ICD 08237

CQ VHF Ham Radio Above 50 MHz

December 1998

- Tragedy at Peggy's Cove: Hams Respond
- Are NiMH Batteries Really Better?
- More Cheap Yagis!
- Ham TV in the 21st Century

Plus 2 **CQ VHF** *Reviews:*

- Adonis Base Station Microphones
- 1998 TAPR CD-ROM

. . . and the 1998 Annual Index

On the Cover: Bev Cavender, W4ZD, of Lake Placid, Florida, stands in the middle of his 2-meter EME (Earth–Moon–Earth) antenna array. Details on page 68.

U.S. $3.99/ Canada $5.50

■ Repeaters & FM ■ Packet Radio ■ VHF/UHF
Weak-Signal ■ Microwaves ■ Amateur
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Product News, VHF Basics, and much more!

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

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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

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$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***
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- ***FREE mobile bracket*** • ***"On Air" LEDs***
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- ***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.*

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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

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CIRCLE 114 ON READER SERVICE CARD

CQ VHF Ham Radio Above 50 MHz

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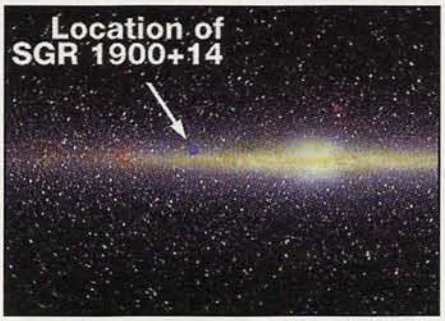

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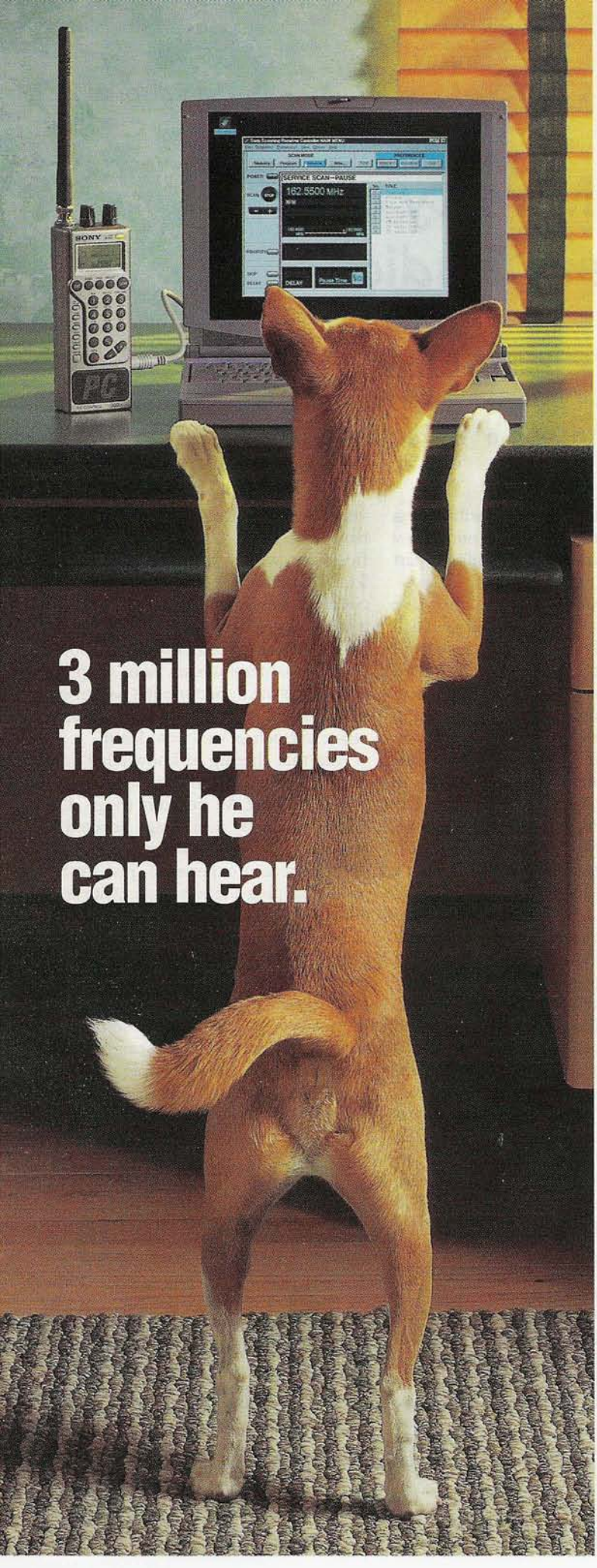
Next Month: "Ozone Propagation: Pondering the Possibility," by David Dunham, WA1CUH



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SONY

The University of Amateur Radio

Imagine a college with countless courses and top instructors, but no exams and—best of all—no tuition. Guess what? You're already registered...in the University of Amateur Radio!

One of the best parts of my job is that I get paid to learn. Whether I'm talking with our writers and our readers, reading the mail, or researching/fact-checking an article, I'm always learning something new. Then—and this is another "best part" of my job—I get to share it with you through the pages of *CQ VHF*.

To me, this has always been one of the things I've loved about journalism in general: the opportunity to learn about all sorts of different things, often from top people in their fields, ask questions, and then turn around and explain what you've learned to the people who weren't able to have that same discussion with whichever expert or experts you interviewed. It's the ultimate in continuing education: ongoing opportunities to learn, and to teach.

But in ham radio, these opportunities aren't limited to the journalists, or to the "leaders." They're available to all of us, and if you're at all active in the hobby, it's almost impossible to *avoid* learning something from someone—and it doesn't have to have anything to do with radio.

A Part of the Culture

Face it. Generally speaking, we are a hobby of very smart people. I'm not being conceited here, just stating a fact. If you look at our reader surveys, you'll see that hams as a group tend to be better-educated than the average person and tend to have professional/technical jobs that require you to have, as my mother would put it, "a good head on your shoulders." But one thing that sets us apart from other groups of smart people is our willingness to share our knowledge with our fellow hams. In fact, sharing information is part of our "ham radio culture."

I can't tell you how many times I've listened to discussions on the air in which one ham is leading another through troubleshooting a computer, or installing a new piece of hardware, answering questions, and explaining how everything works along the way. And if you ask ham #1 how he knows so much about whatever he's explaining, he's likely to answer, "Oh, I do this for a living." The only difference is that his clients at work pay good money for his expertise; for his friends on the radio, though (even if it's a friend he just met), the advice and instruction are free. And computers, of course, are just an example. I've heard impromptu lessons in chemistry, earth science, video production, you name it.

It's not just on the air, either. Hamfests and conferences offer forums with nationally known experts, and the price of admission is peanuts compared to similar conferences in a professional setting. I get flyers all the time for professional conferences, and the fees routinely run from $400 to $1,000, plus the cost of getting there and getting a place to sleep. Ham radio conferences run around $35 for two full days of seminars, generally led by experts with credentials at least equal to those of presenters at professional conferences.

And take a look at the ham radio magazines. Once again, experts in their fields freely share their knowledge and experience with their fellow hams. Sure, we pay for articles; but, frankly, we can't pay very much (and I'm talking about *all* the ham magazines, not just *CQ VHF*). A freelance writer who regularly earns $1,000 or more for an article in a major-circulation magazine isn't going to write a similar article for a ham magazine just for the money (probably $100 to $200)—but if the writer is a ham, he or she probably *will* write it, because it's part of our culture to share our knowledge with each other; to teach as well as to learn.

And that sharing of knowledge goes in both directions. If you look at last month's "Q & A" column (page 42), you'll see nearly a full page devoted to one reader helping another, sharing his knowledge and experience, just for the sake of helping a fellow ham. Quite honestly, I find doing the "Q&A" column to be one of the most educational aspects of putting this magazine together each month; not because I know so much, but precisely because I don't. I want to be sure my answers are accurate, so I sometimes spend an hour or more researching the answer to a seemingly simple question, and educating myself in the process.

Speaking of Research

In fact, the knowledge-sharing ethic is so deeply embedded that, a few weeks back, I had a difficult time when I got an e-mail from a college student asking for help in preparing a 10-page research paper on ham radio public service (I like his choice of subject!). It was a struggle for me not to sit down and tell him everything I knew about it, but rather to give him some general background and point

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

CQ VHF Ham Radio Above 50 MHz

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VHF News

Tynan Steps Down as AMSAT President

Bill Tynan, W3XO, has announced his retirement as President of AMSAT-NA after heading the amateur satellite organization since 1991. Tynan, 72, recommended that he be succeeded by AMSAT-NA Executive Vice President Keith Baker, KB1SF, according to the AMSAT News Service (ANS). The formal announcement was scheduled for the AMSAT Annual Meeting in Vicksburg, Mississippi, in mid-October—just after this issue's press deadline.

Tynan said he decided that now was "a good time" to step aside, despite his disappointment that the Phase 3D satellite has yet to be launched. "When I became president, I hoped that I would see Phase 3D safely into orbit before I left office. I have maintained that hope and worked toward that goal since that time," Tynan told ANS, adding that "The satellite is essentially complete and... will be ready for a launch whenever that can come to pass."

Satellite Mysteries

At press time in mid-October, mysterious problems were bedeviling several amateur satellites, and three of them—RS-16, DO-17, and WO-18—were off the air entirely. Only the 435-MHz beacon on RS-16 was operational at last report, and attempts to "turn on" the satellite's Mode A transponder (2 meters up; 10 meters down) have been unsuccessful, according to the AMSAT News Service (ANS). The downlink-only Dove-OSCAR-17 had no downlinks on the air, and ANS had no additional information on why the satellite was down, or when it might be back on the air. And WO-18, another downlink-only bird, was in housekeeping mode after a software crash.

Plus, the *ARRL Letter* reported that controllers of the new TO-31 satellite (TMSAT-OSCAR-31) had encountered an "anomaly" involving periodic drops of downlink output power to 1 watt. Testing and calibration of the satellite's systems continues, however, and controllers expect it to be ready for amateur use soon.

Meanwhile, the RS-12 satellite, while still working, has gone through many operational changes. ANS says various hams have reported hearing the satellite using modes K (15 meters up; 10 meters down), T (15 meters up; 2 meters down), and KT (15 meters up; both 10 and 2 meters down)—and there have even been reports that the satellite's twin transponder, RS-13, has been active along with RS-12. According to ANS, RS-12/13 is now being controlled by Alex Popkov in Kaluga City, Russia; but there has been no official word about all the mode- and transponder-switching.

Space Station Delays Also Delay ARISS Project

ARISS stands for "Amateur Radio on the International Space Station." So it stands to reason that you can't have ARISS until you have an ISS. And delays in Russia have pushed back the construction schedule by at least several months. The launch of the first ISS crew has now been rescheduled from next summer to January, 2000, at the earliest. And, NASA's Matt Bordelon, KC5BTL, told the *ARRL Letter*, "you won't have an amateur radio signal coming out of the ISS until then." That first crew is scheduled to include Cosmonaut Sergei Kirkalev, U5MIR, and Astronaut William Shepherd, who is studying for his ham license.

On the topic of ham operations from manned spacecraft, SAREX, the Space Amateur Radio EXperiment, is due to return to the air next month, assuming that STS-93 lifts off on or close to schedule in late January. Four schools—one each in Indiana, Rhode Island, Texas, and Virginia—are scheduled for SAREX contacts, according to the *ARRL Letter*. There's no word yet on whether any random contacts are planned.

School groups are also taking part in an APRS (Automatic Position Reporting System) test using the digipeater on the Mir space station, RØMIR. According to the AMSAT News Service, MIREX, the Mir Amateur Radio Experiment group, is sponsoring an ongoing "APRS School

(Continued on page 82)

Compiled by the CQ VHF Staff

Tragedy at Peggy's Cove

When Swissair Flight 111 plunged into the Atlantic Ocean off the coast of Nova Scotia, ham radio operators were among the first responders...in a search and recovery effort that would keep them busy for weeks to come.

The evening hours of Wednesday, September 2, 1998, were like any other in the quiet fishing villages along Nova Scotia's southwestern shore. Many of the local residents, who earn their living from the sea, had retired for the night, while others watched the evening news before going to bed. At approximately 10:30 p.m. local time all that changed as Swissair Flight 111, a Boeing MD-11 bound for Geneva from New York City, plunged into the ocean near the village of Peggy's Cove, tragically ending the lives of 229 passengers and crew on board.

"As we neared our destination, the entire area was lit in the eerie glow of para flares dropped by Canadian Forces Aurora maritime patrol aircraft."—Al Penney, VO1NO

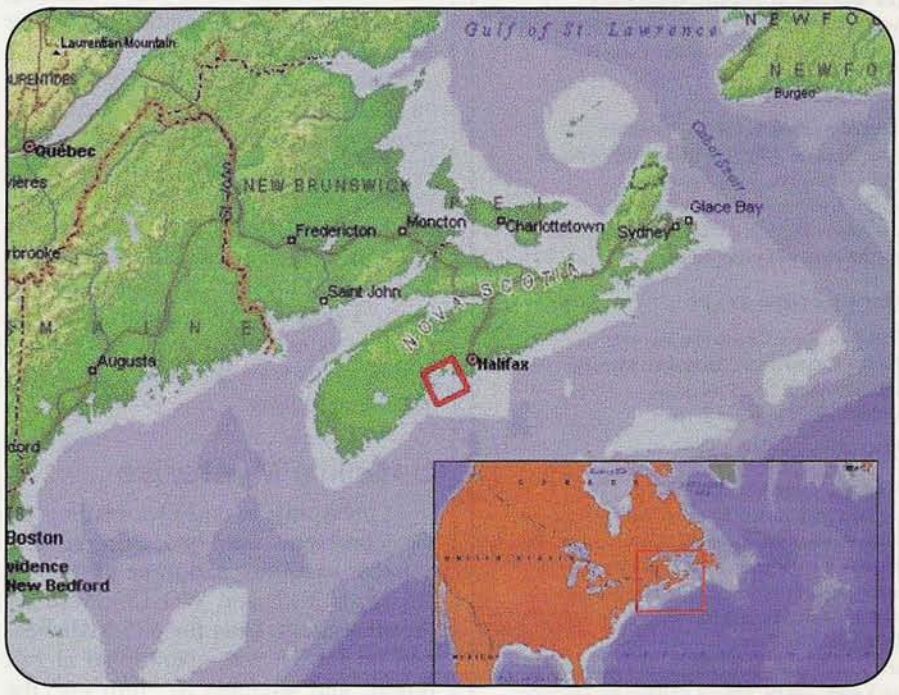

Photo A. Map showing Peggy's Cove area along the coast of Nova Scotia. Map courtesy Canadian Navy.

Peggy's Cove is a quiet, picturesque fishing village of 60 people located at the entrance to St. Margaret's Bay, approximately 50 miles from Halifax (see map, Photo A). Its rocky shoreline and much photographed lighthouse (Photo B) make it a "must see" tourist attraction for visitors to Canada's second smallest province. However, that Wednesday night was anything but quiet as emergency vehicles converged on the village in the hopes of finding possible survivors from this tragedy. Within two hours of the crash, amateur radio operators were also arriving on the scene—to serve in the public interest.

This month we thank Joe MacPherson, VE1CH, who worked with the Canadian Red Cross, and Al Penney, VO1NO/VE1, who worked at the scene in the Command Post for Halifax Regional Municipality-Emergency Measures Organization (HRM-EMO), for supplying us with this story of Canadian amateurs providing emergency communications.

The Response Begins

At 10:40 p.m., Paul Hubley, VE1SAR, contacted Dave George, VE1AJP, and informed him that a great deal of activity was taking place on police, fire, and ambulance frequencies in the Greater Halifax area. Dave is the Radio Amateurs of Canada (RAC) Emergency Coordinator for the Halifax Regional Municipality (HRM) and the contact person for the Emergency Measures Organization (EMO). Dave tuned in just in time to hear 35 ambulances from all over the region being dispatched to Bayswater Beach, at the western entrance to St. Margaret's Bay. Dave alerted Bill Elliot, VE1MR, the President of the Halifax Amateur Radio Club, and apprised him of what was occurring.

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

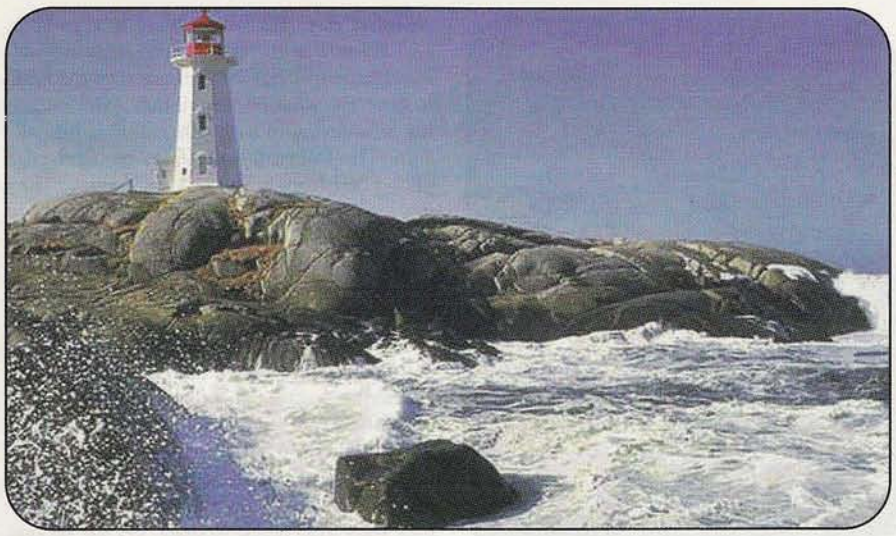

Photo B. Scenic Peggy's Cove, normally a fishing village and tourist stop, was transformed in hours to a disaster response command post. Photo courtesy Nova Scotia Economic Development and Tourism.

At 11:20, Dave and his wife, Sherry, VE1WST, departed their Dartmouth home and proceeded to Bayswater Beach to determine what, if any, assistance was required from amateur radio operators. In the staging area itself, Dave and Sherry encountered dozens of emergency vehicles.

At 11:45, Dave received a pager message from Barry Manuel, the EMO Coordinator for HRM (also an amateur radio operator, VE1JRG), requesting that he proceed to Bayswater Beach. Shortly after checking into the Mobile Command Post, Dave was informed that amateur radio support had been officially requested. He then called Bill, VE1MR, who initiated callout procedures. In a very short time, all key people were informed of the crash and were standing by on the VE1PSR repeater for deployment instructions.

MacPherson received a telephone call from VE1MR with news that an airplane had gone down in the Blandford area of Nova Scotia, across St. Margaret's Bay from Peggy's Cove. He describes his initial reaction:

As I scrambled from my bed and turned on the local television channel, the news bulletins confirmed our worst fears. I immediately began collecting various pieces of radio and other equipment and called the Disaster Response Team (DRT) Leader of the Canadian Red Cross. Although a volunteer amateur radio member of HRM-EMO, my first responsibility as a volunteer is as Telecommunications Officer for the Canadian Red Cross. I was advised to proceed to Blandford and to meet up with the Red Cross Emergency Response Vehicle (ERV) at that location.

Among the first amateur radio operators to arrive at Peggy's Cove were Al, VO1NO/VE1 and his wife Shelly, VE1NOS. While Al and Shelly were busily setting up equipment and installing themselves in the Mobile Command Post, MacPherson was organizing communications for the first Red Cross personnel on the scene. Links were established on Red Cross UHF frequencies to the various participants and to the Mobile Command Post, and later from the ERV to Red Cross headquarters in Halifax.

While enroute to Peggy's Cove to meet the ERV, MacPherson called George Dumphy, VE1AGT, and Ed Wall, VE1HM, President of the Senior Amateur Radio Association (SARA), and asked that the SARA station located at Red Cross headquarters be activated. He also asked that contact be established with other members of SARA to place them on standby in the event that additional amateur radio resources were required. Ed, VE1HM, arrived at the station approximately one-half hour later and checked in with the Emergency Response Vehicle on VE1PSR.

Here's how Al Penney described what he saw as he approached the Peggy's Cove area:

As we neared our destination, the entire area was lit in the eerie glow of para flares dropped by Canadian Forces Aurora maritime patrol aircraft. Closer to the sea surface were military, Coast Guard, and Royal Canadian Mounted Police (RCMP) helicopters. Also visible were the lights of many fishing boats. Despite the intense rain and a heavy ocean swell that threatened to swamp their small craft, fishermen from all over the area selflessly put to sea in a rescue effort.

When we arrived at Peggy's cove at 2:50 a.m., we met Judy Sutherby, VE1NAN, and her husband Leo, VE1PUP. Recent graduates of HARC's Basic Amateur Radio course, they had overheard the drama unfolding on their scanner, proceeded to the site, and offered their assistance. Leaving Judy and Leo to provide communications at the main police checkpoint, I proceeded to the inner perimeter and began organizing amateur communications at the area chosen for the command post—the parking lot behind the restaurant on the point of land jutting into the Atlantic.

The first priority was to establish contact with the person in charge. Things were under-

Photo C. The Command Bus operated by the Halifax Regional Municipality. The front part serves as a command area and the back as a communications center. Photo by Joe MacPherson, VE1CH.

standably hectic, although, in retrospect, I am amazed at how quickly and effectively the various services and volunteers reacted. Leaving Shelley to monitor the radio in the Jeep, I soon found the deputy RCMP officer in charge. I explained amateur radio's purpose and capability, and he seemed quite impressed that I could speak directly with the airbase at Canadian Forces Station Shearwater, the location at which a temporary morgue was being established. After receiving what information he had, I began to set up in the HRM Command Bus (Photo C).

The Command Bus is a converted 48-passenger coach, with incident boards in the forward half and tables in the after end (Photo D). By that time Dave, Sherry, Bill and Bill's wife, Lynn, had arrived on scene. Together we began installing radios and antennas in the bus. When we realized that the aluminum roof would not hold our magnet-mount antennas, we secured them with duct tape, literally the last thing I had grabbed before leaving the house. A requirement to communicate with military aircraft on 5717-kHz USB was accommodated by the use of Bill's Kenwood TS-680, my 40-meter Pro Am mobile whip, and a transmatch.

When the RCMP asked us to set up a link to talk with the warships offshore (Photo E), Dave's HT was programmed for VHF marine channels 8 and 16. Joe, VE1CH, dropped off a UHF HT to enable us to keep in touch with the Red Cross staff. A scanner was set up to monitor other frequencies of interest, and my TS-711 was tuned to the Emergency Net on the VE1PSR repeater. We were also asked to talk to the Coast Guard helicopters landing on the parking lot 15 meters away. Attempts to have them call us on VHF Marine channel 8 failed, and we did not have VHF AM equipment to talk to them on regular aircraft frequencies.

Off-Site Net Controls

In the initial stages of the operation Bill, VE1MR, set up Net Control from his residence. When he departed his home for Peggy's Cove, net control was turned over to Bob Burns, VE1VCK. Soon afterwards though, Bob's pager sounded and he was called off to work. Herb Bradley, VE1HJB, filled in until 3:00 a.m., when Tom Caithness, VE1GTC, came on the air and assumed the duty of Net Control Station (NCS) from his home.

HRM EMO's doctrine had been to have the NCS operate out of the fixed Emergency Operations Centre (EOC) in Dartmouth, where normal administration (e.g. scheduling of operators, arranging for site clearances etc.) would be conducted. But this would not be possible from the Command Bus. With no telephone, a limited number of circuits available, and a cramped and noisy environment, we had our hands full with more immediate problems. Fortunately Tom recognized this and stepped in. For the next six days his shack was manned around the clock (Photo F). He, his wife Betty, VE1BSW, Helen MacRae, VE1HMR, and many other operators did an outstanding job supporting the operation.

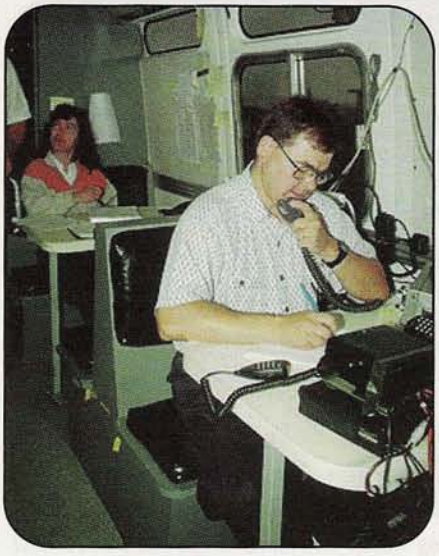

Photo D. Ham operators staff communications positions inside the Command Bus. Photo by Al Penney, VO1NO.

More Agencies, Amateurs Join In

As the magnitude of the disaster became evident, additional agencies became involved and more stations began to join the net. By dawn, amateur radio operators were manning communications in the Command Bus, the Canadian Red Cross (Halifax), the Provincial EOC, Base Operations at Shearwater, and Net Control. In addition, amateurs were asked to provide point-to-point communications for the RCMP, whose own repeater system became too busy to permit the main checkpoint to keep in touch with the Command Post. When their handheld radios could not cope with the intervening terrain, they turned to amateur radio for assistance. A 2-meter simplex link worked well and drew praise from the police.

At approximately 3:30 a.m., the first body was recovered. By then we had realized that the initial reports of survivors being found were incorrect. As more information was received, it became evident that a miracle would have been necessary for anyone to survive. Sadly, there were no miracles for the passengers and crew of Flight 111 that night.

Reporters and Cellphones

The place was absolutely overrun with media! Already there were several large satellite trucks belonging to the major TV networks. That number would swell to 30 or more within a day. Reporters were everywhere, and anyone who moved was interviewed. MacPherson, VE1CH, was asked by the BBC to describe what he was doing. After outlining amateur radio's role, he included his callsign. The following morning, he received a phone call from a Swiss news agency. They had heard the interview on shortwave, tracked him down via his callsign, and called to ask if he knew of anyone who had overheard on a scanner the conversation between the aircraft and the air traffic controller.

Despite the heavy demands made on the cellular system, it performed quite well. While there were delays and interruptions, it did not crash as many of us expected it to. I am no expert on this, but I suspect our location permitted users to access several different sites. The cellular and telephone companies were also quick to react. By the second day, a portable cellular site and a cellular site extender had been established at Peggy's Cove and 82 extra lines were installed.

To put everything in perspective, however, one must remember that none of the infrastructure in the area was damaged. This will not be the case for most natural disasters. Indeed, the primary reason that so many telephone lines could be installed seems to be that a great deal of excess capability existed due to the small population of Peggy's Cove.

A Spirit of Cooperation

Tom MacPherson noted that he was gratified by the response he received not only from local amateurs, but also from

Photo E. Hams communicated not only with other amateurs, but with naval vessels as well. Here, the USS Grapple, *sent up by the U.S. Navy, sits moored and ready to conduct recovery operations. Canadian Navy photo.*

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Lessons Learned

Looking back, Joe and Al were able to assemble the following list of key lessons *they* learned from this operation—lessons that can be adapted by any group of amateur radio emergency communicators:

• The importance of a good training program cannot be overstated. Knowing what was expected of them enabled our people to react quickly and establish an emergency net in a very short time. In HRM (Halifax Regional Municipality), our program consists of a series of day-long courses, each with an associated training manual. Weekly practice nets and a monthly practice session at the club station help maintain proficiency.

• Key people must have access to information, such as frequencies for SAR, VHF marine, CB radio, and air traffic control, important telephone numbers, linking arrangements for repeaters, packet system descriptions etc. This should be able to fit into a pocket. A small three-ring binder with plastic page protectors would be ideal for this.

• Radios, antennas, power supplies, etc. provided for emergency use must be readily available. This means issuing complete stations to key people who will be the first to react to a call for assistance.

• Kits containing message forms, stationary, file folders, pens, pencils, staplers, etc. need to be ready to go. In HRM, the intention is to pre-position these kits in all the likely locations that will be manned in an emergency, e.g. EOCs, hospitals, Red Cross, etc., as well as with several key people. Unfortunately, this was not achieved prior to the crash and we began to run out of message forms in the Command Bus.

• The ability to operate outside the amateur bands is important. We were required to communicate with ships, aircraft, and ground units. This meant HF and most of the spectrum between 108 and 170 MHz.

• Don't ignore CB radio. Many small fishing boats are equipped with CB radios instead of VHF marine sets. We could have come up on CB frequencies, but our HF radio was standing by on a military SAR channel. In emergency situations, you may need CBers for all sorts of tasks. Remember—the supply of amateur radio operators is not endless!

• Every piece of equipment should have a spare fuse taped to it. This is in addition to the box of fuses in the toolkit.

• Rechargeable batteries should have a note indicating their state of charge when not actually in use. Post-It Notes® are ideal for this. In addition, don't store batteries in unplugged chargers. Not all are diode-protected to prevent accidental battery drain.

• Remember that some radio amateurs may have several commitments (Red Cross, fire fighters, military, Coast Guard, etc.) and will not be available for EMO duties directly. Take this into account when preparing operating schedules.

• *OFFICIAL* EMO identification cards and vehicle identification plaques are essential for gaining access to restricted areas. Without proper identification, access is regularly denied by police. This point was also emphasized following the TWA 800 crash in New York. The after-action report said, in part, "A standardized photo identification system should be used to issue event-specific or date-specific access cards....Volunteers should check-in and check-out each shift. All volunteers should have a chain-of-control and everyone working at an incident have an agency/organization identification card—clearly visible at all times."

• Headphones and boom microphones are the *only* solution when working in a noisy area.

• Amateur radio operators must be somewhat forward in explaining our capability to emergency officials, who often are not aware of what we can do for them. Liaison *before* emergencies occur is the best fix for this.

• A separate net to coordinate operators' schedules is useful. HRM EMO doctrine calls for this, but during the emergency it was not deemed necessary as the phones were working. In retrospect, I believe it should have been activated.

• Related to this point is the fact that most of our key people were assigned as first responders. This left very few managers to take care of the administration and long-range planning. The next time we face a similar situation (and even though I am an optimist, I know that there *will* be a next time!), the technical types will be the first to go to the sites to establish the stations. The managers will go to the fixed EOC to organize the operators who follow the Technical Support Team.

• Packet radio was not used in this operation, but probably could have been. We are still refining our packet procedures and hope to have a rapid reaction capability by spring.

• Finally, briefings for amateurs on Critical Incident Stress is an important consideration. Although we were spared the horror that others in this operation experienced, the same may not be true next time. Forewarned is forearmed.

Photo F. Leo, VE1PUP, operating at VE1GTC's home station, which served as net control point throughout the disaster operations. VE1CH photo.

relief volunteers called in well after the crash occurred.

I would be remiss if I did not mention the wonderful spirit of cooperation that grew out of this incident. Tom and his team worked tirelessly to ensure that all locations were manned. Very few people turned down their requests for assistance, and then only for the most serious of reasons. Nevertheless, after several days it became apparent that more amateurs were required than could be found in the immediate area.

On Saturday, September 6, a call for more operators was put out on many repeaters. Amateurs from Truro, Kentville, Windsor, Lunenburg, the Annapolis Valley and the Eastern Shore readily volunteered. At the height of the operation, the Command Post at Peggy's Cove and the Provincial EOC in Halifax were manned from 8:00 a.m. until 8:00 p.m. daily. In all, more than 120 amateur radio operators assisted in this operation.

The Grim Task Continues

As of mid-September, the grim task of recovering wreckage (see Photo G) and body parts continued. Officials noted how difficult the search was, as descriptions were given not by the number of victims recovered, but by the two tons of body *parts* that had been recovered. This search was just as difficult for members

"When their [RCMP] handheld radios could not cope with the intervening terrain they turned to amateur radio for assistance."—Joe MacPherson, VE1CH

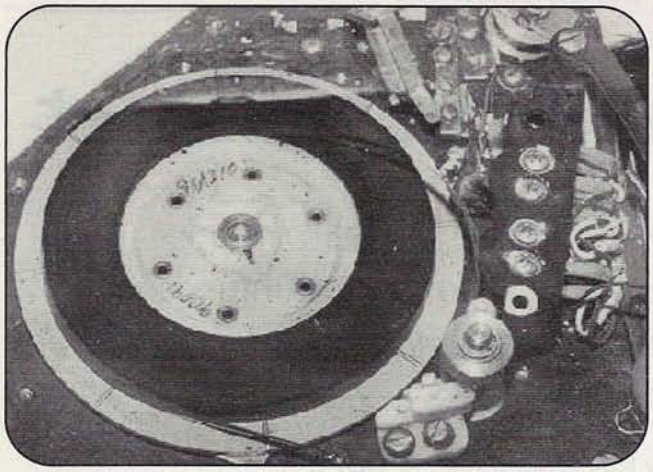


Photo G. The recovered cockpit voice recorder from Swissair Flight 111. Within two hours after the crash, amateur radio operators were providing valuable communications. Transportation Safety Board of Canada photo.

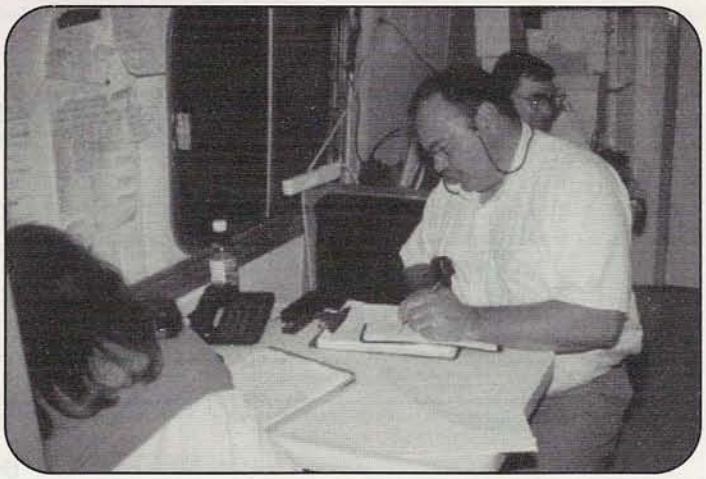


Photo H. Hams busily record information coming in on various local nets. From left: Lynn, VE1ENT (with back to camera), Barry Manuel, VE1JRG, HRM-EMO Coordinator, and an unidentified volunteer. VE1CH photo.

of the Coast Guard and Navy. Many military personnel had not been exposed to such carnage. According to the *Halifax Herald* newspaper, Dave Colvin, an emergency response expert from the University of Western Ontario, commented that ambulance workers and other emergency staff were more prepared to deal with what they saw since they routinely treat victims of auto accidents and other emergencies.

Two weeks after the crash, 30 ground provincial Search-and-Rescue (SAR) teams, which are described as being the best in Canada, were still combing the beaches. While many of these teams had their own private radio systems, many of the members of the teams who were also licensed amateurs coordinated their activities via ham radio, either on simplex or through local repeaters.

Assessing the Amateur Response

Overall, the amateur community responded extremely well to this disaster (see Photo H). All required sites were on the air in a very short time, and connectivity was excellent. Volunteers were plentiful, and each site was adequately staffed. Radio traffic volume was not as heavy as had initially been anticipated, due in part to the quick establishment of extra cellphone and telephone capacity. However, as Al Penney noted, the hams' training paid off:

It quickly became evident that the extensive training program implemented just over a year ago paid big dividends. People knew what they had to do, where they had to go, and what they needed to bring. The emergency net was activated without fuss, and voice procedures were crisp and professional. Many very favorable reports were received from senior officials, both at the scene and elsewhere.

The majority of the traffic handled was tactical, as opposed to the formal messages we had trained for. This was to be expected—due to the rapidly changing nature of the situation, a carefully drafted written message would have been "overtaken by events" before it could be transmitted! Nevertheless, whenever possible a formal message form was used. The message form was designed for any mode of transmission (not just amateur radio), and was produced in three copies. This eased the task of those record keepers attempting to follow the "paper trail" both during and on completion of the operation.

In Closing

As Joe and Al looked back at the events of September, they could not help marveling at how solidly the people in the area came together to do whatever they could to help. And they passed along this message for any family members or friends of the passengers and crew of Flight 111 to whom these pages may find their way:

"From the fishermen who braved the stormy North Atlantic to those who made sandwiches for the volunteers, and everyone in between—we know we speak for all of them in saying to the family and friends of the victims of Flight 111 that we are so very sorry we couldn't have done more."

And a closing note from WA3PZO: This story could not have been put together without the help of Joe, VE1CH, who spent many a long night at the computer following 12 hours a day on the disaster. My thanks also to Al Penney, VO1NO, and the Radio Amateurs of Canada, for helping with this story.

Do you have a public interest story to tell? Send it to Bjosuweit@aol.com or CQVHF@aol.com. ■

ARES and the Internet

Here's how an ARES group in California is using the Internet as a tool for training and communication among its members—even those without Internet access!

By Ray Rischpater, KF6GPE*
(dove@lothlorien.com)

Integrating ham radio with the Internet isn't just about linked repeaters, packet backbones, and streaming audio. Ands we don't have to wait until these are done by enterprising amateurs to take a part. Our local ARES (Amateur Radio Emergency Service) organization is one of many that is daily reaping the benefits of the Internet as a secondary communications tool. In the process, we've learned some important lessons, and we're continuing to evolve in how we provide information to our operators.

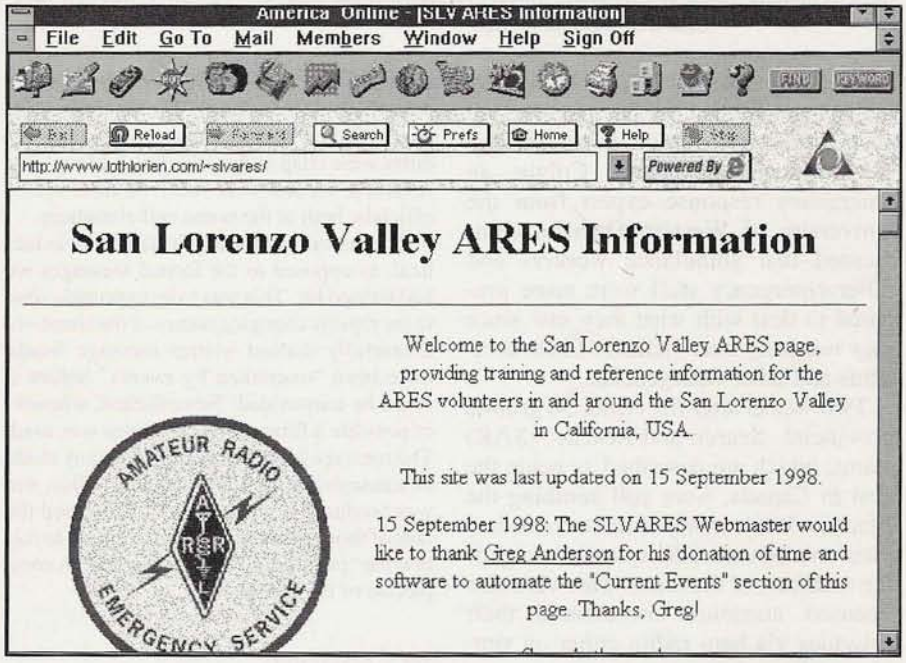


Figure 1. Screen shot of the main San Lorenzo Valley ARES (SLVARES) Web page. It contains links to several other pages with more detailed information, plus additional links to outside organizations.

Why the Internet for ARES?

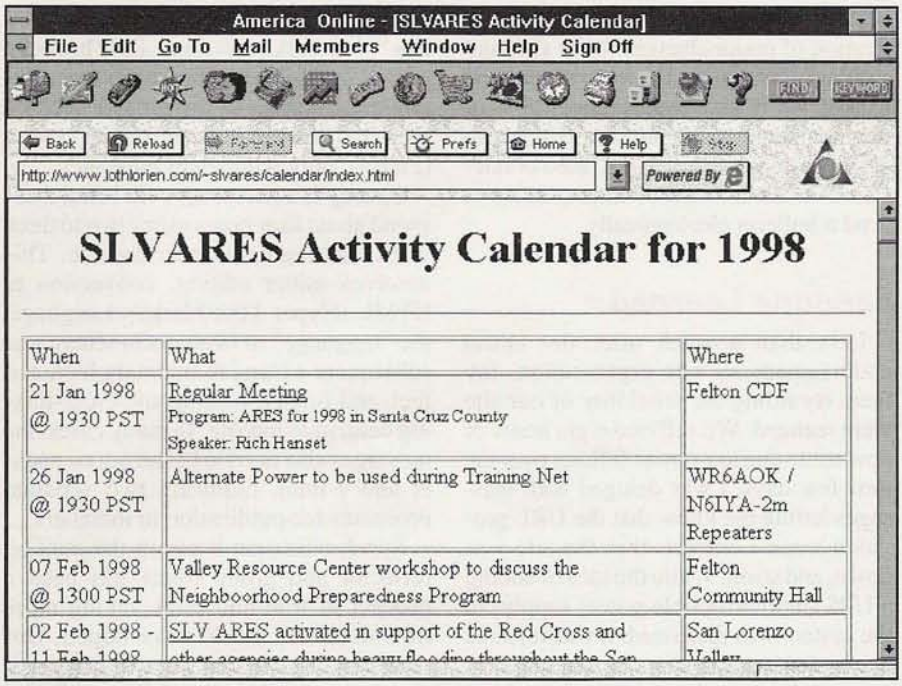
Early on in my experiences with amateur radio (I'm a relatively new ham), I realized the value of a Web site for our ARES organization, the San Lorenzo Valley Amateur Radio Emergency Service (SLVARES), which is part of Santa Cruz County ARES in California. In case you're not familiar with it, ARES is the emergency communications arm of the American Radio Relay League (ARRL).

And while we're defining some basic terms, the Internet is a worldwide network of computer networks, over which messages, photos, and other data may be sent. It's the "highway" part of the "information superhighway." The World Wide Web is a collection of "pages," or "Web sites," all hooked together via the Internet, containing words, pictures, and sometimes sound, that a user may access—again, via the Internet—for education or entertainment. In other words, Web sites contain "information" that travels down the Internet "highway." Often, however, the terms are used interchangeably.

The benefits we've gained through our Web site can easily apply to any other emergency communications group as well. The Web provides an easy way to distribute content and can be used to fuse content from many sources, giving users access to a wide base of information with relatively little effort. But there are some basic considerations to take into account before setting up a Web site for any amateur radio organization, and for an ARES organization in particular.

As a whole, considering the operators in the organization is paramount. Their interests and needs must be met or they'll simply volunteer their time elsewhere. The Internet is already beginning to play a larger role in emergency service as electronic mail and the Web become pervasive. But the Internet has not captured the interest of some amateurs, and others simply may not have access to it at this

Ray Rischpater, KF6GPE, is the Assistant Emergency Coordinator for Training of the San Lorenzo Valley Amateur Radio Emergency Service. While not operating his ham rig at home, he's often transmitting on commercial frequencies at his office, where he writes software for palmtop computers. Ray and his wife, Rachel, live in Boulder Creek, California.



SLVARES Activity Calendar for 1998

When	What	Where
21 Jan 1998 @ 1930 PST	Regular Meeting Program: ARES for 1998 in Santa Cruz County Speaker: Rich Hanset	Felton CDF
26 Jan 1998 @ 1930 PST	Alternate Power to be used during Training Net	WR6AOK / N6IYA-2m Repeaters
07 Feb 1998 @ 1300 PST	Valley Resource Center workshop to discuss the Neighboorhood Preparedness Program	Felton Community Hall
02 Feb 1998 - 11 Feb 1998	SLV ARES activated in support of the Red Cross and other agencies during heavy flooding throughout the San	San Lorenzo Valley

Figure 2. One of the sub-pages on the SLVARES Web site is the group's annual calendar of activities. Other sub-pages include meeting agendas and training materials.

time. Remember, most amateur radio operators providing public service do so because they enjoy public service and *radio*, not necessarily public service and *technology*—hair-splitting from the outside, perhaps, but crucial to recognize when bringing up the topic within an ARES group. Therefore, any use of the Internet needs to ensure that it does not bias activities toward those members with access to the Internet.

Next, an organization like ARES must consider the needs of its served agencies. Internet access may not be realistic for shelters or mobile command posts. And it's important to remember that, during an emergency or other "real" incident, conditions are likely to be unsuitable for real-time access to the Internet, even if the equipment is available.

Much has been written about the Internet's inherent reliability due to the nature of its design. (On the Internet, data is broken into small pieces and sent over whatever route seems best at the time; the network is constructed to dynamically find better routes in the event of a failure at a specific node.) However, it's important to recognize that this applies to the Internet as a *whole*, not necessarily a small region. If the phone or electrical system is under duress in a small area, odds are that those in that area are going to suffer degraded access to the Internet as well. This doesn't impact the network at large, but it certainly affects those without service.

These factors paint a picture in which the Internet plays a *supplemental* role, larger during an emergency service's *daily operation* than when working under duress. The Internet's strengths—providing broadcast and one-on-one communication—allow quick exchange of training material, policies, schedules, and other information. When the organization is mobilized for an emergency or public service event, these things tend to be put into action, and used directly, with little need for additional dissemination. In other words, it's time to turn off the computer (except for packet) and turn on the radio.

Our Site... In the Beginning

With these thoughts in mind, I set out in January, 1997, to assemble a prototype Web site for our ARES organization. I began simply, using the training resources and calendar I had at hand from recent meetings. I used a Macintosh computer running Claris Home Page (one of several Web-page authoring programs on the market). I spent most of my time doing data entry of the existing training materials and later added some original work in the form of log forms and similar resources for users to download and print. I did not mention the effort to others, as I figured that the prototype would probably stand up to examination better than a statement of intent.

A month later, the Web site was brought online at <http://www.lothlorien. com/~slvares/>. I passed the URL (Internet address) to our local Emergency Coordinator (EC), Frank Wyatt, N6FW, for his review. I wanted to make clear to the organization that this was a resource to be tapped, but in no way an attempt to supersede existing materials. After some initial discussions, the decision was made: SLVARES had a Web site of its own (see Figure 1).

Applications

Over the last year, the site has made clear contributions for our organization. Not all were immediately obvious. Within a month or so of public endorsement of the site, several things happened. Most notably, many members of the group had printed the contents of the site and added them to their ARES binders. This was both flattering and surprising; I would not have expected that people would print a collection of documents, most of which had been made available at previous meetings.

From its inception, our EC and I determined that, as the site Webmaster, I'd be responsible for *posting* content, but that, by and large, the content itself would be determined by the EC and the AECs (Assistant Emergency Coordinators), directing their comments through the EC to me. There were many good reasons for this. First of all, I didn't have the necessary background in emergency communications to determine exactly what would have to be posted and what wouldn't. Also, there were confidentiality concerns. Some of the material we hold, such as locations of emergency radios or phone numbers for members, is clearly not intended for public distribution. Finally, coordination through the EC gave the site official endorsement within our organization.

Thus, by necessity, the management of the site imposed an additional layer of organization on our training materials and other resources. This organization had an immediate impact on all members: those with Internet access found an additional source of information, and those without photocopied the informa-

tion from those who did. We found ourselves provided with a press in miniature, publishing information fairly quickly to *all* members.

The site is also a focus for some recruiting. We've had two potential members contact us after moving to our area based on seeing our Web site. It would appear, however, that it's best used in conjunction with recruiting via other avenues, such as club meetings and word of mouth in the community.

What Goes on an ARES Site?

Over time, it became obvious what content we should post to the Web site. Whenever possible, *meeting agendas* are posted, along with any materials handed out during the meetings. While we do not keep formal minutes of meetings, our training materials usually capture any recent policy decisions, and those are posted to the site.

A *calendar* of both past activities (meetings, events, and activations) and planned future activities is available (Figure 2). Whenever possible, this is linked to EC reports about incidents which have occurred. The calendar is updated at least monthly and provides members with a look at both past and future activities. Links from the calendar allow interested readers to send e-mail directly to specific event coordinators, allowing volunteers to register easily for scheduled public service events.

Organization is an important part of the site, both behind the scenes and for readers. The main page contains a detailed list of ARES-related links, and some real-time data obtained from the National Weather Service (NWS) and United States Geodetic Survey (USGS) regarding weather and earthquake conditions in our area (remember, we're in California; see Figure 3). The page also contains a short news section, where we post timely information or details about recent updates to the site.

In addition to the list on the main page, we provide a "What's New" page with a detailed list of changes, sorted by date. The site also provides e-mail updates to interested parties—through a free service, URL-Minder (see "Resources")—when the site's content changes.

A more recent addition to the site has been the establishment of a *mailing list reflector*, so that members are able to contact all other members with e-mail. This is used for meeting announcements, notification of major changes to the site, and similar information. Between e-mail and packet, we're able to reach over 90% of our members, significantly more than can easily be contacted over the radio or telephone in the amount of time it takes to send a bulletin electronically.

Lessons Learned

Less than a week after the initial endorsement by our organization, my fears regarding the reliability of our site were realized. We suffered eight hours of downtime due to a power failure; over the next few days, I was deluged with messages letting me know that the URL provided wasn't correct, that the site was down, and so on. While the idea of adding a UPS (uninterruptible power supply) to the system was discussed, it was rejected due to cost restraints and a reiteration of the site's basic purpose: to provide a communications pathway for the organization *during periods of normal activities*.

An attempt was made at a message board, but it had little success. The notion was to provide an area for users to post discussions, donations or solicitations for equipment, etc. With the exception of a few "nice work" messages, little has been posted in this area. The results are actually quite similar to the activity seen on the local packet bulletin board system (PBBS), only with fewer messages.

Upkeep is a necessary evil. I find that I spend about four hours every two to three weeks adding content to the site. This involves minor editing, conversion to HTML (Hyper Text Markup Language, the "language" of Web documents), and subsequent editing to maintain look and feel, and finally, posting and cross-linking content to the site. In many cases, the messages also need to be put out on packet and e-mail, requiring two separate processes for publication to members.

Synchronization between the mailing reflector and group roster has been a process of trial and error, taking more time than one would have hoped. Our records are generally kept in a spreadsheet program, but the mailing reflector software wants to see a list of addresses as a text file on a UNIX system. After some initial mistakes, we've come to the conclusion that the best way to do things is to export the spreadsheet file to a text file, and then manually strip out non-

Keeping Current—Automatically

Pages on the Web used to be just that—unchanging documents given out to any browser that wanted to see the page. That's changed over the last few years, though, with the introduction of *server side includes*. A *server side include* is simply a directive for the Web server to run a program and insert the results in a Web page. This allows Web pages to be built using templates of pre-written documentation filled with dynamic (variable) data determined *as the page is being browsed*.

A program called *scheduled*, by Greg Anderson, takes advantage of these pages to let Web authors "schedule" data for presentation within a Web page. We use it to automatically update the "Current Events" section of our Web site. As the SLVARES page is loaded from the disk by the Web server application, it encounters a special instruction (the *server side include*) to launch the *scheduled* program. The server launches *scheduled*, which looks at a different file, the one containing our calendar. The *scheduled* program runs through all events on our calendar, and picks out the next event after the current date and returns that to the Web server. The Web server then inserts this information back into the page and sends the finished page off to the viewer for display.

Server side includes such as *scheduled* can dramatically reduce the amount of time you spend managing your site, while making it look like you're busily keeping everything up to date.

Some Related Resources

Resources for *server side includes* include:

<http://hoohoo.ncsa.uiuc.edu/docs/tutorials/includes.html>

<http://www.apache.org/docs/mod/mod_include.html>

Resource for *scheduled*:

<http://pobox.com/~greg.anderson/webresources>

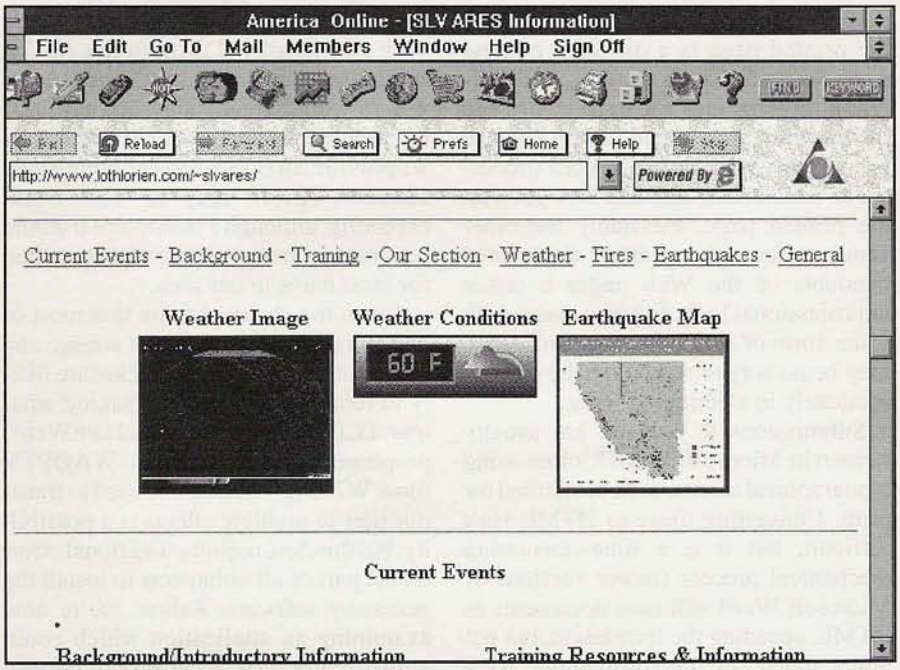


Figure 3. The SLVARES Web site features, among other things, real-time data on weather conditions and recent earthquake activity (they are in California).

e-mail information (phone numbers, call-signs, and so on) to create a list for the reflector software. While this has been automated with scripts, the initial export still takes time, more so than simply editing the e-mail list file itself (which eventually gets out of sync with the roster).

Doing It Yourself

With the advent of good HTML editors (*programs, not people—ed.*) and the proliferation of books about making your own Web site, this medium is available to virtually anyone with a computer and a modem. It's certainly been worthwhile for our organization and is definitely an area in which experimentation can pay big dividends.

So what's needed? First, I'd suggest finding someone in your local ARES organization with the interest and time to devote to the project, and appoint him or her as "Webmaster." Given the workload on an EC or an AEC, it's unlikely that they'll have the necessary time to do their primary job, maintain the Web site, and enjoy doing so. Finding a volunteer to maintain the site and be the Webmaster offloads the work from an existing AEC and can help provide an additional layer of organization.

While experience with the Internet and Web publishing can be helpful, it's not a prerequisite. There are literally hundreds of books about publishing Web sites, and almost any will give you enough information to get started. The Webmaster will need access to a computer and mo-dem with Internet access; additionally, an HTML editor such as Claris Home Page, Microsoft Front Page, or Adobe's Page Mill can be helpful but is certainly not a requirement, as writing HTML can be done with any text editor and a bit of patience.

Rules of Thumb

Work with many Web sites has shown that there are some helpful rules of thumb to follow when constructing a new Web site:

• Keep pages short, no more than a couple of kilobytes each. This may mean that you'll need to break up longer documents into smaller bites. This helps keep a user's viewing experience a quick one, especially for users with slow modems or limited amounts of computer memory.

• Avoid the gratuitous use of multiple fonts, images, and styled text. Your point is clarity, not artistic expression. A white background with black text is easy to read and allows your reader to focus on your content; rainbow bullets, multicolored text, and chaotically spinning images will distract readers.

• Use images sparingly and, if you feel you must use images for links, bullets, and so forth, use the same image everywhere. By using the same image in multiple places, a user's browser usually only has to download the image the first time it's encountered.

• Remember that your document won't appear the same on everyone's computer, and will likely print differently as well. HTML doesn't let authors specify precise page layout operations, meaning that it's impossible to ensure that everyone will see exactly the same thing.

• When in doubt, consult a book on Web design or explore the Web for good examples of clear publishing (see "Resources" for suggestions).

Our organization happens to have a continuous connection to the Internet, but that is by no means a requirement for your group. Many ISPs (Internet Service Providers) offer free Web server space to their customers; or someone you know may have access to benevolent employers or business contacts willing to donate some free space for public service. One good place to look is <http://www.qsl.net>, which gives free space to radio amateurs. The size requirements are usually relatively small—our site occupies significantly less than a megabyte of space.

The Webmaster should be provided with the material to be posted; initially, schedules and training material make good content for an ARES site. Once those are organized and posted, start looking over other information managed by your organization and determine which items are public record—they're the ones to post.

Setting up a mailing reflector may require additional work; you should be prepared to contact your ISP and work with its administration. Many, such as Netcom and others, provide mailing reflector capabilities to all members; others may not, due to the resources they require for administration and services.

Looking to the Future

As useful as our project has been, it's spawned as many new ideas as problems it has solved. This leaves an area ripe for exploration. As the site grows, it would be advantageous to have one authoring environment which generated output optimized for the three communication channels we use: paper, HTML, and text. At present, there's no good way to do this. The issues center around aesthetics and download times. Designing material for the printed page is a different process from designing Web content, with different requirements for page layout and the resulting appearance. While you can print Web pages, or use a word processor to write documents that look good on the printed page, inevitably the other venue suffers, giving either the printed handouts or the Web pages a rather unprofessional look. In some cases, with some sorts of tables or diagrams, there may be no way to reproduce the content accurately in electronic format.

Submissions to our site are usually written in Microsoft Word®, often using typographical conventions best suited for print. Converting these to HTML isn't difficult, but it is a time-consuming mechanical process (newer versions of Microsoft Word will save documents as HTML, speeding the translation, but not doing much for the formatting). As a result, our group is evaluating the use of several Microsoft Word and LaTeX *translators* which translate documents from their native form into HTML. This would allow authors to provide their material in a form best suited to printed publication, while still making it easy to create good-looking pages for posting on the Web site. (*Translators* are separate programs which take a document and make sophisticated typesetting decisions about how it should look in HTML. Many will create hyperlinked indexes, content tables, and link sections of a document into a Web for posting. LaTeX, a typesetting package by Leslie LaPort for the TeX document formatter, by Donald Knuth, is one of the most sophisticated typesetting packages available...and it's free! Again, see "Resources.")

The Packet (non-) Connection

A significant deficiency for our organization is the separation between the Internet site and packet. We have a fairly robust AX.25 (standard amateur packet) community in our valley and some interest in amateur TCP/IP. At present, we have to prepare two separate images of every document to be published and follow two disparate procedures to post documents to both places. This isn't difficult but, again, it takes time, and what tends to happen is that material makes it to either one site or the other more often than to both. A mechanism which transparently took HTML documents from the Web site, translated them to flat ASCII, and posted them to our local PBBS using AX.25 would greatly simplify our posting process. For many of the documents we provide, an HTTP server running over amateur TCP/IP may be well worth exploring, although I'm not sure it would become a primary method of distribution for most hams in our area.

Given the choice, I think that most of our users will prefer Internet access; and those with access only to packet are likely to remain AX.25 users, making amateur TCP/IP a low priority. HamWeb*, proposed by John Hansen, WAØPTV (now W2FS), which can be used to transmit files to multiple clients is a possibility, but this, too, requires additional effort on the part of all volunteers to install the necessary software. Rather, we're now examining an application which could transparently serve local HTML content to packet users via a PBBS interface, providing access to packet-bound users. The interface has been prototyped and a number of initial details discussed, but there are still many things to consider before it becomes a reality.

More Automation

Automation in other areas would be nice, too. We've recently been able to automate the updating process for our "Current Events" page (see "Keeping Current—Automatically"), but there's more we can do. We still need to manually update the "What's New" page after every posting, although it should be possible to use a simple program to create the page automatically from a list of comments. Many of the other pages are linked together with simple table-of-contents pages; and, as pages are updated, these index pages need to be updated as well. A generic tool which would allow a Webmaster to create a directory with files and automatically generate a table of contents and provide all pages with simple next and back buttons would make posting information much easier. Tools to do this probably exist, although to date I haven't looked very hard for them.

Of course, there are many other things that could be kept on a group's Web site. For groups that keep regular minutes of their meetings, those minutes should be

*"HamWeb: Rethinking Packet Radio," John Hansen, WAØPTV, 16th ARRL and TAPR Digital Communications Conference, 1997.

posted. Logs of activities may also be of interest, especially for larger activities. In addition, you can create password-protected sites, allowing you to post confidential information while restricting access to authorized users. Depending on the amount of space and effort available, it may be interesting to experiment with the possibility of posting audio clips of events, or coupling a site with a repeater audio link. And, of course, as more and more organizations use the Web to offer their data, cross-linking between regional ARES groups becomes possible, letting multiple organizations share schedules and training materials.

Conclusion

The Internet provides a low cost, one-to-many medium which is an ideal repository for the kinds of information most ARES organizations manage during their daily activities. While not suited to emergency communications, a Web site can be a valuable asset for your ARES organization. Not only are there immediate benefits to the organization at large, but there are opportunities for experimentation as well. Coupling the Internet with amateur radio can take a wide variety of forms, and the ARES community is bound to benefit from work in this area.

Acknowledgments

A body of work such as our Web site is most definitely not the work of one individual. I'd like to give special thanks to Frank Wyatt, N6FW, our local EC; Frank Adamson, KD6PAL, our AEC for Training when the site was constructed; Rich Hanset, KI6EH, our District EC when the site was originally built; the unfortunately uncited authors of the *Santa Cruz County ARES Blue Book*; and all those who have participated over the last year. Finally, no words can express my gratitude to my wife, Rachel Rischpater, for her support. ■

Resources

URL-Minder is a free service that maintains a list of Web sites and users as well as and e-mails users when a site on their list makes a change in content. Find out more at <http://www.netmind.com/html/url-minder.html>.

For examples of clear Web publishing, we suggest you check out the SLVARES site at <http://www.lothlorien.com/~slvares/>, the *CQ VHF* site at <http://members.aol.com/cqvhf/> (*aren't we modest?—ed.*), the ARRL site at <http://www.arrl.org>, and the following two non-ham sites: <http://www.useit.com/papers/webwriting/> and <http://members.aol.com/Rick1515/index.htm>.

When in doubt, open a search engine such as Yahoo!, pick a random link, and look for things you like.

LaTeX, the free typesetting package described in the text, runs on virtually any computer and produces very nice looking output. For more information, check out <http://www.ctan.org/>.

Adonis: A New Choice for Ham Microphones

You've probably never heard of Adonis microphones...unless you've spent any time hamming in Japan, where the brand is a household name in hamshack accessories.

By Gordon West, WB6NOA*

The microphone line from a company called Adonis may seem brand new in the U.S., but Adonis Electronics Corporation, based in Osaka, Japan, has been around for over 25 years. Adonis is considered the biggest microphone and transmit audio accessory supplier in Japan.

Fancy base station microphones with graphic equalizers and adjustable compression are always sought after by American hams looking to customize their home stations. ICOM no longer produces its SM-10 compressor/graphic equalizer desk mic, nor can you find Kenwood's variable compression MC-85 microphones (except on the used market). Yaesu and Alinco don't offer fancy base station microphones, either, so in Japan, Adonis mics have been very popular accessories.

Adonis microphones and transmit audio accessories are now imported by a Washington state company called RF Limited. This company became the American agent for Diamond Antenna, Japan's number-one amateur radio antenna manufacturer. As the agent for Diamond Antenna, RF Limited made RF Parts Company in San Marcos, California, the exclusive U.S. distributor of Diamond antennas.

"We feel that Adonis products will fill a void that exists in the USA amateur radio market—the imbalance between transceiver technology and accessory microphone technology," comments Eric Lewis, Vice-President of RF Limited.

Photo A. WB6NOA certainly had no shortage of microphones on his shack table when he tested the full line of Adonis desk mics.

"Each year Kenwood, ICOM, Yaesu, and Alinco create better and more high-tech transceivers, while the accessories for these radios do not keep up. With the introduction of Adonis accessories, RF Limited looks to change this imbalance."

"Testing, Testing..."

We wanted to test some of the big fancy base station microphones, so we got four different models, both with and without all of the compression and equalization features you could ever want for a VHF/UHF base station, satellite operation, or even for HF. Each microphone must be ordered with the optional $9.95 manufacturer-specific, pre-wired cable. Depending on how many transceivers you own, you may wish to get several different types of cables to work the mic with any specific set. The company even offers the new Kenwood plastic plugs.

Along with the four microphones we began testing, we brought in about six different specific-manufacturer cables, plus the DC power adapter module. Although each microphone runs for several months on internal AA batteries, the power module allows you to run the microphones off

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

Photo B. Each Adonis mic requires a $9.95 connector cable, prewired for your specific radio. This provides the flexibility to use the mic with several different radios simply by swapping the cables.

of your 12-volt DC supply powering the transceiver. There's no AC power option because this may introduce hum on transmit. Let's start with the most expensive of the four microphones and work our way down in price.

The AM-7500—Top of the Line

This is the top-of-the-line base microphone with three levels of compression and four adjustable levels for transmit modulation equalization. Smooth slide contacts adjust equalization and speech compression is 45 dB high, 30 dB medium, and 10 dB low. Audio level is adjusted with a front-mounted potentiometer. The microphone has a high-sensitivity electret condenser element, and there are 16 transistors, two ICs, and eight diodes to make the microphone sound great over the air.

There are two big buttons to push: one for momentary push-to-talk, and the other for lock. The blinking "on-air" LED (light-emitting diode) switches to constant red when actually transmitting. On key-up, the red LED flashes, reminding you that you still have the microphone power circuit turned on. The 7500 also offers up-and-down buttons for changing frequencies. And to the right of the buttons is an oversized VU meter that also doubles, on turn-on, as an internal battery check.

During testing, the microphone suddenly quit and an audio tone came out somewhere inside the mic. What we discovered was an automatic time-out circuit that first beeps, and then "unlocks" the locked-on mic to receive-only. I think this is a terrific idea because many times some of my cats will accidentally sit on the mic, putting my station on the air without my knowing it. The 7500 does away with this problem. If this feature turns out to be more of a nuisance than a benefit for your specific operating style, the manual includes instructions on how to quickly disable it by cutting a single yellow wire on the inside.

When I tried the graphic equalizer, everyone out there in radioland gave us different opinions on the audio. Some preferred more bass; others wanted more treble; and for satellite DX operation, cutting most of the lows helped me punch through to the satellite. There was no question that the graphic equalizer did a great job tailoring my transmit audio. Everyone liked the sound of the audio, so I judged the Adonis AM-7500 as an exceptional base station mic. Its retail price is $279, plus another $9.95 for the specific-manufacturer pre-wired microphone cable.

The AM-708

This is the little brother to the big 7500, yet it still has some neat features,

such as three-stage speech compression, manual compression level, two types of push-to-talk, up-and-down frequency controls, and the big VU meter. The 708 also has one great feature which I wish the 7500 had: a dual output which allows you to connect two specific-manufacturer microphone cables simultaneously and simply switch between them. The cables just plug into the mic jacks on the back. This is a big improvement over what Kenwood had with its MC-85, which required opening up the bottom and carefully inserting cables into a tiny strip connector. But the Kenwood MC-85 has one advantage: it has three outputs for three different Kenwood radios. With the Adonis AM-708, you have two outputs, but you can mix radios and manufacturers, as long as you have the correct cables. The 708 carries a retail price of $229, and, again, each connecting cable is $9.95.

Model AM-508

This microphone uses an electret condenser mic element with a built-in microphone compressor circuit. The compression switch is located on the under side of the mic for high (45 dB), or low (10 dB) compression. The bottom side also has a two-position mode selector that allows for enhanced highs and lows for FM operation and sharp highs for SSB. I adjusted the switch and didn't hear too much difference, but for the best SSB DX edge, I suggest leaving it in the SSB position.

On the front of the mic are two big push-to-talk buttons, plus up-and-down frequency buttons. There is also a power on and off button with the blinking LED. This mic uses two AA batteries, just like the 708. But keep in mind that the big mic, the 7500, uses four AA batteries.

There is also a screwdriver-adjustable output control, located on the bottom of the mic, to set the levels specifically to your equipment. Again, this mic requires a $9.95 manufacturer-specific rig cable. The AM-508 has a suggested retail price of $129.

Adonis AM-308

This is the lowest priced Adonis desktop microphone, and although it doesn't have voice compression, it does have a built-in amplifier along with the FM and SSB transmit audio selector switch. There is also a screwdriver-adjustable amplifier pot on the bottom of the mic. The top of the AM-308 looks exactly like

Photo C. The Adonis AM-7500 is the company's top-of-the-line desk mic, featuring audio compression, a graphic equalizer, and a multi-function VU meter built into the base.

the top of the 508, with two large PTT buttons, a power button, and up/down buttons for changing frequency. Plus, there is the red LED to let you know you're on the air.

Overall Performance

Everyone commented that these microphones sounded a lot better than my hand mic. Each mic also produced clean transmit/receive switchover with no pops or telltale clunks on the air. This I liked—on-and-off squawks and clunks can sometimes wreck a sensitive amplifier down the line. I also tried each microphone with an antenna system nearby to see if RF would get into the mic circuit itself. No problem, but I always recommend running a base station microphone well away from nearby antennas or your coax feedline.

Plus, as noted earlier, I tried out their 12-volt power adapter to replace the internal batteries, and it worked well. It slips right up in there nicely, so all you see are a pair of wires coming out that need to go to 12 volts DC. Finally, it

Photo D. The Model AM-708 is the "little brother" to the 7500 and doesn't have the built-in equalizer. However, it does have a dual output, letting you hook up to two rigs at once and simply switch between them.

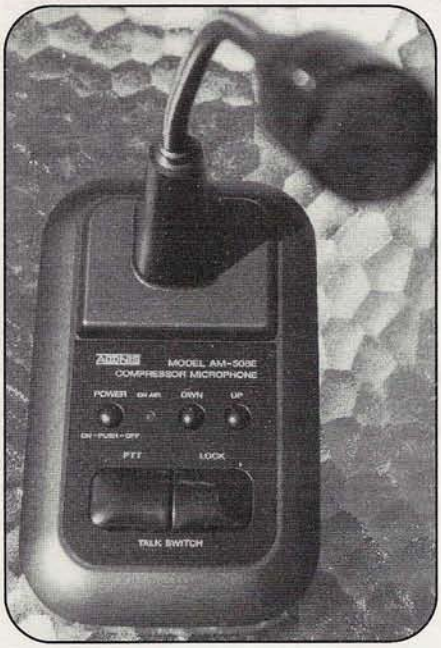


Photo E. The AM-508 loses the meter and the dual output, but still has audio compression and excellent audio. It also costs $100 less than the 708. The even less expensive Model 308 looks just like the 508, but doesn't have the audio compression.

should be noted that Adonis also offers a five-foot-long cabled foot switch for hands-free transmitting.

Just Part of the Product Line

In addition to its line of desk mics, Adonis also offers a variety of mobile microphones, including innovative visor-mounted speaker-mics for hands-free operation, plus a specialized line for motorcycle operation. "For motorcycle mobile, we need a full line of headsets and helmet microphone systems to be distributed here in the USA," comments Motorcycling Amateur Radio Club President Ray Davis, KD6FHN. "I have seen their advertisements in the Japanese magazines, and they have just about everything we need."

Plus, for contesters, Adonis offers the VM-60 digital voice recorder with four different recordings and a total recording time of approximately 60 seconds. The playback can be interrupted at anytime by simply transmitting on the mic (we've been promised a test-drive of this DVR soon). The company also offers a slow-scan television mixer so image and voice signals can be transmitted simultaneously without any video or audio delay. And Adonis also has noise filters for mobile operation, portable HT crossband and repeater boxes, microphone selector switches, and a microphone/packet selector switch for Kenwood 8-pin modulator microphones and transceivers. The full line of products is outlined in the 15-page Adonis USA catalog (see "Resources"). If high-quality audio is important to you, these products certainly deserve a close look. ■

Resources

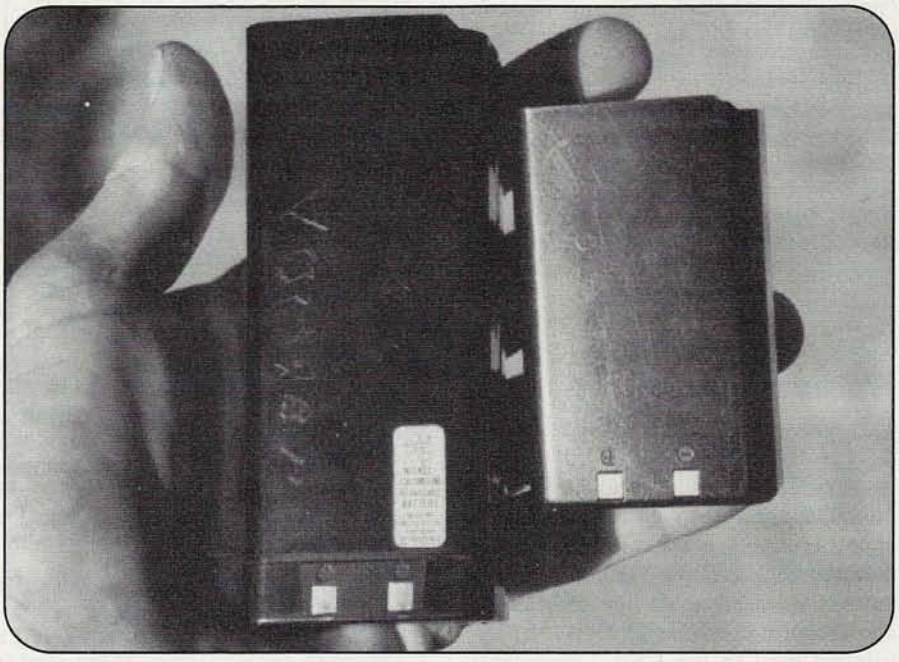
For more information on Adonis microphones and audio accessories, or a 15-page color catalog, contact RF Limited, P.O. Box 1124, Issaquah, WA 98027; Phone: (425) 558-9592; Fax: (425) 558-9704; Internet: <http://www.rflimited.com>.

Are NiMH Batteries Really Better?

Are you thinking of tossing out your NiCd battery packs in favor of those hot new NiMH batteries? Be sure you have all the facts before you toss...

By Ken Collier, KO6UX*
(ko6ux@adi-radio.com)

The relatively recent introduction of new battery chemistries, especially the nickel metal hydride (NiMH), has seriously challenged the supremacy of the nickel cadmium (NiCd) power cell as "the King of Batteries." But, while the newer NiMH batteries offer some real advantages, like higher capacity and lower weight (see Photo A), they also have their shortcomings. Plus, there are still some advantages to using NiCds. There may still be a few good reasons to not throw away all of your old NiCds, at least not yet.



There's a lot to be said for using nickel metal hydride (NiMH) batteries—the small NiMH on the right offers the same performance as the much larger nickel cadmium (NiCd) pack on the left—but there are also some shortcomings you should know about before making a purchase. (WB6NOA photos)

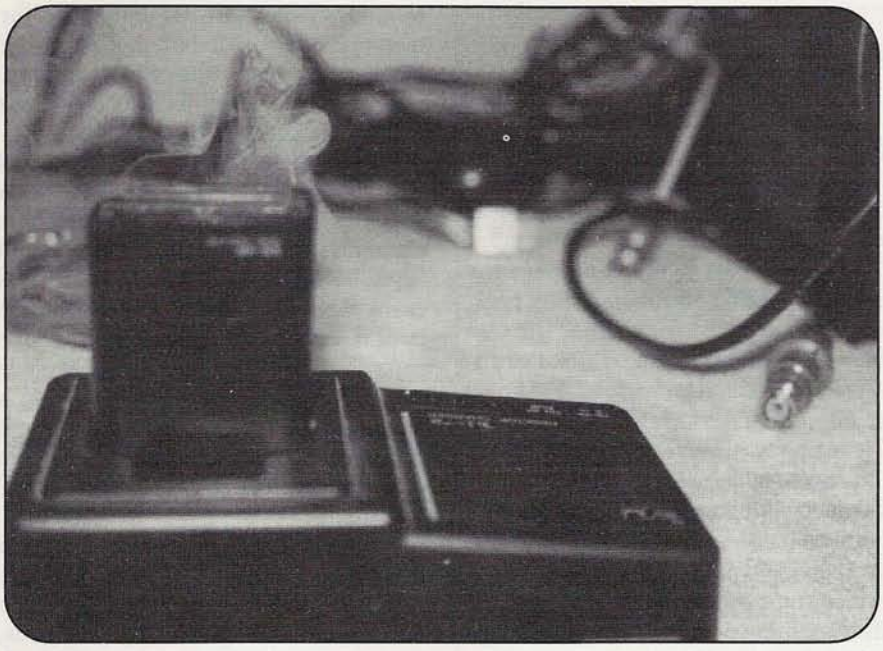
Charging Issues

Probably one of the biggest advantages that NiCds have over NiMHs is the relative ease with which a NiCd can be charged. This is one of the main reasons that a surprisingly high percentage of commercial radio manufacturers and users are continuing to use the venerable NiCd, even while many hams are switching to the newer NiMH packs.

Unlike NiCds, which stay relatively cool even when a high amount of charging current is being applied, NiMH batteries get hot when quick-charged...dangerously hot in some cases. They've sometimes been known to melt down or even burst into flames if overcharged (see Photo B). Due to the potential for disaster, one popular manufacturer of amateur handheld radios, Yaesu USA, voids the warranty on any of their battery chargers that have been used to charge an NiMH battery pack.

This potential for overheating has caused most manufacturers of NiMH batteries to recommend against fast-charging them. Instead, they suggest that you always trickle charge them, a process that can take 10 to 12 hours or more. The manufacturers warn that if, you must fast-charge an NiMH battery pack, you should use only an expensive "smart" charger with either a voltage-detecting or a heat-detecting cutoff circuit, or both. This type of charger (Photo C) is microprocessor driven, and constantly monitors the battery to determine if it has reached full charge and/or begun to get dangerously

*Ken Collier, KO6UX, is the Assistant Marketing Director for ADI/PREMIER Communications Corp. and the trustee of PREMIER's club station W6ADI. His on-the-air pursuits include ragchewing on FM repeaters and chasing DX on 10-meter SSB and FM.



Can you see the smoke rising from the battery pack? Overheating, possibly leading to meltdowns and fires, can be a major problem if an NiMH battery pack is fast-charged in a "standard" NiCd desk charger. Microprocessor-controlled "smart" chargers are safer but considerably more expensive.

hot. When either of those two things take place, the charger shuts down.

These types of chargers are excellent, and often have other features not normally found in less expensive chargers (such as the ability to discharge a battery pack), but they tend to cost 50 to 100% more than a standard fast-charger. As always, value is a key factor. "We can't expect our users to spend 20-35% more on a battery pack only to have to buy a more expensive desk charger in order to use it," commented a local land mobile radio salesperson I interviewed while preparing this article.

Life Span: The Value Equation

These days, value is as important to hams as commercial users. Most hams are pretty budget-conscious, and everyone loves to get a good deal. That's one of the things that has made the NiMH battery so appealing. For roughly 25 to 35% more money, you can get a battery pack for your handheld that offers 150% the capacity (time between charges) of the original stock NiCd pack.

However, these numbers can be somewhat deceiving. Rather than looking at the cost of buying a pack, it's more accurate to compare the actual cost per charge for each over the lifetime of the battery. This varies greatly because each different type of battery pack has a different projected "life span." One can expect each type of battery to be recharged a different number of times before reaching the end of its lifetime and having to be replaced.

In this category, the NiCd wins hands down. A typical NiCd can be expected to survive approximately 750 to 1,000 charges before its capacity is reduced below 80% and it essentially becomes unusable. For a similar NiMH battery pack, that number is perhaps only 500 to 600 charges. NiCd packs are hardier—they just "live" longer.

The greater life span of the NiCd is also one of the reasons that these packs appeal to commercial radio users. In some applications, like security, where a handheld radio is in use 24 hours a day (or in ham radio public service work), it's necessary to cycle batteries—charging one pack while using another. Usually, each battery gets charged two or three times per day (or 600 to 900 times per year). Under this kind of heavy use, many users have found that NiMH batteries consistently fail and have to be replaced before they're even a year old. The warranty periods hadn't even expired!

Also, it's important to note that the more slowly a battery is charged, the more its life span can be extended. Batteries that are trickle-charged consistently "outlive" those that are constantly fast-charged. This is because the heat produced by fast-charging actually boils away some of the battery's electrolyte, thereby reducing its capacity.

Both NiCds and NiMH packs suffer from this problem. A NiCd that's always fast-charged might only be expected to survive 650 to 700 charges. For an NiMH, this number might be 400 or so. With this

Here are two examples, from Maha (left) and Periphex (right), of "smart" chargers which allow you to safely fast-charge NiMH battery packs. But their higher cost must be included in your overall cost calculation of whether it's more economical for you to stick with NiCds or switch to NiMHs.

Batteries by the Hour

One of the job requirements of an editor is to be a born skeptic. And in reading Ken's calculations about determining the overall cost of batteries on the basis of cost-per-charge, it occurred to me that a battery with a 50% greater operating capacity between charges wouldn't need to be charged as often, so a straight cost-per-charge analysis wouldn't be totally accurate.

So I ran my own figures—based on the same basic data ($50 initial cost for a NiCd pack, with a "life" of 750 to 1,000 charges, and $62.50 for an NiMH pack, with a "life" of 500 to 600 charges), and added in a typical "per charge" life of 3 hours' operating time for a NiCd and 4.5 hours (50% more) for an NiMH. I calculated the average life span of such a NiCd pack to be 2,625 hours, versus 2,475 hours for the NiMH pack. Translation #1: You're paying 25% more to get 6% fewer hours. Translation #2: Applying those figures to calculate an average "lifetime cost per hour" to use each battery pack, it costs 1.9 cents/hour to use a NiCd versus 2.5 cents/hour for an NiMH. It may not seem like much until you remember that you're talking about using them each for roughly 2,500 hours! Percentagewise, it will cost you 33% more to use this typical NiMH pack than the typical NiCd pack.

Finally, I did one more run of numbers, since some NiMH proponents claim a 100% performance improvement over NiCds. Assuming 6 hours' usage per charge for the NiMH versus 3 hours for the NiCd, you come out with a much longer average life (3,300 hours versus 2,625). But, because of the higher initial cost of the NiMH pack and the lower number of charges it'll "live" through, the average lifetime cost per hour for the 100%-better NiMH comes out dead even with the NiCd: 1.9 cents/hour. And that doesn't include the higher cost of the "smart charger."

Does this mean you shouldn't buy NiMH batteries? Absolutely not. All it means is that you should have all the facts in hand before deciding which type of battery to buy, then get the one that best matches your operating style and budget.

—W2VU

in mind, you might want to think twice before fast-charging any battery, or before recharging it unless it's absolutely needed. Both practices contribute to the early demise of the pack.

Doin' the Math

Keeping all of this in mind, let's assume for a moment that you purchased two completely identical battery packs, one NiCd and one NiMH. Suppose the NiCd pack cost (for the sake of simplicity) $50 and the NiMH was purchased for a very reasonable 25% more, or $62.50.

If the NiCd pack became unusable after (worst case) 750 charges, it would have cost you 6.7 cents per charge ($50/750 = $0.067). If the NiMH lasts 600 charges (best case), it would have cost 10.4 cents per charge ($62.5/600 = $0.104). This means that over the course of its life, the NiMH cost you about 55% more.

All of this assumes the absolute best possible life span for the NiMH and the worst possible for the NiCd. If the NiCd were to last the more typical 1,000 charges and the NiMH only 500 charges, then you'd be paying 5 cents per charge for the NiCd and about 12.5 cents for the NiMH, and the price difference would be about 250%! Over the course the battery's life, you'd be paying about two and one-half times more to use the NiMH, a battery that offers only 50% more capacity than the NiCd. Based on these figures, the NiCd clearly offers the better value. Its extended life span means that it will cost much less money over the long run. (*Skeptic that I am, I ran off a different set of numbers and came up with a similar conclusion. See "Batteries by the Hour"—ed.*)

Don't Forget "Memory"

In recent years, NiCd packs have earned a bad reputation for developing a condition known as "memory," which causes decreased capacity in the packs. Batteries suffering from memory essentially "remember" how much discharge was required of them during previous use cycles, and their capacity is reduced so that only a similar level of output can be delivered. In truth, advances in NiCd technology have all but eliminated the memory effect. Modern NiCds suffer from little or no effects of *true* memory.

However, the term "memory" has come to be associated with another phenomenon that plagues both NiCd and NiMH packs: crystal formation. In a "healthy" battery pack, the electrolytic chemicals are composed of very small crystals, through which electrons can easily flow. As a battery pack ages, these crystals can increase in size, lowering the capacity of the battery. These crystals can be easily broken up by applying a deep discharge to the battery, bringing it down to about 1 volt per cell. This process is commonly called "exercising" the battery.

The process of crystalline formation affects both NiCds and NiMH packs. Although some folks have billed the NiMHs as "maintenance-free" batteries, they, too, need to be exercised, although not as often as a NiCd. On average, a NiCd needs to be exercised about once a month in order to prevent loss of capacity due to crystallization of its electrolyte. NiMHs need this type of service only once every three months or so.

But regardless of which type of power pack you use, the basic message is the same: If you want the pack to last as long as possible, and not fail you when you need it, you do still have to exert some effort to care for the battery. As the old adage goes, take care of it and it will take care of you.

Conclusions

For some applications, newer battery types like the NiMH offer a great way to extend operating time between charges. However, this additional capacity comes at a price: NiMHs can be difficult to recharge safely, and they are much more expensive than NiCd packs over the long run. Plus, the claim that NiMH batteries are easier to maintain than NiCds has been greatly exaggerated.

The NiCd battery pack, though it requires careful monitoring and good recharging habits, still packs the best punch for the price. NiCds also remain the safest, easiest type of battery to quick-charge, making them the natural choice for "heavy use" situations where cycling of batteries is necessary. So, in spite of the fact that NiMH batteries offer some additional capacity and features, there definitely are some good reasons to continue to use NiCd battery packs. ■

CQ VHF Ham Radio Above 50 MHz

Reader Survey—December, 1998

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

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

And, as a bit of an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to CQ VHF. *This month, we'd like to ask about your non-radio hobbies in which ham radio might play a role.*

	Circle Reader Service #
1. Do you participate in any non-radio hobby/hobbies in which ham radio could play a role?	
Yes	1
No	2
2. If you answered "yes," please indicate whether this hobby is one of the following (circle all that apply):	
Amateur astronomy	3
Amateur radio astronomy	4
Bicycling	5
Boating	6
Camping	7
Chess	8
Computer experimentation	9
Flying (private pilot)	10
Hang-gliding/parasailing	11
Hiking	12
Hunting	13
Motorcycling	14
R/C (radio control) modeling	15
RVing	16
Other	17
3. Do you use/have you used ham radio in connection with one or more of these hobbies?	
Yes	18
No	19
No, but may in the future	20
4. Do you think ham radio's usefulness in "ancillary activities" (e.g., non-radio hobbies) is adequately promoted?	
Yes	21
No	22
Don't know	23
5. Do you know of anyone involved with your non-radio hobby/ hobbies who has become a ham on the basis of its usefulness in the other activity(ies)?	
Yes—me	24
Yes—someone else	25
No	26
Don't know	27

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

What You Told Us

Our September survey asked about *us* instead of about *you*, and it appears from the responses that we're giving you what you're looking for in a VHF ham magazine. Plus, most of you use the magazine to help broaden your horizons. When we asked what topics you read about regularly, 13% of you said you read only articles about your area(s) of interest; 6% read only articles about topics or activities that are new to you; and the vast majority (81%) read a mix of both types of articles.

As to which segments of the magazine you generally read, 89% read the feature articles, 84% read the monthly columns; 79% read news, opinion, letters, and product reports; 77% read the "Basics" section; and 73% regularly read the ads.

Nearly three-quarters of you (73%) are subscribers. Of that group, two-thirds (67%) say they're definitely planning to renew their subscription when it expires; 23% say probably and 10% are undecided. Virtually no one said "no" or "probably not." Among the 27% of you who bought the issue on the newsstand, 34% are regular readers who said the one factor that most influenced your buying decision was that you enjoyed previous issues; 22% said it was the topic—Ham Radio Above 50 MHz; 5% bought the issue because of a specific article; 3% were persuaded by the information on the cover; and the biggest single group (36%) said they were influenced by combination of these factors.

This month's winner of a free one-year subscription is John Gardner of Pompano Beach, FL. As always, thank you for your responses; and thank you especially for your continued votes of confidence. Happy holidays!

The Magic of Radio Wave Propagation—Part 2

We continue our propagation primer with a close-up look at the ionosphere and at VHF/UHF propagation modes.

By Lew Ozimek, N2OZ*
(lozimekn2oz@erols.com)

Part 1 reviewed the discoveries that led to our current understanding of the "science" of radio wave propagation. It defined the concept of critical frequency and the way the atmosphere affects radio waves via refraction, diffraction, reflection, and scattering. The four layers which make up the atmosphere were defined and their general role in radio wave movement was introduced. In Part 2, we'll cover the specific propagation characteristics of the ionosphere, with special emphasis on VHF/UHF signals and some of the special communication modes applicable on these higher frequency bands.

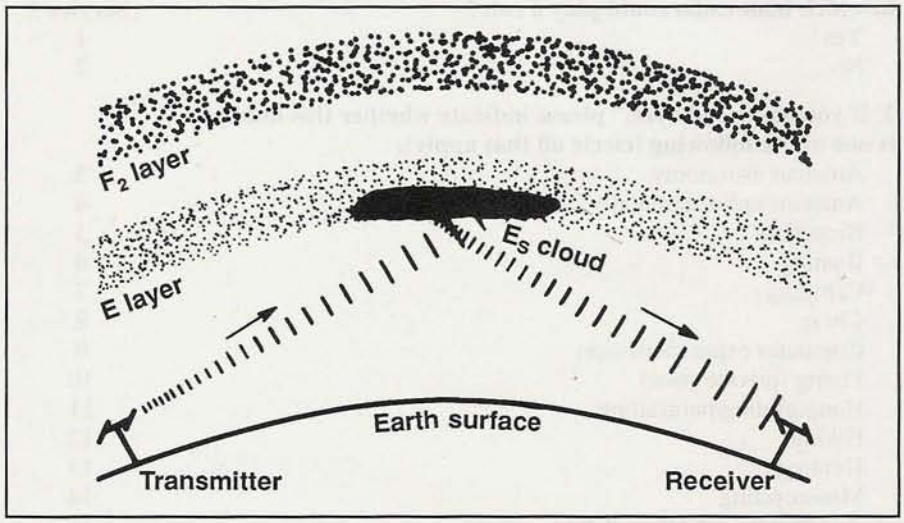


*Figure 1. Sporadic-*E*, or* E_s*, reflections occurs when a VHF signal which would normally travel on a straight line through the* E *and* F_2 *layers of the ionosphere hit a highly ionized* E_s *"cloud," which reflects the signal back to Earth. These clouds may move around, and generally last no more than a few hours.*

The four atmospheric regions which control all radio signals traveling via skywave are the *D*, *E*, F_1, and F_2 layers of the ionosphere (see Part 1 for basic definitions). *D* and F_1 are normally of limited value in *reflecting* or *refracting* radio waves; they usually only absorb signals, except as described below. *E* and F_2 are the true heavyweights in the communication arena, accounting for the bulk of long-range contacts, especially in the HF (high frequency) range. But as most of us know, whenever a rule exists, it's quite common to find exceptions. Such exceptions in radio propagation, however, can open exciting possibilities for VHF/UHF fans.

The D Layer—An RF Sponge

The *D* layer becomes ionized during daylight hours and acts as a giant sponge, absorbing radio energy. The extent of absorption is directly related to the intensity of ionization. Under typical daylight conditions the *D* layer is capable of severely curtailing effective transmission of signals at 1.8 MHz (160 meters) and 3.5 MHz (80 meters). As the frequency increases into and above the 40-meter band, it becomes easier for radio waves to pass through the *D* layer, despite the extent of its ionization. But as long as the *D* layer is ionized, some absorption takes place and the signal strength is attenuated.

At night, the *D* layer ionization drops dramatically, permitting lower frequency signals to pass through to the *E* and *F* layers. When *D* ionization drops sufficiently, the *MUF* (*maximum usable frequency*, see Part 1) will usually rise to a point high enough to achieve good long-distance performance on the 1.8- and 3.5-MHz bands. The ability of 7- and 10-MHz signals to travel long distances also improves because of the reduced absorption in the *D* layer, permitting low-angle waves to reach the *F* layer. This change in the *D* layer at night sometimes permits AM broadcast signals to be received over very long distances.

Lew Ozimek, N2OZ, is retired from the aerospace electronics industry. He's been a ham since 1961 and holds an Extra class license. He teaches licensing classes and is a Volunteer Examiner. Behind the scenes, Lew is responsible for each year's index of articles in CQ *and* CQ VHF *magazines.*

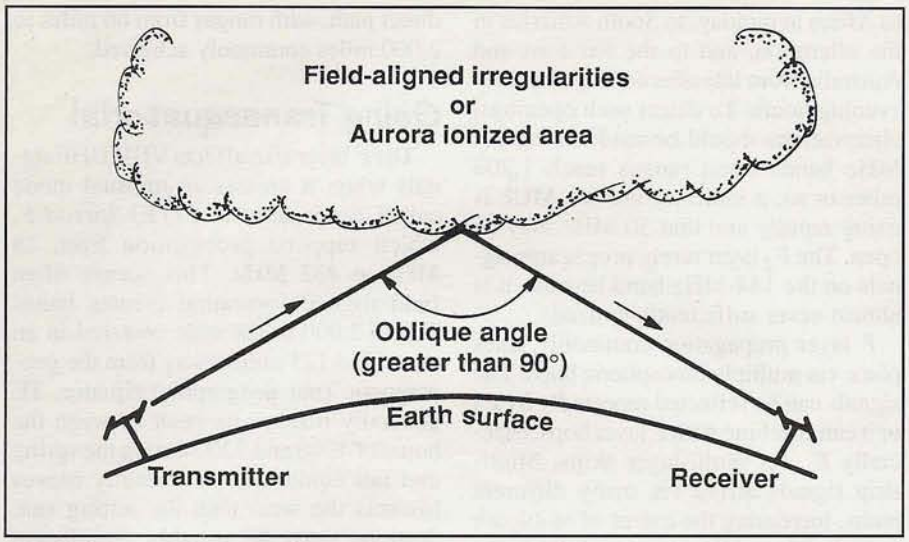


Figure 2. Example of an oblique path between two stations. The refracting medium (in this case, a field-aligned or aurora-ionized area; see text) bends the signal at an oblique angle, that is, greater than 90 degrees. The larger the angle, the greater the distance between the two stations.

The makeup of the *D* layer can be characterized as having *irregularities* which are important to VHF/UHF. These special conditions may permit propagation of radio signals in the 25- to 225-MHz range by *scattering*. Such propagation, called *ionospheric forward scatter*, includes high losses which result in weak, fluttery signals. *Ionospheric forward scatter* is best when the sun is highest (1000 to 1400 local time) and worst at night. Maximum path length is approximately 1,200 miles with signals near the noise level, mandating the use of a sensitive receiver, a good antenna such as a three-element Yagi (as a minimum), and several hundred watts of power. CW is the best mode, but SSB is possible.

"Skipping" to E

Like the *D* layer, the *E* layer essentially exists only in the daytime. But unlike *D*, it has a critical frequency of about 3.5 MHz, and it provides useful *diffraction* of signals between 5 and 20 MHz to allow ranges of up to 1,400 miles. However, the extent of *absorption* by the *D* layer dictates what ranges can be achieved by *E* diffraction (lower radiation angles mean longer time of passage through the *D* layer with more absorption of energy). High-angle signals pass through the *D* layer quickly and lose less energy, but since the high angles of penetration result in lower angles of reflection, the effective *E* layer skip is limited to about 750 miles. Nonetheless, the *E* layer is a major player in VHF/UHF propagation, producing several important propagation modes.

Sporadic-E, or E_s, reflections occur because of unusually dense patches or *clouds* of ionization which develop in the *E* layer (see Figure 1). These clouds normally form quickly, move about suddenly, and last for only a few hours. When they're present, they can produce long-range communication at frequencies up through 144 MHz (with at least one confirmed opening on 222 MHz).

Sporadic-*E* occurs most commonly in the northern hemisphere during May, June, and July, with a lesser season occurring in late December and early January. Openings usually develop between 0900 and 1200 and 1700 and 2000 local time, but there are plenty of exceptions during peak periods. The exact causes of E_s are not yet fully understood. It is independent of the solar cycle, though, so the ionization involved must come from other factors, such as wind shear or meteoric metal ions.

Since E_s is short-lived, the operator must be alert to detect it. When the skip on 28 MHz (10 meters) drops to about 250 to 300 miles, it's an indication that the MUF probably has reached 50 MHz (6 meters) for low-angle radiation, an alert that the 6-meter band is most likely wide open (*monitoring 6-meter beacons is also a good indicator of band openings—ed.*). Then, when the skip on 6 meters drops to about 400 miles, the MUF probably has reached 144 MHz (2 meters), permitting long-range contacts there. When these conditions occur, following E_s up the ladder can be fun. One interesting aspect of E_s is that reflections from the F_2 layer are sometimes reflected up by E_s to be re-reflected down by F_2 to achieve even greater ranges.

Another special form of *E* propagation is *E*-layer *FAI (field-aligned irregularities)*. Sometimes after an E_s event, electrons associated with that event become aligned vertically along magnetic field lines. When this occurs, long-range contacts may be made on 50 and 144 MHz because of "oblique" scattering. The oblique effect occurs when radio waves strike the field-aligned electrons and are reflected obliquely (at an angle greater than 90 degrees). The greater the angle of reflection, the greater the range covered. This effect is depicted in Figure 2.

The best time for this to occur is between the hours of 2000 and 2400. FAI signals are weak and fluttery, like those associated with *aurora*, or *Au* (described later). The best way to be successful is by pointing the antenna at an area that represents a recent E_s reflection point. One hundred watts and a single Yagi can be effective. Contacts have been made in this way on 50 and 144 MHz and are also possible on 222 MHz. Sometimes, FAI appears on 2 meters even if the E_s opening involved only produced long-range contacts on 6 meters.

Meteor Scatter

Meteor Scatter or M_s is another special mode for VHF/UHF. The Earth's atmosphere is bombarded every day by billions of meteors. Don't get concerned that the sky's falling; we're not talking about chunks of space debris the size of the ones that created Meteor Crater in Arizona many years ago or that destroyed the forest area of Siberia in 1908. The meteors we're talking about are tiny specks the size of dust particles or grains of sand that burn up as they enter the atmosphere. At night, these "shooting stars" can be seen during a burning period which lasts anywhere from one second to a minute or so.

An ionized trail 5 to ten miles long follows and exists as long as the burn lasts. These ionized "tails" are capable of refracting VHF signals at frequencies up to 440 MHz. The best reflections occur if the meteor is broadside to the transmitted wave, and the most effective frequencies are usually under 100 MHz

because reflected signal strength drops sharply when the frequency exceeds 100 MHz. The short duration of the ionized stream makes contacts fleeting at best, often necessitating prearranged schedules in order to be successful. Although meteors fall at all times, there are five major annual meteor showers which provide good opportunities for contacts—along with the best chances for random (non-scheduled) contacts (see Table 1). For more details on the phenomenon, see References 2 and 3.

Aiming for an "F"

F layer propagation, which was introduced in Part 1, is the most important factor in the ability of the atmosphere to affect communications. The *F* layer consists of two major elements: F_1 and F_2

The F_1 layer exists only during daylight hours. Signals below 10 MHz (30 meters) rarely reach the F_1 layer because they are *absorbed* by the *D* layer or refracted by the *E* layer. Signals above 20 MHz (15 meters and up) usually pass through the F_1 layer without much difficulty and go on to the F_2 layer. The refraction which sometimes takes place in F_1 during the summer in the 10- to 20-MHz range cannot be distinguished from F_2 refraction.

The F_2 layer persists during the day as a distinct layer, but at night it absorbs the F_1 layer to make a single larger layer. F_2 ionization varies considerably at different times of the day, different seasons, and different points in the sunspot cycle, but it's never completely absent. As the ultraviolet radiation from the sun increases, the MUF of F_2 likewise increases. It builds rapidly starting at sunrise, reaches its peak in early afternoon, and decreases quickly to sunset. *It is the most important factor for long-distance HF communications*. In contrast to other layers, daytime ionization of F_2 is four times greater in the winter than in the summer. This occurrence makes the winter MUF superior to the summer.

Regular F_2 layer openings generally occur at frequencies up to about 30 MHz, but openings are possible on 50 MHz, or even higher, during peak years of each sunspot cycle. Such openings peak during the winter in the direction of the Far East and Europe. For the balance of the year, contacts will mainly be to Africa, South America, and the Australasia region. They are generally daytime events with openings to Europe in the morning, to Africa at midday, to South America in the afternoon, and to the Far East and Australia from late afternoon to the early evening hours. To detect such openings, observations should be made in the 28-MHz band; when ranges reach 1,200 miles or so, it indicates that the MUF is rising rapidly and that 50 MHz may be open. The F_2 layer rarely propagates signals on the 144-MHz band because it is almost never sufficiently ionized.

F layer propagation commonly takes place via multiple ionospheric hops. The signals can be reflected repeatedly by F_2 or it can combine with *E* layer hops, especially E_s, for multi-layer skips. Multiskip signals arrive via many different paths, increasing the extent of *multipath* fading. Most HF contacts follow the shortest *great-circle* path between stations. But sometimes, the opposite route can be employed to provide stronger signals with less fading. This is called *long-path propagation.*

A special form of long-path propagation is *gray line*. At the end of a day, the *D* and *E* layers quickly disappear whereas the *F*-layer MUF declines more slowly. This establishes a special condition which permits contacts on lower frequencies (such as 1.8 and 3.5 MHz) during the period of time between the disappearance of *D/E* layers and the complete decline of *F*. This condition can last for 30 minutes to an hour during sunset, with an equivalent condition occurring at sunrise.

F layers can also scatter signals within the skip zone, producing contacts not possible in any other manner. Such signals are seen just above the MUF for the direct path, with ranges from 60 miles to 2,000 miles commonly achieved.

Going Transequatorial

The *F* layer also affects VHF/UHF signals when it creates an unusual mode called *Transequatorial (TE) Spread F*, which supports propagation from 28 MHz to 432 MHz. This occurs when field-aligned ionization creates bands 300 to 2,000 miles wide centered in an area 65 to 125 miles away from the geomagnetic (*not* geographic) equator. TE generally reaches its peak between the hours of 1700 and 2200 during the spring and fall equinoxes. It normally moves towards the west with the setting sun. Stations must be roughly equidistant from the magnetic equator to make contact, and both high power and large antennas are normally required. It's possible to reach ranges of 5,000 miles in this mode.

Non-Ionospheric Propagation

Tropospheric Propagation

The *troposphere* also provides unique VHF/UHF communication propagation modes. The troposphere was defined earlier as the region which extends from seven to 10 miles above the Earth's surface. The layer has very little impact below 30 MHz (10 meters), but it's very important at frequencies above 50 MHz. *Tropospheric propagation*, or *tropo*, results from weather conditions only and is not affected by solar conditions or geomagnetic activity. The specific tropos-

Table 1

Name	Peak Dates	Meteors/Hour (approx.)
Quadrantids	Jan. 3–4	50
Arietids	June 7–8	60
Perseids	Aug. 11–13	75
Orionids	Oct. 20–21	20
Leonids	Nov. 17–18	25*
Geminids	Dec. 11–13	60

*The Leonids are not included on most lists of major showers, but a "meteor storm" is expected from this shower for 1998 and/or 1999.

Table 1. Major annual meteor showers by dates of peak activity and intensity.

Table 2

Propagation Mode	N.A. Distance Record (miles)	
	144 MHz	222 MHz
Aurora (Au)	1347	1298
Meteor Scatter (MS)	1960	1274
Transequatorial (TE)	3933	3670
Tropo (Continental)	1687	1275
Tropo (Pacific)	2574	2574

Table 2. Range performance comparison between 144 MHz (2 meters) and 222 MHz (1.25 meters), using North American distance records for various propagation modes (as of July, 1998). As you can see, 222 MHz provides similar propagation to 2 meters, although generally over somewhat shorter paths. Data courtesy Al Ward, W5LUA.

pheric propagation modes available to VHF/UHF enthusiasts are quite varied and include the following:

Troposcatter—Most VHF-plus communications are line of sight. The line of sight distance to the horizon of an antenna at 100 feet is about 15 miles. But, under average conditions, radio waves are refracted toward Earth, generally making the radio wave horizon 15 to 20% longer than the visual horizon. Tropospheric refraction will increase the radio wave horizon significantly. However, VHF contacts are made every day at ranges of 50 to 300 miles without any obvious propagation help. Contacts of this nature are called troposcatter, which is a form of scattering in the troposphere. It's caused by temperature and humidity changes, by water vapor, by atmospheric turbulence, or by clouds or dust in the area. No special equipment or procedure is required to use troposcatter, but the maximum range increases significantly with increased antenna height.

Raindrops are quite capable of providing a troposcatter condition known as *rain scatter* at frequencies from 1296 MHz to 10 GHz. The drops of water are large enough in relation to the wavelength of the signals at these frequencies to scatter the radio energy, permitting contacts over the horizon even at low power. Rain scatter on the microwave bands can produce contacts as far away as 120 miles.

Tropospheric Refraction—Changes in temperature, atmospheric pressure, and humidity will change the "index of refraction" of air, which controls the extent of refraction of radio waves. Higher levels of refraction increase the range of VHF and UHF signals by up to several hundred miles. The higher the frequency, the more sensitive it is to refraction, thus microwave transmissions may show these effects before they are seen at lower frequencies.

Tropospheric Temperature Inversion Ducting—This is also known more simply as *tropospheric ducting*. In the troposphere, temperatures normally decrease rapidly with altitude. But if a *temperature inversion* condition develops, the temperatures about one to three miles above Earth will be *higher* than the temperatures closer to Earth. This temperature difference creates boundary lines or *ducts* which are capable of guiding VHF/UHF radio waves over relatively long distances.

I remember being on the bridge of a U.S. Navy destroyer in the waters near Cuba and hearing a voice transmission on VHF from a sister ship which was in Virginia at the time. In all probability, this was some form of tropospheric ducting. There's a regular duct that develops each year between Hawaii and the west coast of the continental U.S., allowing VHF and UHF contacts with the simplest equipment—as long as both stations are "in the duct."

Aurora

Aurora displays are quite common in the northern and southern magnetic pole regions. They're a beautiful sight to behold and consist essentially of ionized layers of atoms and molecules of gas. In the northern hemisphere, they develop in an *auroral oval* that can spread across

Alaska, Canada, Greenland, Iceland, Scandinavia, and Russia. They occur at *E*-layer heights and can be quite disruptive to shortwave communication by absorbing signals and creating flutter. In the 6- and 2-meter bands, however, it is quite common to have *aurora reflections* and *aurora*-E openings which provide outstanding long-range communication. *Auroral ionization* is similar to field-aligned ionization, and it will show many of the characteristics of FAI discussed earlier. Au openings can occur during the day or at night and are generally of short duration. Ranges of 1,200 miles can be achieved by these modes. Auroral contacts are possible even from locations where the aurora is not visible, such as the Au contacts made last summer from Georgia and Florida.

The Longest DX

It's possible for two stations which can simultaneously see the moon to communicate with each other by bouncing VHF or UHF signals off the moon's surface. This is called *Earth-Moon-Earth* communication, or *EME*. Because of the distances involved, path losses are extremely high. In addition, the irregular surface of the moon does not provide an efficient reflective surface, further reducing the signal strength available at the receiving station. As a result, high-gain antennas and high power are required to be successful (*although there has been one single-Yagi-to-single-Yagi EME contact on 2 meters—ed.*). Stations which use this mode can be as much as 11,000 miles apart and still be successful. Now *that* is long range communication!

A Band-by-Band Review

Let me step back, if I may, to summarize, band-by-band, the propagation factors which affect VHF and UHF frequencies, including the 10-meter band (which often acts like a VHF band), with an indication of the level of performance which may be achieved.

28–30 MHz (10 meters)—A transitional band between HF and VHF, it's highly dependent upon solar activity and the resultant long distance F_2 propagation. Normally, communication is open from sunrise to just past sunset, but can be open much later in the day during sunspot peaks. Sporadic-*E* is very common during the spring and summer months. This is the lowest frequency at which contacts can be made using *meteor scatter* (*MS*), Au, auroral-*E, and* Transequatorial Spread *F* modes.

50–54 MHz (6 meters)—Using this band, amateurs can operate regularly via tropospheric scatter and achieve ranges of 200 miles or more. During sunspot cycle peaks, long-range DX contacts can be made during daylight via the F_2 layer, where F_2 *back-scatter* and TE are also very effective. Sporadic-*E* is quite common, achieving single-hop ranges up to 1,400 miles during spring and summer. *Multiple-hop* E-*skip* occurs in the summer as well. Other modes which are possible include FAI, Au, and auroral-*E* propagation as well as meteor scatter.

144–148 MHz (2 meters)—This band offers effective *F* layer propagation only in the TE mode. Sporadic-*E*, and multiple-hop sporadic-*E* occur, but rarely. Aurora propagation similar to that which occurs on 6 meters is possible, but with signals which are weaker and more distorted. Meteor scatter contacts on these frequencies are most common during the annual meteor showers. However, 2-meter MS contacts are possible at virtually any time using the *High-Speed CW* (HSCW) techniques outlined in the September, 1998, issue of *CQ VHF* (see Reference 3). Tropospheric propagation in all of its forms is very important at these frequencies with tropospheric ducting being the most effective with ranges of 1,200 miles over land and 2,500 miles over water.

222–225 MHz (125 centimeters)—This has performance characteristics almost the same as the 2-meter band. A comparison of peak performances on both bands is shown in Table 2. Note the similarity in maximum ranges achieved. The best special modes are those related to tropospheric effects.

420–450 MHz (70 centimeters)—This band has demonstrated long-range communication capability for Au, MS, and tropospheric propagation modes, especially tropo ducting.

902–928 MHz (33 centimeters)—This offers long-range contacts primarily under Au and tropospheric modes, along with EME.

1240–1300 MHz (23 centimeters)—This shows long-range capability normally only under tropospheric conditions and EME.

For all of the microwave bands, amateurs have successfully made contacts by relying on *knife-edge diffraction* and rain scatter, and there have been EME contacts on several microwave bands. The most effective modes, however, seem to be those related to tropospheric conditions.

A Grand and Wondrous Thing

By now, I am sure that everyone will agree that the umbrella surrounding the Earth called the atmosphere is a grand and wondrous thing. The special geomagnetic conditions of the atmosphere, the characteristics of radio waves, and the dependence of such waves on sunspot activity for effectiveness, combine to form a complex and confusing set of concepts. However, these must be at least partially understood if we are to try to use them to improve communication during the current increasing solar cycle. Knowing what to look for and what to try is the first step in expanding our horizons, both figuratively and literally.

The review of the various VHF/UHF modes pointed out that the world of such frequencies is a far more challenging communication problem than HF. Perhaps that's why so many people concentrate on these bands and why they achieve so much pleasure from success.

I hope that your interest has been somewhat piqued by this article and that you pursue the unique communication possibilities covered. Your ultimate achievement may be making special types of contacts, using new modes, or, perhaps, reaching distances far beyond anything you may have imagined in the past. Good luck and good DX. ■

References

1. *The New Shortwave Propagation Handbook* by G. Jacobs (W3ASK), TJ Cohen (N4XX), and T Rose (K6GKU), published by CQ Communications Inc.

2. "Incoming—An Introduction to Meteor Scatter" by G. West (WB6NOA) and "CQ Scatter: A Meteor Scatter Operating Primer" by K. Ramirez (KP4KS); both published in *CQ VHF*, August 1996.

3. "Two-Meter DX Anytime—On the Rocks," by J. McMasters (KM5PO), *CQ VHF*, September, 1998.

Q & A

Questions and Answers About Ham Radio Above 50 MHz

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

Q: I noted your fine article re: Mounting Yagis (June, 1998 *CQ VHF*, p. 52). I am in the process of putting up antennas specifically for satellites and trying to decide, after reviewing the maze of possibilities, which antennas would be simple yet effective for satellites such as AO-10, FO-20, and FO-29. With your experience, over the long run, considering maintenance, are antennas with polarity switching worth the trouble or will a fixed CP (circular polarization) work 90% as well?

Also, do you know of references that discuss the polarization that originates from the above three satellites, i.e., do they have circularly polarized antennas on the sats for RX and TX? Any info appreciated. Thanks,

Farrell Winder, W8ZCF
Cincinnati, Ohio

A: WA5VJB replies:

Well over 90% of the time, you can switch polarization and not detect any difference. There can be a difference on some of the low horizon shots, but I probably wouldn't put up a switching system. Yeah, it works better 2 or 3% of the time, but ask the guys how often it's broken! Water in the connectors, relay won't budge, etc. A working system is far better than the perfect system out for maintenance.

Note from W2VU:

To answer the second part of your question, The Radio Amateur's Satellite Handbook *says AO-10 is operating with only an omnidirectional antenna; FO-20 uses a turnstile antenna mounted on the bottom of the spacecraft for 2-meter receive and a canted turnstile antenna on top for 70-centimeter transmit; and FO-29 uses bottom- and top-mounted turnstiles as well. It is noted that the ring-shaped turnstile on the bottom of the satellite (2-meter receive antenna) "produces right-hand circular polarization only in the direction of the top of the spacecraft." I'm not sure exactly what that last part means, but it sounds like it should be meaningful to someone who understands it!*

Q: I've been trying not to get into a war with our Field Day organizer, but I need an official answer for a question. See, our FD organizer is basically an HFer. Our configuration is a free Novice table (10-meter CW, I think), two HF tables with three bands each, and one VHF table, with two bands last year, three bands this year. We register as 2A.

When getting under way, he visited each of the tables (actually tents spread out over a nice big field), and went over the rules. When he got to our table, he gave the regular, "now remember, choose your bands carefully because once you transmit on a band, you have to stay on it for 15 minutes." I replied, "no, that does not apply to VHF." He checked, and confirmed that as correct. Then he added, "also, you can only transmit on one band at a time."

Trying to remain non-combative, I asked the club president, and he said that we would have to up our transmitter class to 3A to operate all VHF radios simultaneously.

Is that true? Do we get charged a transmitter count if we operate all VHF bands simultaneously? It was very disheartening to work a station on 6 meters while hearing another op from the same station call "CQ Field Day" on two! I'd rather not repeat that situation, but I want to get a clear answer on this. Any help would be appreciated!

73, and keep up the great work!

Steve Jackson, N3VZL
Fairless Hills, Pennsylvania

A: Your president is correct. I checked with ARRL HQ for you, and the "free" VHF station applies to only one signal on the air at a time. The 15-minute rule does not apply, so you may change bands as often as you wish, but if you have more than one VHF signal on the air simultaneously, you will have to change your category. That, of course, is a strategic decision that the club will have to make—does it want to stay in 2A or increase the number of bands on the air at one time. If it were my club, considering that it's unlikely that multiple VHF bands will be "hot" simultaneously, I'd stick with 2A and QSY the VHF station to follow the activity.

*Just remember the basics on sporadic-*E *:if six is open, and the skip starts getting "short" (300 to 500 miles), then you need to start checking for action on two (after you knock off those close-in sections on six). Plus, it's not uncommon to have an FAI (Field Aligned Irregularities) opening pop up on 2 meters as a 6-meter* Es *opening is fading away.*

Q: I would like to see an article on SMIRK numbers and 10-10 numbers. Also, I hear people on the "Magic Band" (6 meters) talking about "Iron City." If there are other such contests, could you please help? Thank you. 73,

Mark Griggs, KB8YMN
Columbus, Ohio

A: SMIRK is the Six Meter International Radio Klub; 10-10 is a 10-meter group and we normally cover only activities related to 6 meters and higher. To get a SMIRK number, contact 6 SMIRK members on 6 meters, get their numbers, then send the list (callsign, SMIRK number, date/time/frequency of contact) along with a check for $6 to SMIRK, c/o, Pat Rose, W5OZI, P.O. Box 393, Junction, TX 76849. You can also find SMIRK on the Web at <http://www.smirk.org> or you can link there from the CQ VHF *Web page <http://members.aol.com/cqvhf/>.*

The 10-10 rules are similar. Work ten 10-10 members on 10 meters, get their numbers, etc. Send your application form (you can get it by mail or download it on the Web), along with $10 annual dues to: Data Manager, 10-10 International Net, Inc., 643 N. 98th St., #142, Omaha, NE 68114-2332. For an information pack, send $2 plus a return address label to Jeff Ritter, N5VAV, 6959 Hovenkamp, Richland Hills, TX 76118; or visit the 10-10 Web site at <http://www.lehigh.edu/lists/tenten-l> (that's a lower case L at the end), or link there from the CQ *magazine Web page <http://members.aol.com/cqmagazine/>.*

Finally, I'm afraid I'm not familiar with any Iron City event. Perhaps it's local in your area.

Do YOU have a question about any aspect of "Ham Radio Above 50 MHz"? We'll do our best to give you a clear, concise answer—or if it's not a question that has just one easy answer, then we'll invite readers to offer their solutions. Send your questions to: Q & A, *CQ VHF* magazine, 25 Newbridge Rd., Hicksville, NY 11801; via e-mail to <CQVHF@aol.com> or <72127.745@compuserve.com>; or via our Web page at <http://members.aol.com/cqvhf/>. Be sure to specify that it's a question for "Q & A."

Product Update

ICOM, IC-706MKII-G

ICOM Responds to Yaesu's FT-100

The HF/VHF/UHF multimode "war" continues to heat up in the amateur marketplace, meaning more choices for more hams in expanding their VHF/UHF operating beyond FM and repeaters. According to the *ARRL Letter*, ICOM America, responding to Yaesu's not-yet-available (at press time) FT-100 mobile multiband multimode radio, has upgraded its IC-706 line to include the new IC-706 MKII-G, a radio that includes 70 centimeters as well as HF plus 6 and 2 meters. In addition, the 2-meter output power on the new 706 model has been increased to 50 watts; the 70-centimeter output will be 20 watts. Both the new 706 and Yaesu's FT-100 are expected to be on the market by the end of this year.

ICOM pioneered the mobile multi-multi market a few years back with the introduction of the original IC-706. Yaesu responded with its FT-100 and the larger FT-847, which ICOM answered with its IC-746 (160 to 2 meters, 100 watts on all bands). Kenwood has not entered the mobile multi-multi fray, concentrating instead on new FM-related VHF/UHF products, such as its VC-H1 slow-scan TV unit that plugs into a handheld and the just-announced TH-D7A, a dual-band HT with a built-in TNC and support for APRS display and messaging, as well as DX cluster "spots."

Premier HTs for 50, 222 MHz

Premier Communications, the makers of ADI radios, has announced two new VHF handhelds: the PR-52 for 6-meter FM and the PR-222 for the 222-MHz (1.35-meter) band. Both are palm-sized

radios with rugged metal chassis and a full 5 watts of RF output. The PR-52 features wide band receive from 40.0 to 53.995 MHz, plus full 6-meter amateur band transmit from 50.0 to 53.995 MHz, and can be modified (with proper proof of license) for MARS operation as well. The PR-222 covers the U.S. 222- to 225-MHz band and is expandable for the Canadian ham band and MARS use (with proof of license). Standard features on each radio include a rechargeable NiCd battery, built-in CTCSS encode and decode, 40 memory channels, direct frequency entry from the 16-button keypad, and programmable repeater shift (default: 500 kHz on 6 meters; -1.6 MHz on 222).

The radios are extremely compact, measuring just 4.25 x 2 x 0.75 inches (HWD), excluding battery pack. Both feature Premier's two-key programming system. Unlike other handhelds, on which each of the 16 keys are assigned functions and subfunctions, all of these radios' main functions (such as CTCSS and repeater shift) are set using just two keys. Simply use the "Select" key to access the item you want to program and the "Change" key to modify it.

The PR-52 and PR-222 are available now from your local authorized ADI/Premier dealer. For more information contact Premier Communications Corporation, 480 Apollo St., #E, Brea, CA 92821; Phone: (714) 257-0300; Fax: (714) 257-0600; Web: <http://adi-radio.com>; E-mail: <premier@adi-radio.com>.

Circle 90 on reader service card

MFJ-259B SWR Analyzer

MFJ has added many new features to its popular MFJ-259 SWR Analyzer, yet has kept the price at only $249.95. The new MFJ-259B gives you a complete picture of your antenna's performance. You can read antenna SWR and complex impedance from 1.8 to 170 MHz. The MFJ-259B has a built-in frequency counter, side-by-side SWR and complex impedance meters, and smooth reduction drive tuning. Using it is easy: set the bandswitch and tune the dial—just like your transceiver. SWR and complex impedance are displayed instantly.

The MFJ-259B takes the guesswork out of building and adjusting matching networks and baluns and will perfectly tune critical HF mobile antennas in seconds for DX, without subjecting your transceiver to high SWR. The analyzer also measures inductance and capacitance, letting you troubleshoot and measure resonant frequency and approximate Q of traps, stubs, transmissions lines, RF chokes, tuned circuits, and baluns.

The MFJ-259B also serves as a complete ham radio test station, including frequency counter, RF signal generator, SWR Analyzer™, RF resistance and reactance analyzer, coax analyzer, and capacitance and inductance meter. Plus, it's truly portable and can be used at remote sites, up towers, or on DXpeditions. It uses 10 AA or NiCd batteries (not included) or 110 VAC with MFJ-1315 ($14.95). Its rugged, all-metal cabinet is a compact 4 x 2 x 6 3/4 inches.

A free instruction manual is available. For more information, contact MFJ, P.O. Box 494, Mississippi State, MS 39762; Phone: (800) 647-1800; E-mail: <mfj@mfjenterprises.com>; Web: <http://www.mfjenterprises.com>.

Circle 91 on reader service card

AOR AR7000B DSP Receiver

AOR USA's new AR7000B receiver —covering 100 kHz to 2 GHz (minus cellular frequencies on U.S. model)—brings together several developments in receiver technology. AOR Vice President Taka Nakayama says the radio "blends a color video display, DSP (digital signal processing) technology, a triple-conversion front end and computer into a precision, high-performance, all-mode receiver."

Modes received by the AR7000B include WFM, NFM, AM, LSB, USB, and CW. There are two VFOs and 1,500 memory channels (15 banks of 100 channels). Banks and channels can have alphanumeric identifies of up to seven characters. The operator can scan selected or all memory banks. The AR7000B can also shift the IF plus or minus 8.5 kHz in 100 Hz steps. Tuning steps, AGC, receiving mode, and bandwidth can operate automatically or be overridden by the operator.

The color display shows several different pages of information, and the video can also be output to an external monitor via a composite video jack on the rear panel. The AR7000B also includes a calendar and clock, with a capacity for maintaining time in UTC and up to four additional time zones. The unit can be programmed to turn on and off at preset times.

Free software for computer programming and control of the AR7000B may be downloaded from the AOR Web sites at <http://www.aorusa.com> or <http://www.aorja.com>. For additional information, contact AOR USA, Inc., 20655 S. Western Ave., Suite 112, Torrance, CA 90501; Phone: (310) 787-8615; Fax: (310) 787-8619.

Circle 92 on reader service card

New RAC Operating Manual

Radio Amateurs of Canada has announced the new 200-page *RAC Operating Manual*. Edited by Doug Leach, VE3XK, this is a complete survival guide with sections covering all aspects of amateur radio operation in Canada: Major segments include: The Amateur Radio Service—the national and international perspective; Licensing —the Canadian structure and how it works; Privileges and Restrictions—what you can and can't do; Operating the Amateur Radio Station—procedures and hints; Amateur Radio Station Equipment—what you need to know; Specialized Communications—the digital modes, television, satellites; and Prop-agation—what to expect on the HF, VHF, and UHF bands.

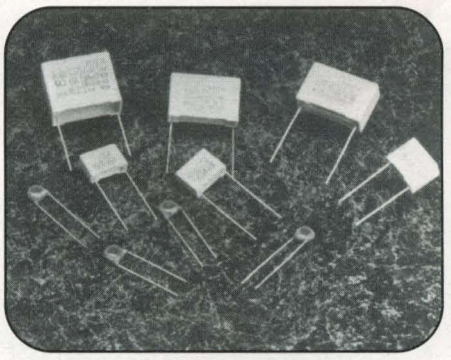
For more information, visit the RAC Web site at: <http://www.rac.ca>.

New AC Capacitor Groups from Ventronics

A broad variety of class "X-2" metallized polypropylene film capacitors, along with class "Y" ceramic capacitors, both with international safety approvals for AC applications, are now available from Ventronics, Inc.

The "X-2" units are designed for interference suppression and general applications, and are suitable for conditions where capacitor failure will not expose individuals to shock. The "Y" types are ideal for line bypass and general uses, especially in settings in which users could be exposed to shock if units are improperly utilized.

Rated voltages for the "X-2" units are 250/275 VAC with 1200 to 1500 VAC maximum ranges and with 0.0047 to 1.0 µF capacitance ratings. They feature flame retardant cases and are "self-healing," with wound polypropylene film dielectrics. The "Y" types are rated at 1250 AC, 2500 and 4000 VAC maximum ranges and with 100 pF to 10,000 pF capacitance ratings. Dielectric strength is 2600 VAC for 60 seconds.



Prices start at 12.5¢ each (bulk) for "Y" capacitors and at 25¢ each for "X-2" units, depending upon ratings.

For additional information, contact Ventronics, Inc., 346 Monroe Ave., P.O. Box 142, Kenilworth, NJ 07033; Phone: (908) 272-9262; Fax: (908) 272-7630; E-mail: <ventronics@prodigy.net>.

Circle 93 on reader service card

More Cheap Yagis

WA5VJB's series on cheap Yagis has generated more "do-it-yourself" enthusiasm than anything else we've published to date. So here are more, this time for 902/903 and 1296 MHz.

If you've been following this column over the past few installments, you know that I first dubbed the antenna design I'm describing here as the "Simple Yagi," and when its low cost became as great a draw as its simplicity, I began calling it the "Cheap Yagi." Actually, its "official" name is the *Controlled Impedance Yagi* because of its wide bandwidth.

My first Controlled Impedance Yagi was made for 915-MHz spread-spectrum systems and used 75-ohm coax. A longtime friend was working for the phone company and had the job of chasing down "cloned" cellphones. He was having a heck of a time running around apartment complexes with his portable equipment and a rubber duck antenna. So I whipped up a short 840-MHz 50-ohm version for him to carry around and the Simple Yagi was born.

The challenge with spread-spectrum is that the antenna must have the same efficiency (for amateur use) from 902 to 928 MHz. Note that I didn't say the same *gain* across the entire band. By peaking the gain of the antenna at the top end of the band, but optimizing the matching section at the bottom of the band, the signals coming out are just about equal over the entire 902- to 928-MHz band. This can be quite important for wideband modes such as spread-spectrum packet and FM ATV (amateur television).

The 33-Centimeter Cheap Yagi

Photo A shows three Cheap Yagis, the top one on 1296 MHz and the bottom two on 902 MHz (the bottom one's longer). You'll find the dimensions and construction details in Figure 1 and Tables 1 (915-MHz spread-spectrum) and 2 (902/3-MHz SSB/CW). The computer predicts only a .04-dB difference between 902 and 903 MHz, so this antenna works well on both calling frequencies (see "A Note on 902- vs. 903-MHz Activity" for discussion of SSB/CW calling frequencies on 33 centimeters). By the way, shortening each element on the 902/903 design by .1 inch will give good 50-ohm performance at 915 MHz.

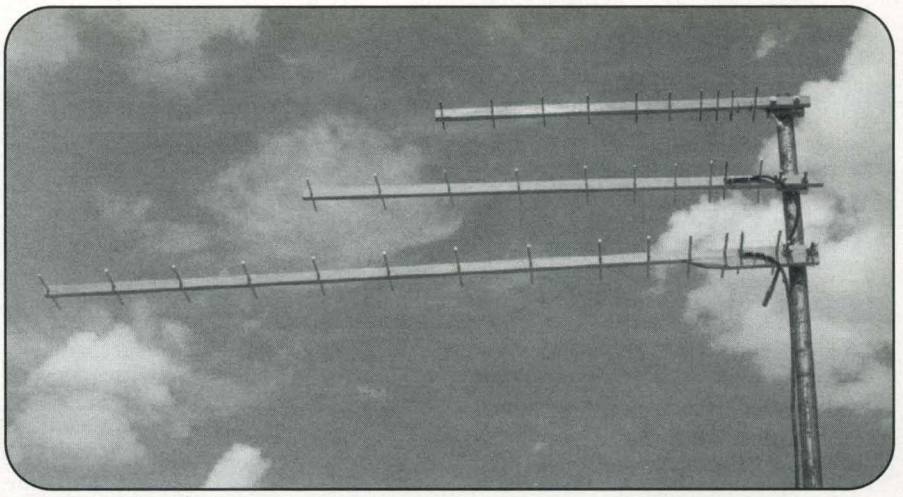


Photo A. A triple stack of Cheap Yagis. The top one is for 1296 MHz and the bottom two are for 902. See text and tables for details on dimensions.

Movin' on up... to 1296 MHz

A good story on this one: Back in 1994, I had been corresponding with Ed Krome,

Table 1. Measurements for 10-Element 915-MHz Spread-Spectrum Cheap Yagi

Element	R	DE	D1	D2	D3	D4	D5	D6	D7	D8
Length	6.1	*	5.6	5.5	5.4	5.3	5.2	5.1	5.0	5.0
Spacing	0	2.4	3.5	6.0	8.9	12.3	17.2	22.3	27.4	32.5

*Table 1. Element length and cumulative spacing dimensions (in inches) for a 10-element 915-MHz spread-spectrum Cheap Yagi. Element material: 3/16-inch diameter rod; if 1/8-inch material is used, make each element longer by .05 inch, or about 1/16 inch. Typical average performance: 14.3 dBi gain, 25 dB front-to-back ratio. *See Figure 1 for driven element dimensions.*

By Kent Britain, WA5VJB (WA5VJB@cq.net)

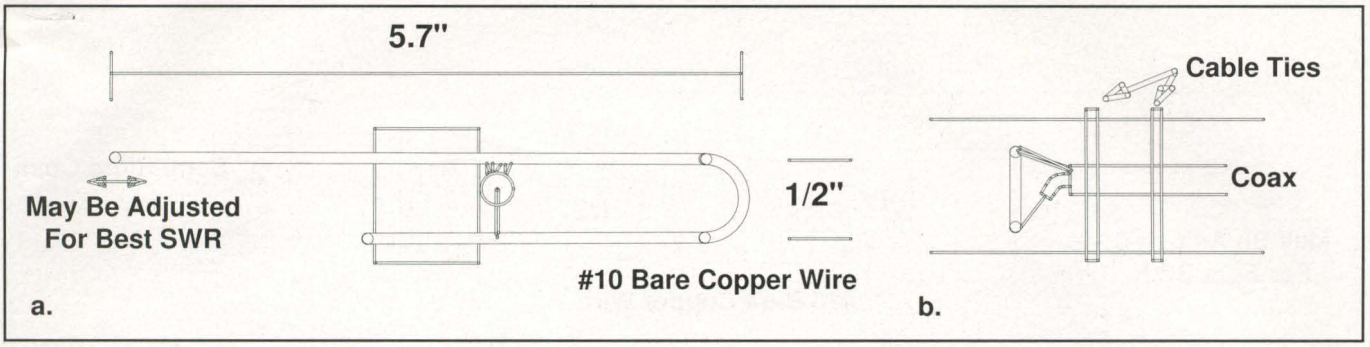


Figure 1a. Driven-element dimensions for all 900-MHz versions of the Cheap Yagi. See Table 1 for other element dimensions and spacings for 915 MHz and Table 2 for 902/903 MHz. Figure 1b. Detail of feedline connection to the 900-MHz Cheap Yagi.

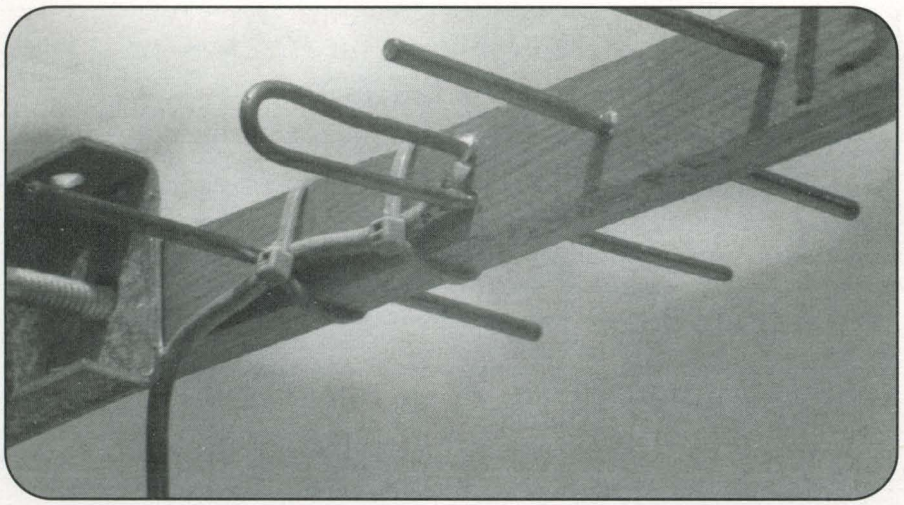


Photo B. Closeup of the feedpoint area of the 1296-MHz Cheap Yagi. I'm using semi-rigid coax as the feedline here, and I recommend it if you can get your hands on it. Can you find the "23 dB RL" notation in the photo? Guess what it means and then go find the discussion in the text to see if you're right.

K9EK, about the 1296-MHz Simple Yagi. Well, Ed also showed up at the Central States VHF Society antenna contest in Memphis, Tennessee, with a 1296-MHz Simple Yagi. He won the 1296 category, beating me by .2 dB *with my own design*!!! At least he proved the design was duplicable.

Figure 2 and Table 3 have all the numbers you'll need to build the 1296-MHz Cheap Yagi. And Photo B is a closeup of the area around the feedpoint. Those of you with sharp eyes will note "23 dB RL" written on the bottom of the boom. This stands for *return loss*. When measured on a network analyzer, the reflected power was 23 dB weaker than the forward power. Return loss is a more precise way of measuring SWR, especially when the values get very low. Twenty-three dB RL works out to about a 1.15:1 SWR. With a little tweaking and fancy test equipment, I've had many of these antennas show 40-dB return loss, or about a 1.02:1 SWR. Of course, the guy at the other end of the QSO is never going to hear this, but it's just fun sometimes to see how low you can go and for no other reason.

Back to Photo B—you may note that I used .141-inch semi-rigid coax. This stuff solders really well and makes an excellent RF connection. I recommend semi-rigid coax it you have it. I've also seen 1/4-inch hardline soldered to the driven element.

Watch That Boom

One problem did show up when the Houston ATV group (HATS) started building 1260-MHz versions. Someone substituted 1-inch square wood for the boom instead of 1/2 x 3/4-inch wood. This put nearly one-third of the element *inside* the wood—kind of like using a telephone pole as the boom for a 2-meter Yagi. This much wood did affect the antenna and shifted the frequency enough to just about kill it on the design frequency. So stay with 1/2-inch-wide wood.

My Secret Tuning Stick

In Photo C, you'll see one of my secret weapons for when I'm working with antennas. It's a stick with a 1-inch piece of element rod taped to one end, and a 2-inch piece of element material taped to the other end. When you place either end of the stick near an element, the coupling effects make the element electrically slightly longer.

When I think I've got an antenna working well on the antenna range, I just place

Table 2. Measurements for 10-Element 902/903-MHz Cheap Yagi with Direct Feed

Element	R	DE	D1	D2	D3	D4	D5	D6	D7	D8
Length	6.2	*	5.7	5.6	5.5	5.5	5.3	5.3	5.2	5.2
Spacing	0	2.4	4.0	5.75	9.0	12.5	17.5	22.5	27.75	33.0

*Table 2. Element length and spacing dimensions (in inches) for a 10-element 902/903-MHz Cheap Yagi with direct 50-ohm feed. Element material: 1/8-inch diameter (silicon bronze welding rod works well). Typical performance: 14.5 dBi gain, 40 dB front-to-back ratio. *See Figure 1 for driven element dimensions.*

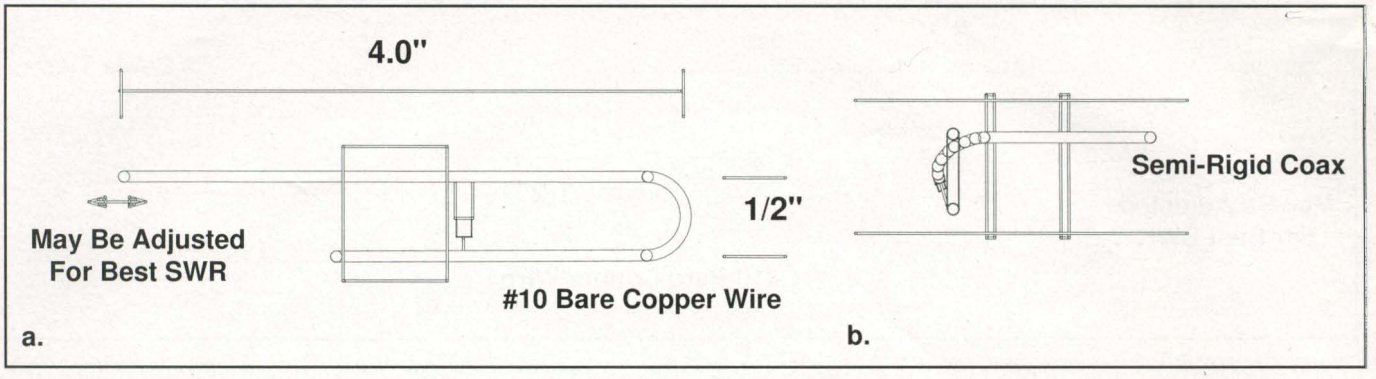


Figure 2a. Driven element dimensions for 1296-MHz versions of the Cheap Yagi. Figure 2b. Optional use of semi-rigid coax.

the tuning stick near each element (Photo D). In theory, detuning each element should make things worse. Well, sometimes (often), placing the tuning stick near the element *improves* gain. So I try again with that element slightly longer. On the other hand, if getting the tuning stick simply near the element instantly makes things worse, I trim off a little of that element and try again.

I never publish one of my designs unless it's been tested out on the antenna range. Computer programs are excellent design tools, but they only get you close to the final design. Computer modeling is valuable, but it's no substitute for testing full-size antennas. In a future article, we'll be covering how to use antenna design programs—and what to watch out for so you don't get burned by them.

Table 3. Measurements for 10-Element 1296-MHz Cheap Yagi

Element	R	DE	D1	D2	D3	D4	D5	D6	D7	D8
Length	4.3	**	3.9	3.8	3.75	3.75	3.65	3.6	3.6	3.5
Spacing	0	1.7	2.8	4.0	6.3	8.7	12.2	15.6	19.3	23.0

*Table 3. Element length and spacing dimensions (in inches) for a 10-element 1296-MHz Cheap Yagi. Measured performance: 13.5 dBi gain, greater than 30 dB front-to-back ratio. Element material: 1/8-inch diameter rod. Making each element .1 inch longer will give good performance between 1260 and 1280 MHz for AMSAT, ATV systems, or for links. The F/B ratio will drop to 20 or 25 dB, but the gain will still be 13.5 dBi. **See Figure 2 for driven element dimensions.*

A Note on 902- vs. 903-MHz Activity

When 902 to 928 MHz was first opened for amateur use, many hams went for the traditional weak-signal frequency of 100 kHz above the bottom of the band. So, in the midwest and on the west coast, 902.100 MHz became the SSB/CW calling frequency. Up in the northeast, though, it was noted that 144 to *903* MHz converters could use commonly available oscillator crystals. So, much of the northeast activity is on 903.100 MHz.

If you're building a new transverter for our 33-centimeter band, I'd like to put in a plug for 902.100 MHz for a couple of reasons. First, it's easy to tune your 2-meter rig from 144.100 to 145.100 MHz and work anyone using 903.100 MHz. (It's a bit more difficult to tune most rigs down to 143.100 MHz.) Finally, as more and more consumer products are sharing 902 to 928 MHz, the noise level is getting higher and higher. These products have very little filtering, yet are required by the FCC to have near zero output on 901.999 MHz. So the wireless modems, spread-spectrum cordless phones, security devices, etc. tend to avoid the very bottom of the band. In many metropolitan areas, 902.1 MHz is about a full S-unit quieter than 903.1 MHz.

We Get Letters...

In my last antenna column, I said that I make sure my projects are duplicable before I publish them. Duplicable means I take my early write-up and diagrams over to my friend Terry Turner, W5ETG,

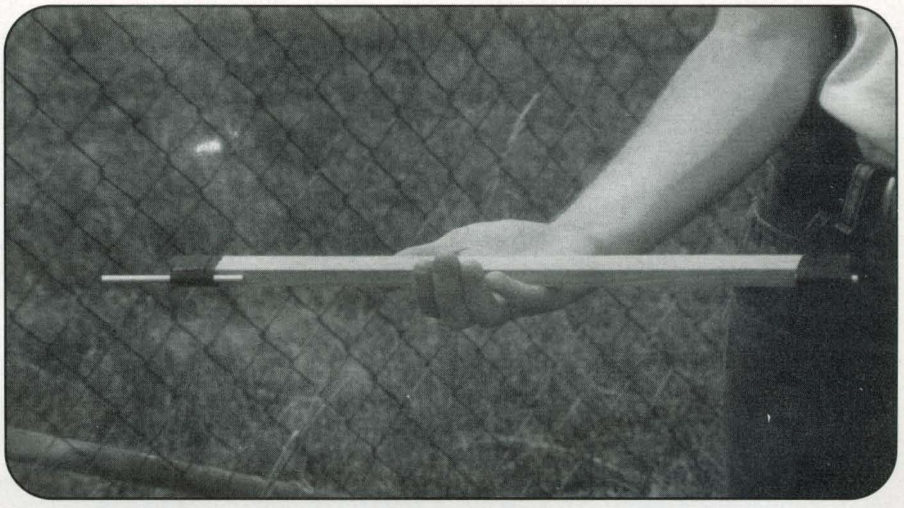


Photo C. One of my "secret weapons" for designing antennas: a "tuning stick" with a 1-inch piece of element material taped to one end and a 2-inch piece at the other end.

and ask him to build one. Terry then gets back with me and we test it out. He usually has several suggestions on how I can make my instructions "clearer"! If his version works, I print it.

I know many of you are reading this column carefully. I made one tiny comment a few months ago about a 6-meter version of Cheap Yagi, and I received at least 15 inquiries for the dimensions. My 6-meter beam didn't tune up the way it should have, and I used some parts from my junk pile. So even I can't built another one just like it.

But even I can only take so much. I picked up a supply of aluminum tubing and promised a 50-MHz Cheap Yagi in the coming months. The "J" driven element doesn't scale well to 50 MHz, so I'm looking at several other designs. I only promise they'll be simple and cheap! For those of you who can't wait for my 6-meter beam, may I suggest the June '96 issue of *CQ VHF* and the three-element "Featherweight" 6-meter Yagi by K1BQT on page 24.

And finally, I realize some of you want the AMSAT 435-MHz versions *now*! I have a computer design and parts strewn about my workbench for a circularly polarized 435-MHz version to go along with that column. I just ask for the time to build a working model before publishing the plans. So *hold your horses*! Until next time, Happy Holidays and 73.

—WA5VJB

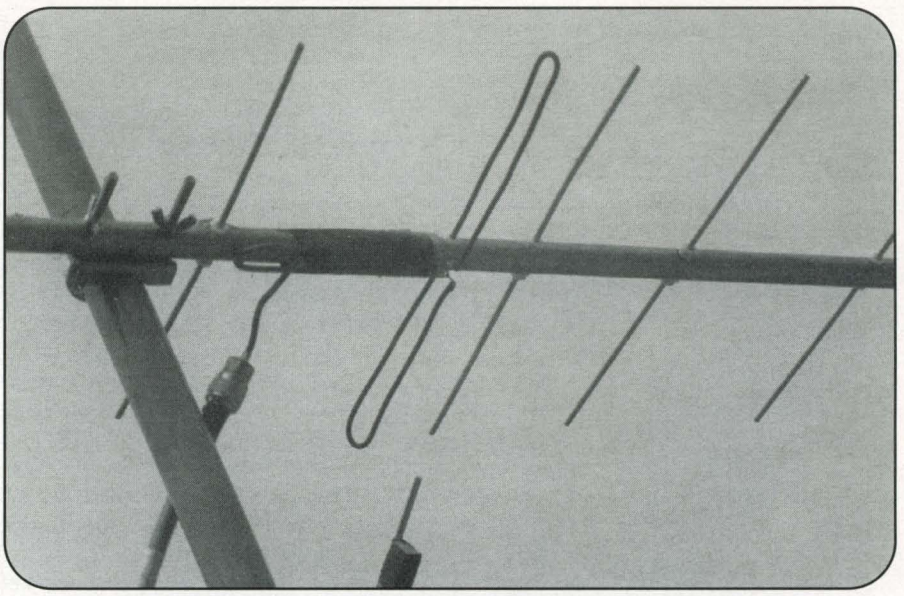


Photo D. The tuning stick in use. By holding it close to the elements of an antenna under test, I can get an idea of whether that element is resonant where it should be, or if it needs more work.

Reader FEEDBACK!

Wait a Minute! Howzat Work?

The following letter was directed to CQ VHF *"Antennas, etc." columnist Kent Britain, WA5VJB:*

Hello, Kent,

I was pleased to discover *CQ VHF* in a magazine store this evening. I have been a ham for 41 years and have not had the pleasure of reading it before. Because I have been toying with the idea of constructing a gain antenna for 2 meters, your article in the October, 1998, issue was timely and I decided to buy a copy.

When I got home and looked carefully at the article, several questions immediately came up:

1. Figures 2 and 3 (page 50) do not indicate the dimensions of the lower parts of the driven rods. I assume (dangerous to do!) from the drawing that the upper portion of the driven rod is centered in the mast. This then would mean that the lower rod (again, I assume that the upper and lower portions are one continuous rod; but those little circles at the bend on the far right side of the drawing concern me) is about 3/8 inch longer than half of the upper rod.

Boy, that must be confusing! Here are my questions:

(a) Is the "lazy-J" driven element one continuous piece of rod?

(b) Is the lower portion of the driven element 3/8 inch (half the dimension of the 3/4 inch mast) longer than half the length of the upper portion?

(c) Is the upper portion of the driven element centered in the mast?

2. I am also confused as to the operation of the driven element.

(a) The driven element appears to be unbalanced; that is, the "left side" of it is a legitimate radiator, but the "right side" is a parallel line with equal and opposite currents flowing in the two legs, and thus will not radiate. I am not at all a Yagi aficionado, but it seems that the driven element should radiate from "both sides." Isn't symmetry required for a Yagi? (Even a Gamma-matched Yagi is symmetrical, although it may not look like it to the uninitiated.)

(b) The impedances seem wrong: The "radiator" (the "left half" of the driven element) is a quarter wavelength long and thus has a low-Z feedpoint. So the right-hand half (which is a quarter-wave stub) is feeding a low-Z point. But this stub then must have a high impedance at the "far right-hand side" (the end opposite the radiating element). Thus it should be open, not shorted.

Another way of looking at this is: the right-hand side of the stub is shorted, so a quarter wavelength from there (which would be just about at the center of the antenna) will be very high impedance. But this is where both the 50-ohm coax is connected and the low-Z antenna (the quarter-wavelength "left side") is fed. I don't understand this apparent impedance mismatch.

As an example of a properly performing and similarly appearing antenna, consider the venerable end-fed Zepp (or J-pole). Here, the shorted stub (quarter-wave matching section) is connected to a half-wave radiator. In this situation, because the end of the radiator (where it connects to the matching section) is high-Z, the low-Z coax properly is connected near the shorted end of the stub.

So, the question: How on earth does your design work?! This is not meant to be a wise-guy question. I certainly don't doubt that you have had success with your design. It's just that my understanding of the theory (as presented above) leaves me confused.

What am I missing here (probably something elementary!)? My guess is that if I am experiencing confusion, there probably are a few more out there like me.

3. While I am writing, I may as well ask this one, too: what is a source of rod for this project? I assume you use copper, or maybe brass.

Kent, thanks for the article, and thanks in advance for your help in helping me understand your design. Tnx es Vy 73,

Jim Wilcox, W3WV/AFA2EX
Falls Church, Virginia

WA5VJB responds:

Hi Jim,

Let me respond to your questions one at a time.

1. About the driven element: Yes, the element is one continuous piece of rod. This was shown more clearly on the 450-MHz versions published in my August column. The low portion is about 3/8 inch longer, but this has almost no measurable effect. And, yes, the upper portion is centered in the boom.

2. About the antenna design and feed: Just think of J driven element as 3/4 of a folded dipole! Take my word for it. Antenna range measurements and NEC Simulations say it works. Over 30 different versions have been designed and used. The Houston ATV Group has built well over 500 of these at last count. Versions for 900 and 1200 MHz appear in this month's column, and satellite, ATV, and other versions will be published in the coming months.

As for the impedance, think of the driven element as a Gamma match with a very, very high pF capacitor that is far enough out to be at the end of the rod. The driven element has an impedance of about 150 ohms in free space. I use the loading effect of the other elements to load it down to 50 ohms. Thus no other impedance matching is necessary. Impedance matching is in the structure of the Yagi itself!

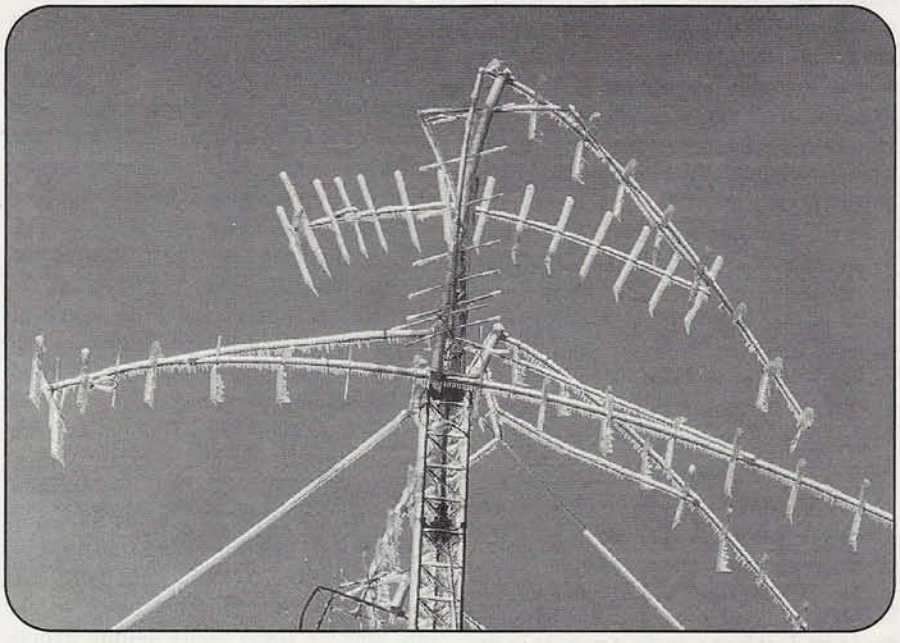
3. About where to find the rod: Welding rod works well. Hobby brass tubing has been used, as well as heavy gauge copper wire. On my 6-meter one, I used aluminum tubing and hose clamps (and no, folks, the 6-meter version still isn't ready to be published).

73, Kent

The Ice Season Cometh

Summer is gone, the clocks have changed, and soon many of us will be knee-deep in the white stuff. Will you be prepared if you're "snowed under" by a blizzard? You could procrastinate, but why not take a few minutes to plan for tomorrow?

The one part of your station that faces the greatest risk from winter weather is—what else?—the part that's outside: your antennas. If you have outside antennas, now's the time to give them a thorough preventative maintenance check up. Screws come loose, connectors come loose, and sometimes things that should be waterproof aren't. Far better to check everything out now while the skies are clear and the temperatures are reasonably warm.



Can you protect your antennas from winter's ravages? WB2D's tips this month will help prevent damage from typical winter weather. On the other hand, a major ice storm, such as the one that hit the northeast last January, will defeat even the best-maintained antenna system, which this was. (Photo courtesy Dave Olean, K1WHS/ARRL)

Where to Begin

If you haven't done so recently, start with a simple SWR test (or, if you're using a wattmeter, check for a higher-than-normal reflected power reading). Does it seem normal? Just because the SWR or reflected power reading *seems* normal doesn't mean it is. For instance, moisture inside a piece of coaxial cable often acts as an attenuator without disturbing the apparent impedance of the cable, particularly if you're taking an SWR reading at the dry end of it.

When I worked in the commercial two-way business years ago, we had a UHF base station that was giving its owner fits—poor reception, weak transmitted signal, etc. But the radio checked out just fine on the bench. And the antenna? A directional wattmeter read 100 watts forward and less than 1 watt reflected, apparently an ideal SWR. So, finally we climbed the tower and put the wattmeter in line between the 7/8-inch "hardline" transmission line and the antenna. Now, we had about *3* watts forward power and still very little reflected! Obviously, there was something wrong with the transmission line. We replaced the line and all the problems disappeared.

But there was nothing *visibly* wrong with the transmission line until we took off the connector at the antenna end. Water poured out of the line. We threw that piece of cable away. The moral of the story is to move the wattmeter to the antenna end of the station if there is any hint of a problem. That will give you a good idea of whether the problem is in the antenna or the transmission line.

You will also want to check the antenna itself for hardware that has loosened up or corroded. Both can be the source of major problems with an installation. If there is corrosion, you'll want to clean it off and re-establish the connection. You might want to consider treating the connection with something to minimize further chemical reactions, particularly oxidation. Over the years, I have heard of just about everything being used for treatment. Spray paint (use a good grade) works well in many situations, but I have

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

also heard of hams using everything from petroleum jelly to nail polish to seal sensitive contacts.

Check Those Connectors

As far as coaxial cable connectors are concerned, it is a good idea to disconnect the cable from the antenna and reconnect it. The abrasion from that simple act is enough to break up any minor corrosion that might have built up between the surfaces of the connectors. Some connectors are reasonably weather-tight (BNC and N for instance), while others (such as the ubiquitous "UHF" connector) are notoriously lousy in this respect. For a couple of dollars at RadioShack, you can buy a roll of very pliable putty that forms a wonderful seal around any coax connector. It will add an additional level of protection to the good connectors and save the bad ones from sure destruction. Incidentally, the connector on the 7/8-inch hardline that I mentioned was theoretically waterproof. Sure.

One note of caution here: I have never found plastic electrical tape to be of much value for weatherproofing. Some hams swear by it, but, based on my own experiences, I'd be more inclined to swear *at* it. On the other hand, using it as an outer cover of the pliable putty does add a measure of mechanical stability to the putty, particularly if there is likely to be any flexing of the transmission line near the connector (with a rotating beam, for instance).

But there are other considerations, too. Maybe you want to add a new antenna to the farm. Is it better to do it now or in the middle of February? When I worked for the two-way company, I had to take care of an outdoor problem on a day when the temperature never climbed above 10 degrees F. And this job was totally on the ground. I got the job done, but it took about six times as long to do it, and I apparently suffered some mild frostbite in my fingers. Maybe Santa Claus can come a little early and deliver the antenna now rather than waiting for the coldest part of the winter. Trust me, putting up any antenna is easier, faster, and safer in warm weather.

Time to Experiment

So far, we have just been considering scenarios that pretty much maintain the operational status quo, but maybe you want to do something different this winter? Think about it now. If you've never tried weak-signal work, this winter might be the time to get started. One thing you'll find out very quickly if you don't already know it, FM antennas are lousy for most weak-signal work. That's because FM is standardized on vertical polarization, while weak-signal modes use horizontal polarization. Some studies have suggested that there can be up to 90 dB isolation between vertical and horizontal polarization. That is a lot of signal to give away. (Space communications can be done with a vertical antenna in some cases, but it is far from ideal.)

"I have never found plastic electrical tape to be of much value for weatherproofing. Some hams swear by it, but, based on my own experiences, I'd be more inclined to swear at it."

Or maybe you're thinking of trying out a new band. Most of the time, we would probably get the equipment first and the antenna second. Why not the other way around? You could get the antenna now and install it while the weather is decent. Honest, there's no truth to the rumor that you get an extra 3-dB gain for every 10 degrees below freezing at the time of installation. The ARRL Lab proved that this was bogus years ago. Go ahead and put the antenna up now.

One final point about antennas: Are you sure they're going to stay up? A long, long time ago in a state far, far north of here (I'm in Florida, if you're just tuning in), I put up the most elaborate set of antennas that I had owned up to that point. Two friends came for the weekend in late fall, and we spent hours getting everything just right. The antennas were as high as you could reasonably go without benefit of a tower. Everything was perfect, except I had never lived where ice storms were routine each winter. During the first storm of the season, one guy wire snapped and everything came down much more quickly than it had gone up. It was a long time before I got the antennas back up.

Weird things happen, even to those who own towers. My friend had a 90-foot tower in his backyard that might have been *slightly* overloaded. Then came the ice, followed closely by the wind and a very strange series of noises. When he went out the next morning, he found that one of the top guy wires had snapped. He still had the 90-foot tower—but while the first 60 feet were still vertical, the top 30 feet were now horizontal. Yes, he got the antennas down, but not until spring.

Assume the worst is going to happen and that all your antennas are going to be wiped out at a time when you just don't want to go outside. Buy or build a simple antenna that can be erected quickly and easily and store it in your garage or storage shed with *everything* (including feedline, mounting hardware, and a simple mast) you need to put it up and use it.

Emergency Prep

The same forces that bring down antennas and towers also wreak havoc on power and phone lines. What are you going to do if a storm suddenly cuts you off from the rest of the world? Now is the time to prepare. If your circumstances permit it, an auxiliary electric generator is an excellent choice. If it has the capacity, you can keep your gas/oil furnace running as well as the radio. If choices have to be made, just tell the rest of your family that it is far more important to provide auxiliary power to your ham radio than to the TV. If a generator is out of the question, a large deep-discharge marine battery can keep a 2-meter FM rig running for days.

One very useful accessory for a handheld is a battery pack that accepts disposable cells. Some of the tiny handhelds don't have such an accessory available, but you can always make an external supply out of a few parts from RadioShack. Most rigs offer a DC input jack. If all else fails, you can always cut up a defunct battery pack and use it to connect the external power source.

These preparations should be made now, while you have electricity and the stores are open for the inevitable one or two missing parts. That's not to say that you won't have to jury-rig something during an emergency. A butane-powered torch/soldering iron is worth its weight in gold then: they're inexpensive and come in handy in all sorts of situations. Get one now.

Long Winter Nights

Except for a couple of shows, the new TV season has, in my humble opinion, proven to be another excursion into the vast wasteland. And there is only so much

operating that you can do. So, what are you going to do with all that free time in the evenings? Upgrading your license comes to mind. If a club near you is offering an upgrade class, take it. If not, you can do it solo. Either way, it's probably much easier than you've imagined.

One of the things to keep in mind is that CW is a skill that's learned. There has never been a newborn CW operator. Everybody must learn. Some people have a more efficient learning strategy for mastering CW than others. That just means that they'll do it more easily and more quickly than the others. I'm not suggesting that you try *harder*, but I will suggest that you work *smarter*.

It's an auditory skill, so the first rule is to think in auditory terms. That means listening to whole character patterns, not breaking each character down into its component dots and dashes. There are two things that make this much easier. First, make sure the speed is too *fast* to count characters. In other words, I think you should completely bypass five wpm and start with 20 wpm or higher. When the code is coming that quickly, you can't count the dots and dashes. Second, instead of listening to the dots and dashes, focus your attention on the *silence* surrounding them. In effect, these two "tricks" force you to listen to the sound of the character.

I've known of people to go from little or no CW knowledge to 20 wpm in *three days* using this method. Will you be as efficient as they were? Maybe not. Perhaps it will take you a long time, say two or three weeks, to master 20 wpm. But no matter how quickly you learn using this method, it will be much faster than counting dots and dashes. If you did it that way, you'd get to about seven to nine wpm and be stuck on that plateau for a long, long time.

There are a number of good study guides on the market for the theory exams. After you've read through the study material, I think one of the best ways to prepare is to take practice exams. Several companies offer computer programs that generate sample exams from the question pools. You'll get used to the format of the exam and quickly identify the areas that you need to review. If you have a bean counter bent, you can even track your progress with records and charts.

"The same forces that bring down antennas and towers also wreak havoc on power and phone lines. What are you going to do if a storm suddenly cuts you off from the rest of the world? Now is the time to prepare."

The one secret to upgrading is to make it fun, whether CW or theory. An hour with a playful attitude is worth about 20 hours of hard work. This is a hobby. Just play with it and make it fun.

Other Challenges

This is also the perfect time to think about broadening your horizons a bit. Why not take up that new mode you've been thinking about? Or maybe you want to try your hand at building an accessory for the station. You'll find books and video tapes on many facets of our wonderful hobby.

Are you ready for the great tomorrow? The long winter nights are upon us. ■

Interstellar Aurora?

Scientists think a huge Aurora opening on August 27 may have been as much as 20,000 years in the making. And hams may be able to help in their research...

"Hey, buddy!"..."Yeah, you, with the antenna on your hard hat. Come here. I need to talk to you."..."Just one question, buddy: Where were you on the morning of August 27, at 1022 UTC, to be exact?"... "Sleeping? A likely story. Listen, we *know* you were on the radio then, and there's some folks downtown who are real interested in what you heard...or maybe, didn't hear."

Bad dialog from a "B" movie? Well, there's no question it's bad dialog, but it's from real life. If you were on the radio—any radio (TV included)—talking, listening, or watching at 1022 UTC on August 27, and you noticed anything unusual, anything at all, some high-powered astronomers want to hear all about it.

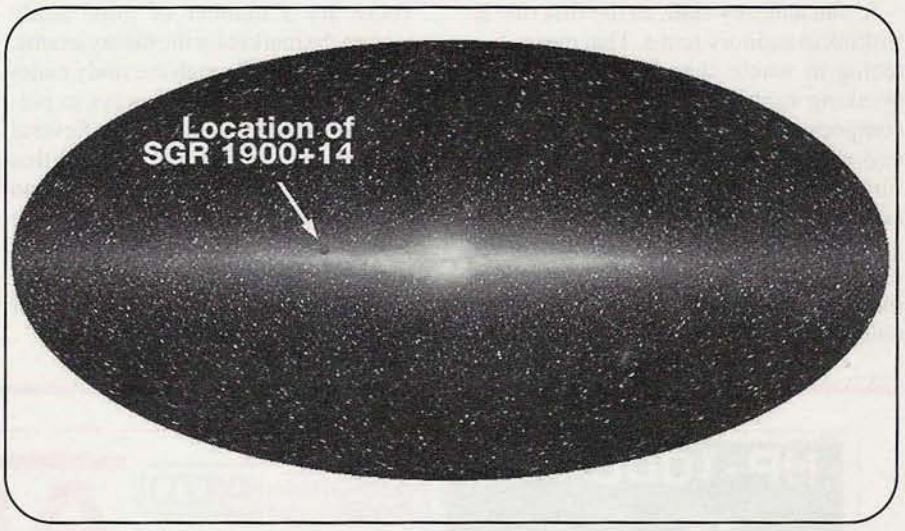


Photo A. The approximate location of magnetar SGR 1900+ 14 in the constellation Aquila. A gamma-ray blast from this neutron star hit the Earth on August 27, the first known event from outside our galaxy to cause changes in our ionosphere and magnetic field. (NASA image)

A Long Time Ago in a Galaxy Not Too Far Away...

The full news release from NASA is in a box elsewhere in this column, but here are the basics as they apply to hams: Between 15,000 and 20,000 years ago, out in the constellation Aquila (see Photo A), a massive starquake broke apart the solid surface of a "magnetar" (a type of neutron star) known to astronomers as "SGR1900+ 14," and released a five-minute burst of X-rays and gamma rays that "pinned the meters" on seven gamma-ray-detecting satellites as it approached our planet. And when it hit the Earth's ionosphere on August 27 of this year, it turned night into day (ionospherically speaking) over the western U.S., the Pacific and eastern Asia.

It may also have caused a near-total radio blackout for several minutes and may have touched off a major Aurora, followed by a geomagnetic storm. On these last points, however, scientists are not certain of the connection (if any) and are asking hams, among others, to help in their research.

Help Your Local Astronomer

Paul Harden, NA5N, is one of those astronomers. He works at the National Radio Astronomy Observatory (NRAO) in Socorro, New Mexico, home to the world's largest radio telescope, the Very Large Array (VLA). Harden says the burst is the first known event from outside our own galaxy to have affected the Earth's environment. In addition to making the ionosphere on the *dark* side of our planet react the same way it does to sunlight, and even to the energy from a solar flare, Harden says some of the radiation *may* have reached the Earth's surface.

"These are the things that happen from an M- or X-class solar flare," says Harden. "But to occur as the result of an extragalactic event *15,000 light years away*, one can only imagine the power required to cause it...and why astronomers are so interested in this very rare event—only the third time it's been observed." The only other known large gamma ray bursts to hit the Earth occurred in 1979 and 1984, although they did not affect our ionosphere or magnetic field as this one apparently did.

Why Hams' Help Is Needed

Since the blast of radiation hit the portion of the Earth that was in darkness, the observatories that normally monitor solar

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

NASA's Report on the Gamma Ray Burst

The following is the complete text of the NASA news release announcing the gamma ray burst discussed in this month's "Weak Signal News" column.

Tremendous Gamma-Ray Flare Blasts Earth

An intense wave of gamma rays, emanating from a catastrophic magnetic flare on a mysterious star 20,000 light years away, struck the Earth's atmosphere on August 27, 1998, providing important clues about some of the most unusual stars in the Universe. Scientists said the gamma radiation posed no health risk to humans.

The wave hit the night side of the Earth and ionized (or knocked electrons out of) the atoms in the upper atmosphere to a level usually seen only during daytime. This astonishing blast of ionization was detected by Prof. Umran Inan of Stanford University. "It is extremely rare for an event occurring outside the solar system to have any measurable effect on the Earth," Inan said. It was so powerful that it blasted sensitive detectors to maximum or off-scale on at least seven scientific spacecraft in Earth orbit and around the solar system.

The wave of radiation emanated from a newly discovered type of star called a magnetar. Magnetars are dense balls of super-heavy matter, no larger than a city but weighing more than the Sun. They have the greatest magnetic field known in the Universe, so intense that it powers a steady glow of X-rays from the star's surface [see Photo B], often punctuated by brief, intense gamma-ray flashes, and occasionally by cataclysmic flares like the one observed on August 27. Astronomers think that all these effects are caused by an out-of-control magnetic field—a field capable of heating, mixing, and sometimes cracking the star's rigid surface to bits.

In June a team of scientists led by Dr. Chryssa Kouveliotou of NASA's Marshall Space Flight Center in Huntsville, AL, used NASA's Compton Gamma Ray Observatory to detect a series of about 50 flashes from the star, a type called a Soft Gamma Repeater (SGR), known as "SGR1900+14" in the constellation Aquila. During the flashing episode, Kouveliotou's team, in collaboration with Dr. Tod Strohmayer and his colleagues at NASA's Goddard Space Flight Center, Greenbelt, MD, pointed sensitive X-ray detectors aboard NASA's Rossi X-ray Timing Explorer satellite toward the star. They found faint X-rays coming from the star, which pulsed regularly in intensity every 5.16 seconds.

These 5.16-second pulses already had been detected in April, when Dr. Kevin Hurley, University of California, Berkeley, aimed the Japanese/NASA Advanced Satellite for Cosmology and Astrophysics (ASCA) at the star. Comparisons of the ASCA and RXTE data showed that the X-ray pulses were gradually slowing down.

The finding implies that the Soft Gamma Repeater has a magnetic field about 800 trillion times stronger than Earth's magnetic field, and about 100 times stronger than any found anywhere in the Universe. Kouveliotou and her team had earlier found that another SGR was also a magnetar. This was exactly what Dr. Robert Duncan, University of Texas, Austin, and Dr. Christopher Thompson, University of North Carolina, Chapel Hill, predicted in 1992 when they originated the "magnetar" theory.

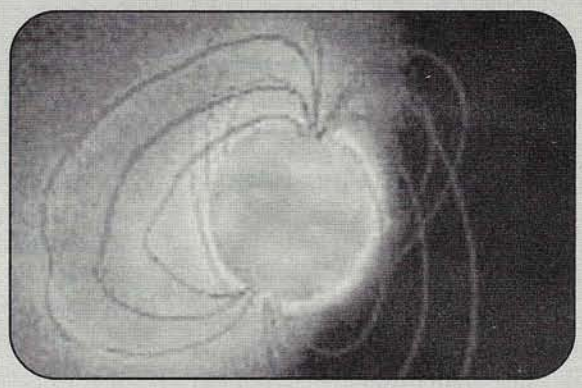


Photo B. Scientists' conception of a magnetar and the intense magnetic field surrounding it. See text for an explanation of magnetars. (NASA image)

Before the NASA team could announce these conclusions, SGR1900+14 emitted the tremendous flare of August 27, which was observed by almost every spacecraft with a high-energy radiation detector in space.

"Magnetars seem to answer several mysteries about the structure and evolution of stars," said Kouveliotou. "We think magnetars spend their first 10,000 years as Soft Gamma Repeaters. As they weaken with age and slow their rotation, they become Anomalous X-ray Pulsars—stars that do not have enough 'juice' to flash anymore, but which emit a steady flow of X-rays for perhaps another 30,000 years. After that, they fade to black and drift for eternity through the heavens. The absence of observable pulsars in some supernova remnants just means that the pulsar's lights have gone out sooner than we expected."

A magnetar forms from the explosion, or supernova, of a very large, ordinary star. The star's heavy center collapses under its own gravity into a dense ball of super-compressed matter 12 miles across. This "neutron star" consists mostly of neutrons in a dense fluid, but the outer layers solidify into a rigid crust of atoms about 1 mile deep, with a surface of iron.

Even with this solid crust, a magnetar is incredibly unstable. Almost unimaginable magnetic fields, about 800 trillion times that of Earth's, cause the crust to crack and ripple in powerful starquakes. The energy released in these explosive starquakes streams out into space as intense flashes of gamma-rays. In the August 27 flare, pure magnetic energy was also released, as the star's entire crust was broken to bits.

"A magnet this strong could erase the magnetic strip on the credit cards in your wallet or pull the keys out of your pocket from a distance halfway to the Moon," said Duncan.

gamma and x-ray radiation were shut down for the night, so there's a real lack of instrumented data on this event. This is why reports from hams who might have been on the air, or listening to any radio service (including AM radio), might be helpful, according to Harden.

So again, if you noticed *anything* while listening to a radio on Thursday morning, August 27th, around 1022 UTC (0622 EDT or 0322 PDT), please report it to Paul Harden, NA5N, at <pharden@nrao.edu>, or c/o *CQ VHF*. Paul says it is important to include your QTH and that of the "other guy," so that path trajectories and distances can be determined.

Reports So Far

The most likely impact of such a gamma ray burst on VHF propagation would be in the form of a strong aurora (Au), since similar radiation from our own sun is what causes Au to begin with (see February, 1997, *CQ VHF* for more on the sun and Au). As soon as this news came out, I posted a message on the two major VHF weak-signal e-mail reflectors (the W6YX "VHF Reflector" and the European-based "VHF-DX" reflector), asking for reports of unusual propagation on August 27. What emerged was a picture of a very busy period for Au buffs, including a major solar flare, which actually made it quite difficult to create any sort of direct association between the gamma-ray burst and any effects on VHF propagation.

"Here in England, we experienced a *huge* aurora," reported an SWL named Karl. And Paul Kiesel, K7CW, near Seattle (CN87) reported:

We had a pretty good aurora that night....I got home from work and found the aurora session already in progress, though there weren't many stations on the air yet. On 6 meters, signals were good, and there were very few Canadian stations, I noted. As it turned out, I only worked two Canadians on 6 meters in the session, but I heard probably six others, north of me, in VE7 (CN88, CN89 and DN09). I worked one VE6 in DO31. However, there was a lot of action to the south. I ended up pointing my antenna at about 80 degrees for the duration of the aurora. I worked the following grids on 6 meters: CN85, CN88, DN06, DN08, DN10 (Nevada!), DN16, DN36, DN37, DN44, DN46, DO31 and six stations in CM88 and CM98 (California).

On 2 meters, signals were also relatively good. I heard a lot more than I worked because my antennas are nearly on the ground due to construction. I worked the following grids on 2 meters: CN85, CN87 (QRP 1-watt station), CN94, CN96, DN13, DN17, DN45, and DN47 (NW7O mobiling down Interstate-15). I also heard, but couldn't reach, CM98, CN80 and DM09 (K7XC, whose phone was always busy!). It was a pretty good aurora that extended fairly far down to the south.

Similar reports were received from hams across the U.S. and in Europe, revealing an auroral event that was not only widespread but very strong as well, with contacts reported as far south as Virginia and North Carolina. "To work somebody that far south indicates a real strong Au," explained Frank Ayers, Jr., W2FCA, from FN22 in upstate New York. But there was also a problem: the times and locations of the reported Au contacts didn't match up with the time or location of the arrival of the gamma rays. In fact, the good Au conditions had started at least two days prior to the gamma rays' arrival. In fact, the only report that really matched up with the timeframe of the radiation burst came from Australia:

I seem to remember working VK3AMK on Au b/s at that time and heard that VK7GUN worked in to mainland VK in the 1000 Z period. As I am currently 13000 km from those logs, I am unable to confirm exact details; however I do remember that it was the first significant 6-meter propagation for many months, as we lacked winter *Es* this year—almost a total waste of listening time during June, July, and August.—Steve Gregory, KL7SIX/BP51 / VK3SIX/QF12ag.

Here Comes the Sun

Then Pat Dyer, WA5IYX, in Texas, pointed out the solar flare:

That [Aug 27] date coincided with a large magnetic storm caused by an Aug. 24 solar flare, so it might be very hard to sort out any

A Personal Note

You may have noticed that the "Weak Signal News" column has been missing for the past few months, and returns this month under my byline. Tim Marek, K7XC, is still our weak-signal columnist, but he has been going through a variety of major personal crises, ranging from a bout with pneumonia in the early summer, to the untimely death of his girlfriend in September (see below). We wish Tim well as he tries to work through these difficult times, and will welcome him back when he's ready to resume writing his column.—W2VU

N7TUA/R, Silent Key

By Tim Marek, K7XC

It is with great sadness that I report the loss of Jennifer Nugent, N7TUA, my significant other, fellow rover, microwave engineer, and best friend.

She was unique! A self-taught microwave engineer who never owned any 432 equipment but built a one-of-a-kind design 432-MHz EME array just to prove a theory to herself! Her knowledge of VHF/UHF/microwave was sizable, leading to some heated debates on things like antenna theory and the physics of RF propagation. She had a different way of looking at problems and came up with some of the most original solutions I have ever seen. In the nine months we were together, I had never seen anyone as passionate as she was about VHF, UHF, and microwave (her favorite). Look in the December, '98 *QST*, ARRL June VHF Contest results, for her first (and only) Rover score. I'm sure she would have made many notable and innovative contributions to amateur radio VHF and above weak signal work.

I will miss her...a lot. Words do no justice as to how sad I am, so I will merely ask you all to remember her in your prayers and be thankful that she is finally at peace.

A "Roving" Legacy

Jennifer's father, Chuck Nugent, has donated her entire mobile station to me to do with as I see fit. In memory of Jennifer, I plan to create the "N7TUA Memorial ROVER Station." It will consist of all of her 28-, 50-, 144-, and 432-MHz gear in a rack mount complete with amplifiers and will be made available to seriously interested parties for use as a rover station in the various VHF+ contests. I can't think of a more constructive way to use the equipment and at the same time preserve the memory of someone very dear to my heart. Parties interested in supporting and/or using the memorial station can contact me at K7XC@vhf.reno.nv.us.

73 de Tim Marek—K7XC/R...sk

of the causes/effects. Our local TV weatherman (who really should've known better) jumped to the conclusion that the aurora that he'd seen then while on vacation in New Hampshire was due to that gamma-ray burst!

Quoting Pope, "a little knowledge is a dangerous thing"—and can sure lead folks in to quickly making 2 + 2 = 5 judgments. Now if there'd been no prior solar activity and that magnetic storm had come along...

Other hams came to similar conclusions. Among them, Roger Horne, G4HBA, in Great Britain:

Unfortunately, the Gamma ray flare reported may just have coincided with a major solar event. On 27th, Aug I experienced a major radio aurora on 50 MHz. This event was extremely widespread, and was reported globally. The 21:00 Z solar indices for the 27th were 135/82/3. During the height of the storm, the A index is reported to have peaked at 138, and the K index at 8 or 9.

This storm was attributed to a C.M.E. [coronal mass ejection] from an X-class flare that took place on the 24th of August and indeed was a major event. An M-class flare erupted about 30 hours later on the 25th. so, as you can see this was a very active time on the solar surface.

It is reported that the main impact from the X class flare was 24 hours later than expected in the main body of the plasma, arriving on the 27th August.

Conclusion?

So...it would appear from the observations of these hams scattered around the U.S. and, indeed, around the world, that *if* the gamma ray burst did cause any aurora on VHF here on Earth, it was mixed in with a very active Au period that began several days earlier and, fueled by two large solar flares, continued for several days afterward. But the research is ongoing, and any reports from the specific time of the burst's arrival—1022 UTC on August 27—may prove to be very helpful as astronomers try to sort out the effects on Earth of this "strange visitor from another galaxy." Our thanks to all who responded to the request for reports. All of the reports have been forwarded to Paul Harden at NRAO.

"That [Aug 27] date coincided with a large magnetic storm caused by an Aug. 24 solar flare, so it might be very hard to sort out any of the causes/effects."—Pat Dyer, WA5IYX

Other Weak Signal News

A 6-Meter DX "Wake-up Call"

It was widely expected in early fall that November and December might provide the first solid F_2 openings of the current sunspot cycle on 6 meters, and there were "signs of life" on six and nearby frequencies, as TEP (transatlantic propagation, a form of F_2 skip) became more frequent. Jack Henry, N6XQ, in San Diego, reported hearing and working the following during September:

31 Aug 2330—Heard VK (Australian) TV video 46.171 up to S7; could not raise any VKs on 28.885 (the VHF DX scheduling frequency)

1 Sep 0030—Started hearing all 3 ZL (New Zealand) video carriers 45 MHz S1-S2; VK video was getting much weaker at this time.
0200—Returned from dinner and heard ZL TV audio 50.760 in and out
0208—Heard ZL2KT calling CQ on 50.110 peaking 559; had partial contact with Ray 50.110, did not copy my sig rpt.; Ray and the 50.760 faded fast. I believe all of this propagation to be F2.

24 Sep 0240—LU7FA SSB 57-59

24 Sep 2340—LW5EJU SSB 57
2345—LU3DL SSB 59
2355—XE2HWB/B 579

25 Sep 0210—LU9EHF SSB 57

The opening on the 25th was also into Los Angeles.

We (in California) observed only a fraction of what the W5s are reporting into South America and seem to get it a little bit later. 47.9 MHz Chile music is usually present during the openings. Several days I have heard the 47.9 with no 6-meter signals observed.

And Zaba, OH1ZAA, in Finland, posted this "wake-up call" on the VHF e-mail reflectors:

It is perfectly OK to start checking the EU-VK path [Europe-to-Australia]. With fluxes above 140 or so, the chances are increasing from the end of October to X-mas and chances are good up to mid-March, 1999, for the first serious slot. It is important to make noise on the calling frequencies....There will be probably some listen, listen, listen-style applied but here one needs the call, call, call-line as well....Good luck!

Barefoot EME

Finally, we have this report from Chip Margelli, K7JA, of a (relatively) low-power, single-Yagi EME contact:

I am pleased to report that I worked W5UN at 0135 UTC/2 October 1998 on 144 MHz EME. Ho hum?

I was running a completely barefoot FT-847 with *no* external PA [power amplifier] and *no* external preamp, into 75 feet of LMR-400 feedline, feeding a single 10-element K5GW Yagi on a tripod on my roof!!! The 500-Hz CW filter was engaged, and the DSP [digital signal processing] bandpass filter was set to 25 Hz. W5UN was about 4–6 dB at about 28 degrees of elevation (i.e., no ground gain!). I was also hearing K5GW, but I unfortunately arrived home late for our sked at 0100 UTC.

Congratulations, Dave. Great ears and a great system! Any other big guns out there want to give it a try?

The Outlook for December

Winter's chill tends to put a damper on VHF activity, but this December 6 meters in particular could be hot enough to melt the snow on your roof! Wintertime sporadic-*E* should be back, as well as the possibility of long-awaited F_2 propagation and the super DX that comes with it. As of October, 15, 12, and 10 meters were wide open, and 46-MHz video signals from New Zealand were regularly being heard in the western U.S. For "ping jockeys," December and early January will feature three meteor showers to keep things "burning" on six and two.

So keep your rig warm for a hot time on the air this December. And, of course, all the best to you and your family for the Holiday Season and the new year. ■

Resources

More information on magnetars and the August 27 gamma ray burst are available on the following Web sites:

National Radio Astronomy Observatory:
<http://www.nrao.edu/pr/magnetar.html>

NASA:
<http://www1.msfc.nasa.gov/NEWSROOM/> and
<http://www.magnetars.com/>

Fun on a Budget: QRP'n via Satellite—Part 2

If last month's column got you started trying to work OSCAR-27 on your dual-band handheld, this month's installment will help you increase your chances for successful contacts.

Are you ready for more big-time thrills on a small-time budget and more high-flying adventures in VHF/UHF QRP (low power), friends? Well then, the excitement continues right here in Part 2, and it is blowout fun for everyone!

Did you try your hand at QRP'n on AO-27 with your dual-band FM talkie during the past month? Were you surprised at your ability to communicate nationwide using only a pocket-size rig and a whip antenna? If you answered "yes," you probably would like a few more ideas and tips for increasing your contacts-per-pass ratio. If you said "no," you're probably wondering what's wrong or (heaven forbid!) whether success with QRP is unpredictable and simply a matter of luck rather than skill (banish the thought!). That's why we're continuing with a second part to this column.

This month, I'll share some secrets and tips for success, pass along some antenna ideas (both commercial and homebrew), and give you a quick course in becoming QRP-proficient. There's an additional hidden benefit here too: if you become a sharp operator with low power, imagine how good you'll be if you ever go back to high power, try moonbounce, meteor shower DXing or rare grid square DXing. It boggles the mind!

Yes indeed, QRP works! In fact, it's the hottest trend in amateur radio today. You must, however, be a true believer and a positive thinker to be successful. Ah, but positive thinking alone is not the answer: it must be supported by "stacking the odds" in your favor (sorry 'bout that, Dale Carnegie!). In other words, weed out all possible guesswork so success is imminent...indeed, unavoidable. Then you can't miss! How do you get that mindset? Read on!

A Potpourri of Tips for Success

Whether working HF, VHF, or satellites, a QRPer's greatest assets are operating expertise and communications savvy (the ham's version of "knowing when to hold up, when to fold up, when to walk away, and when to run"). With that in mind, I compiled a selection of time-proven tips and techniques to ensure your success right from the start (my famous philosophy of squeezing maximum information into minimum space). Let's begin by quickly reviewing some basic, yet vital, facts on gear and then focusing on operating effectively.

First, your dual-band FM transceiver should be capable of full duplex operation (receiving on one band while transmitting on the other band), have extended 70-centimeter reception to include 436.780 MHz (± Doppler), and be able to tune in 5-kHz steps. Can you get by using a half duplex rig? No, you must monitor the downlink frequency while transmitting to know if and when you are getting into the satellite, when others are "walking over you," and the best position (pointing angle) for your antenna at each instant. Why not just run high power (QRO) and bulldoze your way in? Tsk, tsk! One QRP QSO holds more merit and excitement than 10 QRO QSOs.

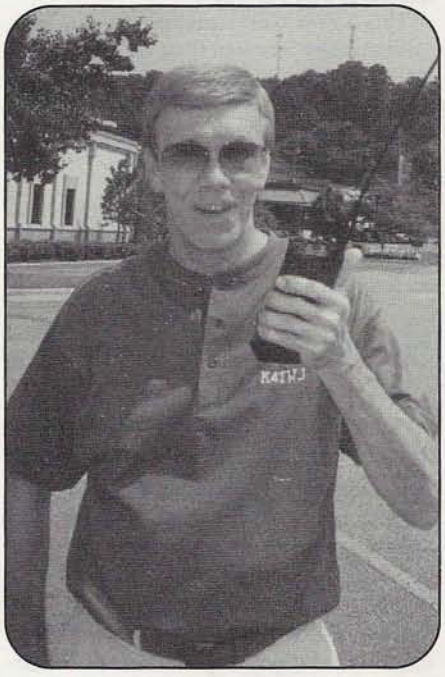


Photo A. Sometimes, even the most ideal-looking spot for QRP'n via AO-27 holds hidden surprises. This "clear sky view" location seemed perfect for horizon-to-horizon operation, but look closely and you'll see a large cellphone site in the distance right behind me.

Furthermore, no one can accuse you of being an alligator (all mouth and no ears, that is). If necessary, they can just impolitely talk over your QRP signal (hmmm, being a QRPer could be a big asset!).

After setting up your talkie, an extended-length whip antenna to use with it, and earbuds wired to hear only 70-centimeters in both ears (see Photo A), test your trans-

By Dave Ingram, K4TWJ

Table 1.

Date (December '98)	Middle of Pass Time in UTC	Satellite Approx. over Listed State
1	1651	MO
2	1624	KS
3	1735	UT
4	1710	CO
6	1616	VA
7	1549	SC
9	1633	KS
10	1608	IL
12	1655	CO
14	1601	VA
16	1646	KS
17	1618	OH
18	1553	SC
20	1639	CO
21	1612	VA
23	1657	KS
24	1625	MO
25	1605	VA
27	1654	IL
28	1619	MO
30	1550	VA
31	1522	SC

Table 1. Predicted times for some randomly selected AO-27 passes over the U.S. during December. Middle-of-pass time is approximately six minutes after AOS (Acquisition of Signal) and six minutes before LOS (Loss of Signal).

mitting and receiving capabilities on some fringe area repeaters. Acquire the knack of quickly changing bands and frequencies while working full duplex. Ensure that your whip/pull-up antenna reaches out better than your rig's supplied duckie. Study how foliage and mid-morning temperature inversions unexpectedly attenuate, reflect, or duct signals and alter your direction of communications.

Avoid using cheap earbuds unless you can ensure their audio response with your talkie is communications quality. Some (many?) earbuds have bass/treble boosts and actually reduce mid-range (voice) response. If you experience problems understanding call letters, check your 'phones! As I finished writing this month's column, MFJ announced its MFJ-2911 earbud earphone (see Photo B). I just got to try one and it's ideal for operating QRP on AO-27. Best of all, it's only $4.95! For information, contact your favorite dealer or MFJ Enterprises (see "Resources" for contact info).

Are you now set up for satellite fun? OK, refer to "AO-27 Secrets of Success," elsewhere in this article, double check to ensure your anticipated pass time and frequency/time chart is correct, and go for it! Some orbital predictions for this month are included in Table 1 to help you, and another frequency/time relation chart (perchance you misplaced the one in last month's column) is included in Table 2. For best first-time results, try to select a pass that's high in the sky/near overhead for maximum signal advantage. As explained last month, this pass may be an hour and 42 minutes earlier or later than our selected pass times shown in Table 1. Operate outdoors so a clear sky path exists between you (actually your rig's antenna) and AO-27. Immediately before pass time, double check your rig's performance on previously referenced fringe

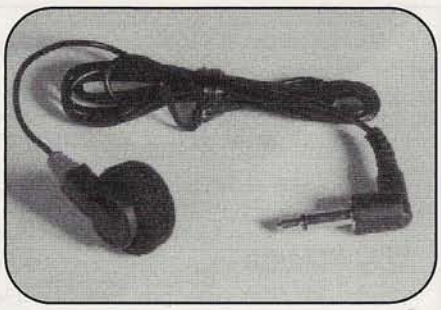


Photo B. The MFJ-2911 earbud earphone became available just before we went to press, and is ideal for working QRP on AO-27. (Photo courtesy MFJ)

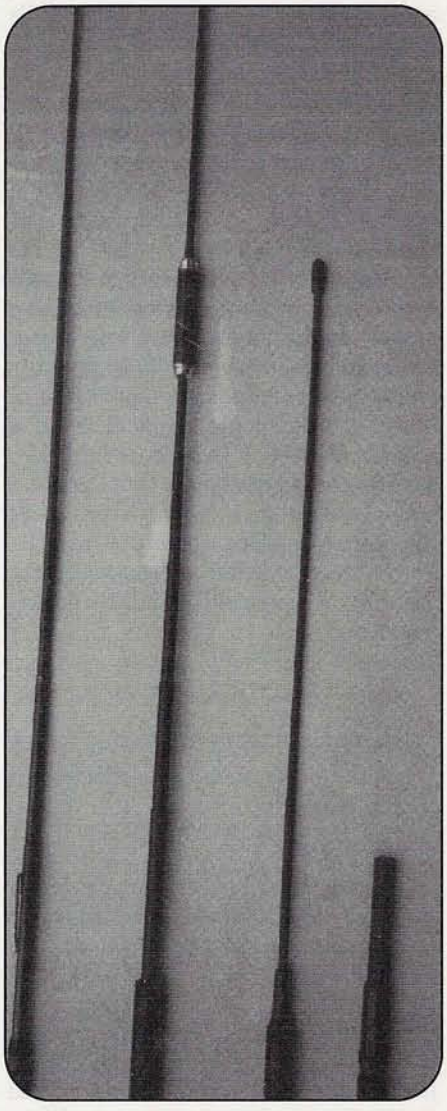


Photo C. Some QRP-worthy antennas that increase your FM handheld's effective radiated power (ERP) include (left to right) Kenwood's 3/8-wave 2-meter pull-up whip, Premier's AL-800 dual-band "Big Daddy" pull-up, and MFJ's 1717 flexible dual-band whip. A standard dual-band duckie is included at the far right for size reference.

Table 2.

Transmit/Uplink Frequency (MHz)	Receive/Downlink Frequency (MHz)	Notes
145.845	436.805	AOS
145.850	436.800	
145.850	436.795	Middle of pass
145.850	436.790	
145.855	436.785	LOS

Table 2. Uplink/downlink frequency relation chart with Doppler shift corrections for each approximately 2.5 minutes of an AO-27 pass.

area repeaters. *Switch back to AO-27's frequencies*. Check yourself by briefly transmitting on 145.850 MHz while receiving on 436.795 MHz (this might seem trivial, but getting frequencies confused or transposed at this time is all too easy. Trust me.). The satellite should not be in range yet, so you shouldn't hear anything on 436.795 MHz.

What's that? You say you heard howls and/or your own voice—probably fuzzy or distorted? Egad, Sinbad, it's the dreaded dragon of *intermod*! Quite possibly you're near a cellphone repeater site or business band paging system antenna without realizing it (see Photo A again... and look very closely this time). Make a mental note of how it sounds for future reference (maybe tape record it), then get out of there and find a cleaner spot for "satellite'n"—hopefully before actual pass time!

Into High Gear

When the satellite moves into range, it's time for you to move into high gear. Open the squelch on your rig's 70-centimeter receiver, make sure you're listening on 436.805 MHz for AOS (acquisition of signal) rather than on the center frequency of 436.795 MHz or that fringe repeater frequency you checked, then transmit on 145.845 MHz. Move your talkie so its whip antenna is broadside to the satellite's estimated position, then try pointing the whip's tip in that same direction. This should help give you a good feel for hand-positioning antennas. Within three or four minutes (probably after you've Doppler-corrected your frequencies to 436.800 MHz receive/145.850 MHz transmit), you should hear your own signal being relayed via AO-27. It may sound unusual due to mild receiver desensing, but, with practice, you can determine its difference from intermod sounds (this is when that previously mentioned tape recording is handy).

Got it? Congratulations—you're "in"! Be nimble, brief, and concise (otherwise the big signal guys will tromp over you!). I find calls/replies like "**K4TWJ—QRP Dave in Alabama**" get across maximum information in minimum time. Possibly you can streamline my technique. Find what works best for you.

Special Tips (Don't Tell Anyone Else)

Finally, here are a few special tips. Know your grid square. Many satellite operators are avid awards chasers looking for new grids (see Figure 1). Operate portable from a rare grid, and you could easily be bombarded with calls. Also, keep a grid square map handy for spotting QTHs (yours when traveling; others' when at home). Listen for those prime minutes when AO-27 is near your horizon and out of range of the big guys. If you live close to a border, the satellite may be closer to a DX area, like Alaska or the Caribbean, and accessible from your QTH.

Remember that rainy and/or heavily overcast days can produce atmospheric moisture and unexpected signal ducting or attenuation. During such times, you may not be able to communicate via AO-27—even if it's in a clear sky position. Be patient. Better days and clearer skies will follow.

If you're really lucky, you might someday be surprised with the ultimate compliment of having "a very good signal for QRP" (translation: "I can't believe you're actually QRP"). Don't expect such favorable words, however; some folks feel embarrassed when outdone by a simple QRP rig (sort of like those old Beetle bumper stickers stating "you have just been Volkswagened—passed by 32 horsepower").

QRP Wednesdays?

During past times and satellites, Wednesday was traditionally "QRP Day." Everyone voluntarily ran low power on their favorite satellite. The trend has faded with time, but if enough interest is voiced, there's a chance it can be reinstated. Interested? Send your vote on a postcard or QSL to *CQ VHF*, and we will collect, tally, and pass them over to AMSAT with hearty encouragement to bring back QRP Wednesdays. This could be the start of something big!

Antenna Notes and Ideas

As previously discussed, using a better-than-duckie or extended length antenna with your FM talkie is vital for successful QRP'n via AO-27 (see Photo C).

AO-27 Secrets of Success

Here's a condensed potpourri of tips for satellite QRP'n success on AO-27. Some may seem obvious, but they're also among the easiest to forget:

Be sure that...

... your predicted pass times are correct.
... your transmit and receive frequencies are right.
... your rig is transmitting on 2 meters and receiving on 70 centimeters.
... your added-on satellite antenna "outworks" your rig's supplied ducky.
... your rig's 2-meter volume is near zero.
... your rig's 70-centimeter volume is "up" and 70-centimeter squelch is open for easy copy of weak signals.

"If you're really lucky, you might someday be surprised with the ultimate compliment of having 'a very good signal for QRP' (translation: 'I can't believe you are actually QRP')."

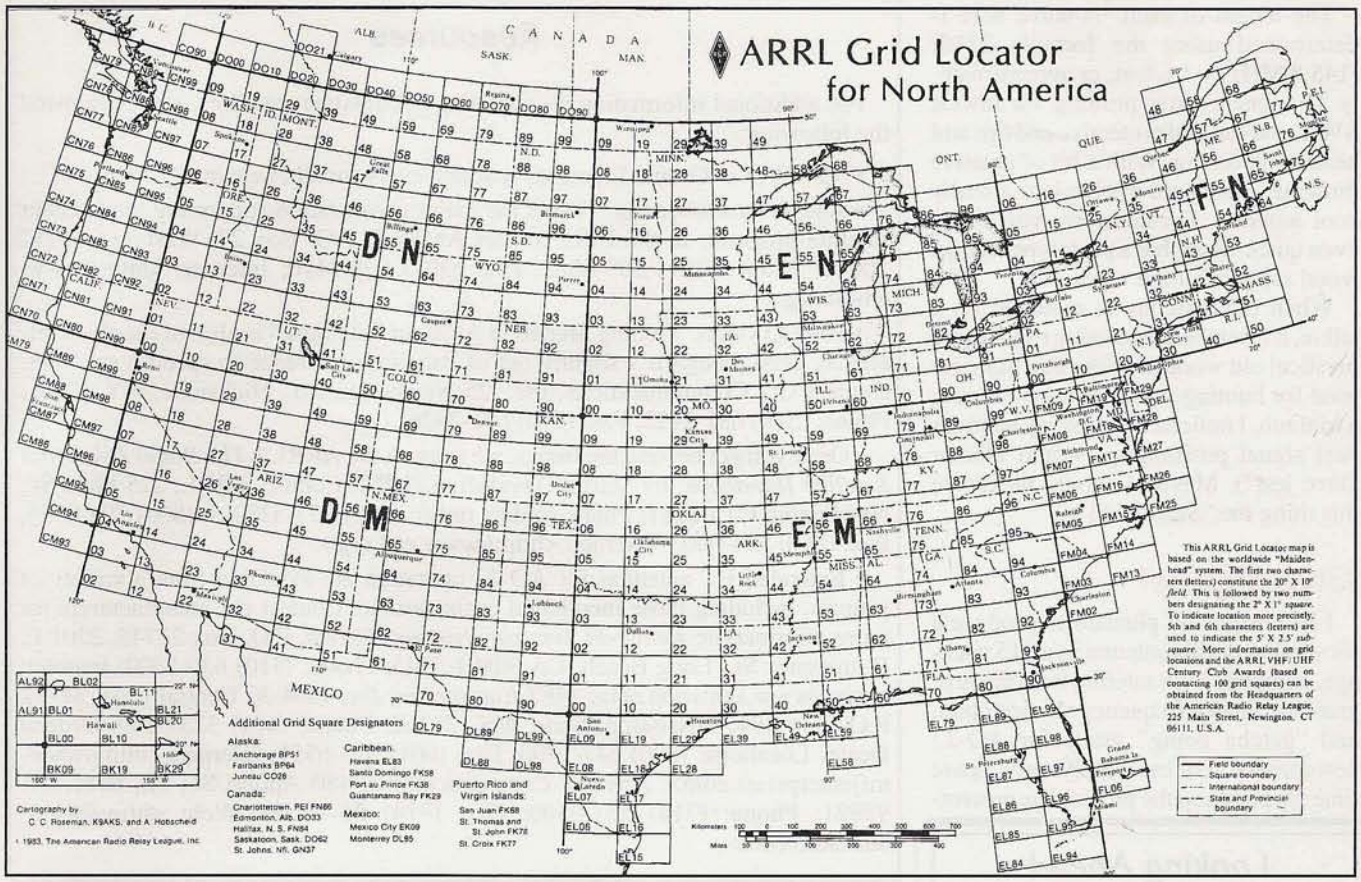


Figure 1. Grid square maps are quite popular among satellite operators and VHF awards chasers. They also permit pinpointing locations. This is the ARRL VUCC Grid Locator Map (© 1995 ARRL, reprinted with permission)

Two good choices are the MFJ-1717 and Premier's AL-800. The MFJ-1717 is 17 inches tall and exhibits approximately 2 dB gain on 2 meters/3 dB gain on 70 centimeters, as compared to a rig's supplied duckie antenna. The Premier AL-800 is 10 inches collapsed, 34 inches extended. Compared to a duckie, its gain is approximately 3 dB on 2 meters/5.5db on 70 centimeters. Other pull-up antennas worth trying include Kenwood's older 3/8-wave pocket-clip whip for 2 meters (only) and AEA's older 5/8-wave Hot Rod whip (also for 2 meters only). The Kenwood and AEA whips exhibit a medium to high feedpoint impedance on 70 centimeters, but since we'll only be receiving on this band, they should work well regardless. Just remember not to transmit on 70 centimeters using a 2-meter antenna!

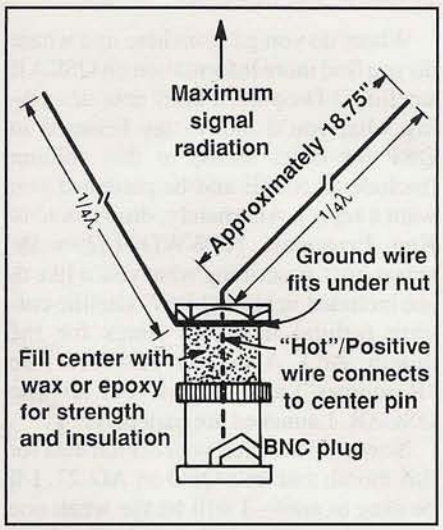


Figure 2. Outline of an easy-to-assemble Vee dipole (a.k.a. the "Satwitch") for QRP'n via AO-27. See details in text.

Two more notes: Avoid using ultra thin diameter whips (they're too springy or floppy to hold a steady signal position or polarity) and always check a 2-meter antenna's 70-centimeter receiving abilities with its mated talkie before pronouncing it "satellite ready."

Roll Your Own!

Feel creative and adventurous? Consider homebrewing a unique style antenna just for satellite work. Like a turnstile antenna, you ask? No, but you're thinking on the right track. Crossed dipoles would be a good choice for a high-power setup that could afford the luxury of spraying RF energy in all directions, but losing half your power to the wrong polarity is not acceptable for QRP. So consider your assets, then expand on that idea. Since your rig and antenna are right in your hand, you can position them "on the spot" for optimum transmit and receive signal strength. Now if you could just find a small gain antenna to fit on the talkie...hmmm...

Let's fabricate a full-size half-wave dipole from two pieces of thin, yet sturdy, solid wire (like small diameter copperweld) and form it into a Vee, as shown in Figure 2. Next, solder one end of each wire into a BNC connector (again, see Figure 2) so it can be attached to our FM handheld. This configuration places your talkie at the antenna's feedpoint to eliminate transmission line losses, makes the antenna easy to maneuver by hand, and directs RF energy forward or slightly upward. Its 70-centimeter impedance will be medium-high, but that should not noticeably hinder satellite reception.

The length of each 1/4-wave wire is determined using the formula 234/F (145.8 MHz) = 1.6 feet, or approximately 19 inches. After pruning for lowest SWR, you can add protective end tips and heatshrink tubing. With a bit of creative thinking, this could evolve into a really cool antenna. Furthermore, you could even quick-assemble a prototype using a wood support for the wires.

When this antenna is mounted on a talkie, it resembles a dowsing rod—those mystical old wooden sticks that pioneers used for hunting water. Hmmm...during a trial run, I noticed it pulled my hand for best signal positioning (would Doctor Dave jest?). Maybe I should nickname this thing the "Satwitch"!

Kits, Anyone?

I had originally planned to produce a kit version of this antenna in a $15 package, complete with satellite tracking program, laminated frequency relation chart, and "getcha going" guide for AO-27 newcomers. Unfortunately, my spare time for pursuing the project has presently dropped to zero. But if enough of you are truly interested, I could shift priorities and start making kits. Talk to me (with an SASE)! My address is Dave Ingram, K4TWJ, 4941 Scenic View Dr., Birmingham, AL 35210.

Resources

For additional information on operating the amateur satellites, we recommend the following:

- N2WWD's "Orbital Elements" column every month, here in *CQ VHF*.
- AMSAT membership. This is the major organization supporting the amateur satellite program. In the U.S., contact AMSAT, P.O. Box 27, Washington, DC 20044; Phone: (301) 589-6062; Fax: (301) 608-3410; Internet: <http://www.amsat.org>.
- The CQ video, "Getting Started in Amateur Satellites," is also an excellent reference, even though it's slightly out of date with reference to specific satellites. Contact CQ Communications, Inc., 25 Newbridge Rd., Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926.
- Once you get beyond the basics, we suggest the ARRL's *The Radio Amateur's Satellite Handbook*, by Martin Davidoff, K2UBC. Contact ARRL, 225 Main St., Newington, CT 06111; Phone (orders only): (888) 277-5289 or (860) 594-0355; Fax: (860) 594-0303; Internet: <http://www.arrl.org>.
- Extended HT antennas for AO-27 operation are available from a variety of sources, including those mentioned in this article. Contact the manufacturers for more information: *Kenwood Amateur Products Group*, P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745; Phone: (310) 639-5300; Internet: <http://www.kenwood.net>; *MFJ Enterprises, Inc.* (8–4:30 Central time, M–F), P.O. Box 494, Mississippi State, MS 39762; Phone: (601) 323-5869; Orders/Dealer Locations: (800) 647-1800; Fax: (601) 323-6551; Internet: <http://www.mfjenterprises.com>; *Premier Communications*, 480 Apollo St., #E, Brea, CA 92821; Phone: (714) 257-0300; Fax: (714) 257-0600; Web: <http://www.adi-radio.com>.

Looking Ahead in CQ VHF Ham Radio Above 50 MHz

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

- "Make Your HT Talk Forever," by Ken Collier, KO6UX
- "The 550T+ Laser Team," by Eric Stroud, KB2TCQ
- "Ozone Propagation: Pondering the Possibility," by David Dunham, WA1CUH

Plus...

- "2-Meter Mountaintopping with Mirrors," by Ed Butler, KF6DXX
- "An Indoor OSCAR Station," by Carl Jensen, KE6SGU

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.

Expanding Your Satellite Horizons

After getting your feet wet QRP'n with AO-27, you may be inspired to expand your horizons by working some of our SSB/CW satellites, like RS-15 or OSCAR 10. Terrific idea, and the gear up cost is quite reasonable if you go QRP. Russia's RS-15 is a very good choice, as it's presently operating mode A (2 meters up, 10 meters down) in a low/near earth orbit and easily accessed with low power. (*Don't worry if you don't have 10-meter operating privileges. As long as you're transmitting within your privileges, like on 2 meters with a Technician license, you're OK—ed.*) OSCAR 10 is a bit aged and has some ailments, but it still relays signals over one-third of the world several days weekly. Getting set up with a fancy antenna system for OSCAR 10 now is also the perfect way to prepare for our next big Phase III satellite in the future. Go for it, friends! High-band hamming in the new millennium is going to be great!

Where to Next?

Where do you go from here and where do you find more information on OSCAR satellites? Drop me a brief note describing what you'd like to see featured in QRP (or other areas) in this column (include an SASE and be patient if you want a reply). Alternately, drop a note to Ken Ernandes, N2WWD (n2wwd@amsat.org), describing what you'd like to see included in his *CQ VHF* satellite column (orbital data/pass times for the month, etc.). Also, join AMSAT (see "Resources") and support your favorite OSCAR. Launches are expensive.

Now double check your orbital data for this month and let's QSO on AO-27: I'll be easy to spot—I will be the weak one running low power! 73 and may the force of QRP be with you!

—Dave, K4TWJ

The 6-Meter DX Window: A Dissenting Opinion

A well-known VHFer says the solution to the "problem" with the 6-meter DX Window is simple: "It ain't broke. Don't fix it."

I read with interest October's pages concerning the debate about widening the DX window ("The 6-Meter DX Window: Why, Where, and How Big?" by Bill Tynan, W3XO, and Ken Neubeck, WB2AMU; plus editorial comments in "Line of Sight"). I thank you for the space to voice my opposing viewpoint. I have several points of opposition:

1. It may seem to some that the "SMIRK Board of Directors" would be representing a large contingency. That is not the case. My SMIRK (Six Meter International Radio Klub) number is 5633. The SMIRK membership was never polled. The SMIRK Board represents only a small handful of hams who are primarily located in and around the south-central states. In fact, the 1997 SMIRK contest results indicate that very few 6-meter operators actually invest any time in SMIRK events. As I said, it only *seems* that the SMIRK BOD represents a large number of 6-meter operators.

2. The whole idea that we need a wider DX window serves only those who have already accomplished that which the rest of us are striving for. They were able to rack up their 100 countries, finding them easily in the narrow DX window, and in the lower end of the domestic window. The rest of us, who have not yet worked our first 100, will have to tune 100 kHz to find the DX we need. The widening of the DX window seems a little self-serving.

Consider an Easter egg hunt. In which circumstance will you be more successful in reaping a large harvest of hidden Easter eggs? If they are spread over an acre? Or over a square mile? I suppose that, once your basket is full, it would be easy to say, "Open it up."

3. The current DX window is not too narrow. It is a *perfect* starting point to watch for and call for DX. I say starting point because, even without unnecessary legislation, it already does open up when the band opens up.

4. The idea that there will be many more 6-meter operators this sunspot cycle than last is unfounded. I hope it's true, but operating reports and published contest results suggest just the opposite. It's been a long time since so few hams have submitted logs in the 6-meter category of any VHF contest. We might point only to Field Day, where VHF tables are gaining popularity, to get No-Code Technicians involved. I think it's great that Field Day VHF is growing, but few, if any, of the Field Day VHF operators will be in there with the rest of us for the many exciting F_2 openings to come. The large number of radios that now include 6 meters does not indicate to me that we are going to have a hard time finding a place to work DX.

"The whole idea that we need a wider DX window serves only those who have already accomplished that which the rest of us are striving for."

5. Finally, I take great exception to the SMIRK idea that DX is only those stations outside the contiguous 48 states and VE1-VE7 (*the southern Canadian provinces—ed.*). I am amazed that Florida stations can work "DX" stations in Cuba, and Texas stations can work "DX" in Mexico, but I (in Michigan) cannot work "DX" on Prince Edward Island or Vancouver, British Columbia —even though they are farther away! That is ridiculous!

Many of the proponents of the "wider DX window" are very good people and have my respect. But having given much consideration to this issue, I must disagree with them. I feel the change will help a few, but will do harm to the greater number of 6-meter operators, *especially* the new ones. ■

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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.*

By Dave Bostedor, Jr., N8NQS*

**Dave Bostedor, Jr., N8NQS, is Editor of the* Great Lakes VHF/UHF Newsletter *and Chairman of the Great Lakes VHF/UHF Contest Club, KC8AAZ. He lives in Jackson, Michigan.*

The FODtrack Antenna Tracking Interface

The FODtrack interface, designed by XQ2FOD, helps you automate antenna tracking in your satellite station. This homebrew controller, when hooked up to your PC, gives you "hands off" antenna pointing and tracking as a satellite moves across the sky.

Amateur satellite communications has some complexities that can pose interesting challenges. If you're using beam antennas, one challenge is keeping them pointed at the satellite as it moves across the sky. Doing this manually is especially difficult when working low altitude satellites, since they move quickly. It wasn't too long after I began using beam antennas for satellite communications that I started looking at options for automatic (computer-controlled) antenna pointing and tracking.

I was looking for an external interface to the computer that would allow me to hook it up between any computer and a Yaesu G-5400B rotor, whether I was at home or giving a field demonstration. The FODtrack interface, designed by Manfred Mornhinweg, XQ2FOD, from Chile, fit this goal perfectly. I included a brief discussion of the FODtrack in the June 1998 "Orbital Elements" column while describing the WA2PNU portable satellite station. I've since gotten inquiries about the interface, so I decided to provide a more complete description, plus a few modifications and some help toward building one yourself.

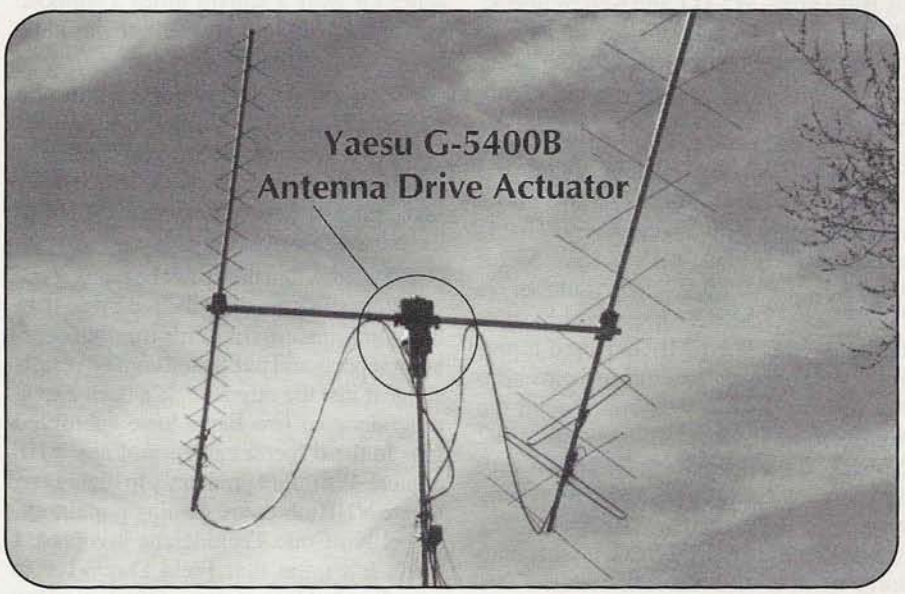


Photo A. The Yaesu G-5400B drive actuator has the two motors that point the antennas to the desired azimuth and elevation angles, tracking the satellite across the sky.

About the Yaesu G-5400B

To describe how the FODtrack works, I need to first give you some insight into the Yaesu G-5400B azimuth/elevation (AZ/EL) rotor. The G-5400B has two basic components: the two-axis (AZ/EL) *drive actuator* and the *control box*. The drive actuator has the motors and gearing and does the actual antenna pointing (see Photo A). The control box, shown in Photo B, has up and down switches for manually controlling elevation and left and right switches for manually controlling azimuth. The two meters show the current antenna AZ/EL position on the control box's front panel. These are voltmeters, getting two 0- to 5-volt DC feedback signals from the actuator. The drive actuator has rheostats on the AZ and EL axes that follow the antenna position and feed back the corresponding voltage.

On the back panel of the control box is an 8-pin DIN connector. The pins of this connector include a ground, +13.8 volts DC, and the two AZ/EL feedback voltages. The remaining four DIN connector pins correspond to the up, down, left, and right switches on the front panel. Grounding any of these pins is equivalent to pressing the corresponding switch on the front panel.

How the Interface Works

From your computer's point of view, the FODtrack is a "fire and forget" inter-

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

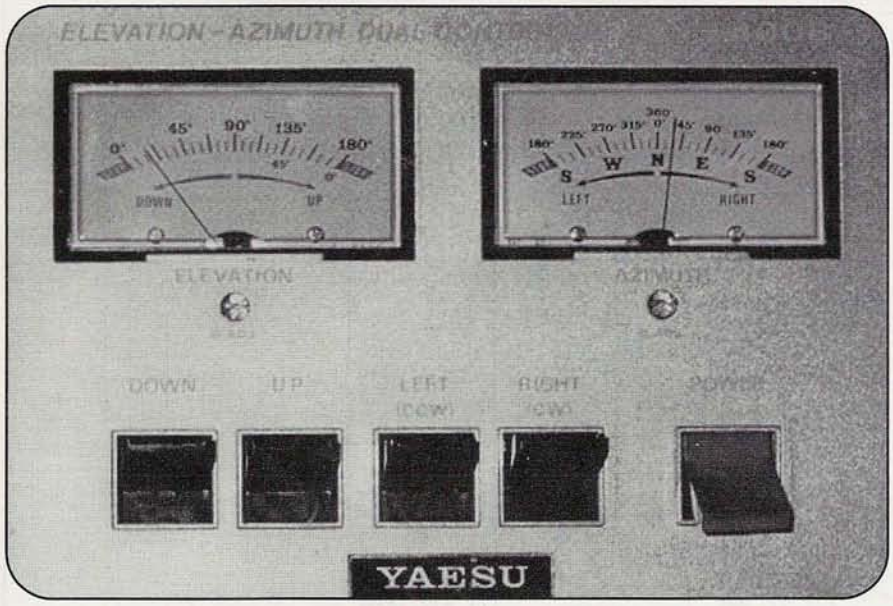


Photo B. The Yaesu G-5400B control box has two voltmeters that read back the antenna azimuth and elevation angles as well as switches to move the antennas up, down, left, or right.

face. Your computer sends AZ and EL angles in digital form to the FODtrack. The FODtrack uses analog circuitry to "close the loop," pointing the antennas in the AZ/EL direction received from the computer. The XQ2FOD schematic diagram of the FODtrack interface is reproduced in the Figure. You can download the entire FODtrack information package from my personal Web site, <http://www.mindspring.com/~n2wwd>, under "Tracking" then "Antenna Control."

The FODtrack receives antenna pointing AZ and EL angles from the computer's parallel (printer) port. This information is input to the AD7528 dual digital-to-analog converter (DAC). The actual AZ or EL angle is encoded as an 8-bit (0-255) integer by the computer. When a signal is sent on pin 16, the DAC accepts an encoded angle at pins 7 through 14. The signal on pin 6 tells the DAC whether the angle is an AZ or an EL (i.e., the two angles must be sent at different times). The DAC then outputs two voltages, corresponding to the input AZ and EL angles at pins 4 and 18.

The FODtrack uses three operational amplifier (op-amp) ICs: two LM324 quad op-amps (RadioShack # 276-1711) and one LM358 dual op-amp. The LM358 produces reference voltage levels needed by other parts of the interface. One of LM324s is used as a difference amplifier, measuring the difference between the rotor's current AZ and EL angles (fed back as voltages from the control box) and the commanded AZ and EL angles output as voltages from the DAC.

The other LM324 compares the difference between the commanded AZ/EL positions and the angles fed back from the rotor. If the difference is small (within one bit of the commanded value), it's considered within the "dead band" and the rotor remains stationary. If the difference is either higher or lower, an NPN switching transistor will bias on at the base, causing the emitter to go to ground and switching on the rotor. The switching transistors are set up in pairs in which only one can be switched on at a time, depending on whether the difference between the commanded and feedback angle is above or below the "dead band." When the rotor reaches the correct angle, the difference is in the dead band and the rotor is switched off.

Building the First Prototypes

The first FODtrack interfaces I built used point-to-point wiring on a perforated board with foil backing pads and cost a total of about $40 each. The interfaces worked reasonably well from the beginning and were built not only so I would have one available for my personal ham shack, but also with a view toward making an inexpensive tracking interface easily available to other interested satellite operators. The first FODtrack interface I built appeared in the June 1998 "Orbital Elements" column.

My partner in this project was my friend Dr. Fred Winter, N2XOU, who is an electronics technology professor at Suffolk County Community College in New York. Fred was interested in using the FODtrack as a student project in the Electronics and Communications curricula at the college, as well as for automating his own satellite station. With the help of a student, Fred laid out the circuit board design on the computer so these could be

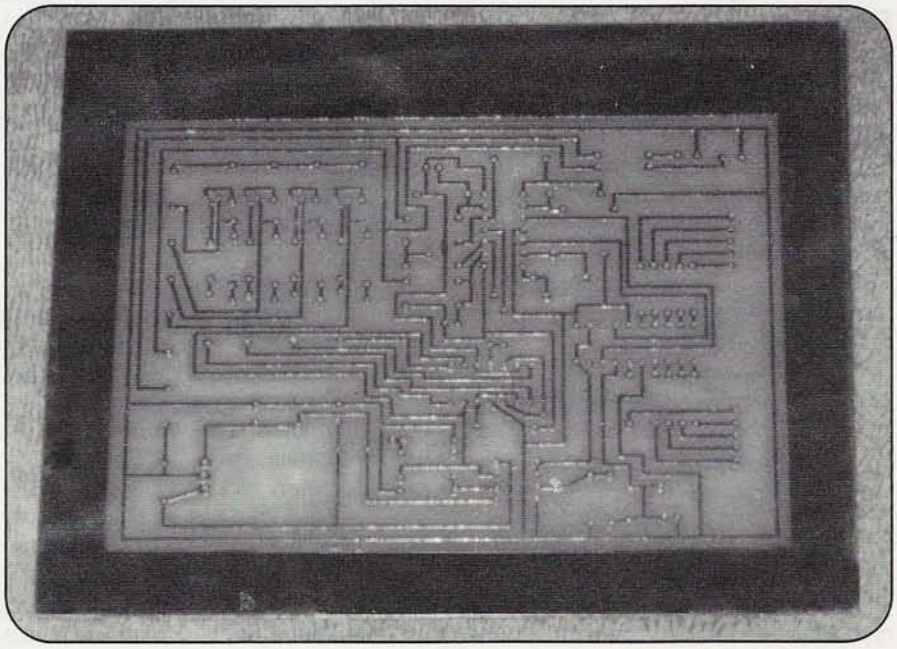


Photo C. The traces on the etched side of the modified FODtrack interface board.

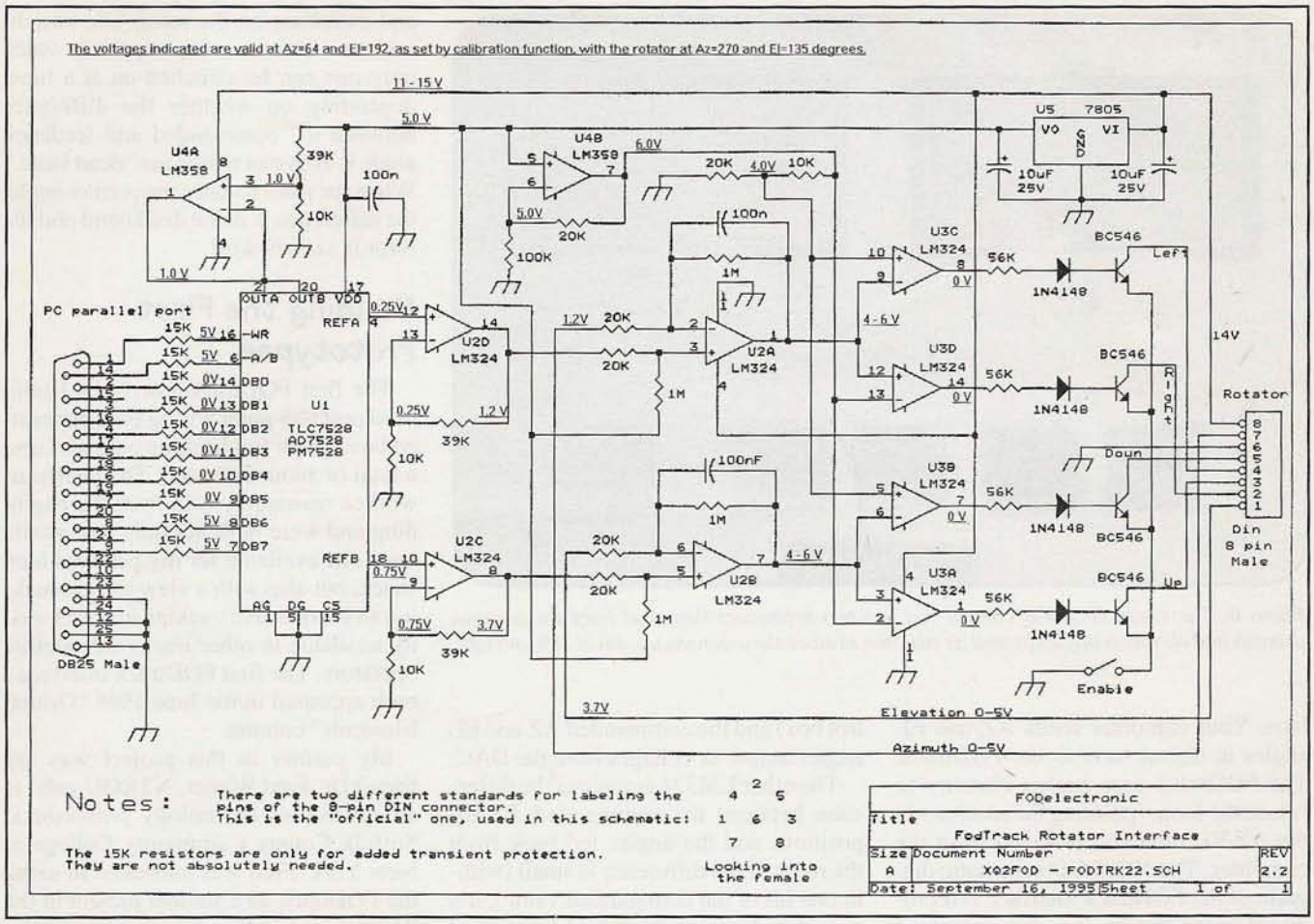


Figure. The schematic diagram of the XQ2FOD FODtrack interface. This is the original version, without the modifications described in this article.

produced and made commonly available (more on this later).

Finding the D/A Converter

The component most difficult to find was the DA7528 dual DAC in the dual in-line package (DIP), although this IC is relatively easy to find in the surface-mount package. When I began this project, I was able to find DA7528s in the DIP as closeouts from Jameco Electronics and Digikey. You can currently get this IC from Tech America (part #AD7528JN, catalog #900-6747) and Marshall Industries (Texas Instruments part #TLC7528CN). See their contact info in "Resources."

Oscillations and Other Problems

After using the first FODtrack prototype for several weeks, I noticed an intermittent oscillation problem that caused relay chatter in the G-5400B control box. Using my digital multimeter, I discovered a voltage flickering on the AZ/EL feedback lines—slight, but enough to cause the observed problem. Since the voltage was flickering around a central value, it made sense to filter the feedback lines to better define the central DC voltage value. I discussed the matter with N2XOU and we agreed to tap the feedback lines with resistor-capacitor (RC) filters to ground.

Filtering the feedback lines eliminated the oscillation problem. Once that was gone, however, a similar problem became more obvious. I noticed occasional slow "back and forth motion" when the FODtrack caused the G-5400B to move simultaneously in AZ and EL. My first suspicion was mechanical "overshoot"—the FODtrack was too slow to cut off and the rotor over-compensated (known as *hysteresis*). I attempted, unsuccessfully, to correct this by widening the "dead band" in the FODtrack. When this didn't work, I became suspicious of electrical interference, since all four NPN switching transistors have their emitters connected in close proximity to the same ground strip. I added additional diode isolation between the four transistor emitters and the common ground strip. This reduced the problem down to an extremely rare occurrence that I can live with.

Interface Modifications

The Yaesu G-5400B completes a 360-degree azimuth rotation in approximately 50 seconds (0.02 Hz). We wanted to make sure the filters wouldn't prevent the FODtrack from reading the changes due to rotor motion, so we set the filter cutoff frequency five times as high at 0.1 Hz. The RC filters that get this cutoff frequency have a 10 µF electrolytic capacitor and a 180K resistor, one connected in series from each feedback line to ground. The AZ/EL feedback lines now each have a filter that grounds the AC voltage shifts above 0.1 Hz.

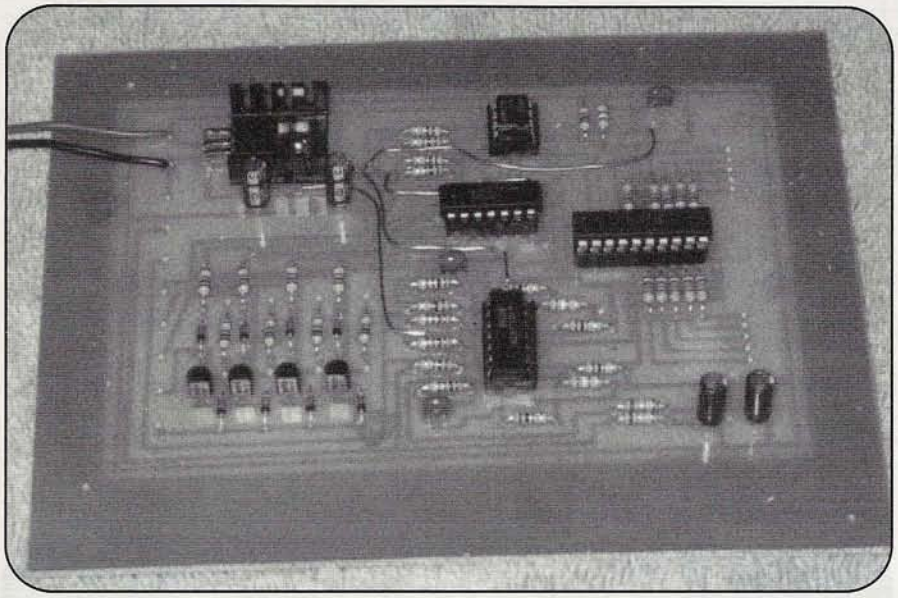


Photo D. The modified FODtrack interface board populated with components.

As mentioned previously, the second modification was adding the diodes between the four transistor emitters and the common ground strip. We used 1N4148 diodes; the same as the schematic shows at the base of these transistors.

Additional modifications we made were the addition of LEDs. We typically use a red LED to show whether the NPN common ground strip is connected to the interface's ground (i.e., the interface is active) and also have a "diamond" pattern of four green LEDs. The green LEDs correspond to up, down, left, or right motion of the G-5400B. The LEDs are connected with their anode (positive side) to current-limiting resistor to a constant voltage source on the FODtrack. Their respective cathodes (negative sides) are connected to the transistor common ground strip (red LED) or to the corresponding (up, down, left, or right) grounding pins on the DIN socket for the green LEDs.

Developing the Circuit Board

N2XOU took the lead on developing the circuit board. While the basic XQ2FOD circuit board layout is included in the FODtrack package on my Web site, it doesn't include the modifications we made to the interface. N2XOU worked with one of his students to develop a circuit board layout that includes these modifications. The first board was made on a machine at the school as part of a project for the student. N2XOU used a commercial photo-etching company to make several copies of the board. Photo C shows the traces on the etched side of the board; Photo D shows the board fully populated with components.

N2XOU has agreed to have additional boards etched by request. You can contact him at his *Callbook* address or by e-mail to <fwinter@ix.netcom.com>. Because of the cost of etching the boards, N2XOU anticipates making boards available for $15 each, plus shipping and handling. If there's sufficient interest, he'll consider also making available component kits and/or finished and tested interfaces.

Software Support

When I first discovered the FODtrack interface, the only software support I found for it was the tracking program included with the FODtrack information file. This program is optimized for use with digital satellites. Since I was interested in operating voice and CW modes, I wrote some driver software for this interface. In addition, Paul Willmott, VP9MU, implemented FODtrack support in his satellite tracking software, *The Station Program,* which is available from AMSAT-NA (see "Resources"). Since then, FODtrack support has also been added to the *NOVA* satellite tracking program, also available from AMSAT.

Summary

The FODtrack interface offers an inexpensive way to automatically track satellites, pointing your beams using a Yaesu G-5400B AZ/EL rotor. The FODtrack, with the modifications recommended in this article, may be built for less than $50. The Station Program and NOVA are both popular satellite tracking programs that provide automatic antenna pointing through the FODtrack interface. The FODtrack is definitely an option worth considering if you want to automate antenna tracking in your satellite station.

Resources

The Station Program and *NOVA* are available on the AMSAT-NA Web site, <http://www.amsat.org>; or by contacting AMSAT, P.O. Box 27, Washington, DC 20044; Phone: (301) 589-6062; Fax: (301) 608-3410.

The DA7528 DAC chips required for the FODtrack interface are available from:

Marshall Industries, 9320 Telstar Ave., El Monte, CA 91731; Phone: (626) 307-6000 or (800) 833-9910; Fax (626) 307-6173; e-mail: <info@marshall.com>; Web: <http://www.marshall.com>, and

Tech America, P.O. Box 1981, Fort Worth, TX 76101-1981; Phone: (800) 877-0072; Web: <http://www.techam.com>.

Information on the basic FODtrack program is available from Orbitessera (my Web site): <http://www.mindspring.com/~n2wwd>. Click on "Tracking" then "Antenna Control."

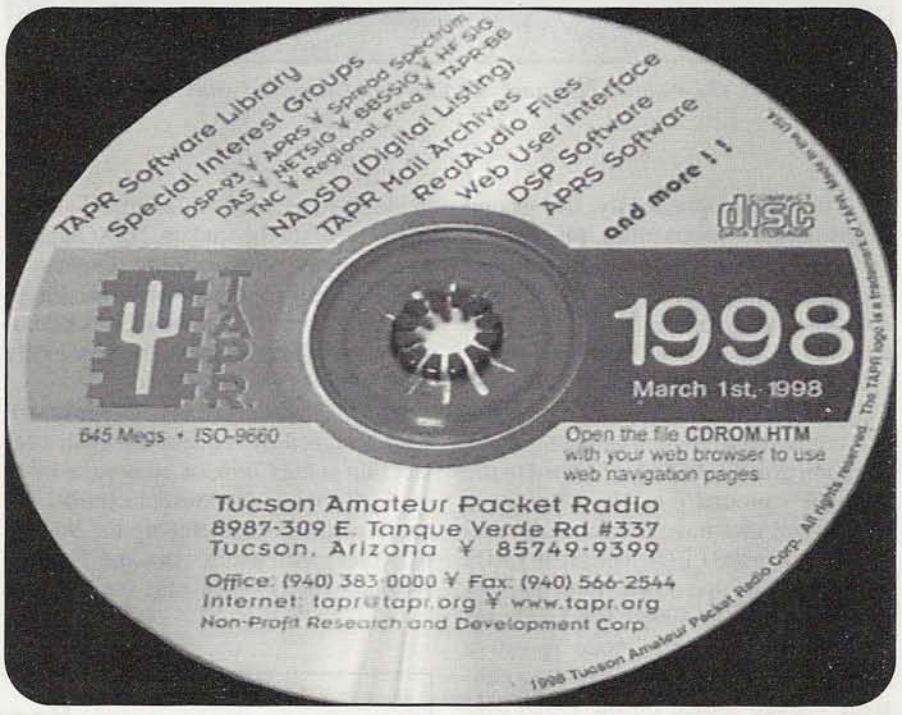
Information on the circuit board for the modified version is available via e-mail from Fred Winter, N2XOU, <fwinter@ix.netcom.com>.

Information Transfer

What does this magazine have in common with CD-ROMs, books, and lasers? Well, for one thing, they all can be used to transfer information; for another, the information we'll be transferring in this part of the magazine is all about a CD-ROM, a book, and an in-progress laser project.

Welcome back to the Digital Data Link. Things caught up with me last month, and I just couldn't get a column out. After nearly three years at this, I guess it was inevitable, but I just want to apologize to everyone for disappointing you last month. For this month's column, we have a little mixture of topics, all too small to make a whole column, but each interesting enough to bring to your attention.

Before we start, I need to clarify something that I wrote in the August issue. I had mentioned that NEDA was experimenting with FlexNet. However, some misinterpreted that as meaning that NEDA was converting over to FlexNet. So, to clarify: Only a few NEDA members, not officially sanctioned by NEDA, are playing with FlexNet on a small scale, with the goal of learning and writing about it. While NEDA might devote some space to the topic in their next *Report*, NEDA is not officially doing anything with FlexNet. With that out of the way...



The 1998 TAPR CD-ROM. This tiny disk carries a wealth of data, something for everyone. See the text, or visit <http://www.tapr.org> for more details.

The 1998 TAPR CD

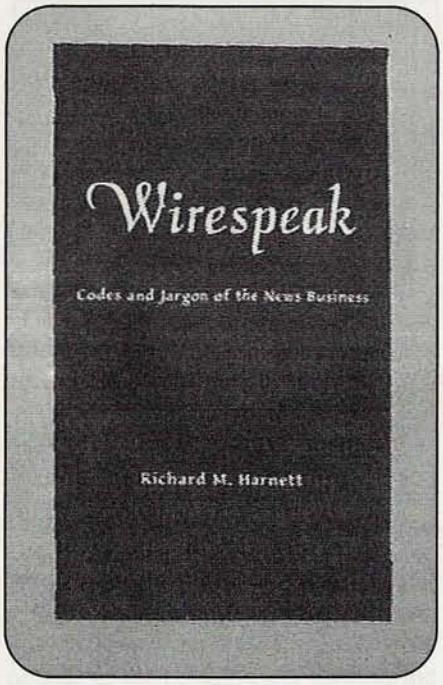
It's still 1998, but not for much longer. So, you really should consider getting yourself a copy of the 1998 TAPR CD, from Tucson Amateur Packet Radio. There's just so much on the one little CD-ROM—they've filled it up at nearly 650 MB (more than my hard drive!)—that it nearly defies listing. It literally took me days to browse through most of the material here and, even then, most of it was just given a quick glance. Although it makes for good reading, I saw most of it as a reference, something that you can use later to look up something.

Probably the most useful part of the CD are the *SIG archives*. In case you didn't know, TAPR maintains an active Web site (<http://www.tapr.org>), and, on the same server, it also operates a number of *Special Interest Groups*, or SIGs, which are merely e-mail reflectors devoted to a specific topic. Anyone can send a message in to the SIG server, and it gets resent to everyone who subscribes to the list. There's a SIG for packet networking (NETSIG, my personal favorite), a BBS SIG, APRS SIG, HF SIG, spread-spectrum SIG, and more. As you can imagine, the amount of knowledge shared in these forums is staggering.

The SIG archives are just a chronological compilation of nearly every single message (the rare SPAM is omitted, but

"There's just so much on the [1998 TAPR] CD-ROM—they've filled it up at nearly 650 MB (more than my hard drive!)—that it nearly defies listing."

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



Wirespeak: Codes and Jargon of the News Business *offers a nostalgic look at the origins of data compression over 100 years ago, when telegraph was king.*

not the comments concerning same). Searching through these archives—four years' worth—should answer any possible question on most any digital-data related subject you may have thought of...and many that you haven't.

Much More Than Messages

If that isn't reason enough to get the CD, consider the *software library*. A complete library of the latest versions of just about every kind of packet-related software there is: BBS, Networking, Linux, Satellites, APRS, Weather, Terminal Programs, TNC-2 Code, and so very much more. Anything and everything is in there.

Then, there's the *North America Digital Services Directory* (NADSD), a fairly complete listing of every on-air digital server on the continent. This listing is the most complete such list, far eclipsing what the *ARRL Repeater Directory* ever had. Using the volunteer efforts of dozens of local info providers, this on-line system, reproduced on the CD-ROM, is kept up to date fairly well (in the rare case you notice something missing or wrong, be a good sport and send in an update).

Couldn't make it to last year's DCC (Digital Communications Conference)? Listen to it through the RealAudio files on the CD-ROM. The soundtrack from most other meetings in the past year or two are on there, too. Don't have RealAudio? Don't fret, it's on the CD-ROM.

There are also large chunks of real estate devoted to the many projects TAPR is sponsoring, such as the Totally Accurate Clock, the Mic-Encoder, Spread Spectrum (including some early info on the TAPR SS Radio), and the DSP-93 digital signal processing project. If some of these names are unfamiliar to you, I'd say you're missing out on a bunch of cool stuff!

Browsing through the CD-ROM is simplified by the liberal use of HTML menus. Although a Web browser isn't supplied on the CD-ROM, I'd be very surprised if you didn't have one already, or at least know where to get one for free. In a pinch, visit <http://www.netscape.com> to get a copy of Netscape; <http://www.microsoft.com> for Microsoft's Internet Explorer; or, if you don't have Web access, call CompuServe or AOL for their sign-up disks, both of which have free Web browsers included.

(Editor's Note: I had trouble accessing the files on the CD from the Web browsers on my Windows95 computer—I kept getting a message telling me that I had to log on to the Internet first. But when I used the Windows Explorer, the Win95 version of File Manager, to search the CD and double-click on whatever I wanted to see, it worked just fine. So, if you're using Win95 and have trouble accessing the info with your Web browser, try the Windows Explorer route. And, by the way, I agree with Don's assessment: this CD is a great resource for anyone interested in ham radio digital communications.)

I could go on and on, but I think you get the idea. Your purchase of the 1998 TAPR CD-ROM not only provides you with a tremendous amount of information at your fingertips, but also helps support TAPR which, as I've said before, is a good cause. Members can get their own copy of the CD-ROM for only $18, and

"Wirespeak, by Richard M. Harnett, is a nostalgic look at the data compression techniques used by news agencies around the turn of the century."

non-members (What? How can you be a non-member!) for $20, both add $5 for shipping. If you *aren't* a member, you might consider adding another $20 for a year's membership; you'll get your money's worth. For detailed contact info, see "Resources" at the end of the column.

"Wirespeak"

I usually don't do book reviews—except for the *Wireless Digital Communications* book from TAPR that I reviewed a few months ago—but *Wirespeak: Codes and Jargon of the News Business* caught my fancy. I first read about it in the local newspaper, sent away for a copy, and found it to be enjoyable, in a nostalgic sort of way.

Long before computers, at the dawn of the radio era, voice modulation hadn't been invented yet. Instead, the wire (and early radio) telegraphers sent *trinary* digital data, modulated with OOK (On-Off Keying)—what we today refer to as Morse code. *Trinary*? Yes, the American Morse code (not to be confused with the International Morse code in use today) had *three* data states: Short ON, Long ON, and OFF.

Once the telegraph came into widespread usage, those who used it frequently, such as the news agencies, found that it was expensive. Hence, efforts were made to reduce this expense, and the result was what we call *Wirespeak*.

Wirespeak, by Richard M. Harnett, is a nostalgic look at the data compression techniques used by news agencies around the turn of century. Written by a former UPI reporter, it's an insider's guide to the strange words invented to get around Western Union's per-word charges, as well as the secret code words used to prevent eavesdropping. It also explains the origin of 73 and 88, which hams use to this day. It even explains the origin of the word "ham" to mean an amateur radio operator.

One example of Wirespeak given in the book is the following message: "HB BAIRESWARDING EXNXCUMFDR-PAPER UTMOSTING ARRIVE PRE-CONFAB A CUMGAINZA." Translation: Hugh Baillie (President of UPI) was going to Buenos Aires from New York with FDR (President Roosevelt) documents and was trying to arrive before the FDR conference with Gainza Paz (a distinguished Buenos Aires publisher).

An overseas "cable" would cost about 50 cents per word, in an era when two dollars a day was not a bad salary. Everyone in the business knew these strange words by heart, so the eight words above, costing a small fortune to send, could easily be translated into a whole paragraph of copy.

Wirespeak starts out with an explanation of the jargon used by the wire services, then goes into extensive listings of various codes that were used. Since these codes were, at the time, closely held secrets of the news agencies, they remain poorly documented outside of this book. A chapter on "cablese" and the fine art of word count reduction is short but fascinating. An extensive glossary allows you to make up your own messages, as well as decode those in the book. In addition, the origins of some of the codes and words used in the book are explained, sprinkled with amusing anecdotes. A chapter listing the secret codes of UPI and AP, which someone would have killed for a century ago, gives some insight to the times.

Although not exactly related to modern digital data, this book offers an interesting insider's view of how news was gathered and distributed a hundred years ago. More than half of its 174 pages are devoted to reference listings of various codes and abbreviations. History buffs will appreciate the effort that went into preserving this quaint bit of Americana, and you can definitely win a trivia contest with this book in hand.

Lasers in the Jungle

I live in a nice neighborhood in northern New Jersey. Although I'm friendly with all of my neighbors, and have never caused any TVI or phone interference, I believe that keeping a low profile when it comes to big antennas is a good idea. No sense in inviting problems. The neighborhood is kind of upscale, I guess, and a big tribander on the roof would probably attract some unwanted attention.

In the past, I've limited my antennas to either something invisible (like an 80-meter dipole in the trees) or small (like a 10-meter ground plane on a TV mast). Two-meter beams look enough like TV antennas to get away with, even though everyone has cable. However, when a longish chunk of Rohn 45 tower fell (almost literally) my way a few years ago, I decided I might as well put it up and get some use out of it.

I thought about putting it right next to the house, which is a single story ranch,

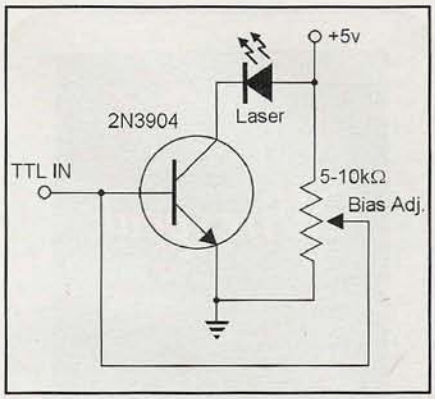


Figure. The schematic diagram for the simple switching scheme I used to modulate a laser pointer above 12 kHz. A data rate of 9600 baud should be easy with this scheme, but I have yet to find a good detector. The transistor is a common NPN switching type—make sure the one you use is rated for the laser's current demands.

but decided it wouldn't look as nice to the neighbors as it would to me. Having a big backyard, I found a nice spot, right next to the garden shed, about 100 feet behind the house. Hidden by tall oak trees, as well as the house itself, you have to really look hard to see the tower from the street.

Along with the tower came a few lengths of hardline, ranging from $^{3}/_{4}$ to $1\text{-}^{1}/_{4}$ inches. So, I did what any sane suburbanite would do...I rented a backhoe and dug a trench out to the tower, right through the back lawn, and buried two runs of that black corrugated PVC drainage pipe. With great effort, I pulled five pieces of hardline, along with a multi-conductor control cable, through the pipes and ended it all with a grounding panel inside the shed. (The story of the towers and cables is a good one, but that will have to wait for another day.)

I now had a great place to hang antennas. The only problem was that it was about 120 feet away from the shack. I couldn't run 110-volt AC out to the shed—not legally, anyway—and trying to operate the FlexNet machine on 12-volts DC was out of the question. Besides, I'd rather keep the sensitive hardware indoors, if possible.

So, the problem was how to get data out to the shed, where I'd put some of the radios and TNCs, from the house, where the rest of the stack was located. Data on an RS-232 cable just won't go 120 feet. I'd thought about all kinds of schemes, finally deciding upon something that turned out to be the most difficult option.

A friend had just given me one of those cheap laser pointers, and I decided to get another one and make a bi-directional laser data link: a TeraHertz radio, so to speak. The laser I'm using is still quite bright at 200 feet, with a dot about the size of a dime, so this should work. I won't get into the details until I really get it all working, but this will serve as an introduction. I've managed so far to modulate the laser pointer well above 12 kHz, using a TTL (Transistor-Transistor Logic) signal generator and a simple transistor driver (see Figure).

My light detector for now is an old solar cell, which leaves quite a bit to be desired in terms of sensitivity. I get about 30 microvolts of signal, and about 60 microvolts of noise, so that's the next obstacle to overcome. Texas Instruments makes a nice light-to-voltage converter, so now I'm in the process of finding a sample.

There's no reason why this system, once I get it working, couldn't work over a much greater distance. High-gain antennas for light are fairly common and inexpensive (they're called *telescopes*), and aiming a visible laser is easy, so long as the other station is line of sight. Probably get lots of multipliers for the VHF/UHF contest next month...

I've drawn the circuit I'm using to drive the laser pointer in the Figure. This is a classic transistor switch circuit, and, when the base voltage causes the transistor to conduct, the laser sees ground and lights up, either on or off. A reader suggested that I try linear modulation (AM) instead of OOK, but that will have to wait for a better detector, as well as a slightly more sophisticated drive circuit. As the project progresses, I'll keep filling in the details.

Opinions Needed

I'd like to take an informal poll: Is anyone out there interested in reading about mods (modifications) for commercial equipment, such as Motorola and GE radios, to allow these older radios to run at 9600 baud? Drop me a note if you're interested. I happened upon a UHF Motorola MITREK at a hamfest and thought others might be interested in reading how to make it work at 9600.

Well, that's about it for this month, and for 1998. It has been a good year for me, and I hope that it was also good for you and your loved ones. At this time of year, it's traditional to pause and give thanks for what we have. I think if we all did this, throughout the year, it would be a better world in which to live. Wishing you the joy and peace of the season, and a happy, healthy, and prosperous New Year. 73.

Resources

Tucson Amateur Packet Radio, 8987-309 E. Tanque Verde Rd., #337, Tucson AZ 85749-9399; Internet: <http://www.tapr.org>; E-mail: <tapr @tapr.org>; Phone: (940) 383-0000; Fax: (940) 566-2544.

Wirespeak, Richard M. Harnett, ISBN 0-9657410-5-2. 1997, 174 pp, $20.95, postpaid; Shorebird Press, 555 Laurel Ave., #322, San Mateo CA 94401; E-mail: <shorebird@aol.com>; Phone: (415) 342-4674.

TAPR's S/S Radio Provides High-Speed Packet and Much More

The following letter was directed to CQ VHF *"Digital Data Link" columnist Don Rotolo, N2IRZ:*

Dear Mr. Rotolo,

In the October, 1998, edition of your "Digital Data Link" column, you mentioned that you would be interested in hearing about radios that can handle data rates greater than ISDN. You might want to quickly mention the TAPR (Tucson Amateur Packet Radio) 915-MHz spread spectrum data radio that they are working on and give the address so people can check it out. I am not a member of TAPR, but I have considered it and consider getting back into packet radio after seeing this radio.

It is very well designed and they are putting a lot of consideration into all aspects of its design. It will be a plug-and-play-type operation: just plug it into your network card and you can use any TCP/IP software that will work through a network card. Plus, it does a bit more than just transmit data. It will measure SWR as it sweeps across the band, and you have the ability to "direction find" other data radio users. You can determine the distance a radio is away from you so it would say the radio is, say, five miles away. It would be somewhere within a five-mile circle, but with multiple users you could "triangulate" the exact location and there wouldn't be "GPS errors." It also has automatic power control.

The other nice feature is that you can use multiple radios at a node site into one antenna using a multiplexer. This allows you to support many users without interference.

As you can see, I am quite excited about this radio and I think it will make great use of this "unused" band. Who knows, if this radio takes off like the TNC-2 there might be a need for dedicated high-speed link radios. Maybe someone will design one in the microwave bands. They could "copy" the design from the 915-MHz radio and pump up the data rate. There is about 200 MHz of space at 3 GHz, a band that is essentially unused.

Thanks for letting me go on and on. I really enjoy your column, thank you for taking the time and effort to write it! 73,

Kevin Koziol, KD1NW
Hope Valley, Rhode Island

N2IRZ responds:

Dear Kevin,

Nice to hear from you! Thanks for taking the time to write. I am, in fact, always interested in hearing about higher-speed radios. I'm aware of the TAPR spread spectrum (S/S) project and have been following it closely for some time now.

I have to agree completely with you: this is exciting stuff. It isn't quite ready for sale yet, as there is still considerable work to be completed. You can be sure that once I can get my hands on a pair, you'll be reading about it.

S/S is great technology, but it has its downfalls. One is that if there is an interfering signal that is stronger than the "processing gain" of the S/S decoder, you get no data at all. It is also expensive to implement, as compared to narrowband technology.

Although I believe that a fast S/S radio alone will not "save" packet, it will certainly give it a boost. Thanks again for writing, and for the great info about the TAPR project.

(For more information, contact Tucson Amateur Packet Radio, Inc., 8987-309 E. Tanque Verde Rd., #337, Tucson, AZ 85732; Phone: (940) 383-0000; Fax: (940) 566-2544; E-mail: <tapr@tapr.org>; Web: <http://www.tapr.org>.)

—N2IRZ

Life in a "Somewhat Rare" Grid (FN30)

Can the grid square containing New York City be "rare" for anything except open space? Apparently so, says WB2AMU, who lives there...

Grid FN30 encompasses much of the Long Island area, parts of northeastern New Jersey, and a tiny part of Connecticut...and, oh yes, virtually all of New York City. This grid has been home to me for all of my life and, on 6 meters, it's provided me with a lot of fun.

A Relative Rarity

You'd think because much of FN30 is in the highly populated New York metropolitan area that there would be a lot of hams on the Magic Band from there. However, as I regularly see from the numerous QSL requests for my grid, there's actually relatively little activity 6 six meters from FN30. In fact, when I made a trip in 1996 to a number of rare grids in the west, I received only five QSL card requests. Yet for that same summer, I received about 10 times as many requests for FN30 cards! (It's surprising to see that both newcomers and veteran 6-meter operators need this grid.)

Why is FN30 somewhat rare? Well, in the New York area, 2-meter FM activity is king. There are dozens of repeaters on 2 meters here, while there's only *one* 6-meter repeater!

A long time ago (like the 1950s and 1960s), six was quite popular in this area, particularly for mobile operating and Civil Defense work. Much of this activity was on AM with crystal-controlled transmitters. Even so, I remember looking at my father's (W2ZUN) logs and seeing that long-range distances, such as Saskatchewan, could be worked! But now, with the AM days gone, there are maybe a little over a dozen (yes, a dozen) active hams on 6 meters from FN30.

Pluses and Minuses

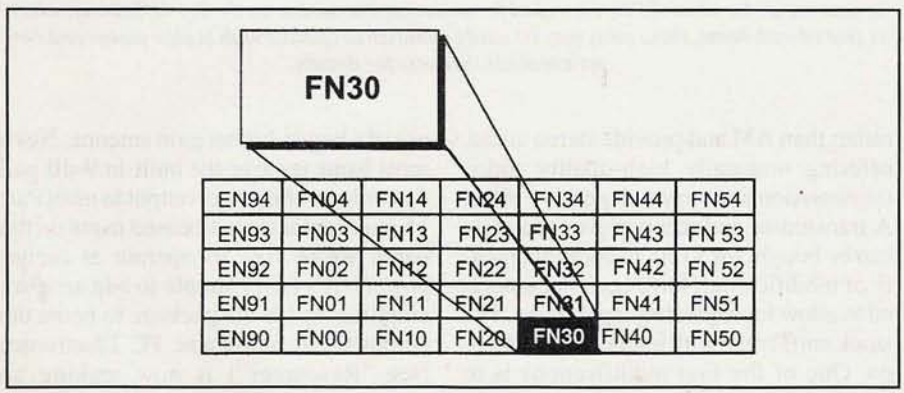
There are both advantages and disadvantages to operating from FN30. One of the main *disadvantages* is that the two or three highest points on Long Island are barely 300 feet high. No mountains here! Also, there are no stations to work to the southeast or to the east, save for Bermuda via sporadic-*E*. Also, RFI is a concern because there are a lot of people here. However, cable TV and judicious use of output power prevents us "FN30ers" from getting into too much TVI trouble.

One of the major *advantages* to operating 6 meters from FN30 is that there are many hams in the tri-state area who can be worked during the VHF contests that are held throughout the year. There are always plenty of VHF operators in Connecticut, Massachusetts, New Jersey, and in lower New York State. Of course, you need to be on one of the "big" hills (the 300-foot variety) to be able to get most of them. You can't say the same about a lot of more sparsely populated areas in the western states of the U.S.

And What about FN40?

All active FN30 operators have been asked the same question by our 6-meter comrades in other states: Can we take a ride to activate nearby FN40? And we all laugh silently whenever we're asked this question, as we know that this grid is entirely in the ocean, even though a lot of maps incorrectly show FN40 as touching part of Long Island. You need a boat for this one. However, this is another story that will be discussed another time.

A number of operators, including Jay Buscemi, K2OVS, and Frank Moorhus, AA2DR, have been working hard with me to try to encourage more hams in this grid to get active on the Magic Band so that we'll have more local stations to talk to and so faraway stations will have a better chance of working FN30 when the band is open. In addition, more FN30 hams will take some of the workload off the dozen of us who are presently active to keep this grid "alive" on 6 meters. ■



FN30 is home to New York City and the Long Island suburbs. But despite its very high population, it's actually somewhat rare on 6 meters!

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)

Moving ATV Toward the 21st Century

As pressure on amateur VHF/UHF spectrum grows, ATVers must look toward the microwave bands and spectrum-efficient digital video technology for our future operating needs. The building blocks are already in place.

Amateur Television has always needed spectrum to function. Traditionally, it's used the 70-centimeter band and AM television. This has given way in the last decade to greater use of UHF and microwave bands above 70 centimeters. Today, there's ATV on all bands between 420 MHz and 10 GHz. Recently, a consumer television product has provided new opportunities for UHF-plus experimentation. This product is known as the Wavecom and operates in and near the 2.4-GHz amateur band. It's a perfect way to experiment with ATV on a low cost basis.

The low-power Wavecom TV transmitter/receiver package can put a microwave ATV station in your hands for about $120. Designed for unlicensed home use on the 2.4-GHz band, which is shared with hams, these units may be easily modified to operate with higher power and better antennas. See text for details.

Catching the "Wave"

The Wavecom is the next generation version of another consumer TV product has been around for a number of years: the "Rabbit." Many ATVers have seen or experimented with this unit, which is a Part 15 device (low-power, unlicensed) that produces AM television in the 900-MHz amateur band. It was intended for home use in sending television signals from a VCR or cable box to a remote location, often a TV in a bedroom or other location in the home. This first-generation device is still around and in use by many ATVers all over the U.S. The availability of linear amplifiers from the cellular telephone industry has spurred interest in this band and these very low power devices.

The Wavecom performs a similar function in the home, but uses the 2.4-GHz band. These devices use FM television rather than AM and provide stereo audio, offering unusually high-quality video transmission at a very inexpensive price. A transmitter and receiver pair typically can be bought for $120. In addition, plenty of modifications have been documented to allow for expanded capabilities. The stock units come with a small panel antenna. One of the first modifications is to replace this built-in antenna with an external antenna connector to allow the use of a larger, higher gain antenna. Next, most hams remove the built-in 9-dB pad that reduces the power output to meet Part 15 requirements (as licensed users on the band, we're free to operate at higher power). It's fairly simple to add an extra amplifier inside the package to boost the output to 50 milliwatts. PC Electronics (see "Resources") is now making an external add-on board that provides for a variety of additional capabilities.

By Ed Manuel, N5EM (n5em@amsat.org)

"The pressure for our spectrum will never go away. Compressed DATV has the potential for allowing us to continue to pursue our facet of the hobby and decrease some of the bandwidth that we currently require."

So what can you do with one of these little microwave devices? First, they're fun to play with in your home. You can actually use them for the originally intended purpose! But that hardly does them justice. The transmitter is so small that it can be attached to a camera or camcorder and powered from a portable battery pack. This allows wireless transmission from your "porta-cam" to the companion receiver and is the first step in making your portable ATV setup truly wireless. With a wireless link from the camera to the shack or mobile setup, you can now repeat your camera video and audio with your regular ATV transmitter. A little "glue" in the form of a control unit that senses video and keys the transmitter and you have a one-way video link that is really portable.

The more ambitious ATVer now starts thinking about a reverse link to send the repeater output back to a tiny television or monitor on the portable camera for full-duplex wireless operation. This is not a trivial undertaking, but has been done by a number of ATVers across the country. Another idea is to take one of these receivers and, with the addition of some external filtering, add a 2.4-GHz receiver to your repeater. This will allow the small transmitters to be used as an alternative input by your repeater system users.

Microwavin' in Columbus

This is exactly what one ATV group in Columbus, Ohio has done. They already had an ATV repeater that operated in the 70-, 33-, and 23- centimeter bands. This is an impressive system—sitting atop a 645-foot building—with inputs on 439.25 MHz lower vestigial sideband, 915 MHz FM ATV, and 1280 MHz FM ATV; and outputs on 427.25 upper vestigial sideband and 1250 MHz FM ATV. In addition to the user inputs and outputs, there are remote inputs for weather radar, bulletin boards, NASA TV, and outside cameras.

To this already fine system, a Wavecom receiver was repackaged and added for a new 2.4-GHz input. This receiver is set to Wavecom channel 1 (2433 MHz). For transmit, an HFT model 2500 was purchased. This transmitter has 600 milliwatts of output, which provided a stable, higher power transmitter without extensively modifying a Wavecom. A commercially available 10-watt amplifier made by SSB Electronic USA provides 5.5 watts of power with the available 0.6 watts of drive. The transmit frequency is set to 2411 MHz, which corresponds to Wavecom channel #4. Both the input and output are filtered by 8-pole interdigital filters made by DCI. Both transmitter and receiver are connected to gain vertical antennas using about 40 feet of 7/8-inch hardline.

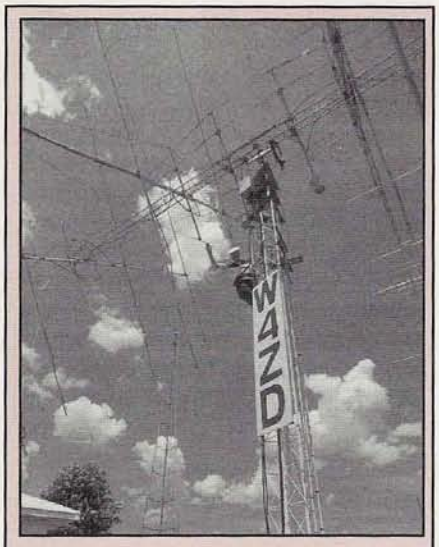
This transmitter's signals have been seen as far away as 60 miles on a mobile ATV station operated by Ken Morris, WA8RUT. Ken says that there are about 12 active local hams who routinely watch the 2.411-GHz output of the repeater using Wavecom receivers and an assortment of antennas ranging from the Conifer Dish to a coffee can antenna! The station using the coffee can antenna (WA8RMC) is located 14 miles from the repeater site.

There are currently about seven Columbus area ATVers who have been able to get into the 2.4-GHz ATV repeater *input*. All of these amateurs are using the Wavecom transmitter with an MMIC amplifier (described in the modifications Web site; see "Resources"). Typically, these modifications yield around 80 milliwatts and successful stations have used loop Yagis or the W1XT Conifer Dish satellite antenna. Most of these stations have P5 (excellent) signals from such inexpensive equipment.

Cost Factors

One deterrent to exploring the world of ATV has always been the perceived high cost of equipment. The traditional model of the ATV station is an amateur with a tall tower, lots of big, expensive commercial antennas for several bands, expensive Heliax® feedlines, and expensive, high-power amplifiers. Many hams who pursue ATV without the use of a repeater *do* have stations like this and enjoy chasing ATV DX. If you can manage it, go for it. You'll have lots of fun.

But many amateurs are not so lucky. They live in urban areas with a variety of



On the Cover

Ho! Ho! Ho!—No, it's not Santa Claus, it's Bev Cavender, W4ZD, of Lake Placid, Florida, waving to wish everyone a happy holiday season. In addition to Bev, the tower supports his 2-meter EME (Earth-Moon-Earth) array of 16 17-element M^2 Yagis, each of which is five wavelengths, or 33 feet, long. The array has both azimuth and elevation control for following the moon across the sky.

At the other end of the feedline are two separate radios. The transmitter is an ICOM IC-271H, driving a Henry 3002 amplifier to produce 1500 watts output. On the receive side is a Kenwood TS-940S with a Microwave Modules receive converter.

Bev says he has two ways of tracking the moon: The first is a video camera mounted on his tower. He simply centers the image of the moon on the monitor in his shack and moves the array as needed to keep the moon in the center of the screen. The second method, for cloudy nights and other times when the moon is not visible, is a computer tracking program.

Bev has been a ham for 50 years and has been working EME since 1985, when he was looking for a new challenge. So far, Bev says he has used EME contacts to achieve Worked All States on 2 meters and was the first ham to reach 500 grids on 2 meters in the ARRL's VUCC (VHF/UHF Century Club) listings.

Bev's tips for newcomers to EME: "It's not as hard as everybody thinks it is...just aim your antenna at the moon." Well, there's a little more to it than that, of course, but there's been at least one report of a single-Yagi to single-Yagi EME contact. (Cover photo by Larry Mulvehill, WB2ZPI)

restrictive covenants that limit or prohibit the large towers we've come to associate with ham radio. For this kind of environment, we really need the help of a repeater situated at a high location. Of course, an ATV repeater is not a trivial undertaking. In Houston, we decided that we needed the combined efforts of a group to make the repeater system a reality. Once the repeater is up and running, the burden of getting high power and big antennas is dramatically reduced for the individual ATV user. Now it becomes practical to make a small investment in equipment and use surplus or old video equipment to get on the air.

Additionally, mobile and portable ATV stations become a reality. For the most recent Houston Marathon, I set up my station about three miles from the repeater, using a 2-watt transmitter on 1255 MHz and a tri-band vertical on a telescoping painter's pole. This station provided P5 video from my checkpoint on the marathon course. It was certainly a lot easier to put up than a bunch of Yagi antennas and it also fit in my car. Of course, being able to see the repeater's input antenna never hurts.

Digital ATV

Let's talk about a completely different subject. Have you looked into digital television yet? Perhaps you already have a small satellite dish receiving commercial television from the direct broadcast satellites. Perhaps you have a DVD (digital video disk) player in your house. Have you thought about where digital video might fit into ATV?

At the most basic level, doing Digital Amateur Television (DATV) requires a method of digitizing video (or having a source of digital video), a method of transmitting that digital signal, a method of receiving and extracting the digital signal, and a method of displaying the resultant video. Sounds simple enough on the surface, doesn't it? If only it were!

The first problem we face is the incredible amount of information in a video signal. It would take a lot of bandwidth to send it after digitization if we stopped here. Fortunately, we have some help. In order to reduce the amount of bandwidth needed to send a video signal, we can employ *digital video compression*. If you look at a video scene, you'll see that, for the most part, a lot of the information doesn't change very much. Take a typical ham shack scene. Maybe I'm moving my hands or turning my head, but the background is relatively static. A smart piece of compression software will take advantage of this fact and only send information about the portions of a scene that need to be updated from the last frame. This can save an enormous amount of bandwidth.

Some of these compression algorithms are MPEG, MPEG-2 and MJPEG. I won't attempt to go into the techniques and differences that these standards use (or even what they stand for), but they're out there in consumer products that are available right now.

Capture the Frame

One class of product that you might want to investigate is the *video capture device*, intended for use with your PC for capturing images from an external video stream. These devices range from under $100 to around $1,000. Of course, you get what you pay for in terms of quality and resolution. These devices have some immediate application in the ATV shack. First of all, you can start by using the device to capture video clips from your camera and VCR. After you get the video into your PC, you can do a variety of editing and special effects, including adding titles. This can provide you with some enhancements to improve the look of your video. You can also start to learn more about video compression and how it works.

(Let me say right now that video compression is a compromise. A number of ATVers have told me that they're not interested in DATV until there's absolutely no difference in the picture quality between it and conventional analog video. I can understand that position; I'm interested in the quality of fast scan ATV, too. But there are many outside factors driving our selection of mode and band. The pressure for our spectrum will never go away. Compressed DATV has the potential for allowing us to continue to pursue our facet of the hobby and decrease some of the bandwidth that we currently require. Inexpensive digital video compression is still not ready to replace high quality analog television. But, like all technology today, the quality of digital video compression is rapidly improving and the cost is continually dropping.)

Two consumer video capture devices are the *Buz* from Iomega and the *Dazzle* from LA Vision. The Buz utilizes hardware Motion-JPEG (MJPEG) as the

"With the availability of consumer digital video products that do more for less money, the possibilities for use in DATV just keep growing. What we need now is for some of you technically inclined ATVers to start experimenting and then let us know what you're doing by publishing your work."

video compression method and sells for around $200. It allows capture of a video stream of 720 x 480 pixels at 30 frames per second in up to 24-bit color (16 million colors). The Buz uses a SCSI input on the host computer and can transfer data at a sustained rate of 6 MB/second. You can find all the technical details at the Iomega Web page at <http://www.iomega.com/>. The Dazzle Digital Video Creator, which sells for around $250, utilizes MPEG video compression. It captures video at resolutions up to 352 x 240 pixels at 30 frames per second, and playback (video output) is full screen. Here we begin to see some differences. The Buz is designed to produce video that is based on a computer screen; the Dazzle is designed for a regular television screen. Both are useful and have their own distinct advantages and disadvantages. The Dazzle connects to an enhanced parallel port (ECP or EPP). It can manage a video bit rate of 56 kB (kilobytes) to 2.5 MB (megabytes) per second, depending on the resolution you've selected. You can read more about the Dazzle at <http://www.la-vision.com/>.

Both of these devices require a decent Pentium computer. For example, the requirements for the Dazzle include a P133 or better with 32 MB of RAM recommended (I can tell you that more is definitely better). Additionally, the bundled software that comes with the Dazzle will fill *over 200 MB of your hard drive*. Another thing to consider before you take the plunge and start doing digital editing is the incredible amount of hard drive space a video file takes. Here's where those new 7- to 10-GB hard drives come in handy!

On the low end of video capture is the plug-in card for your PC. I've seen several of these for under $100 at the local surplus store. One of these has a built-in television tuner for TV reception and can also capture external video. These provide a good start for playing with digital video.

Let's go back to the concept of transmitting digital video for a moment. Remember that we need a stream of digitized video. Here's where the new crop of external video capture devices is so interesting. The digitization is done external to the PC and then fed into a port on the computer. The possibility of taking one of these devices and extracting a digital video stream to something like a transmitter is very intriguing.

Talking to Your Computer

One thing that has recently changed is the rate at which we can put digital information into the PC. I've already discussed two devices that use the parallel port and a SCSI port for input. There are now two new interfaces for your PC that promise to take DATV into the next century. They are the *Universal Serial Bus* (USB) and the *FireWire* port.

USB is a new peripheral port that you'll find on the current crop of personal computers. It's capable of supporting up to 128 devices and can transfer data at rates of from 1.5 megabits per second up to 12 megabits per second. You'll find that this a great asset if you ever try to get two or three serial ports and a couple of parallel ports working at the same time on one PC. You can even convert conventional serial and parallel devices to USB with adapters. Find out more about USB and some of the products that are available at: <http://www.usb.org/faq.html>.

The other data communication standard that has great promise for digital video is called FireWire (also known by its standard, IEEE 1394-1995). It was developed by Apple Computer, principally for transferring digital video. It can transfer data at rates quoted from 200 megabits per second up to 400 megabits per second. With speeds like that, you can bet we'll see more equipment with this interface. You can already buy a digital camcorder with a FireWire output. The best site I've found on the Web for explaining what FireWire is and what it can do is <http://www.dvcentral.org/Firewire.html>.

Start Experimenting!

With the availability of consumer digital video products that do more for less money, the possibilities for use in DATV just keep growing. What we need now is for some of you technically inclined ATVers to start experimenting and then let us know what you're doing by publishing your work. As I said before, DATV is not ready to replace high-quality analog ATV, but it may very well have a place on our ham bands as an additional mode. It's entirely possible that DATV may provide a means to dramatically reduce our need for spectrum and give us a way to provide more ATV channels in the same amount of spectrum. There are certainly some areas where the demand for ATV channels outstrips the available spectrum.

I'll be following very closely the progress in this area and I'll report back as things develop. ■

Resources

For more information about the products mentioned in this article, please contact the following:

DCI Digital Communications, Inc., Box 293, 29 Hummingbird Bay, White City, SK S0G 5B0 CANADA; Phone: (306) 781-4451 or (800) 563-5351; Fax: (306) 781-2008; E-mail: <dci@dci.ca>; Internet: <http://www.dci.ca>.

P.C. Electronics, 2522 Paxson Lane, Arcadia, CA 91007; Phone: (626) 447-4565; Fax: (626) 447-0489; E-mail: <TOM@HAMTV.COM>; Internet: <http://www.hamtv.com>.

SSB Electronic USA, 124 Cherrywood Dr., Mountaintop, PA 18707; Phone: (717) 868-5643; Internet: <http://www.ssbusa.com>.

W1XT, Bob Myers, 37875 N. 10th St., Phoenix, AZ 85027; Phone: (602) 465-0936; E-mail: <bmyers@primenet.com>; Internet: <http://www.primnet.com/~bmyers/>

To learn more about the Wavecom units and get details on possible modifications, see <http://www.ipass.net/~teara/atv4.html>. One source of the units themselves is ATV Research, 13-1 Broadway, P.O. Box 620, Dakota City, NE 68731; Phone: (800) 392-3922; Web: <http://www.atvresearch.com>.

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 send 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.*

Shuffling the Deck Chairs on the Titanic

Dear *CQ VHF*:

I have been an amateur radio operator for about four years now, and, I must admit, some of my interest has faded. I have been closely following the FCC license restructuring effort and the associated debate in your magazine to see if something would happen to "re-energize" the hobby for me. With that, I thought it would be time to share with you and your readers what I see as the largest impediments to the hobby gaining and keeping new hobbyists.

First let me tell you that, in my humble opinion, the FCC license restructuring project is nothing more than shuffling the deck chairs around on the Titanic. It seems to be keeping everyone busy, but it doesn't get to the root of the problem.

I believe that the coming of the digital age has left the hobby in the dust and that, unless the FCC modifies the rules to allow amateur operators to experiment with the latest digital modes without the long drawn-out authorization process, the hobby will continue to decline. I genuinely believe that the future of amateur radio is in digital modes that allow much of what is happening with the Internet to spill into the hobby.

The amateur radio hobby bug first got me while I worked at a digital wireless networking company as a software engineer. Obtaining my amateur radio license started as a way to refresh my knowledge of RF technology, but what really intrigued me was the concept of mobile data networking. Imagine a handheld device like a PalmPilot™ with a wireless modem that would allow you to send and receive e-mail, join chat rooms, surf the Web, and many other possibilities all from palm of your hand and from remote locations. The application is "Killer"! How can I make it happen?

Then the reality kicks in. To do this means greater channel throughput and far more sophisticated networking protocols than the current allowable narrowband data schemes allow (9600 baud on AX.25? You must be kidding!). So how about the relatively well-published IEEE 802.11 protocol and TCP/IP via spread-spectrum in the 900-MHz range? Nope, not authorized in amateur bands. So I started digging on the topic and found that TAPR (Tucson Amateur Packet Radio) is working hard to move the monolith and make something happen in this area. Two years later, still nothing.

For many of us educated in the digital age, the true holy grail of making amateur radio interesting again is to make it an opportunity to play with what we have learned. Amateur radio can jump on the wave of activity that is happening in the Internet technologies. All that needs to happen is for the ARRL and the FCC to stop fighting over Morse code speed requirements and think about the future of amateur radio in the digital age. Until someone recognizes this and modifies the rules to give a home to these creative energies, many like myself will slowly lose interest. Thanks for listening,

Alan Percy, KB2TVT
Orchard Park, New York
<apercy@brooktrout.com>

The 6-Meter DX Window Debate

Dear *CQ VHF*:

I agree with Ken Neubeck, WB2AMU, that the 100-kHz DX window is "over-kill" ("The 6-Meter DX Window: Why, Where and How Big?" October, 98 *CQ VHF*). During *Es* openings, everyone spreads out over the 50.125 to 50.250 segment of the band, so I assume any F_2 DX opening would also result in stations moving up to find a clear frequency. The 50-kHz DX window is a good compromise *if the calling frequency was changed to 50.150*...the end of the DX window.

As Ken mentioned, there has not been "any significant migration" to the proposed 50.200 calling frequency...old habits are hard to change. I monitor 50.200 in addition to 50.125 and I seldom find anyone in the Northeast on 50.200. It's been two years since the proposal was first made and the results have been no change! If we used 50.150 as the calling frequency, more operators might want to "move up slightly" from the current 50.125—*plus,* DX stations could identify band openings toward the U.S. if they set their rigs to scan the new 50.100 to 50.150 DX window. If there were some QRM at the top of the DX window, it would be minimal and there would still be an extra 25-kHz for DX station use to escape the "loud stations" on 50.150.

Dave Ripton, K2SIX
Morris Plains, New Jersey

Dave—The primary reason cited at the Central States VHF Society conference for moving the calling frequency to 50.200 rather than 50.150 (the original proposal called for .150 and was voted down) was to enable people to move up and *down from the calling frequency when the band is open—as is currently common practice on 2 meters—without "bumping into" the DX window. As I have said before, the problem with considering the DX window and the calling frequency as a single issue is that the DX window is something to be used when the band is open, while the calling frequency is intended for use when the band is* not *open or you're waiting to hear an opening begin.*

Dear *CQ VHF*:

I just picked up a copy of *CQ VHF* at HRO and read your editorial (October '98 issue). I was extremely pleased to see that you took the initiative to take a position on the 6-meter DX window and calling frequency shift. So many editors only report what others submit to them and don't take the time to analyze situations and take a leadership position.

I still see a problem in getting people to move to 50.200. One of the arguments I hear against 50.200, and which was even

mentioned by Ken Neubeck in your October issue, is that "I go to 50.200 and no one is there, so I go back to 50.125." The problem is that the word about a change is not spread at the same time. I made a proposal at the SMIRK breakfast that an effective date be established that the changeover takes place. You seemed to be the main opponent to this idea. Perhaps this idea needs to be contemplated again.

Keep up the good work with the magazine. I especially enjoy Kent Britain's articles. My main interests are 6 meters, weak signal, and microwave. Robin, WA6CDR, and I just returned from operating in Mexico for the second half of the ARRL cumulative microwave contest. Despite crummy conditions, we were able to complete three QSOs in excess of 800 kilometers—EME type signal levels with more QSB. I am sending off my subscription to the magazine today. 73,

Jack Henry, N6XQ
San Diego, California

Jack—First of all, thank you for subscribing. You are absolutely right about the discussion at the SMIRK breakfast and I've given a lot of thought to that whole idea. I still believe there will be resistance—as there was with the APRS QSY last year—if any given group says, "You will all do this on such and such a date." But I now think that what needs to be done next is for the organizations that have gone on record in support of the move to adopt a date by which their members will QSY to .200 as their main listening frequency. No one else will have to move, but if you want to work the folks who belong to SMIRK or Central States or NEWS, then you've gotta go to .200 to find them. Obviously, the organizations should consult with their members before setting a date. I think that would go a long way toward getting the ball rolling.

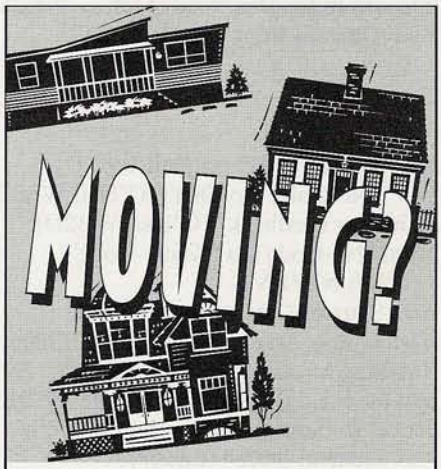
Let's Hear It for the Kids!

Dear *CQ VHF*:

I am writing this letter in support of Jonathan Bausman, KC2BRN's letter to *CQ VHF* ("Letters," August, 1998). I agree with Jonathan's request for space in the magazine for young amateurs. This section would show support and encouragement for the young hams of America. It would also be a great recruitment tool for amateur radio. Throughout your magazine, section after section encourages all hams to unite and become involved. The young hams of today who request a section dedicated to the youth of amateur radio might one day be the Senators, members of Congress, or FCC Commissioners whom we need on our side unless we American hams succumb the same way the Guatemalan hams have—a license with no privileges. Thank you.

Jacob P. McWilliams, Sr., WD4EHW
Ft. Huachuca, Arizona

Jacob—Thank you for your support of Jonathan's request for a regular column devoted to young hams. Many of our young hams are certainly active and involved, as Bob Josuweit pointed out in November's "In the Public Interest" column. On the other hand, our surveys show that very few of our readers are under 18, and I'm still not sure how we'd fit in another column right now. But *I'll certainly consider it*— if *there's sufficient support among the readership and a good candidate steps forward to conduct the column. So, folks, it's up to you: Does* CQ VHF *need a kids' column? Are any of you willing to take on the responsibility of writing it? Let us hear what you think.*



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Space/Satellite

Technical

Weak Signal

Hamfest Calendar

The following hamfests are scheduled for late November and December, 1998:

Nov. 20–21, Annual Hamfest/Swapfest, Latimer Community Center, **North of Ocean Springs, MS**. Talk-in: 145.110 (-600). For information, contact Phil Husberger, W9NZ, 1207 Lancelot Ln., Ocean Springs, MS 39564, or call (228) 872-1499.

Nov. 21, Amateur Radio & Electronics Auction, Newton Masonic Hall, **Newtonville, MA**. Talk-in: 146.64 (-) Waltham Repeater. For information, contact Eliot Mayer, at (617) 484-1089; E-mail: <wlmj@amsat.org>; Web: <http://ourworld.compuserve.com/homepages/emayer/auction.htm>.

Nov. 28, Evansville Winter Hamfest, Vanderburgh County Fairgrounds Exposition Center, **Evansville, IN**. Talk-in: EARS Wide Area Repeater Network, 145.150- Evansville/146.925- & 443.925+ Vincennes (alternate: EARS repeater 145.110-). Use 107.2 CTCSS on all frequencies listed. For information, contact Neil WB9VPG (812) 479-5741, or write: EARS, 1506 S. Parker Dr., Evansville, IN 47714; E-mail: <EARSHAM@aol.com>; Web: <http://members.aol.com/earsham/>.

Dec. 5, Jacksonville ARS & Illinois Valley ARC Hamfest, Turner Jr. High School, **Jacksonville, IL**. Contact Tim, KB9FBI, at (217) 245-2061.

Dec. 12, 5th Annual Columbia County Hamfest & Computer Show, Columbia County Fairgrounds, **Lake City, FL**. For more information, contact Colin Boutwell, WA5RKR, at (904) 755-7960 or (800) 752-7969; E-mail: <wa5rkr@isgroup.net>. ■

Operating Notes

For December, 1998, and January, 1999:

December

5–6	ARRL International EME Competition, 2nd weekend (see rules, 10/98 *CQ VHF* p. 69)
14	Geminids meteor shower peak
14–18	BCC Meteor Scatter Contest (Europe)
22	Ursids meteor shower peak
27	Good EME conditions

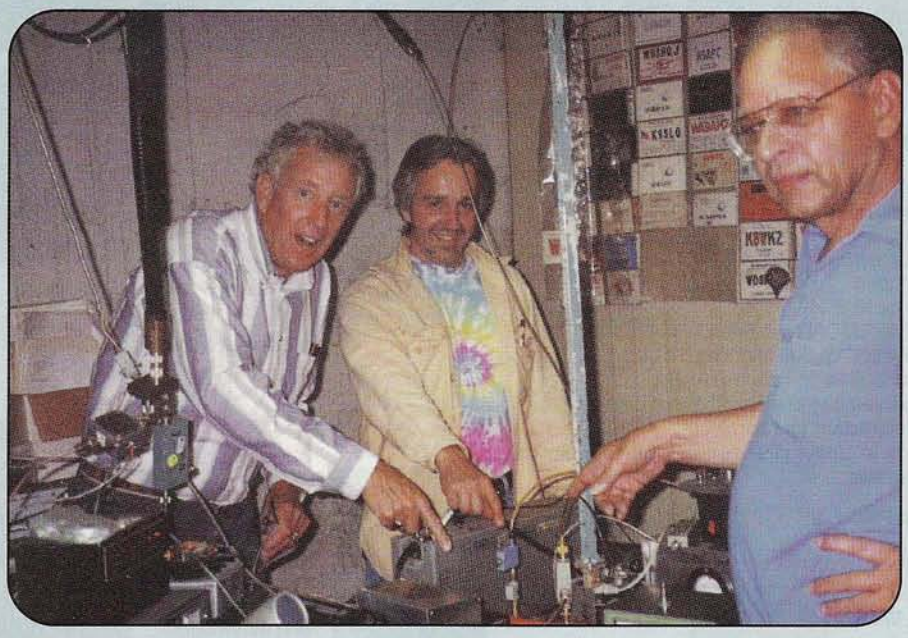
January

4	Quadrantids meteor shower peak
23–24	ARRL January VHF Sweepstakes (Note: the ARRL contest is later than usual this year because January has five weekends in 1999.)

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

Picture This!

"Phun Photos"



"As I descended the steps, I walked into a basement that even Marconi would be proud of," writes CQ VHF *Senior Contributing Editor Gordon West, WB6NOA, of his visit last July to the mountaintop QTH of Tom Mott, W2DRZ, in Frewsburg, New York, during the 1998 CQ World Wide VHF Contest. Operating the contest along with Tom (at right in top photo) were Dave Moffett, N2XTX (center of photo, next to Gordon), and Dave Woodburn, N2ODU (not pictured). All are members of the Frewsburg Amateur Radio Team (motto: "Let's Light Up the Mountain"), and they were operating every band from 6 meters to 10 GHz. Tom's "small" dish antenna (bottom) provided additional multipliers from the Pioneer spacecraft and "E.T." (at home). But on the serious side, Gordon noted that "one of the best parts of this operation was how the three hams conducted themselves in person, as well as on the air. Throughout the contest, they stayed off of the calling channel, and they worked each and every station out of the noise in an unhurried and unfrantic manner." And they racked up a pretty impressive score, to boot! Good work, guys!*

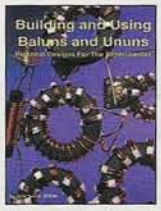
"Toto, I don't think we're in Michigan anymore." Dave Bostedor, Jr., N8NQS, obviously had a good time while operating portable from San Clemente Island in DM02, a nearly all-water grid off the coast of southern California. Looks like you were really roughin' it, Dave!

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!

Holiday Gift Ideas

Building and Using Baluns and Ununs

by Jerry Sevick, W2FMI



This volume is the source for the latest information and designs on transmission line transformer theory. Discover new applications for dipoles, yagis, log periodics, beverages, antenna tuners, and countless other examples.

Order No. BALUN . . . $19.95

The Vertical Antenna Handbook

by *Paul Lee, N6PL*

Learn basic theory and practice of the vertical antenna. Discover easy-to-build construction projects.

Order No. VAH..... $9.95

Keys, Keys, Keys

by Dave Ingram, K4TWJ

You'll enjoy nostalgia with this visual celebration of amateur radio's favorite accessory. This book is full of pictures and historical insight.

Order No. KEYS $9.95

33 Simple Weekend Projects

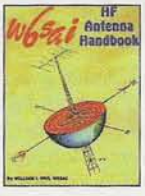
by Dave Ingram, K4TWJ

Do-it-yourself electronics projects from the most basic to the fairly sophisticated. You'll find: station accessories for VHF FMing, working OSCAR satellites, fun on HF, trying CW, building simple antennas, even a complete working HF station you can build for$100. Also includes practical tips and techniques on how to create your own electronic projects.

Order No. 33PROJ.... $15.95

W6SAI HF Antenna Handbook

by Bill Orr, W6SAI

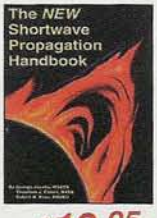


Inexpensive, practical antenna projects that work! Guides you through the building of wire, loop, Yagi and vertical antennas.

Order No. HFANT $19.95

The NEW Shortwave Propagation Handbook

by W3ASK, N4XX & K6GKU



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

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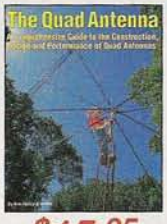
The Quad Antenna

by Bob Haviland, W4MB

Second Printing

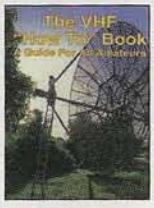


An authoritative book on the design, construction, characteristics and applications of quad antennas.

Order No. QUAD..... $15.95

The VHF "How-To" Book

by Joe Lynch, N6CL



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

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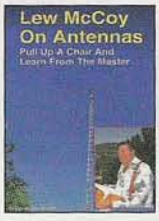
McCoy on Antennas

by Lew McCoy, W1ICP

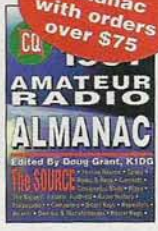


Unlike many technical publications, Lew presents his invaluable antenna information in a casual, non-intimidating way for anyone!

Order No. MCCOY $15.95

CQ Amateur Radio Almanac

by Doug Grant, K1DG



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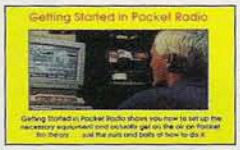
Getting Started in Ham Radio– How to select equipment, antennas, bands, use repeater stations, grounding, basic soldering.



Getting Started in Packet–De-mystify packet. Info on making contacts, bulletin boards, networks, satellites.

Ham Radio Horizons–Step-by-step instructions for the prospective ham on how to get involved.

Getting Started in VHF–Intro to VHF. Repeater usage, packet, satellites and more exotic VHF op modes.

Getting Started in Amateur Satellites– How ops set up stations. Locate and track ham satellites.

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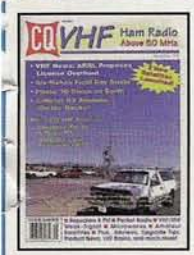

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Basics

Packet Bulletin Boards—Ham Radio's "General Store"

Today's digital communications networks—including ham radio packet networks—fall under the buzz phrase of the "information highway."

The reason you get onto a highway, any sort of highway, is to go somewhere. Usually, on a real highway, we have a specific destination in mind before we ever leave home. It's not much different on packet. Most of us turn on our packet stations to make contact with another specific station. In many cases, that station is our local *PBBS*, or *Packet Bulletin Board System*.

Since we're using a travel analogy, let's think of our PBBS as a small-town general store. In many towns, the general store is a combination post office, newsstand, and gossip center. If you want to find out what's happening, you stop by the general store.

On the ham bands, you can "stop by" your PBBS to pick up your mail, send off a note to a friend across the country or across the ocean, find out the latest ham radio news, and see if anybody knows where you can find that elusive piece of gear you're looking for. See the similarities?

In many ways, ham radio's general store is better than a real one. It's open 24 hours a day, seven days a week, you don't have to leave home to get there, and all the local stores are hooked together in a global network that automatically forwards messages and bulletins around the corner or around the world.

Using a PBBS

Let's take a look at how you connect to a packet bulletin board and what you can expect to find there. Like other specialized packet stations, most bulletin boards are either identified by a ham radio callsign followed by a dash and one or two numbers, or by an *alias* that generally includes the letters BBS (for example, the WA2SNA BBS in northern New Jersey uses the alias "BBSNNJ").

There are several different types of bulletin board software and each one is a little different. But they all have some features in common. When you log on for the first time (by typing "C," a space, the callsign or alias of the BBS, and pressing "enter"), you'll get a "new user" screen that asks a few questions, such as your name, location, and "home" BBS.

That last one's important. Your "home" BBS is where you want to receive your packet mail. Generally, it's the board you check into most frequently. If you check into a different board sometime, don't worry—you won't insult it by telling it you "live" someplace else. But you will let that system do two things: First, on some systems, any messages you send out from the board you're "visiting" will direct the receiving station to reply to your "home" BBS. And second, if a message coming to you without a full address happens to reach this bulletin board, it will automatically forward it to your correct "home address." *Please*...have just one "home" BBS.

Once a bulletin board "knows" who you are, it'll let you see what's there. The basic command for "listing" messages is "L." Just press "L" and "Return" or "Enter." The board will send you a list of all bulletins plus personal messages to or from you that have been posted since your last check-in. If this is your first, prepare for a long list. If you only want to see your mail, type "LM." It means "List Mine."

What Does It Mean?

On a typical listing of messages, each line represents one message. The information you'll see includes the message number, the type of message (is it "P" for personal or "B" for bulletin?), and a status code ("Y" or "N" to indicate whether it's been read), its size in bytes, the message address, including callsign and destination, plus the return address, the date and time the message arrived on this BBS, and a brief description of what it's about.

To read a message, type "R," space, and the message number. You can string together several numbers to read a group of messages with just one request. After you've read a message addressed to you, it's a good idea to delete it by typing "K" for kill, followed by the message number and a "return."

Sending a Message

To send a message, the basic command is "S." For a personal message to another ham, type "SP," space, that ham's callsign, and, if he or she is at a different bulletin board, the "@" sign, followed by the call of the destination BBS. Don't include the dash and SSID number, but it is good practice to provide routing information—basically a two-letter state abbreviation, the country and the continent, each separated by

Checking into your local packet bulletin board will let you send and receive mail, get the latest ham news, see what other hams want to buy and sell, and even download files and computer programs. This is Tom Klimala, KM4LB, of Raleigh, North Carolina, at his packet terminal.

a period. A typical address would be <W2VU@WA2SNA.#FN21.NJ.US.NA>. This would tell any forwarding station that the message is heading—in reverse order—to North America, the United States, New Jersey, Grid Square FN21 (different systems use different regional identifiers), and finally, the WA2SNA bulletin board. WA2SNA will hold the message for W2VU until he checks in, and then will list it as a waiting message.

After you tell the BBS you want to send a message and who you want to send it to, it will ask you for a short description, then tell you to type the message. When you're finished, type "CONTROL-Z" or "/EX" on a separate line. Your message will now be automatically forwarded by the BBS to its destination.

Sending a Bulletin

Sending a bulletin is pretty much the same, except that you type "SB" instead of "SP" and the address generally isn't a callsign. It's either "All" or some descriptive name, such as "Info." "Info @ USBBS" will send your information request to all packet bulletin boards in the U.S.

Please think carefully before you distribute a message widely; for instance, do you *really* need to send this to the whole country? And try to avoid "ALL@ALLBBS," or "ALL@WW," worldwide, unless it's truly important for hams everywhere to see your message. If it isn't, then your message just becomes clutter on the airwaves.

Files and Programs

Most bulletin boards also include file sections which contain either computer programs or long text files which you may download. One example is a file which will give you schedules and beam headings for working amateur satellites. You may also be able to download a public-domain program for tracking those satellites. Procedures vary on different systems, so check the help screen of your BBS or ask the *sysop* (system operator) how to access and download files on your system.

Handling Traffic

You can't travel on any sort of highway without seeing other traffic. In ham radio, the term *traffic* usually refers to radiogram messages sent via the American Radio Relay League's "National Traffic System." Many BBSs forward ARRL message traffic (generally addressed to "XXXXX@NTSzz," where the Xs are a Zip Code and the "z"s are a state abbreviation. A radiogram going to Hicksville, New York, for example, would be addressed to <11801@NTSNY>. There's a whole separate procedure for handling ARRL messages. We won't cover them here except to say that, if you see a message for someone local to you, feel free to pick it up (read it) and deliver it (generally by phone). If you do, be sure to then "kill" the message (using the procedure outlined above) so it's not picked up and delivered a second time by a second ham. To find out about traffic-handling, check into a local VHF voice net on a repeater, or contact your ARRL Section Manager.

Exit Ramp

When you've gotten your mail, checked the latest news, and maybe picked up a new program for your computer, it's time to leave "Ham Radio's General Store." That's the easiest command of all. Simply type "B" or "Bye" and press "return." The BBS and your TNC will do the rest. ■

Oops!

We "stubbed our toe" a bit using a new state-of-the-art printing process with our November issue. N2EMR's report on "Hams & Hurricane Bonnie" in the "Public Interest" column ran incomplete and a few graphic lines printed in another column in error. We will be reprinting N2EMR's report in its entirety in next month's issue.

Also, we got caught in the sticky web of World Wide Web addresses in the "Resources" box in October's "Put Your Repeater on the Internet with a PIC Microprocessor Interface" (pages 28 to 33). The correct address (URL) for a free trial version of "Internet Phone" software is

<http://www.vocaltec.com>

and the company's e-mail address is

<info@vocaltec.com>

Sorry if any of you got lost in cyberspace, and thanks to Trevor Jorgenson, N9MVM, for finding his way through the maze and giving us the correct URL.

Line of Sight *(from page 4)*

him toward additional sources of more specific information so he could do his own research.

And the research connection doesn't end there. If you look at this month's "Weak Signal News" column, you'll read about an immensely powerful gamma-ray burst that hit the earth on August 27 after traveling through interstellar space for at least 15,000 years. As it happened, the burst hit the dark side of the Earth, so all of the scientific equipment that normally measures X-rays and gamma rays from the sun was either shut down or blocked from this burst. How could astronomers learn what effect, if any, this burst of radiation had on our planet? Well, through hams and other radio hobbyists, for one thing. And they're asking for our help. Read "Weak Signal News" for details if you were talking on or listening to any radio or TV at 1022 UTC on August 27.

Get Involved!

What does it take to be a student at the University of Amateur Radio? Not much: just open your eyes and your ears, followed by your mind. Listen. Then ask questions if you don't understand something. Or offer your own information if you have something to add. What does it take to be a professor at the University of Amateur Radio? Not much more: primarily a willingness to share your knowledge and experience with other hams. Each of us has *something* about which we know more or have more experience than someone else. If your area of expertise comes up in a conversation, don't be shy. Jump in and—politely—offer to help out. You can start on your local repeater or simplex/weak-signal net. And if you find a topic that lots of people want to know more about, think about sharing it with a wider audience, perhaps through your club newsletter or even one of the national magazines. We're always looking for new writers with fresh ideas.

This Month's Curriculum

The *CQ VHF* campus of the University of Amateur Radio offers a variety of educational opportunities this month, from instruction in how to respond when a major disaster occurs in your back yard, to tips on winterizing your antennas and part two of our primer on radio wave propagation. There's no tuition, just the cost of the "workbook," and the final exam comes when you're able to apply the knowledge you've gained. We hope we'll earn a good grade from you this month.

Season's Greetings

In closing, from all of us at *CQ VHF*, best wishes for a happy holiday season and a healthy, happy and prosperous 1999. 73 de 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.

News *(from page 5)*

Days Test," and is encouraging schools to use APRS via RØMIR for position and status reports. MIREX officials are also asking non-school stations *not* to send APRS-type transmissions or beacon transmissions via RØMIR. At press time the Mir digipeater had been shut down due to misuse.

Digital Conference Focuses on APRS, Spread-Spectrum

Continuing growth of the Automatic Position Reporting System (APRS) and development of amateur spread-spectrum (S/S) communications were major topics as September's ARRL/TAPR Digital Communications Conference (DCC), according to the *ARRL Letter*.

A major step forward for APRS was Kenwood's announcement that it's introducing a new dual-band HT—the TH-D7A "Data Communicator"—that features a built-in packet TNC with support for APRS display and messaging, plus DX Cluster "spots." The TH-D7A is expected to be available by the end of this year.

On the S/S front, Tom McDermott, N5EG, reported on progress on TAPR's S/S radio project (moving along well, but still a lot of work to be done); Dewayne Hendricks, WA8DZP, described ongoing S/S networking projects in the San Francisco area under TAPR's FCC STA (Special Temporary Authority), including one that uses commercial Part 15 wireless LAN (local area network) equipment operating under amateur rules; and Japan's Packet Radio User's Group (PRUG) showed off three experimental 2.4-GHz S/S stations that they'd built and had in operation. The three stations were transferring data among themselves at about 800 kb/second—leaving "standard" 1.2-kb packet and even top-of-the-line 56-kb computer modems in the dust.

Getting a "BLAST" from Multipath

Make multipath your friend. That's the message that a group of scientists discovered after re-examining a 50-year-old mathematical theory that underlies all of today's high-speed communications systems. Multipath is the tendency of VHF signals to follow several routes simultaneously from transmitter to receiver, with delays along one or more paths causing signals to fade and strengthen.

According to reports in the "CGC Communicator" newsletter, relayed to hams by "Newsline," a team of researchers at Lucent Technologies (formerly Bell Labs) in New Jersey took advantage of multipath effects to send several transmissions simultaneously on the same frequency, with each transmission having its own antenna. Multiple antennas are also used at the receive site, with a fancy computer program separating out the signals. The scientists say their system, called BLAST (**B**ell **L**abs **LA**yered **S**pace-**T**ime), has the potential to increase the capacity of fixed wireless links by as much as 20 times, without increasing the bandwidth. It will apparently be most useful for digital communications and at VHF and above, where ionospheric propagation is less of a factor than at lower frequencies. Actual use of the system is still several years away. More information is available on Lucent's Web site at <http://www.bell-labs.com/projects/blast/>. ■

Note: "Product Update" appears this month on page 34; "Letters" begins on page 70.

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 Amateur Radio Club: Meets every 1st Tuesday of the month, CDF building, 118 Fortuna Blvd., Furtuna, CA. 7 p.m. PST. Thursday night net, repeater 147.090, 7:30 p.m. PST. Contact Guy Vitello, (KE6JQW), at (707) 768-3145; 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, 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>.

GA, College Park REACT 4921: Training in packet, computers, radio building, space radio, FCC. Net. ev. Mon, 8:30 p.m., MatPARC Club 145.41-repeater. Contact: Thorton Williams, 2001 Godby Road, Ste. 0-6, College Park, GA 30349.

IL, Olney, Olney Amateur Radio Club-Richland County: Meetings 2nd Thursday of each month, 7:30 p.m., Hardees banquet room, 912 E. Main Street., Olney, IL; Repeater: 146.760-. Contact Vice President Ben Rose, KB9OTJ, at <harley@wworld.com>.

IL, Skokie, Free Live Online Hamfest: Buy, sell, trade. Instant listing of all your items for sale or wanted! No charge for this classified listing of radios, antennas, computers. Open chat room to discuss the details of your purchase or sale! Sponsored by the Tri-County Radio Group, Inc.; Web site: <http://quality-enterprises.com/tcrg/onlinefest/>.

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>.

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.

NY, Tonawanda, Radio Association of Western New York (RAWNY): Meets 2nd Tuesday if each month from September to May, 8 p.m., at Church of the Nativity, corner of Thorncliff and Colvin Blvd., Tonawanda, NY. Web site: <http://hamgate1.sunyerie.edu/~rawny>.

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 on the third Wednesday of every month except December at 8 p.m. at the 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>.

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. E-mail: <LARC@net-quest.com>.

PA, New Castle: Amateur Radio League of Lawrence County (ARLLC) and Lawrence County ARES (LCARES). Meetings every 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 our Web site: <http://pages.prodigy.com/arllc>.

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

Advertisers' Index

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, 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 amateur radio 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). At the conclusion of the 10-week course, participants will be given an FCC license exam on Saturday, November 21st at the same location. 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>.

SC, Columbia: ARRL/VEC testing session for all license classes will be held third Saturday of each even month (August, October, and December), at 9 a.m., at Heathwood Hall Episcopal School, 3000 South Beltline Blvd., Columbia, SC. For more information, visit the Web site at: <www.qsl.net/ ku4qn>, e-mail: <KU4QN@juno.com>, or call (803) 779-5234. Exam fee is $6.35. Elements 2 (Novice written exam), and 1A (5-wpm code) are free of charge.

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

CCT®, Inc.: Antennas—High Efficiency Unique Designs HF to UHF. Computer Systems, Sub-Systems, CPU & Motherboard Upgrades, Components. High Voltage Capacitors, Parts. CCT® Radio: <http://www.cctnetwork.com>.

Communications Specialists, Inc.: Manufacturers of Tone Signaling Equipment including CTCSS encoders and decoders, Morse Station IDers, Repeater Tone Panels and much more. Please see our ad in this issue; <http://www.com-spec.com>.

KMA Antennas: VHF, UHF & HF log periodics, Yagis and unique 6-meter antennas. Please mention *CQ VHF* when you visit <www.qsl.net/w4kma>.

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>.

VisualRadio® is a powerful control software for AOR, ICOM, Kenwood, JRC, YAESU, and more. Starting at U.S. $122. Download demo from <http://ourworld.compuserve.com/homepages/ visualradio>. For info/order: Cord Schuette, St. Johns, MI; Phone/Fax: (517) 224-1791; E-mail: <Schuette@email.mintcity.com>.

Woodhouse Communication: Antennas and publications for weather satellite imaging: <www. view2earth.com>.

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HF/50/144/430 MHz All Mode Transceiver

"Compact, too--great for our next 'rover' operation."

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The FT-847 changes base station operation forever. Now, three radios in one--HF, VHF/UHF, satellite; technology in its finest application, from the world leader in amateur communication.

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Take the next step in all-band performance and take home the FT-847 today!

LIMITED TIME! SUPER NEW LOW PRICE!

Only one transceiver gives you all mode operations on HF/50/144/430 MHz with full Satellite capability.

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Designed for the FT-847. Works on 7/14/21/28/50/144/430 MHz Amateur Bands for mobile operation.

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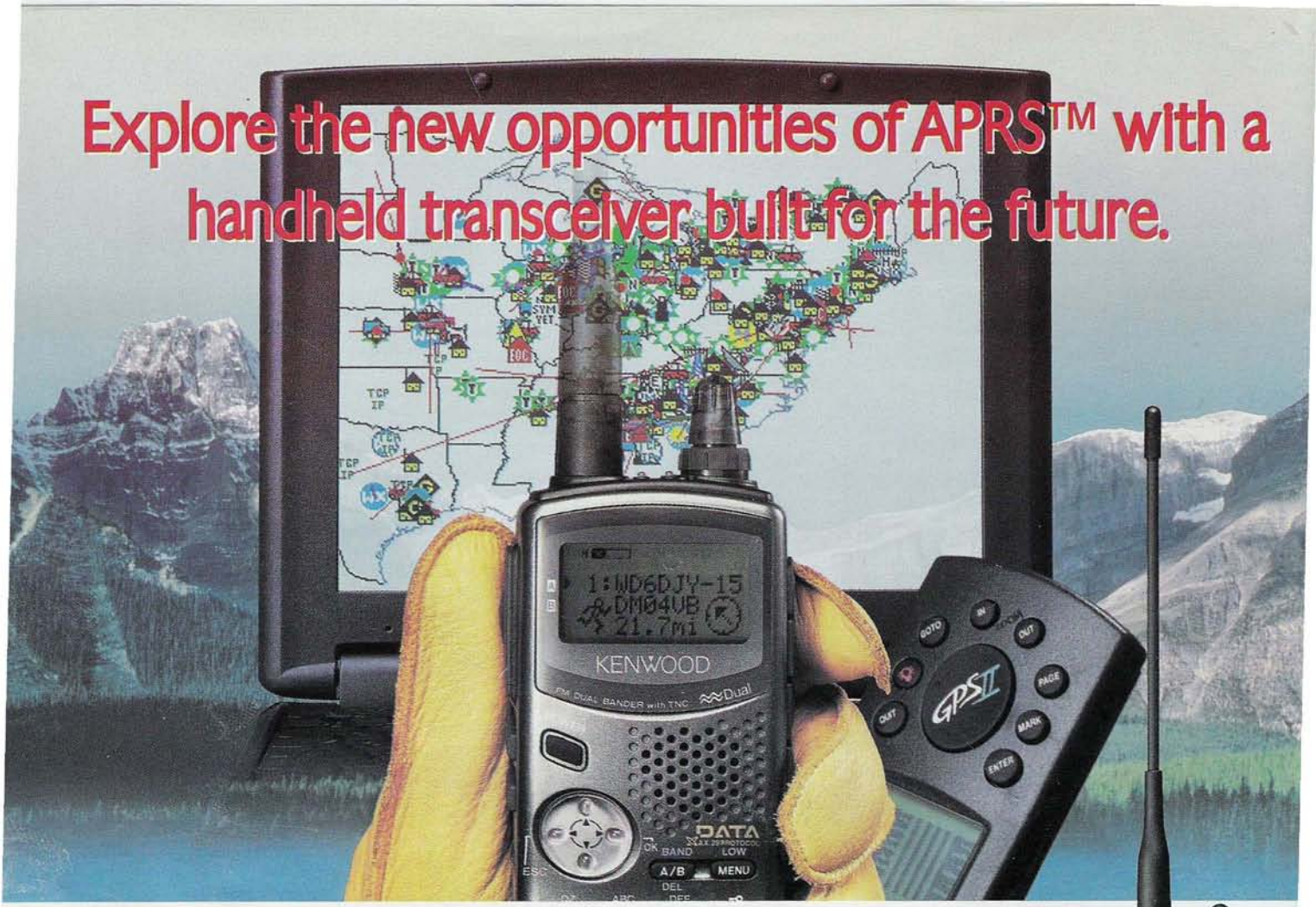

TH-D7A DATA COMMUNICATOR 144/440MHz FM Dual Bander

Meet Kenwood's new TH-D7A, an FM dual-band (144MHz/440MHz) handheld transceiver equipped with a TNC and all the features needed for easy amateur radio data communications — and especially APRS.

The TH-D7A offers exciting new adventures in Ham radio with a wide range of data communications options — including simple packet operation using the AX.25 protocol and the Automatic Packet/Position Reporting System (APRS), which is rapidly gaining popularity worldwide. You can also send and receive SSTV images using Kenwood's VC-H1.

APRS (Automatic Packet/Position Reporting System)

- **Position/directional data**
  Hook up to an NMEA-0183 compatible GPS receiver and you can transmit your exact position for automatic calculation of distance, current speed and heading. Manual input of latitude/longitude is also permitted.
- **Versatile messaging**
  Transmit your own alpha messages (up to 45 characters),. bulletins, comments (up to 20 characters), and fixed messages (8 patterns).
- **Station List**
  Store received APRS data in up to 40 memory channels
- **Grid square locator**
- **TX interval** (0.5/1/2/3/5/10/20/30 min.)
- **Packet path selection for Digipeat**
- **Weather station & PHG data reception**

Visual Communicator Control

- **Text superimpose function**
  Add your call sign, RSV reports, comments, etc.
- **VC-H1 shutter**
  Command a connected VC-H1 to initiate transmission
- **Fast FM**
  Send an image in just 14 secs (approx).
- **SSTV transmission mode selection (9 modes)**

- **Dual receive for voice & image transmissions (VHF only)**

FEATURES

■ Built-in 1200/9600bps TNC (1 packet, 1 frame, 256 bytes) compliant with AX.25 protocol ■ Dual receive on same band (VHF only) for both voice and data (two frequencies simultaneously) ■ Large (12 digits X 3 lines) dot-matrix LCD, multi-scroll key, menu mode & other user-friendly features ■ 200 memory channels with 8-character memory name input ■ 16 backlit keys ■ Built-in CTCSS (38 EIA-standard subtone frequencies) ■ 16-digit, 10-channel DTMF memory ■ MIL-STD 810C/D/E water resistance ■ High-gain dual band antenna ■ High-speed (9600bps) PC-based packet communications for chat, BBS, etc. ■ Kenwood Skycommand System (KSS) II for remote control of fixed HF transceiver– TS-570S/D(G) or TS-870S (requires optional PG-4R) ■ Monitoring DX cluster, TM-742A/TM-V7A remote control (DTMF remote), etc.

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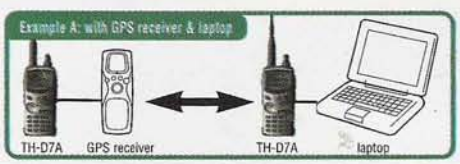

NOTICE:

The TH-D7A has not been approved by the F.C.C. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the F.C.C. has been obtained. Pending approval in December, 1998.

KENWOOD
Amateur Radio Products Group
98ARD-1794

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