at 7:30 p.m., Oxnard Public Library, 251 S. "A" Street, Oxnard. For more information about VCARC, see club Web site: <http://www.fishnet.net/~k6mep>, or call (805) 642-5770.

CO, Bicycle Mobile Hams of America: National non-profit club of bicyclists who use VHF radios for emergencies, lost riders, route information, chatting, etc. 450 members in 46 states, 6 countries. Annual Forum at HamVention. 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.

FL, Highlands County Amateur Radio Club: Meetings held 3rd Monday of each month, 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Visitors are welcome. Repeaters at 147.045 +.6, 442.350 +5.0, with packet on 144.970. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio@strato.net>.

FL, Major Armstrong FM Association: Meetings held 2nd Saturday of each month, 12 noon, Pizza Hut of Lantana, 6170 South Congress Ave., Lantana, FL. Visitors welcome. Info e-mail: <WA4AW@juno.com>.

KY, Mammoth Cave Amateur Radio Club: Meetings held 3rd Tuesday of each month, 7 p.m. at "Doc Cady Memorial Club Room" in the lower level of th Glasgow City Hall, East Public Square, Glasgow, KY. Visitors always welcome. ARRL exams given at 9 a.m. on 2nd Saturday of each "even" month (e.g., Feb, Apr, Jun). Club repeaters are 146.940- and 444.925+. A net is held every night at 8 p.m. local time on 146.940. Contact Bill Wilkinson, KE4KRN Publicity Committee at: <bwilkinson@glasgow-ky.com> for information. Visit our Web site: <http://www.scrtc.blue.net/mcarc/>.

MA, Falmouth Amateur Radio Assoc. (FARA): Meetings held last Thursday of the month at 7:30 p.m. at Falmouth Town Hall, Main Street, Falmouth, MA. ARRL exams at all levels given at 9 a.m. second Saturday of every month at the Town Hall. Primary rptr. 146.655. Contact President Lyman Mix, WA1KPE, at Box 815, W. Falmouth, MA 02574 or visit Web page: <http://www.falara.org/index.html>.

MB, Canada, Winnipeg Amateur Radio Emergency Service Inc. (WARES): Callsigns VE4YWG (Public Service Communications), VE4EOC (City Emergency Operations Centre). Meetings 3rd Tuesday of month, 1930h Sir Wm Stephenson Library, 765 Keewatin St. Membership open to all licensed amateurs at least 18 years of age living in or near Winnipeg and interested in emergency amateur communications. E-mail Jeff Dovyak, VE4MBQ, Emergency Coordinator at: <ve4mbq@ve4umr.ampr.org>; Web site: <http://www.geocities.com/CapeCanaveral/Hanger/1632/wares.html>.

MO, Morely: Tri-County Amateur Radio Club, (TRICO): Callsign KBØZAW. Meetings 2nd Tuesday of every month at 7 p.m. at Scott County Emergency Management Agency in Morely, Missouri. Membership open to all licensed hams and their family members. Visitors are encouraged and welcome. ARRL exams given with prior requests. The club repeater, 146.730-. Net held every Thursday at 8 p.m. local time, on 146.730-, and every Sunday at 9 a.m. on 3.905. Contact Clay Adams at <kc5pin@ldd.net> for info. Web site: <http://www.geocities.com/capecanaveral/hall/2819>.

NC, Charlotte: 2-meter SSB net, 144.220 USB, Wednesday nites @ 9:30 p.m. est/edt. Net control stations are Wilton/WB4PCS & Bill/W4GRW both are in Charlotte area of EM95. This net is now 5 weeks old & we have been averaging 20 check-ins each week (purpose is to increase activity on 2-meter SSB & promote fellowship).

NC, Stanly County Amateur Radio Club: Meetings held every 4th Thursday of the month at Stanly Community College. Two-meter nets held at 9 p.m., local, Wednesday (146.985) and Friday (147.390). Six-meter ragchew each Tuesday at 8:30 p.m. (50.135). For more info, visit our Web site at <www.qsl.net/scarc>.

NY, Binghamton Amateur Radio Association, Inc. (BARA): Meetings 3rd Wednesday of each month 7:30 p.m., Unitarian Universalist Church, 183 Riverside Drive, Binghamton. Visitors welcome. Club Station with HF/VHF operating positions, Club Repeater W2OW 147.390 MHz output/147.990 MHz input, PL 100 Hz, Autopatch. See our Web site at: <http://binghamton.edu/bara> or write BARA, P.O. Box 853, Binghamton, NY 13902.

OH, Cincinnati, Weather Amateur Radio Network (WARN, W8NWS): This is the Cincinnati, Ohio, chapter of Skywarn. In addition to club details and weather-spotter training information, the Web site features a searchable southwest Ohio repeater database, and a search engine covering all known ham club sites in the Greater Cincinnati area. Membership forms and mailing list to receive club news and announcements are also available online at <http://www.warn.org>.

OH, Adena Area, Triple States Radio Amateur Club: Features an all-mode 6-meter net on 50.150 on Wednesday nights at 9 p.m. EDT (50150 FM), SSB/AM/CW. Will have a reunion of Six Meter Operators at the Wheeling Hamfest, Wheeling Park, WV Sept. 12. For info newsletter, send adr to TSRAC 2011 St. Hwy 250, Adena, OH 43901; E-mail: <k8an@aol.com>.

OH, Cleveland Area, Cuyahoga Amateur Radio Society: Meets 3rd Wednesday of every month except December at 8 p.m. at Busch Funeral Home community room, 7501 Ridge Rd., Parma, Ohio. June, July, and August, "Picnic Meetings" are held at the Cuyahoga County Metropolitan Park. Repeaters are on 146.82(-), 443.825 & 444.75 (+), 53.83 & 53.01 (+), plus digipeater at 145.07, and club simplex frequency of 146.475 MHz. For more info, contact club president, Tom Wayne, WB8N, at (440) 232-4193 or at <wb8n@en.com>.

OK, Tulsa: American Airlines Amateur Radio Club. Repeaters 145.345, 147.000+, 147.000-, 449.875, autopatches on 147.00 and 145.345. Club meetings held last Saturday of the month at 9 a.m. local time at Lil Abners Restaurant, Catoosa, OK. W5YI VE testing for all amateur radio classes held immediately following meeting. For more info on VE testing, club activities, and map on how to find Lil Abners Restaurant, see club Web page: <http://www.webzone.net/n5jk/aaarc.htm>.

PA, Foothills Amateur Radio Club (FARC), Greensburg: Meetings 2nd Tuesday of month at Red Cross Building, Plymouth Ave., South Greensburg, at 7:00 p.m. EST. Two-meter repeater on 147.18 (+600, PL 131.8). Contact N3SRJ, 907 Arlington Ave., Jeannette, PA 15644, e-mail: <n3srj@bellatlantic.net>; Web: <http://www.geocities.com/Heartland/Acres/7896>.

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. Lambda Amateur Radio Club (ALRC), P.O. Box 56069, Philadelphia, PA 19130-6069; E-mail: <lambda-arc@geocities.com>.

PA, Monessen Amateur Radio Club: Meetings 3rd Monday of month at Mon Valley Community Health Center, Monessen, PA, 4th floor at 7:30 p.m. Everyone welcome. Repeaters on 147.27+, 443.8+, 224.58+. Net on Tuesday at 8 p.m. on 147.27+. For more info, contact Allan, N3UML, P.O. Box 26, Sycamore, PA 15364, (724) 852-6449 evenings.

PA, New Castle: Amateur Radio League of Lawrence County (ARLLC) and Lawrence County ARES (LCARES). Meetings 2nd Tuesday of each month, 7:30 p.m., American Red Cross Bldg., 222 North Mercer St., New Castle, PA. Weekly informational net @ 9:30 p.m. every Thursday on 147.195(+) MHz and 146.625 (-) MHz linked repeaters. SKYWARN severe weather nets as situation requires. Contact Club Secy, ARLLC/LCARES, P.O. Box 7931, New Castle, PA. 16107-7931 or visit: <http://pages.prodigy.com/arllc>.

PA, Philadelphia: The Holmesburg ARC meets last Thursday of each month at the NE Philadelphia Naval ASO at 8 p.m. Repeater - 146.685. General interest, classes. For more info: <www.harcnet.org>; <WA3PZO@harcnet.org>.

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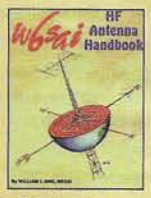

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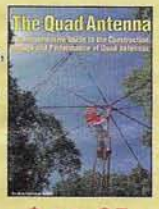

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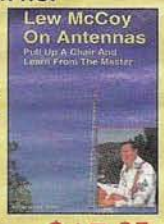

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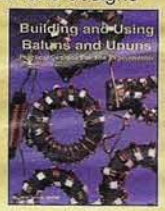

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PA, Skyview Radio Society, New Kensington: Business meeting 1st Tuesday, social meeting 3rd Tuesday of month at SRS clubhouse, 2335 Turkey Ridge Road, Upper Burrell Twp. at 8:00 EST; 2-meter repeater 146.64 MHz (-600, PL 131.8). UHF repeater 444.3 (+5 MHz). Net Thursday at 9:00 on 146.64. Contact N3WAV, 116 Arizona Dr., Lower Burrell, PA 15068. E-mail: <n3wav@aol.com>.

TX, The Clear Lake Amateur Radio Club of Houston TX: Meetings are the 3rd Wednesday of every month at 7 p.m. at the Webster Volunteer Fire Dept. 17100 Texas Ave. in Webster, TX. Meetings are open to anyone interested in amateur radio. Our Web site has the info <www.clarc.org>.

TX, No Code International: An international non-profit club of hams who are dedicated to the elimination of morse code testing as a requirement for amateur HF licenses. SASE for information to: No Code International, P.O. Box 565206, Dallas, TX 75356 or visit our Web site at: <http://www.nocode.org>.

UT, Rocky Mountain Radio Association (RMRA): Offers Utah, Wasatch Front, unique UHF to 6, UHF to 2, and UHF to HF remote gateways. Net Thursday at 9 p.m. on 447.900 PL 114.8 UHF/6-meter gateway open 24 hours on 448.700 PL 114.8. Visit the RMRA Web site: <www.inconnect.com/~rmra>; or e-mail: <rmra @inconnect.com> for more information.

WV (Bluefield) East River Amateur Radio Club (ERARC): Meets 1st Monday of every month at Ryan's Steakhouse, 7 p.m., in the Bluefield, VA, WalMart shopping plaza. See our Web page at <www.inetone.net/erarc/> for information on VE EXAMS, weekly breakfast meeting, club info, and weekly ARES net. Info: <w4vt@sera.org> or call KD4ZUA at (540) 326-3419.

WV, Charleston, Kanawha Amateur Radio Club (KARC): Meetings held first Friday of each month at 7 p.m. at the South Charleston City Hall Annex, 4th Avenue and D street in South Charleston. Weekly Sunday net at 8:30 p.m. on 145.35 W8GK Club repeater. Mail to: KARC, P.O. Box 1694, Charleston, WV 25326. For information, contact Jim Damron, N8TMW, Publicty Director, at: <103347.610@compuserve.com>.

WV, Plateau Amateur Radio Association, Inc. (PARA), Oak Hill, WV: Meetings held the first Tuesday of every month, 7:30 p.m. in the basement of the New River Pawn Shop, 328 Main Street, Oak Hill, WV. Mailing address is PARA, P.O. Box 96, Fayetteville, WV 25840. Repeaters are 146.790-; 147.075- and 443.300+. For more information, contact Juddie Burgess, KC8CON, Secretary, at <kc8con@usa.net>.

Exam Sessions

CA, Cypress: ARRL amateur radio license test sessions start at 9 a.m., every 2nd Saturday of odd months. We test all levels, Novice through Extra, reservations not required. The address is 10824 Hope St., Cypress, CA (nearest cross streets are Katella and Valley View). For information, contact Harrision Spain, AC6TI, via e-mail: <spain@ugsolutions.com>; Phone: (714) 952-6114; Web: <http://www.serve.com/n6ehm/testing.html>.

FL, Highlands County: Examinations held 4th Monday of each month, 7 p.m. Agri-Civic Center Conference Room 1, South US 27, Sebring, FL. Walk-ins are welcome. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio @strato.net>.

FL, West Palm Beach: Exams held 1st Saturday of each month, 9 a.m. VA Medical Center, 7305 North Military Trail, West Palm Beach. Walk-ins welcome. For info, contact Steve, W2QX, at (561) 585-8504; or e-mail: <WA4AW@juno.com>.

NC, Wilmington: Azalea Coast Amateur Radio Club will hold a VE testing session on Oct. 10, 1998 10 a.m. at Morton Hall. University of North Carolina Wilmington Campus. Contact Jack, WD4OIN, at (910) 791-1556.

OH, Cincinnati: OH-KY-IN Amateur Radio Society are forming ham radio classes for all levels of licenses, Novice through Extra, including the No-Code license in the Cincinnati, OH, area. Classes will be held every Thursday evening for 10 weeks at the Salem Presbyterian Church located at the corner of Mozart and Higbee in Wester Hills (behind the White Castle Restaurant at Harrison and Boudinot). All morse code classes are free! The course is open to persons of any age, and no prior experience is necessary. For more information, contact Carol Hugentober, K8DHK, at (513) 5323 or Bruce Vanselow, N8FWA, at (513) 251-1555.

OH, Cleveland Area: Cuyahoga Amateur Radio Club holds exam sessions on the second Sunday of each odd-numbered month (except May), at the Olde Independence Town Hall, 6652 Brecksville Rd. (Rte 21), Independence, OH. Sessions start at 9 a.m. Fee is $6.95 and a valid ID and copy of your FCC license is required (if you are already licensed). For more info, contact Gary Dewey, NI8Z, at (216) 642-1399 or at <gdewey@en.com>.

OH, Colerain: The Triple States Radio Amateur Club holds exams the last Monday of every month at 6 p.m. at Citizens Bank. Courtesy call you are coming required. Phone: (740) 546-3930; Fax: (740) 546-3685; E-mail: <k8an@aol.com>.

PA, Monessen Amateur Radio Club: Test session 1st Sat. of even months. Feb., April, June, etc. 10 a.m. at New Eagle Boro Bldg. Main St., New Eagle, PA. Walk-ins welcome but pre-registration preferred. For more info contact Allan, N3UML, (724) 852-6449, P.O. Box 26, Sycamore, PA 15364.

PA, Parkway Philadelphia: The Philmont Mobile Radio Club sponsors exams on 1st non-holiday Thursday of each month at Franklin Institute, 20th and Ben Franklin Pkwy, Philadelphia, PA. Walk-ins welcome. Exams start at 6:30 p.m. For more info contact, Dusty Rhoades, ND3Q, (215) 879-0505.

TX, Houston: The Clear Lake Amateur Radio Club (CLARC) serves the SE (NASA) area of Houston. We give VE exams 2nd Saturday of each month, check in at 9 a.m. at the Clear Lake Presbyterian Church 1511 El Dorado in Clear Lake. Our Web site has all the info: <www.clarc.org>.

Personal Web Site Listings

Jim Bridge, KQ6BS, URL: <http://www.qsl.net/kq6bs>. Specialty: weak signal.

"The Radio Picture Archive," URL: <http://www.e-etc.com/rpa> (corrected). Speciality collection of pictures of radios.

Commercial Web Site Listings

Byers Chassis Kits: Aluminum chassis and cabinets kits, VHF & UHF antennas and parts. Catalog: Callbook address. E-mail: <k3iwk@herd.net>; <http://herd.net/byerschassiskits>.

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MS-Windows Software: RAC Callbook CD-ROM, Ultimeter Weather Stations and more, info <n2ckh@cybercomm.net>; Web: <www.QTH.com/n2ckh.bytewise.org>

Teletec: Manufactures 6, 2, 1 1/4 meter and 70 cm Linear Amplifiers as well as Receive Preamplifiers; <http://www.Teletec-usa.com>.

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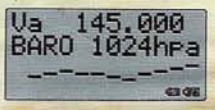

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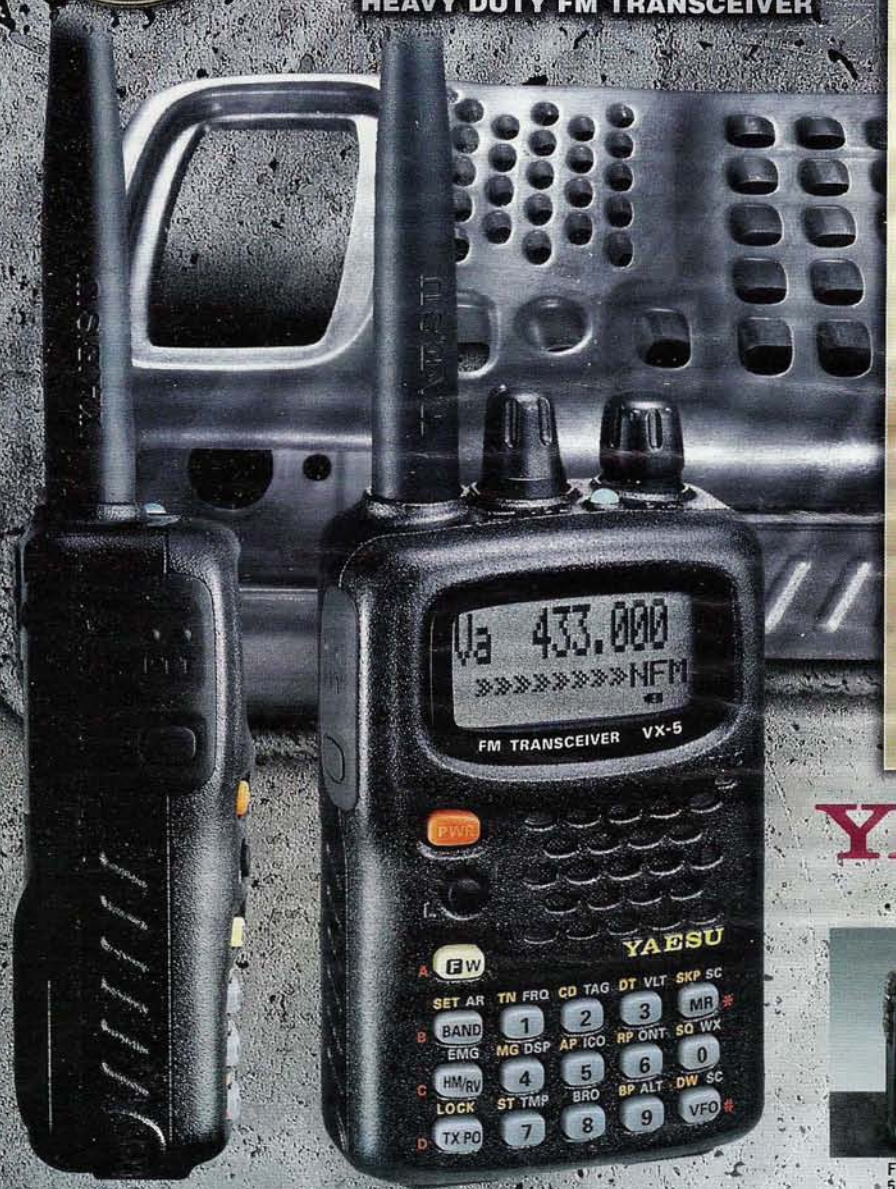

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