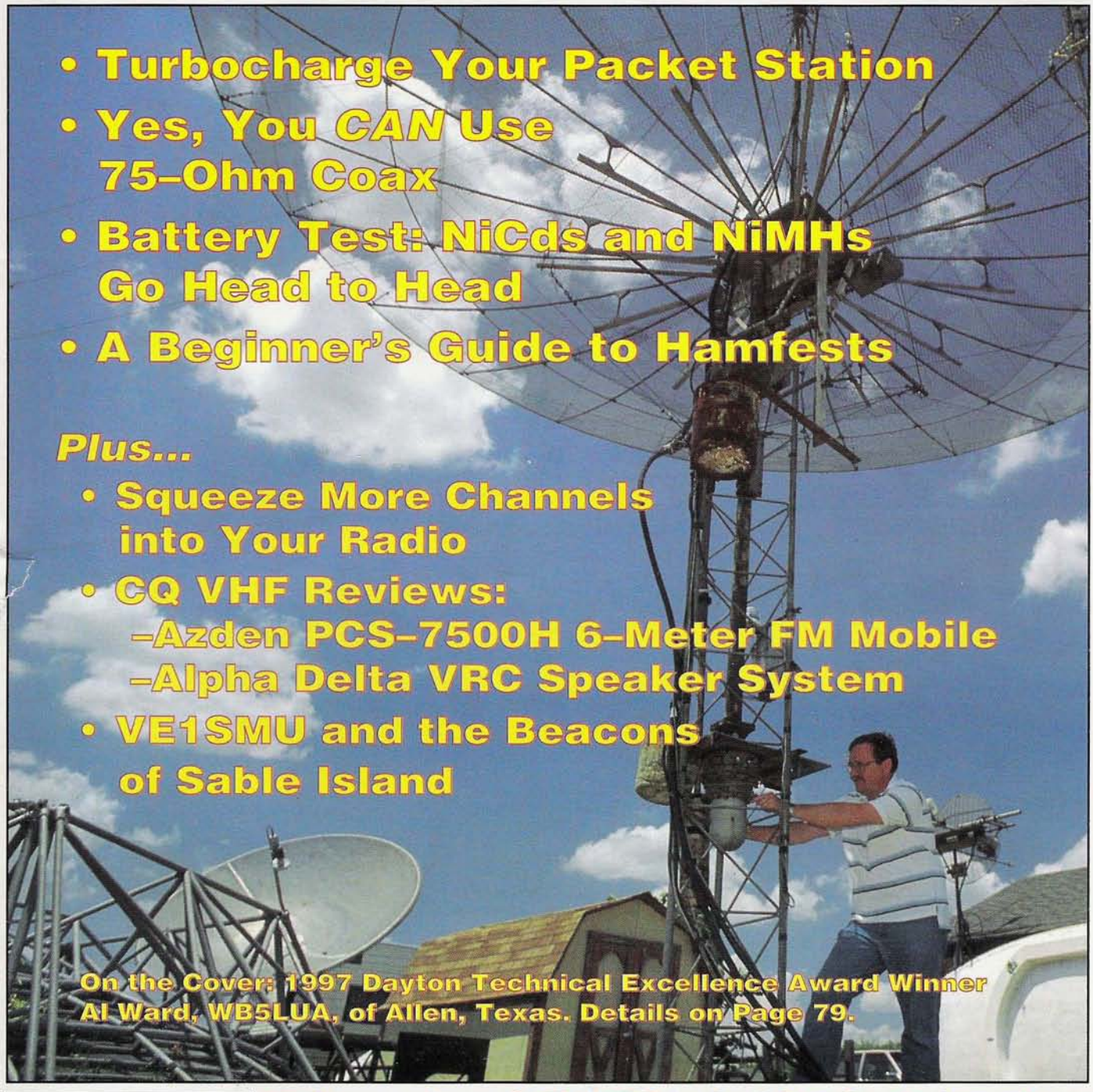
ICD 08237

CQ VHF Ham Radio Above 50 MHz

July 1997



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- VE1SMU and the Beacons of Sable Island

On the Cover: 1997 Dayton Technical Excellence Award Winner Al Ward, WB5LUA, of Allen, Texas. Details on Page 79.

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MODEL	A27010S	
Frequency, MHz	144-148	430-450
No. Elements	5	5
SWR 1.2:1 Typical		
2:1 Bandwidth, MHz	≥4	≥10
Power Rating, Watts PEP	350	350
Boom Length, ft (m)	6.17 (1.9)	
Longest Element, in (cm)	40.3 (102.4)	
Turning Radius, ft (m)	6 (1.8)	
Mast Size Range, in (cm)	1.25-2 (3.2-5.1)	
Wind Load, ft^2 (m^2)	.725 (.07)	
Weight, lb (kg)	1.8 (.81)	

MODEL	AR270	AR270B	ARX270U/N
Frequency, MHz	144-148 / 430-450	144-148 / 430-450	144-148 / 430-450
SWR 1.2:1 Typical			
2:1 Bandwidth, MHz	>4 >15	>4 >15	>4 >20
Power, Watts FM	250 250	250 250	200 200
Height, ft, (m)	3.75 (1.13)	7.7 (2.3)	16.5 (5)
Mast Size Range, in	1.25-2 (3.2-5.1)	1.25-2 (3.2-5.1)	1.25-2 (3.2-5.1)
Radial Length, in (cm)	6.75 (17.1)	20 (51)	20.5 (52.1)
Wind Load, ft2 (m2)	0.27 (0.03)	0.47 (0.044)	0.95 (0.088)
Weight, lb (kg)	2 (0.9)	2.4 (1.09)	5 (2.3)
Construction style	High strength aluminum	High strength aluminum	Fiberglass enclosure

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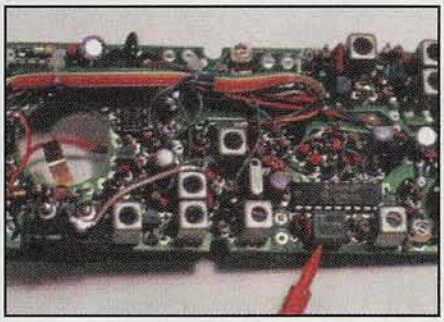
CQ VHF Ham Radio Above 50 MHz

Volume 2, Number 7—July, 1997



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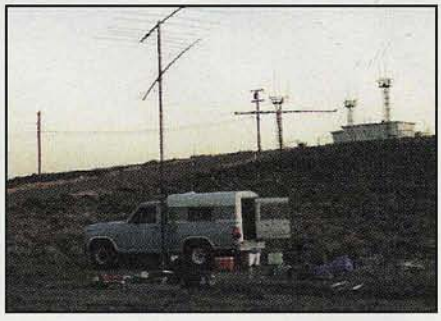

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Next Month: "Build a 25-Amp, 12-Volt Power Supply," by Chuck Pearce, K3YWY

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TM-261A

FM Mono Band Mobile

- 144 MHz operation
- 62 memory channels
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- DTMF memory for autopatch
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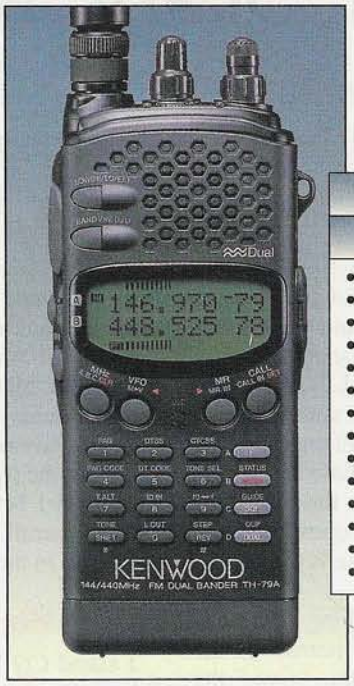
- Multi-scan capability
- Backlit microphone
- MIL-STD 810C and 810D
- Dual menu system
- Repeater reverse switch
- DTSS selective calling
- Built-in CTCSS encoder
- Wireless cloning

"Super! I can use alphanumeric memories to store names, call signs, and repeaters on my TM-261A."

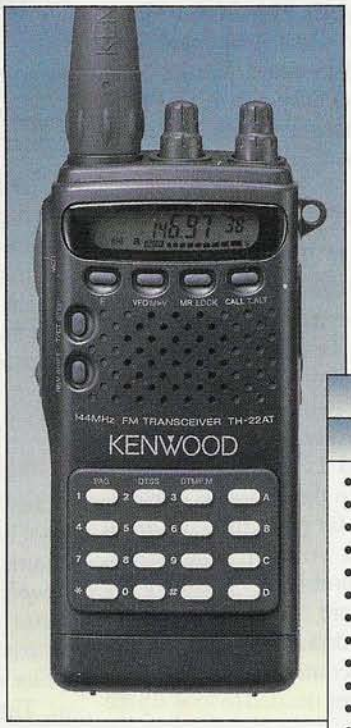


TH-79A(D)

FM Dual Bander

- 144 MHz / 440 MHz operation
- Dual receive on 2 bands
- Dot-Matrix LCD display
- 7 character alpha-numerics
- 82 memory channels
- Operator's Guide function
- DTMF memory for autopatch
- Wireless cloning
- PC programmable
- MOS FET power module
- High performance antenna
- CTCSS encode/decode
- Remote control feature
- Airband receive

"Great! My TH-79A(D) receives on 2 bands at the same time. Comes in a 5W version too."



TH-22AT

FM Mono Bander

- 144 MHz operation
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- MOS FET power module
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Those "Scary" New Test Questions

There's a whole bunch of new questions in the revised question pool for the Novice/Technician license exam. But is it really anything to worry about?

Normally, there's not too much fuss over the release of an updated question pool for amateur exams. At one level of license or another, it happens once a year, on July 1. But this year was different. This year, it was time for a new set of questions for Elements 2 and 3A: the Novice and Technician written exams. And this year, for the first time, the exams include 10 new questions (five in each element) on RF safety, as mandated by the FCC.

What's causing something of an uproar, though, is the 46% increase in the number of questions in the "pool," the publicly available list of possible questions from which the tests are created. And the uproar basically goes like this: "When a potential ham picks up a license manual and sees 924 possible questions instead of 550, he or she will be scared off by the sheer volume of the material." I think this reasoning is faulty, and I'll explain why, but first, let's see where these numbers come from.

The "10-to-1 Rule"

The FCC rules setting up the Volunteer Examiner (VE) program require that each question pool "contain at least 10 times the number of questions required for a single examination" (§97.523). The rules also stated that Element 2 (Novice) was to be a 30-question exam, and that the Element 3A (Technician) exam would have 25 questions. So a test with 55 questions overall would be drawn from a pool of *at least* 550 possible questions. And the Question Pool Committee, a group with representatives from all of the Volunteer Examiner Coordinators (VECs) that actually writes the exams, has generally stuck pretty close to this 10:1 ratio. Or has it?

In truth, the number of questions in the pool has been slowly creeping upward. The "old" Novice/Technician question pool contained 632 questions, 15% more than the minimum of 550. Now, with 10 new questions on RF safety added to the exams, the total number of questions in the new pools equals 924, from which a 65-question exam will be generated. This increases the pool-to-exam question ratio from 11.5:1 before July 1 to 12.7:1 after July 1. Overall, there are nearly 300 more questions in the new pool than in the old.

"Open Book" Questions

I asked *CQ VHF* Senior Contributing Editor Gordon West, WB6NOA, who also writes license manuals, to fax me a couple of paragraphs explaining the changes. He sent me 10 pages! Amid all of this, he made two key points: 1) the exams are not harder, even if they look like they are; and 2) the number of RF safety questions in the pool was mandated by the FCC at far more than the usual 10:1 ratio; but if you can read tables, you'll have no problem. "Most of the safety questions are 'open book' on the exam," says Gordon. "The Novice and Tech exams will contain all the RF safety tables and figures needed to look up the correct answers."

Well, that takes care of the RF safety questions, but they make up only 60% of the added questions: the other 40% cover the traditional topics that have always been on the exams.

Is this some sinister plot by the Question Pool Committee to scare off potential hams? Not at all. In fact, it's simply a continuation of a process that began a while ago. As noted above, the "old" pool didn't have a 10:1 pool-to-exam question ratio—it was 11.5:1. So the number of pool questions versus exam questions has been slowly edging up anyway, and it hasn't seemed to scare off too many potential hams. The combination of the usual increase plus the 10 new exam questions pushes the ratio to 12.7:1, an increase of 1.2 pool questions for each exam question (smaller than the increase which has brought it from 10:1 to 11.5:1). But the really big question about the new questions is this: *So what?*

> ***" 'When a potential ham picks up a license manual and sees 924 possible questions instead of 550, he or she will be scared off by the sheer volume of the material.' I think this reasoning is faulty...."***

Do More Pool Questions Mean a Harder Test?

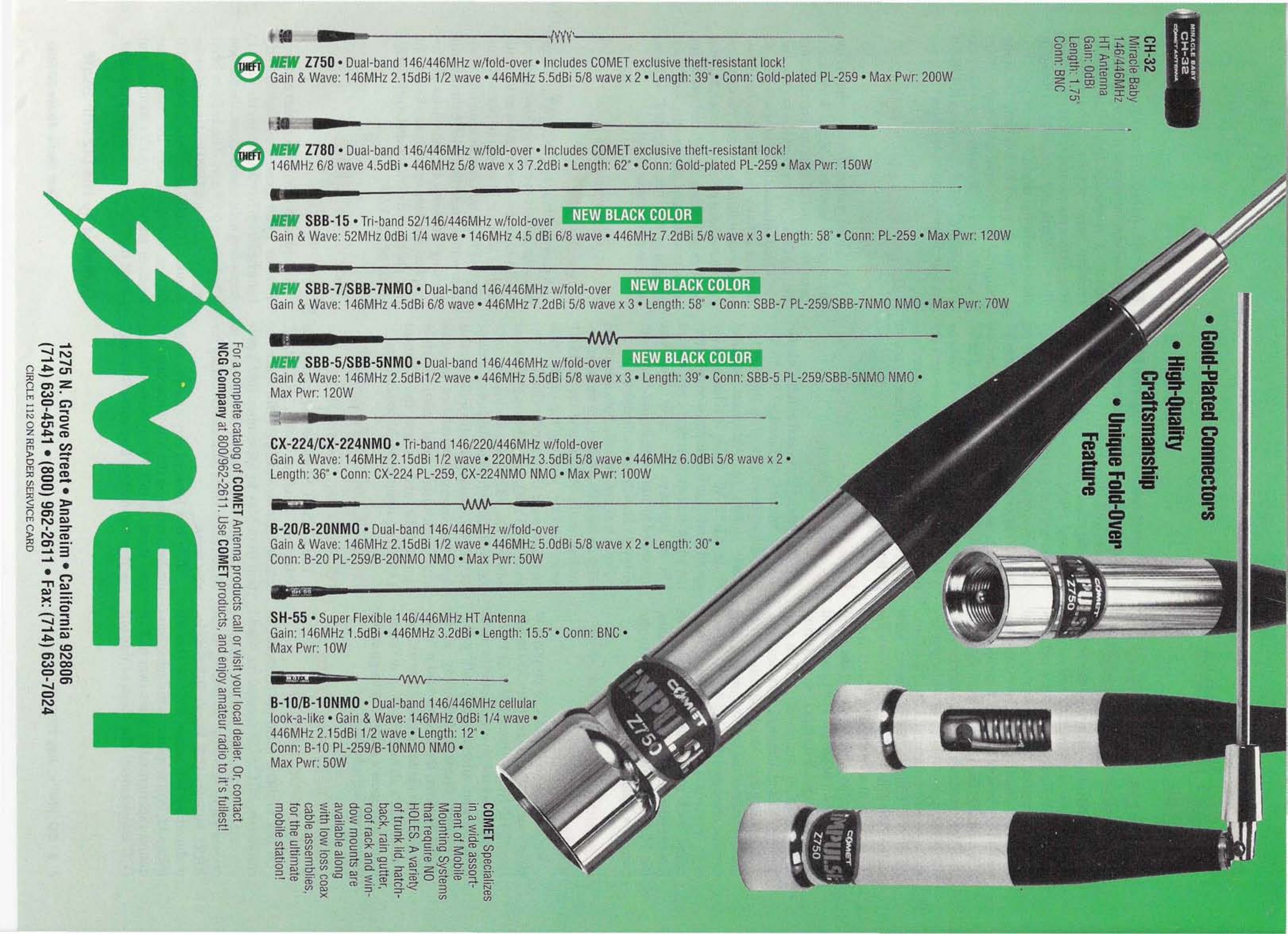
Just because the size of the question pool has been growing doesn't mean the exams are getting any harder. *The only people for whom this is a problem are those who are trying to memorize the entire question pool in order to pass the exam without really learning the material.* There's no question: It's much harder to memorize 924 questions than to memorize 632. *But if you learn and understand the underlying material, it doesn't matter how many possible questions will be used to make up your exam.* Maybe one reason for increasing the size of the question pool is to help make sure people don't become hams simply by memorizing questions and answers without understanding what it's all about. And, if that's the case, I'm all for it.

License to Learn

I've long held the opinion that a ham license of any class is a license to learn.

(Continued on page 83)

By Rich Moseson, W2VU, Editor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NEW SBB-7/SBB-7NMO • Dual-band 146/446MHz w/fold-over
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Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259/SBB-7NMO NMO • Max Pwr: 70W
NEW SBB-5/SBB-5NMO • Dual-band 146/446MHz w/fold-over
NEW BLACK COLOR
Gain & Wave: 146MHz 2.5dBi1/2 wave • 446MHz 5.5dBi 5/8 wave x 3 • Length: 39" • Conn: SBB-5 PL-259/SBB-5NMO NMO • Max Pwr: 120W
CX-224/CX-224NMO • Tri-band 146/220/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 220MHz 3.5dBi 5/8 wave • 446MHz 6.0dBi 5/8 wave x 2 • Length: 36" • Conn: CX-224 PL-259, CX-224NMO NMO • Max Pwr: 100W
B-20/B-20NMO • Dual-band 146/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.0dBi 5/8 wave x 2 • Length: 30" • Conn: B-20 PL-259/B-20NMO NMO • Max Pwr: 50W
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CIRCLE 112 ON READER SERVICE CARD

VHF News

ARRL: Let Hams Handle Malicious Interference

The ARRL has petitioned the FCC to privatize enforcement of malicious interference problems, and for a new enforcement mechanism to avoid having to deal with the Commission's chronically understaffed field offices. In a petition for rule making, the League asked the FCC to allow members of its Amateur Auxiliary to bring evidence of malicious interference violations directly to the Commission's Chief Administrative Law Judge. The Chief ALJ would determine if a complaint warranted FCC action and would then be able to designate valid complaints for hearings. The League said it would help AA members in preparing and submitting complaints, and in presenting cases at administrative hearings.

According to an ARRL bulletin, the petition noted that the vast majority of amateurs do obey the rules, but that "in a very few, persistent, serious enforcement cases," FCC action has been needed but has not been forthcoming. At press time, the FCC had not yet responded to the League's Rulemaking petition.

League Calls for Delay in Vanity Fee Hike

Responding to the FCC's proposal to raise vanity callsign fees from $30 to $50 (see "VHF News," June, 1997 *CQ VHF*), the ARRL says no change should be made in the fee until all four vanity call "gates" have been opened. According to an ARRL bulletin, the League said it "does not object to the fee increase per se," but that it "wants all hams to have an opportunity to request a specific callsign under the current fee schedule."

Hams Exempted from CB Enforcement Bill

A bill to allow local governments to enforce the FCC's CB regulations would not extend to amateur radio or other licensed radio services, according to an ARRL bulletin. U.S. Senate Bill 608, introduced by Wisconsin Senator Russell Feingold, is in response to the same frustration experienced by hams over lack of FCC enforcement. The focus of this bill is RF interference emanating from illegal CB equipment or CB equipment used on unauthorized frequencies.

At the request of the ARRL, amateur radio and other FCC-licensed services were specifically exempted from the legislation's coverage, and the bill calls on the FCC to provide "technical guidance" to states and municipalities in enforcing the Commission's rules. As a final safeguard to amateurs who might erroneously be subjected to local enforcement actions, the bill provides an appeal process to the FCC. So far, there's been no action on the legislation.

New Ham Astronaut on Mir: KB5UAC

If everything happened as scheduled in May, Astronaut Jerry Linenger, KC5HBR, has been replaced aboard the Russian Mir space station by Astronaut Michael Foale, KB5UAC. Foale is scheduled the spend more than four months on the orbiting space station. Linenger came aboard Mir in January. The crew swap was scheduled to take place in mid-May, with a May 15 launch date scheduled.

Foale was not the only ham scheduled to fly on the STS-84 docking mission, according to the ARRL and the AMSAT News Service. Among the other crew members were Commander Charles Precourt, KB5YSQ, and Mission Specialists Edward Lu, KC5WKJ, Carlos Noriega, KC5WKK, and Jean-Francois Clervoy, KC5WKG. The report also indicates that Foale has received permission to speak with unlicensed third parties while aboard Mir and to use the German SAFEX equipment on 70 centimeters.

Foale "Looking Forward" to Mir Ham Contacts

The AMSAT News Service reports that Astronaut Michael Foale, KB5UAC, scheduled to be aboard the Mir space station from May to September, told a prelaunch news conference that he plans to be active on Mir's ham station during his stay there.

"I do look forward very much to using the ham radio on the Mir throughout my stay there, to talk to anybody who can speak to me in either English or Russian," Foale said. Asked if there was anything in particular he wanted to hear about, he added, "I'm open for anything. I just like chatting with people. Specifically, I request that people just tell me about their lives on Earth and what they're doing in their part of the world."

Foale also said he's hoping for some "slightly longer contacts" rather than "just the brief collections of QSOs we do on the shuttle." So, if you contact KB5UAP on Mir, be prepared to ragchew!

Mir Off the Air in April and May

Mir's ham station appears to be off the air at press time (mid-May). There have been no reports of random contacts, and the AMSAT News Service says it has "received information that states that all amateur activity from Mir has been suspended until further notice." No explanations have been given. However, Mir has been experiencing significant problems with its power and air systems, so it's not surprising that "non-essential" systems may have been shut down.

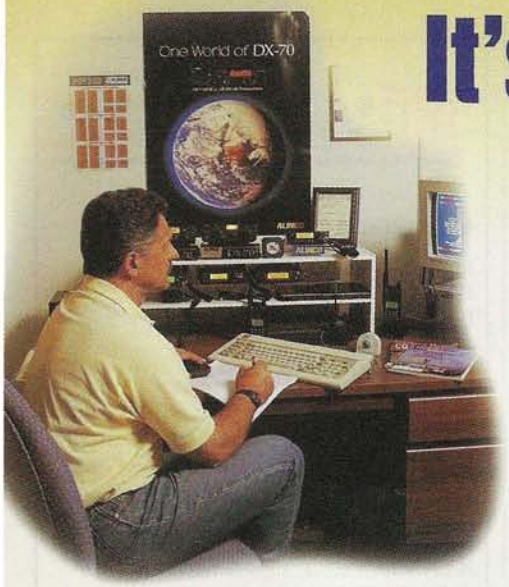
Ham Astronaut Leaving NASA

Astronaut Jay Apt, N5QWL, retired from the astronaut corps in May, leaving NASA to take a new position as Director of the Carnegie Museum of Natural History in Pittsburgh. Apt flew on four shuttle missions, including a 1996 shuttle-Mir docking mission, on which he photographed amateur operations aboard Mir (see photos in the March and April, 1997, issues of *CQ VHF*).

"Rockoon" Flight Successful

A combination balloon/rocket carrying amateur radio gear was successfully launched from North Carolina on May 11. According to Internet reports, the balloon lifted off at 6:59 a.m. The balloon burst unexpectedly at 60,000 feet instead of the planned 100,000 feet. But controller Bill Brown, WB8ELK, saw the burst on his amateur television (ATV) monitor and issued the "fire" command to the rocket.

Compiled by the CQ VHF Staff



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Get a terrific performer for year 'round fun, (Field Day and every day) at a very low price. Tried and true, the DX-70TH and DX-70T are great values. A DX-70 is your ticket to exciting communications on ten bands!

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This battery-powered timepiece has a moveable bezel imprinted with cities representing the world's time zones. As the bezel is rotated, the indicated time shifts automatically to the local time of the chosen city. A moving sun/moon graphic shows if the displayed time is day or night. You'll sound well-informed, knowing the local time of your DX contact!

- 100 memories
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- Detachable faceplate, remote mounting kit available
- SSB, CW, AM, FM and Digital Modes, including 6 Meters
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- Selectable RF Gain and AGC
- CTCSS encode for 10M and 6M FM repeaters
- Narrow Filter, standard
- Selectable Scan Modes
- Auto Power Off
- Multi-function control simplifies operation

- Full QSK, semi or automatic break in
- Quick offset for "split" operations
- DX-70TH features 100 watts output on HF and 6M
- DX-70T outputs 100 watts HF, 10 watts on 6M, MSRP under $1,000!

EDX-2 Auto Antenna Tuner

- Tunes 160-10 Meters (40 foot wire antenna required for 160M, 9.8 foot minimum for others)
- Fully integrated with Alinco DX-70 radios
- Weather resistant housing, can be mounted outdoors
- Comes with 16 feet of coax and control cable (cables may be extended)
- Maximum input: 200 watts
- Perfect for mobile, marine, home or portable use

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CIRCLE 153 ON READER SERVICE CARD

The rocket engine fired and carried its payload to an estimated altitude of 30 miles before falling back to Earth, and it sent back spectacular photos. The flight package included APRS (Automatic Position Reporting System) equipment as well as an ATV transmitter, allowing hams up and down the east coast to monitor its progress via packet and to view live ATV pictures from space. For updates and photos, visit Bill's Web page at <http://fly.hiwaay. net/~bbrown>.

RS-16 Update

As we went to press, the new RS-16 satellite was still not fully operational. Latest reports had the Russian satellite's 70-centimeter beacon operating, but the 2-meter and 10-meter beacons turned off. The *Spacenews* newsletter reported some background on the satellite. Along with its Morse beacons, RS-16 also transmits high-speed telemetry, and some amateurs are having better luck receiving and decoding it than controllers in Russia, due to having more sensitive receivers. One of the satellite's controllers estimated that testing would continue into May or June, after which he expected RS-16 to begin operating in Mode A (2 meters up; 10 meters down).

VHF Pioneer Ed Tilton, W1HDQ, SK

Former *QST* VHF Editor Ed Tilton, W1HDQ, died March 1 in Florida at age 89. Tilton was the ARRL's first VHF editor, inaugurating his column, "On the Ultra Highs," in 1939 and writing it monthly until his retirement in 1960. That column is the predecessor of today's "World Above 50 MHz" column. He also wrote the ARRL's first *VHF Manual*.

Tilton is credited with a variety of VHF/UHF "firsts." ARRL Executive Vice President Dave Sumner, K1ZZ, said of Tilton, "Perhaps more than any other individual, he led the exploration of the extended-range properties of the VHF and UHF bands."

State Judge Dismisses Interference Suit

A Superior Court judge in New Jersey threw out a neighbor's interference-based lawsuit against a ham, ruling that he had no power to decide the case. According to a report in the Newark *Star-Ledger*, Judge Reginald Stanton dismissed the nuisance charges against Walter Kornienko, K2WK, of Lafayette —but only because FCC rules prevented him from deciding the case.

"The FCC controls just about everything to do with the operation of ham radios under very extensive and broad laws and regulations," said Stanton. But he also noted that "there is no question that there has been meaningful intrusion into the (neighbors') home and their expectations of enjoying a reliable and reasonably high-quality level of telephone and television reception."

Kornienko's neighbors had charged that his transmissions caused interference on their TV and phone, and activated their electric garage door opener. They wanted the judge to declare his operation a nuisance and impose restrictions on his operating. Kornienko's attorney argued that he was operating within the bounds of his FCC license and that the neighbors hadn't made sufficient effort to shield their electronic devices from interference.

The article further quoted Judge Stanton as saying that, under FCC regulations, "If [Kornienko] is obeying the FCC rules and the [neighbors] can't fix the situation in their home, that's tough and they'll have to lump it."

Deadline Looms for Young Ham Award

Even though this is the July issue, most of you will get it in mid-June, so it's worth one final reminder that nominations for the 1997 Young Ham of the Year Award must be received by June 30. The award is jointly sponsored by the Amateur Radio Newsline, Yaesu USA, and our sister magazine, CQ.

Nominees for the award must be 18 or younger, FCC-licensed amateurs, and residents of the continental United States. To qualify, a nominee must be providing significant service to the hobby, his/her community or the nation, and amateur radio must play a role in that service. Simply having a license at age three or passing the Extra exam by age five isn't enough. Nominees must actually be demonstrating leadership skills through amateur radio.

For additional information and nominating forms, send an SASE to 1997 Young Ham of the Year Award, c/o Newsline, 28197 Robin Ave. Santa Clarita, CA 91350, or visit the CQ and CQ VHF Web sites at <http://members.aol.com/cqmagazine/> and <http://members.aol.com/cqvhf/>, respectively. Remember, the deadline is June 30.

CQ VHF Ham Radio Above 50 MHz

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CIRCLE 130 ON READER SERVICE CARD

Letters

Your Spot to Speak Out

CQ VHF *welcomes comments and suggestions from our readers. We'll print a representative sampling each month, and we reserve the right to edit letters we receive 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, *76 N. Broadway, Hicksville, NY 11801; or via e-mail to <CQVHF@aol.com>; <cqcomm@delphi.com> or <72127.745@compuserve.com>. Please specify that it is a letter for* CQ VHF.

Make Better Use of Repeater Channels

Dear *CQ VHF*:

I am writing in reference to the "Narrowing our Splits" Op-Ed piece in your fine December '96 issue. While the intentions are good, I don't think reducing the channel spacing below 15 kHz is realistic with the current generation of user's equipment (I still get into it with the states that made the backward move to 20-kHz spacing). This would necessarily involve equipment adjustment and modification. Many hams are justifiably intimidated when opening the cover of their super-rigs. I don't think changing the IF filters and coils is a viable option for the majority of users. The manufacturers may or may not get around to redesigning the equipment, and, if so, the transition into mass usage would take many years.

Instead, I'd like to see better use made of the existing channels we now have. I would like to see an operational policy change rather than a mechanical one. For the last few years, I've been using an ICOM IC-R7100 and PC logging software to monitor repeater activity...and lack thereof. This system summarizes the elapsed time that repeaters (100 at a time) were actually active during a given time period, usually an unpublicized, random month or two, 24 hours a day per band. This sorted activity report provides the evidence necessary to withdraw and reassign paper machines. Also, an interesting pattern emerged: 10% of the repeaters were carrying 90% of the traffic. Underwhelming, eh?

Using the above supportive evidence, it would seem reasonable to take the lowest third, by usage, of these repeaters and relegate them all to a handful of non-protected CTCSS (PL) mandatory channels that would be set aside for these low-activity operations. The different PLs would keep them separate (the commercial troops have been doing this for ages). It probably wouldn't be popular with the Mom 'n Pop operations, but it certainly would accommodate more users, and that is the responsibility of us coordinators...to accommodate the most users within the limited spectrum available.

73,

Whit Brown, WBØCJX
Golden, Colorado

Note: The writer is the Frequency Coordinator for Colorado and Frequency Coordination Chairman of the Mid-America Coordination Council (MACC).

Whit—We purposely held onto your letter for a few months, knowing that Rod Wheeler, who wrote the December Op-Ed piece, would be following up with a "how-to" article on implementing the changes he suggested. You'll find it elsewhere in this issue. But I'd like to respond to two of your points.

1) You're absolutely correct, in my opinion, that our existing repeaters are inefficiently utilized. And not just in Colorado. Even here in metro New York, your statistics would probably stand up. I haven't made a detailed study, but I do know that, outside of rush hour, you can count on being able to make contacts on only three or four of the dozens of 2-meter repeaters in this area. Go to 440 or 220, and you're lucky if it's one. Your idea of reassigning lightly-used repeaters to shared channels is intriguing.

2) Even if it's beyond the ability of the typical repeater user to change his radio's IF filters (and Rod's article makes it seem pretty straightforward), one of this magazine's goals is to encourage discussion of the issues we face and to present technically-sound ideas for dealing with those issues. If the ideas shared here can serve as stepping-stones toward eventual solutions, then we'll have achieved that goal—even if the specific ideas presented are not what is eventually adopted.

Why FM?

Dear *CQ VHF*:

I generally don't write to magazines about their articles, good or bad. The good articles, I clip and file; the bad ones, I stew about for a while and forget them with the hopes that the authors will continue their educations or even get some. For the most part, I believe that *CQ VHF* has been a long time in coming and appreciate the fact that it has finally arrived.

I did, however, cringe a little over the article by Bill Orr, W6SAI, "Discover the World of 1.2 Gigs" (October, 1996, *CQ VHF*). Now, I have the utmost respect for Bill Orr. He has been my hero for years and there are more Bill Orr publications in my library than any other author worldwide. The point of the article that I gagged over was discovering this wonderful band, in this day and age, in the *FM mode!* I thought we did that back in the days of the modified APX-6. To introduce this band to the younger generation, or anyone else, for that matter, via the "pickle pushing mode," and then talk through a semi-smart box on a hill, they may as well stay on 2 meters or go back to CB.

Here on the Front Range of Colorado, there is a considerable amount of activity on 1.2 GHz, but it's not on FM. Our Thursday night net (8:00 p.m. local) on 1296.1-MHz USB or CW (depending on conditions) always draws a half-dozen or so check-ins from Cheyenne, Wyoming, in the north, to Colorado Springs, Colorado, in the south (approximately 160 miles apart), Evergreen, Colorado, to the west of Denver, and Aurora to the east.

From our vehicle-accessible mountaintops (some over 14,000 feet), CW and SSB contacts of over 400 miles on 1296.1 MHz are routine. The band is prone to atmospheric enhancements, making it a real joy to work, but not with 2 to 5 MHz-wide signals and a receiver with just as wide a bandwidth.

The cost of getting on 1.2-GHz SSB is no more, and maybe a little less, than getting on FM, but the rewards in experience and gratification of being on CW/SSB are so much greater. A 1.2-GHz FM rig is going to cost on the order of $400 to $600 new, but if a ham is already on 2-meter SSB or has a 2-meter SSB transceiver available (such as the IC-706), then a Down East Microwave transverter (built

and tuned) costs $395 and provides 3 watts output. A single 55-element loop Yagi from Down East or Directive Systems is $148 (*you'll need the antenna for either mode—ed.*). Some half-inch hardline up the tower and you have a quarter kilowatt effective radiated power and you're not limited to line of sight or 10 miles or so to the nearest repeater, even if there is one available.

C'mon, people. Let's leave "gud 'ole FM" to the bread trucks and the police departments, bang your head and—for once—try something new and exciting!

73,

Dave Clingerman, W6OAL
Denver, Colorado

Dave—I think the point that Bill was trying to make by sharing his experiences on 1.2-GHz FM was that the excitement of discovering a new band isn't (and shouldn't be) limited to any single mode. And while you'll definitely talk farther on SSB or CW, FM is an equally valid mode for operating 1.2 GHz. And there's certainly no reason to insult people who may be more comfortable with FM or to discourage them from using the band. There's plenty of room for all modes on 1.2 GHz, and we need to encourage activity of all sorts in order to help protect the band from commercial incursion. We'll be happy to consider any well-written article about the joys of operating CW or SSB on this or any band, but we won't tell FM operators that they're not "real hams" or that they need to limit themselves to 2 meters or 70 centimeters.

Ideas from Down Under...

Dear *CQ VHF*:

The December issue's "Beginner's Corner" mentions coastal ducting, and I wanted to share some of our experiences here in Australia. On the odd occasion, stations from Perth, Western Australia, approximately 1,000 kilometers (600 miles) away, access our local 2-meter repeater here in Exmouth, Western Australia. During the afternoons and evenings in our summer months, I regularly work a 2-meter repeater 300 kilometers (180 miles) away on 5 watts. Direct contacts are possible as well, sometimes even on the 1,000-kilometer path.

I'm in the process of setting up a 6-meter station and 2-meter OSCAR station as well. It will be interesting to try all these different modes.

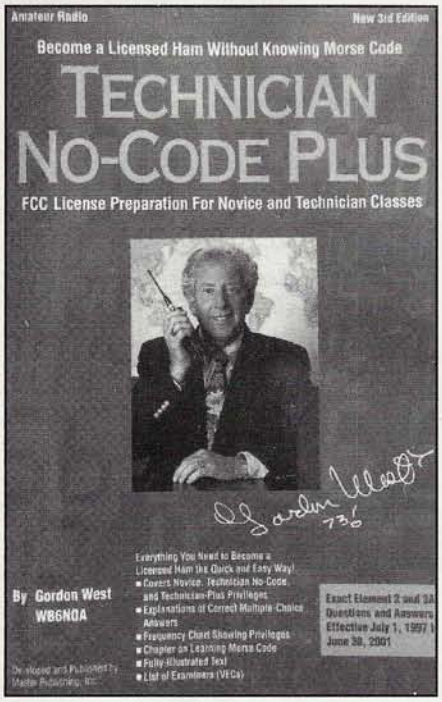
Also, what is the best way for me to get the first six back issues here in Australia, or do I contact you direct for them?

Rick Kowalewski, VK6XLR
Exmouth, Western Australia

Rick—Sounds like summertime ducting gives you lots of great contacts! Thanks for sharing it with us. We're always interested in what hams around the world are doing on VHF, either for our "Letters" page or for our "VHF Worldwide" department. We invite VHF-active hams everywhere to let us know "what's up" in their part of the world. Our writers' guidelines are available via the CQ VHF *World Wide Web page, <http:members.aol.com/cqvhf/>, or our FTP site, <ftp://members.aol.com/cqvhf/general/writguid.txt>. If you don't have Internet access, mail us a request, along with a business-sized self-addressed envelope (with $.55 postage in the U.S.).*

*Also, back issues are available from our office for $3.50 U.S., postage included. Simply mail in an order specifying the issues (*CQ VHF, *76 N. Broadway, Hicksville, NY 11801), along with a check or money order for U.S. funds, or fax your credit card order to (516) 681-2926.*

Product Update



Updated Gordon West License Manual

A new and much larger set of exam questions for the Novice and Technician class licenses goes into effect on July 1, and Gordon West, WB6NOA, has his new *Technician No-Code Plus* license manual ready just in time, along with six new audio cassettes that cover the same material. West is a well-known licensing instructor and is also Senior Contributing Editor of *CQ VHF*.

The Novice/Tech question pool has grown dramatically, from its previous 550 questions to 924, even though there are only five additional questions in each of the two exam elements (2 and 3A). Virtually all of these new questions cover the FCC-mandated exam material on RF safety. West says that the exam questions on RF safety will be "open-book-style," with references to tables included on the exam, and that the FCC mandated many more questions for this material than the usual ratio of 10 pool questions for every exam question.

The updated *Technician No-Code Plus* book lists for $12.95; the audio cassettes are $29.95. They will be available from many amateur dealers, the CQ Bookstore, or may be ordered directly from the W5YI Group at (800) 669-9594.

Circle 100 on reader service card

Drake Returns to Ham Market

R. L. Drake has re-entered the amateur radio market with its TR270, an FM desktop transceiver exclusively for 2-meter operation. The TR270 permits full 2-meter transceiver capability (142 to 150 MHz) and also permits independent dual-band reception (136 to 174 MHz and 420 to 470 MHz). This broad range lets users

listen in on public service, marine, weather, and amateur bands.

In addition to its FM voice capability, the transceiver utilizes internal card slots for the integration of other radio applications (1200-/9600-bps packet radio, satellite, weather fax, and data reception). The optional TNC270 Terminal Node Controller and DEMOD270 Demodulator plug-in cards fit neatly inside the TR270, eliminating both the need to jury rig multiple components together and unnecessary cabling.

The TR270 offers over 60 user-defined parameters, such as selecting filters or antennas, setting memory scan modes, and customizing channel lists for receiver and transmitter. It will also automatically configure operating parameters to fit the selected operating mode; for added convenience, operating parameters and repeater offsets are factory installed.

Other features include 400 channel memories, built-in 140-watt, 115/230 VAC switching power supply, high-quality dynamic mic, external DC input for mobile or emergency power operation, DTMF and CTCSS tone encoding and decoding for both 2-meter and wideband (decode) receivers, external audio-in jack, external speaker jack headphone jack, and transmit time-out timer.

For more information, contact R.L. Drake, 230 Industrial Drive, Franklin, Ohio 45005; Phone: (513) 746-4556; Fax: (513) 743-4510; WWW: <http://www.rldrake.com>.

Circle 101 on reader service card

Update

In April's "Product Update" column, we reported ("Mapping Program Available Online") on an upgrade to NA3T's "AZ_PROJ" azimuthal-equidistant mapping program for hams. Joe, NA3T, informs us that the download site for the program has changed. Copies are free for personal use and may be downloaded from Joe's Web page at: <http://www.arscorp.com:1080/>.

Yes, All My Coax Cables Are 75 Ohms (and everything works OK!)

CO2KK exposes some myths about using 75-ohm feedline with 50-ohm rigs and shows us how to build a "cotangent transformer," a simple matching device to make it all work.

By Arnie Coro, CO2KK*

How many times have you heard that 50-ohm cable is a must? Equipment instruction manuals, advice from the experts, and antenna handbooks all seem to agree that present-day amateur radio technology is all set for 50-ohm impedance devices *only*.

Of course, you probably haven't had the opportunity to actually *measure* your transceiver's real output impedance, with really professional instruments. But if you ever do, be ready for quite surprising numbers coming out of those dials! I'll give you a hint—the reading probably *won't* be 50 ohms.

The 50-Ohm Myth

But let's go back to the myth: "50-ohm cable or nothing!" Now, reading that last line, maybe your mind went to that tail end of low-loss, 75-ohm CATV cable that the technician at the local cable company offered just for the asking not too long ago. Or perhaps you remembered what you paid for the latest run of 50-ohm coax for your new 2-meter antenna, and you hurriedly compared it to what an equivalent run of 75-ohm TV-type cable would have cost. And maybe, you're now thinking how many newcomers to the hobby could get started at substantial savings by using lower cost 75-ohm TV cable for their rigs.

Keep thinking about possible sources of 75-ohm coaxial cable, and I'll happily show you how to use it in many applications, *without the slightest chance of damaging your transmitting equipment.*

No Difference on Receive

Thorough testing of 75-ohm coax used in place of 50-ohm cables for receiving applications shows practically *no detectable difference*, even at frequencies as high as 150 MHz. Try it yourself. Measure a length of 75-ohm cable to replace an equal length of 50-ohm coax, use the same type of connectors, arrange your setup so that you may switch cables easily, and watch your results.

If the 75-ohm cable has the same kind of dielectric and the shield or braid coverage is equivalent to that of the 50-ohm coax it replaces, signals from 100 kHz to 150 MHz will show practically no measurable difference.

I've conducted this experiment time and again to show my friends what actually happens. My test bed is a typical receiving setup for SWLing (shortwave listening), using a broadband Tilted Terminated Folded Dipole (TTFD) antenna covering 6 to 30 MHz. The antenna is located about 100 feet (approximately 30 meters) from the receiver.

Changing the 50-ohm coaxial cable for an equal length of 75-ohm cable, of the same average quality, produces no measurable difference on signals received.

For those really tough-to-convince guys, I use a very low power signal source located about 10 wavelengths away from the antenna. The solid-state, crystal-controlled 10-meter source is installed at my closest ham neighbor's shack (about a city block away) so I can run the tests around 28.5 MHz with the 10-meter band closed and have a very stable signal at the receiving antenna. Again, changing from the 50-ohm RG-213 to a 75-ohm RG-11/U makes no difference on any of the receivers I've tried.

Arnie Coro, CO2KK, is a professor at the University of Havana and broadcasts two weekly radio shows on Radio Havana's shortwave service—"DXers Unlimited," devoted to SWLs and other radio hobbyists; and "Breakthrough," a science and technology program. A licensed ham since age 17, Arnie's main interests are VHF/UHF, HF propagation research and promoting amateur radio among young people.

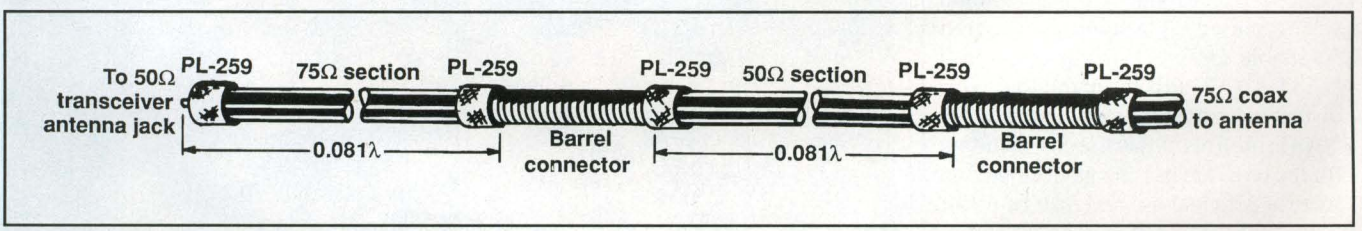


Figure 1. The cotangent transformer. Two .081-wavelength pieces of coax, one 50-ohm and the other 75-ohm, connected as shown, allow you to use lower-cost 75-ohm feedline with no loss in signal strength.

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Checking SWR at 75 Ohms

When using 75 ohm coaxial lines directly, without the *cotangent transformer* impedance conversion system, I measure the SWR at 75 ohms very easily with two different instruments. One is a modified commercially built SWR and power meter, in which I simply replaced the length of 50-ohm line between its two female SO-239 connectors with a similar length of 75-ohm coax.

This particular instrument uses a toroidal transformer as the coupling device to the line, so it was a fairly easy job to just desolder the 50-ohm coax line, then very carefully remove the toroid, and finally, install an identical length of 75-ohm line. I tested the "new" instrument by connecting a 75-ohm terminating resistor to the antenna side and feeding low power to the transmitter side. It showed a 1:1 SWR, indicating good calibration. Then I attached a 150-ohm resistor, and sure enough, it showed a 2:1 SWR. In this case, I didn't have to recalibrate, as the instrument's performance was essentially the same at the new impedance as at the old.

The other 75-ohm SWR meter I use is a homebrew instrument, made with a length of 75-ohm coaxial cable to which two small lengths of enameled copper wire are introduced between the braid or shield and the inner conductor for sampling the forward and reverse currents along the transmission line. Those homebrew meters are easily built and calibrated and provide a low-cost approach to the measurement of coaxial lines of different impedances.

You may use the same technique to make your own SWR meter for the atypical, but still useful, 90-ohm and 150-ohm coax lines that occasionally become available. In practice, the only part of the meter that must be built is the sampling device, as the rest of the equipment may be used with plug in pick up units. (*We'll try to bring you more details of this approach in a future issue. —ed.*)

One final comment for the purists: Yes, it's true, the impedance of the coaxial *connectors* must be taken into consideration when making *very* accurate measurements. But in most amateur applications, the very slight error on the SWR meter introduced by the "bump" caused by connectors is not really significant. After all, what you want to know is that your antenna system is running at the lowest possible SWR!

A similar test set-up was installed for 145.000 MHz, using a very simple J-pole antenna, to which either 50-ohm RG-58/U or 75-ohm RG-59/U was attached. The cable run was about 30 feet (some 10 meters), and again, several receivers were used for the tests. Once again, the results showed practically no difference, using a carefully controlled weak-signal source some 50 wavelengths away from the J-pole. Just in case, I ran additional tests on 145.000 MHz, with a steady carrier delivered from a station some 50 kilometers—about 31 miles—away, under normal 2-meter band conditions (no tropospheric enhancement at all). The results once again were the same—virtually no difference between 50- and 75-ohm cable.

"Changing the 50-ohm coaxial cable for an equal length of 75-ohm cable, of the same average quality, produces no measurable difference on signals received."

In all of these tests, I made no attempt to match the 75-ohm cable to the antennas. I simply changed the transmission lines, taking care that cables with equivalent percentages of shielding were used, and, of course, that both had the same kind of dielectric.

All of the above tests consistently showed that changing from 50-to 75-ohm coax produces practically no measurable signal change at the receivers used. So I decided to go a step further and run some more tests while transmitting.

Transmitting with 75-Ohm Cable?

My 75-ohm transmitting tests produced some very interesting results. Here are my findings:

In the frequency range from 1.8 MHz (the 160-meter band) to 14 MHz (the 20-meter band), I found that replacing the 50-ohm cable on simple halfwave dipoles without any type of matching devices did have some negative effects. The same happened with a quarter-wavelength vertical antenna built especially for these tests and carefully resonated on 14.15 MHz.

The basic negative effect—a mismatch—could be easily corrected by using even the simplest L-match type antenna tuning unit, which is a very good device to install anyway, with *any* transmitting gear. Because cable lengths were not excessive, running the 75-ohm line with even a 3:1 VSWR (Voltage Standing Wave Ratio) didn't mean a lot. Besides, the rig was fed via the antenna tuner, so it was "seeing" a perfect 1:1 SWR all the time, regardless. But I decided to investigate a little more.

The typical halfwave dipole strung up at the average amateur station will usually show a much lower impedance than the 73 ohms in free space predicted by theory. In my tests, this proved quite true. In fact, all of my test dipoles measured resistive components clearly below 50 ohms. But I found I could raise the antenna's impedance from the 35 or 40 ohms at resonance, to 75 ohms, by installing a very simple matching device at the center insulator (see below). By doing this, you can create a complete 75-ohm system and resolve the minor mismatch at the transmitter with an antenna tuner.

But What about VHF?

At CO2KK, no 50-ohm coax is used on the antennas I operate from 160 to 2 meters. It's very difficult to find 50-ohm cable here at any price, so all of my cables are 75-ohm types.

You, too, may use 75-ohm cable to replace 50-ohm coax in all your antenna downleads above 28 MHz. So, get ready to move that big drum of 75-ohm, 1.25-inch cable still waiting for a taker at the cable TV company headend. Here's how to do it:

The secret behind using 75-ohm coax on the 10-meter band and above is to use a *single band* matching device known as the *cotangent transformer*.

The Cotangent Transformer

The cotangent transformer is built using carefully cut lengths of coaxial cables, and what it does in practice is to provide an effective narrow-band impedance transformation that makes your 10-meter or VHF transceiver (either 50 or 144 MHz) "believe" that 50-ohm coax is connected to it.

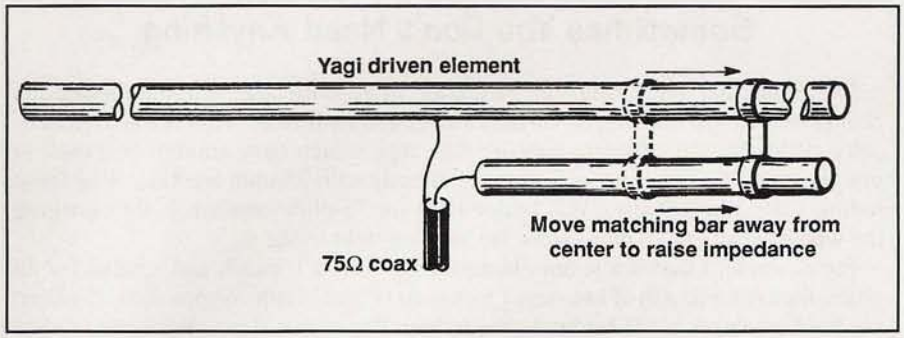


Figure 2: If you're using a Yagi with a gamma match, simply moving the matching bar away from the center of the antenna will raise the impedance for using 75-ohm feedline.

You may also use this single-band matching device at lower frequencies, say on 21 MHz or even 7 MHz. But my approach is to forget about using it on those lower frequencies and simply fix the very slight mismatch with the antenna tuning unit.

Get out Your Tools

If you want to use a cotangent transformer, you must build your own, because no one is offering them for sale yet. If you have some experience soldering coaxial connectors and cables together and you're good with measuring tape, then you may start the mass production of cotangent transformers right away.

I have several of these devices at CO2KK, one each for 10 meters, 6 meters, and 2 meters. Most amateurs use a single coaxial cable to feed each VHF antenna, so the 50-MHz Yagi has its own downlead, while the 2-meter J-pole for local FM work uses a separate cable. This is standard amateur practice, and one that makes it easy to use cotangent transformers to match single-band antennas so that you may use low cost, or special low-loss, 75-ohm coaxial cables.

Designing the Cotangent Transformer

The cotangent transformer consists of two equal electrical lengths of 50- and 75-ohm coaxial cables. The two sections must be exactly 29.3 electrical degrees at the transformer's resonant frequency, which is equivalent to .081 wavelength. (If you're interested in the math involved, the actual theory behind this matching device is based on the formula: $\cot^2 F = Z1/Z2 + Z2/Z1 + 1.$)

As with all coaxial cables, you must remember to take into account the *velocity factor*, which in our case is usually either 0.66 for polyethylene dielectric, or either 0.80 or 0.82 for foam dielectric. In determining the actual length of the cable sections forming the 50-/75-ohm transformer, you must also take into consideration the type of connectors used.

All the tests I've conducted at CO2KK were at a maximum power output of 100 watts PEP on 28.5 MHz, 50.125 MHz, and 144.2 MHz, and showed near perfect 1.1 to 1 VSWR at the transformer's center design frequency.

A practical cotangent transformer cut for the 50-MHz calling frequency (50.125 MHz) will provide a very good match from 50.0 to 50.5 MHz, which in my case is all I really needed for my 6-meter activity. The same holds true for the cotangent transformer cut for the 144.200-MHz weak-signal CW and SSB calling frequency. I have not done any tests at 222 or 432 MHz with these devices, so the results offered here are limited to the 10, 6-, and 2-meter bands.

Starting with 6 Meters

Let's say you want a cotangent transformer that will allow you to run 75-ohm cable from your five-element Yagi to your 50-MHz transceiver's 50-ohm output. You select an operating frequency of 50.125 MHz, and that'll give you enough coverage for the entire SSB/CW range, from 50.000 to 50.500 MHz.

Start by calculating the wavelength at 50.125. No, don't reach for your calculator, I'll do it for you, right now. The wavelength is 300/50.125 = 5.985 meters. You need .081 wavelengths to make each section of the cotangent transformer, so 5.985 x .081 = .484 meters, or 48.4 centimeters. *BUT!*—that's the length of each section in *free space*, and your 50- and 75-ohm lines are made of coaxial cables

Sometimes You Don't Need Anything

I've found that many radios allow the use of 75-ohm cable without the need to change to 50-ohm impedance via the cotangent transformer. This is true of practically all of the now-obsolete vacuum tube rigs, which have enough of a built-in margin in the PI or PI-L networks to deal directly with 75-ohm feedline. With these radios, I use a homebrew SWR bridge built for 75-ohm impedance, thus keeping the whole system at 75 ohms from the antenna right to the rig.

For example, I match a seven-element Yagi with a T-match and a balun for 75 ohms, then run a length of low-loss 75-ohm coax (that's able to cope with 75 ohms) via the homebrew SWR bridge to the transmitter output stage. Solid state radios may also be designed or modified with networks to handle 75 ohms.

The type of bridge I use here is built with a small length of 75-ohm coax as a line section to which two small wires are coupled for the forward and reverse coupling.

that have a specific velocity factor. The electromagnetic wave travels inside the cable at much lower speed than in free space. So you reach for the calculator once again, and after deciding to use for the first test a standard polyethylene dielectric cable with a velocity factor of 0.66, you get: 48.4 x 0.66 = 31.9 centimeters. So your cotangent transformer centered at 50.125 is going to be made of two sections of cable, each 31.9 centimeters long.

Now—you must really pay attention to this one—the two cables must be very carefully prepared so that, when the connectors are fitted, each section will be *exactly* 31.9 centimeters in length.

Building Your Transformer

The most practical way of building reliable cotangent transformers is by using either PL-259 or standard BNC-type male connectors. I prefer to use the PL259s for power outputs above 10 watts, leaving the BNC connectors for low power work.

You'll need four male connectors and two double-barreled coaxial female connectors to build each cotangent transformer. After carefully soldering the male connectors to both the 75- and 50-ohm coax sections, you simply join them together with one connector. Now your cotangent transformer is ready for action, but you must also hook it up correctly.

When connecting the transformer between your new low-loss 75-ohm cable and the 50-ohm transceiver, the section with the *50-ohm* cable length is connected to the *75-ohm* antenna downlead via the second barrel connector, while the 75-ohm end of the transformer is connected to the transceiver's 50-ohm female connector. That's all there is to it!

If you want to run some tests with your 50-ohm SWR meter, place the SWR bridge between the transceiver and the cotangent transformer's 75-ohm cable section, and measure VSWR at 50.05, 50.1, 50.125, 50.15, and 50.2 MHz. Write down your results. If the 75-ohm cable connected to your antenna system was matched properly, you should get nice, low VSWR readings at the 50-ohm end of the cotangent transformer.

Tuning the Antenna for 75 Ohms

Next question: how did I match the 6-meter antenna to the 75-ohm coax? Well, very easily, by using a homebrew 75-ohm SWR bridge (see "Checking SWR at 75 Ohms") and just moving the Yagi's gamma-match bar a little farther away from the center of the dipole driven element (see "Sometimes You Don't Need Anything").

After obtaining a 1.15:1 SWR at 50.125, which I considered good enough, installing the cotangent transformer at the other end of the cable brought the VSWR at the 50-ohm antenna terminal to the very nice figure of 1.2 : 1.

Now, Get Busy!

You may calculate your own cotangent transformers for any band from 1.8 MHz to 144 MHz, but I'm sure that the device is much more easily used on bands from 14 MHz up, where the size of the two cable sections is rather practical.

No, it's not a broadband matching device, but who needs broadband matching while chasing DX on the weak signal portions of 50 and 144 MHz? So start cutting and soldering, and put that 75-ohm coax to good use! ■

75-Ohm Cable: Additional Options

There's more than one way to make 75-ohm cable work in a 50-ohm system. Here are some more possibilities.

While we were working on CO2KK's article about using 75-ohm coax in 50-ohm systems, there was a discussion on the Internet VHF reflector that started with this message asking about connectors: "I just acquired, at the world's lowest price, all the CATV aluminum jacket hardline two people could pick up and put in my truck. Any idea about connectors?"

Most of the replies had nothing to do with connectors, but about matching networks and the reasons that hams use 50-ohm cable and CATV systems use 75-ohm. Here are some highlights."

A Bit of History

Jerry Johnson, KØCQ, had quite a bit of information to offer. According to Jerry, 50-ohm cable first came into common use because it was easy to make hardline from 1-1/2-inch (shield) and 1/2-inch (center conductor) copper water pipe. The impedance of those lines was approximately 50 ohms and it became a standard. Jerry says the cable industry's use of 75-ohm line is based on a 1948 article in an electronics magazine (he didn't say which one), which—based on computations for copper lines with air dielectric—showed that 75-ohm feedline had less loss than an equivalent length of 50-ohm line. Jerry notes that additional losses from other dielectrics probably cancel out that advantage.

Matching Devices (Commercial, Too)

KØCQ says the easiest way he knows to match 75-ohm coax to a 50-ohm system is by using three variable capacitors spaced 1/8-wavelength apart, as follows:

In a box, mount three variable capacitors, reactance say 25 ohms at maximum capacitance. Ground the rotors. Between the capacitors, put a 1/8-wavelength piece of good coax. Connect (one) outer capacitor to the transmission line to be matched and (the other) to the radio (with bridge for tuning). Adjust for your desired radio load impedance.

Two other hams note that impedance transformers are available commercially. Greg Stahlman, KJ6KO, says the Olde Antenna Lab of Denver offers "Z-verters" for 2 meters and up (see address below). Owner W6OAL describes them as 1/4-wave sections that transform 75 ohms to 50; but he also notes that, in most cases, the 75- to 50-ohm mismatch results in only a 1.5:1 SWR on an otherwise sound system. The other ham (full name and call not given) wrote that a company called ZD Engineering will make custom 1/4-wave matching transformers cut to any band you want, and they include the N connectors that the original writer was looking for. He didn't have ZD's address, and, unfortunately, neither do we. Perhaps one of our readers has it and can pass it along to us.

Homebrew Connectors

Finally, Rod Johnson, KA7YOU, offered a "recipe" for homebrewed connectors for 1/2-inch hardline, using brass tubing fittings. Rod said he found this idea "many years ago" in a magazine and has now forgotten which one it was and who wrote the article. But he remembered these details:

I use the type of tubing couplings which are called compression fittings. They have a nut and a ferrule on each end and a short center piece with the nuts screw onto. There is a short area in the middle, with a reduced diameter, which acts like a stop for the ends of the tubing when it is assembled. This needs to be drilled out with a 1/2-inch drill.

I install one end cap and a ferrule on the back side of a PL-259 (it just fits over the back end) and solder the ferrule on. The hardline is prepared to fit into the PL-259 by cutting back just enough of the aluminum jacket to allow the center conductor to come out through the center contact far enough to solder it. Leave as much of the foam insulation as possible to maintain the impedance characteristics.

The second nut, ferrule, and the center portion of the brass coupling are slid over the hardline in that order. Then the hardline is pushed into the prepared PL-259 assembly, and the nuts are tightened down on the hardline. I prefer to use some form of anti-oxidation paste on the aluminum jacket prior to installation.

(If anyone remembers the original source of this idea, please let us know so we can give proper credit. Thanks.)

For More Information...

If you want to get the full technical lowdown on impedances and transmission lines, W6OAL recommends Walt Maxwell's classic book, *Reflections*, available from the ARRL (225 Main St., Newington, CT 06111; Phone: (860) 594-0200). Jerry Sevick's book *Baluns and Ununs* will also be helpful (CQ Communications, 76 N. Broadway, Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926). And you can contact Dave, W6OAL, at the Olde Antenna Lab of Denver, 6224 S. Prince St., Littleton, CO 80120, to find out about his "Z-verters." Dave tells us he is planning to move to larger quarters later this year, so keep an eye on his ads here in *CQ VHF* for any address changes.

Finally, you can join the VHF reflector on the Internet (it's really a weak-signal reflector, with a fair amount of useful information squeezed in among the gripes and flames that you find on most any unmoderated reflector) by sending an e-mail message to <vhf-request@w6yx.stanford.edu>. Just write "subscribe" and your callsign in the first line of the text and you're in. You should get an acknowledgment message almost immediately. And be prepared to receive a lot of e-mail.

—W2VU

Battery Test: NiMH and NiCd Packs Go Head to Head

NiMH, or nickel metal hydride, batteries are becoming popular for laptop computers and cellular phones. But are they safe for your handheld?

By Gordon West, WB6NOA

Amateur radio handheld manufacturers have traditionally offered the hardworking nickel cadmium (NiCd) battery pack as part of their HT packages. The nickel cadmium battery system offers the advantage of rechargeability after depletion of up to 500 times, or about three years of life. If you regularly "exercise" your NiCd pack, and you don't overcharge it, you might be able to enjoy up to five years of useful life, as I do.

Another option that's growing in popularity is the handheld that comes with an empty battery tray, allowing you to put in AA-sized alkaline cells. The single-use alkaline cells have some distinct advantages over NiCds:

- Almost twice the power density
- Almost no self-depletion
- Readily available at drug stores, etc. in an emergency
- Almost everything runs on them, so you can usually locate spares

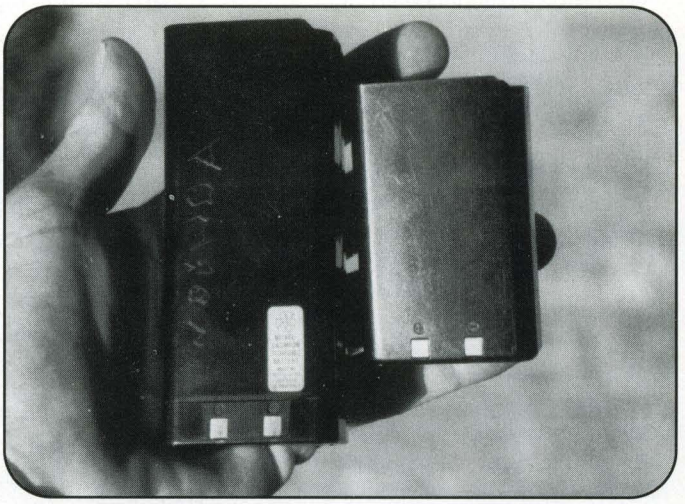
For emergency communicators, the best thing about alkaline cells is that they can sit on a shelf for several years and be ready to deliver a full charge with almost no self-depletion. Put a set of freshly charged NiCd batteries on the shelf and they'll lose 10 percent of their capacity every week. And if you leave NiCds continuously on a charger, you risk overcharging them, causing the inside chemistry to irreversibly cook dry.

On the down side for the alkalines, however, these batteries don't recharge. While there are variations on the alkaline cell that might allow you to "reuse" them up to 10 times, everyday alkaline batteries must be properly disposed of after the cells are depleted.

NiMH: A New Option

Nickel metal hydride (NiMH) battery packs are becoming a common replacement for NiCd battery packs in portable cellular phones. Since a portable cellphone and ham radio handhelds exhibit similar characteristics in battery consumption, is there a compelling reason for hams to also switch from NiCd to NiMH?

The big advantage to NiMHs is that they offer much greater energy in a package about the same size as AA alkaline and NiCd cells. Depending on how you operate your handheld (high or low power settings), an NiMH battery pack could last anywhere from 25 to 40 percent longer than a comparably sized NiCd battery pack (see Figure 1).



More power for more hours. The large NiCd battery pack on the left and the smaller NiMH pack on the right each provided the same amount of power for the same amount of time—16.5 hours!

There are additional advantages of NiMH battery packs over your hardworking NiCd pack:

- Less environmentally toxic
- No memory effect
- Same voltage per cell (1.2 volts)
- Faster charge time
- Greater tolerance to heat build-up

But the NiMH cell has a few problems of its own when compared to traditional NiCd cells:

- Higher initial cost
- "Smart charger" recommended for this type of cell

"Put a set of freshly charged NiCd batteries on the shelf and they'll lose 10 percent of their capacity every week"

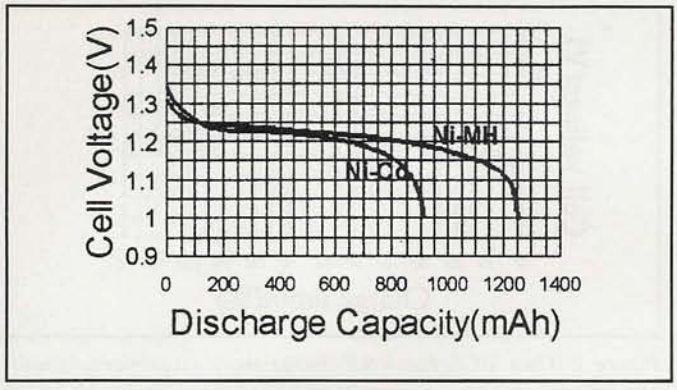


Figure 1. NiMH battery packs produce the same voltage as equivalent NiCd packs but maintain that voltage longer, meaning more operating time between charges. (All graphs courtesy NEXcell Battery Co., Ltd.)

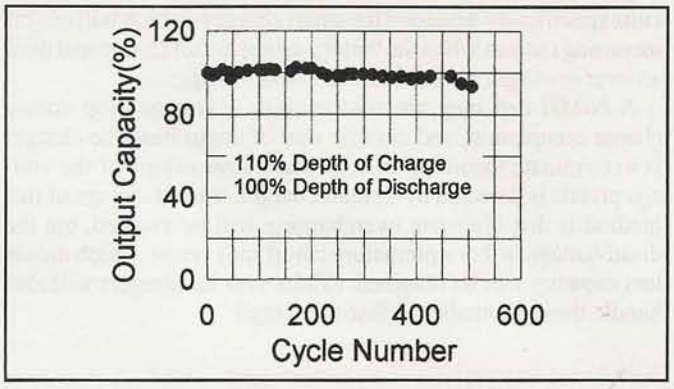


Figure 2. Battery manufacturers such as NEXcell say that NiMH battery packs—like NiCd packs—should last through at least 500 discharge/recharge cycles before needing to be replaced.

- Possible burnout by a "dumb" charger
- Debate about cell "shelf" discharge rate
- Almost equal three- to five-year overall life span (see Figure 2)

A quick word about the second and third bullets: "Smart chargers" are fast chargers with circuitry designed to detect temperature changes in a battery pack and shut down the charger before the cells start to overheat. Most "dumb" NiCd fast-chargers either have no automatic shutoff features or shut off when a certain voltage is reached. NiCds have a significant voltage "elbow" when they reach full charge, but the voltage rise in NiMH cells is much less pronounced and may be missed by a "dumb charger" (see Figure 3). This is why the "smart chargers" monitor temperature changes.

Longer Playing Power

During my recent comparisons of NiCd and NiMH battery packs, there was an obvious increase in how long I could run my HT on the NiMH cells before the batteries died. During a regular day out in the field, I can get about six hours out of my normal battery pack and almost eight hours use from the NiMH pack. Same size, but a substantial increase in how long I could receive, play loud audio, and transmit on medium power. This, I like.

But I had been warned that my NiMH battery pack would self-discharge faster than a NiCd pack if I didn't regularly exercise it on my new smart charger.

"This may have been true on earlier NiMH technology, but the new nickel metal hydride technology allows our cells to hold their charge like comparable NiCds," comments Charles Chueh, President of Maha, an NiMH manufacturer. "I have seen 50 percent to 100 percent increase in amateur handheld playing time over NiCd battery packs with our new nickel metal hydride packs, too. And it looks like our new nickel metal hydride battery packs will last even longer than NiCd packs if operators are careful on how they charge them."

Since NiMH is relatively new to the amateur field, however, there have not been enough years going by to see whether or not they will actually outlive a new NiCd pack.

Not on OUR Charger

Several months back, Yaesu sent out a memo to dealers and users saying that any attempt to use NiMH batteries with one of their fast base chargers could result in fire, flames, explosions, and just about anything else bad that you can think of. But Charles at Maha indicates that Maha's packs will work with most existing amateur slow chargers and wall adapters, and they won't have a problem charging up if you give them a day or two. The key here is avoiding the use of "dumb" fast chargers, commonly sold for NiCd packs. And everyone agrees that trying to "supercharge" these new battery packs might lead to some real overheating problems.

"Maha nickel metal hydride battery packs will work with rapid chargers, with proper termination," says Chueh. "If the rapid base charger has temperature cut-off termination, or peak voltage cutoff, there shouldn't be a problem."

But what happens if you put a nickel metal hydride pack into a "dumb" fast charger that doesn't have these advanced-feature, high-voltage/high-temperature sensing circuits?

"I can't tell you about other nickel metal hydride packs, but Maha battery packs are equipped with a built-in temperature cut-off termination in case of rapid charger overcharge," Chueh notes. He says the built-in thermistor shuts off at a temperature of 55 degrees C. But after a couple of hours, the thermistor again completes the circuit, and the fast charging starts all over again. Chueh recommends that, unless your fast charger has a temperature-sensing circuit *inside the charger*, you should charge NiMH packs only with a slow charger or wall adapter. In other words, without temperature cutoff circuitry, constant high charging of any NiMH battery pack—or, for that matter, even a NiCd pack—will dramatically cook those little cells into oblivion.

I recommend that you choose NiMH batteries *only* if you can spend the extra $100 or so and also choose the appropriate smart charger for a fast, safe charge, as well as a continuous maintenance charge without overcooking.

The Experts Agree

At the recent Consumer Electronics Show where NiMH packs were popping up everywhere as replacements for traditional NiCd batteries for cellular phones, almost every manufacturer (actually, importers of these cells and packs) strongly urged the use of their specific brand of rapid charger and charger battery maintainer circuitry.

"One popular charging method is a technique where the voltage during a quick charge is monitored, and the charge is ended as a voltage drop is detected," commented a representative from NEXcell Battery Company of Monrovia, California. This technique requires the use of new, readily available integrated cir-

cuits specifically designed for smart chargers which will cut off incoming current when the battery achieves full charge and does an ever-so-slight nosedive in terminal voltage.

A NiMH cell may not always show a voltage drop during charge completion, and another way of controlling the charger is to terminate incoming current when a zero slope of the voltage profile is detected by a smart charger. The advantage of this method is that high-rate overcharging will be avoided, but the disadvantage is that a premature cutoff may occur, which means less capacity will be obtained. (Maha says its chargers will also handle these anomalies in fast-charging.)

NiMH Charging Techniques

Believe it or not, the charge efficiency highly depends on the temperature *in the room* where you are charging your NiMH cells. At low room temperatures, the batteries are cooler and the charge is more efficient. As the oxygen recombination process is slowed down at low temperature, a certain rise in internal cell pressure may occur depending on charge rate.

The most common and convenient method of charging NiMH cells is something called *limited constant current charging*. The current is limited to eliminate excessive temperature rise and pressure build up. But, again, this requires a smart charger. However, you can safely recharge NiMH cells with existing dumb chargers—*if* you closely follow these simple precautions:

- Use a "Wall Wart" slow charger: A timer should be set to terminate the charge after 12 hours to avoid extended overcharge. These are the ubiquitous little charger cubes that plug into the wall to charge or power nearly everything electronic.
- Use a quick charger: The timer should be set to terminate charge after four hours, or—if the charger is thermostatically-equipped—if the temperature goes beyond limits.
- Use a fast charger: This requires both temperature monitoring as well as a timer back up to prevent overcharge.
- Use a trickle charge: Ideal from existing "Wall Wart" chargers, but useful only if you allow enough time for the battery to completely recharge and provide periods of "exercise" (using the equipment) to help equalize all cells within the battery pack.

Don't Mix Your Cells!

If you're thinking of trying one or two NiMH cells in your NiCd pack, *DON'T*! Cells of different type or capacity won't work in a single battery pack. For example, an NiMH cell mixed with a NiCd cell might cause one battery to self-discharge into the other battery. Or one might charge up faster than the other, causing the charger circuit to shut down prematurely or causing the circuit to accept an overcharge. Don't experiment!

Too Much Industry Caution?

Some amateur radio after-market battery suppliers indicate that NiMH technology is still too new for them to make a major switch from the hardworking NiCds over to NiMH. They also worry that they could be the target of returned dead battery packs if the NiMH cells get overcooked in a manufacturer's fast charger and that the NiMH packs won't receive a full charge from some of the wimpy "Wall Warts" supplied by some manufacturers that barely produce 60 milliamps of charging current.

"Thank you, but we will wait to see," comments one prominent battery manufacturer. "We will let our competition burn up a few handhelds long before we ever trust this new type of battery chemistry in existing handheld rapid chargers."

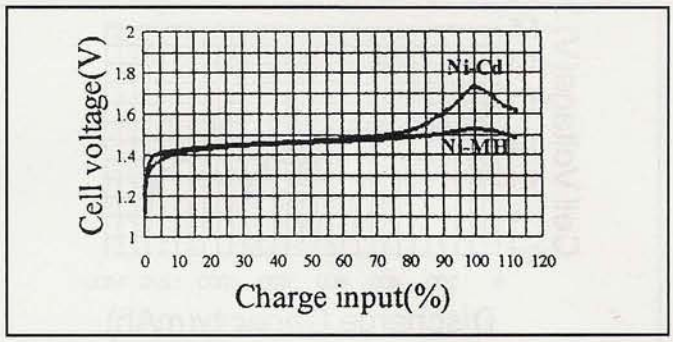


Figure 3. When NiCds reach full charge, there's a pronounced voltage "elbow" that cues many existing fast-chargers to stop charging. The voltage rise for NiMH cells is much smaller and may be missed by chargers designed for NiCds.

On the other hand, the consumer electronics industry is jumping into this new technology with abandon because it means longer operating time for portable electronics and less memory effect from under-charged or over-charged NiCds. But those who supply the new generation NiMH cells in the consumer electronics industry also supply the new smart chargers that are all but mandatory for a safe, fast charge. As one other expert explains, "How the new nickel metal hydride gets charged is the critically important issue."

Most consumer electronics battery experts were also surprised that few amateur radio manufacturers were offering smart chargers and NiMH battery systems. "As ham operators wanting to squeeze the very last drop out of any battery in an emergency, we would think you would be well ahead of us in this new technology," commented one consumer electronics battery engineer, adding, "The new integrated charging circuits are now on one simple chip, and you best get in step with the times."

Check it Out

One thing is for sure: if you're still using one of those wall adapters to charge your handheld, you might want to look into a new breed of charger that can bring your pack up to a full charge quickly and safely. And, regardless of whether you're using NiCds or the new NiMH cells, regularly exercise your batteries by running them for a day until they begin to brownout and then cycling them up and down again for best capabilities and longest life.

If you just let your handheld sit on a trickle charger, regardless of the type of battery you use, the battery won't last as long as one that has been properly maintained. ■

Resources

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

Maha Communications, Inc., 2841-B Saturn St., Brea, CA 92621; Phone: (800) 376-9992 or (714) 985-9132; Fax: (714) 985-9221; Internet: <http://www.maha-comm.com> or (e-mail) <sales@maha-comm.com>.

NEXcell Battery Co., Ltd. (U.S. Office), 1251 S. Shamrock Ave., Monrovia, CA 91016; Phone: (818) 358-0121; Fax: (818) 358-5322; Internet: <http://www.battery.com.tw/>.

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CIRCLE 99 ON READER SERVICE CARD

Very Converting to ^ Narrow Band

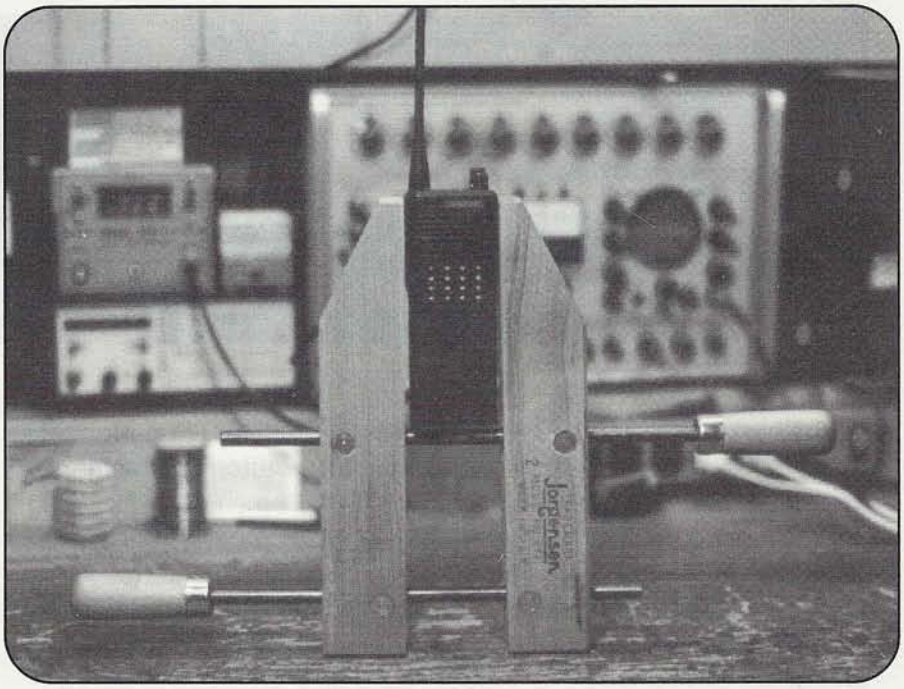
Commercial FM users are squeezing more channels into available UHF spectrum by reducing their bandwidth to 12.5 and even 6.25 kHz. Here's how we can do the same on our 440-MHz band.

By Rod Wheeler, WA6ITC*

Editor's Note: When we printed WA6ITC's "Op-Ed" promoting narrower FM bandwidths in the December, 1996, issue of CQ VHF, *we also challenged him to show us how to do it. He met the challenge. Here's how.*

With more and more amateurs joining our ranks, and it's well over half a million now, we're going to have to use our precious spectrum of frequencies more efficiently.

In reading through the 1984 *Radio Amateur's Handbook* (now *The ARRL Handbook*), I found "The Amateur's Code," right in the front, next to a picture of Hiram Percy Maxim. Point #3 of the code says "The amateur is progressive....He keeps his station abreast of science. It is well-built and efficient. His operating practices are above reproach." On the same page, under Technical Developments, it says that the "ever-growing Amateur Radio continually overcrowds its frequency assignments, spurring amateurs to the development and adoption of new techniques to permit the accommodation of more stations." This need for additional channels on which we can operate will lead to ever narrower channel spacing and bandwidths to more efficiently use our limited radio spectrum.



How do you squeeze more channels into our crowded repeater subbands? You could try this approach, but a narrower IF filter could be much more effective—and less expensive! (Photos by Joel Gelfand, KD6BRI)

We've done a lot to improve this situation on the HF bands, where the use of single sideband transmission has given us a three-fold increase in usable "channels" over the days of AM. For some reason, we haven't done the same in the VHF and UHF spectrum. On 440 MHz, for example, we stopped at 25-kHz channel spacing while the commercial operators went to 12.5-kHz and are now heading for 6.25-kHz spacing.

Maybe it's time to start converting our old 440-MHz FM radios to take advantage of 12.5-kHz channel spacing. The radios will still work fine on the current repeaters but will have sharper IF selectivity. It's like working on the HF bands, but when the bands gets busy, you'd simply switch to narrower filters to help block out adjacent stations.

It's Not Really Difficult

A simple switch of the IF filter in your radio and the implementation of CTCSS encode and decode will open up a lot of new channels for all of us. Old amateur equipment from the '70s and '80s was

**Rod Wheeler, WA6ITC, has been a ham since 1959 and has been involved with repeaters since 1964, including two 12.5-kHz bandwidth machines in the Los Angeles area. Professionally, Rod is the Radio Shop Foreman at Disneyland.*

Converting Surplus GE Repeaters to 12.5 kHz

Many amateurs use the General Electric MASTR II, Executive II, and MVP series radios as the building blocks of their repeaters. The 150- and 450-MHz versions of this radio use an 11.2-MHz IF system. Narrow filters at this frequency are difficult to find. But Communication Specialists (see "Resources") has an abundance of 10.7-MHz filters with a bandwidth of 3.75 kHz, so I thought it might be possible to modify the GE radio to a 10.7-MHz IF system.

I replaced the 11.2-MHz filters with the 10.7-MHz narrow filters, realigned the IFs, and it worked! The receiver now had a true 12.5-kHz bandwidth and worked just fine—and all with a few dollars worth of filters. There will be one additional expense: a new receive crystal. Since the IF was changed, I'll have to order crystals .5 MHz higher than I want to listen to in order to end up on the right frequency. Changing the 10.7- or 21.4-MHz IF filters ahead of the 455-kHz filters will improve the overall receiver operation and avoid relying on one filter for all bandpass requirements.

designed for 25 kHz channels because the commercial equipment back then also used 25 kHz separation. Today's amateur FM equipment is a lot better, but it can still be narrowed with little effort and cost. Turning down the transmitter's deviation is even easier, and, if everyone used ± 2.5 kHz, it would allow for a little extra adjacent channel spacing.

I found CTCSS encode and decode capability to be the single greatest help in rejecting adjacent channel interference, with different tones reducing adjacent channel interference by as much as 40 dB. So, by using narrow filters *and* CTCSS encode/decode, we could double, and someday quadruple, our channels on the 440-MHz band. Applying the same concepts to the 2-meter and 222-MHz bands could help solve overcrowding there, too.

Don't Panic!

Now don't panic over the thought changing our current 25-kHz channel spacing to 12.5 kHz on the 440 band. The commercial users did it in the early '80s and found it worked very well. Even changing to 10-kHz spacing on 2 meters and 222 MHz isn't that big of a deal; it's like changing from AM to SSB was on HF. In fact, you don't even need a schematic to modify most FM radios. And, if you do the work yourself, the cost should be about $10. Now that shouldn't wipe out anyone's bank account.

A Bit of Theory, or... Why Bother?

What's the point in changing to a narrower bandwidth if none of the repeaters in your area are doing the same? First, you'll have a tighter receiver that's less prone to interference. Second, you'll be able to use spectrum more efficiently. But how does all this work?

Let's take a look at where selectivity in a receiver is achieved. There are three basic areas of selectivity in the receiver. First is the *front end,* where the input frequency is selected. However, the filter here is usually a bandpass type of filter and the selectivity is designed for a whole band, not a particular frequency. Second is the *Hi IF* Here we find the 10.7 MHz or similar frequency amplifiers and filters. These add greatly to the receiver's selectivity, but only bring it down to the ± 30 kHz range. In some radios (notably the GE MVP and Executive II radios used for many repeaters), you can add filters

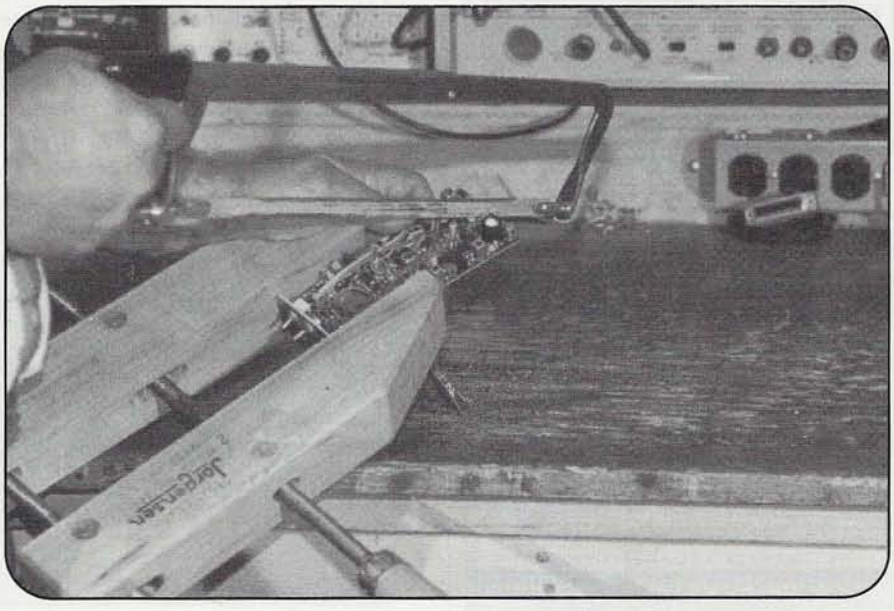
"I found CTCSS encode and decode capability to be the single greatest help in rejecting adjacent channel interference...."

in this area to improve selectivity. Finally, there's the *Low IF,* generally 455 kHz, which is where most radios get their real selectivity, mainly because it's easier and less expensive to do it at 455 kHz than at higher frequencies (see Figure 1).

The Low IF filter is located near the receiver's discriminator or audio detector (sometimes, there's more than one filter, as shown in Figure 1). The vast majority of radios use filters made by muRata. These look like small black cubes with either "455" or "55" written on the top followed by a letter; that letter tells you how selective your radio is (see Figure 2). The filters are very inexpensive and readily available (see "Resources").

Open Up That Case

To sharpen the selectivity of your radio, you'll need to find out which filter you have and which one you need. Take your radio apart and find the receiver board and locate the 455-kHz IF filters (see photo).[1] (Remember the letter after the "455" or "55" tells you the bandwidth



No, this won't narrow your bandwidth, although it WILL significantly reduce your deviation level! Again, a narrower IF filter might be a better option.

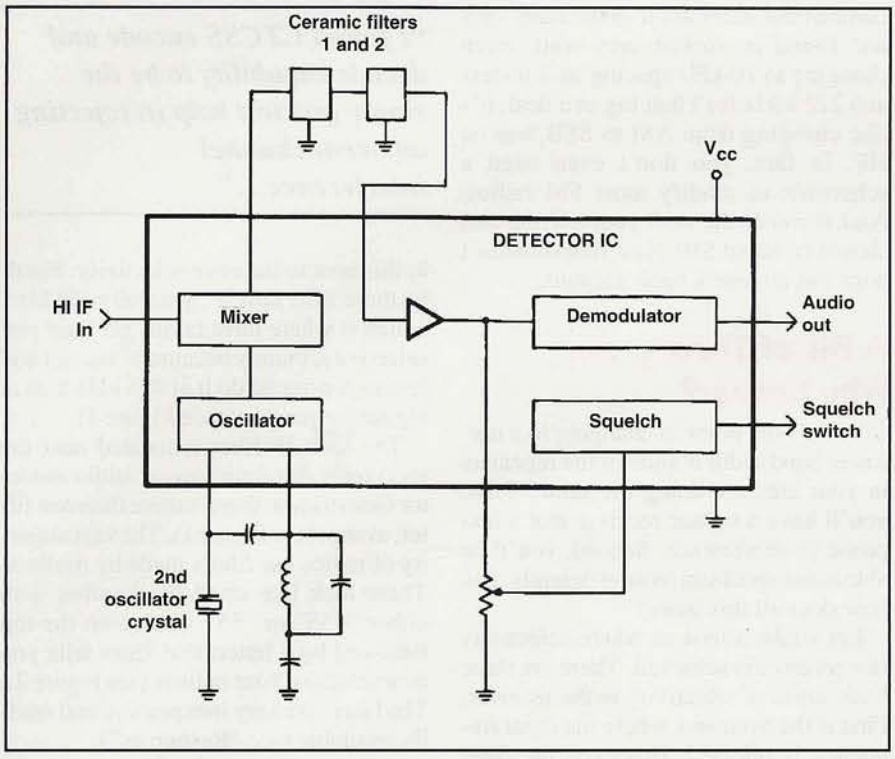


Figure 1. A basic IF detector circuit. Note that some use only one filter; others use more than one, as illustrated above.

"You don't even need a schematic to modify most FM radios. And if you do the work yourself, the cost should be about $10.00."

bandwidth. These filters are too wide for the demands of 12.5-kHz channel spacing and should be changed.

To determine the necessary bandwidth for a given transmitted signal you can use the following formula (assuming a maximum modulation frequency of 3 kHz):

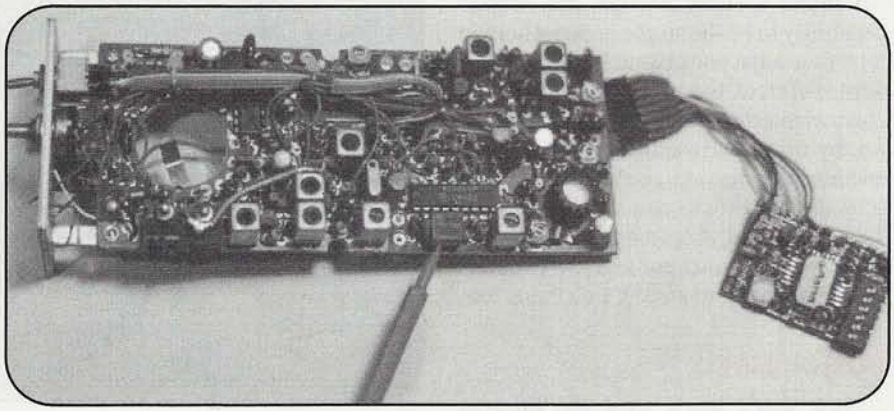
2 (deviation in kHz) x 2.4 = bandwidth in kHz[3]

For instance, with ±5-kHz deviation, you have (2 x 5) x 2.4 = 24-kHz bandwidth. So even though you only deviate ± 5 kHz, your signal takes up more actual spectrum. Your receiver only needs to hear the major portion of the transmitted signal in order to give you readable copy, which is why ±10-kHz IF filters work for ±5-kHz deviation. Now, if you reduce your deviation to ± 2.5 kHz, it changes things to (2 x 2.5) x 2.4 = 12 kHz.

Again, because the receiver doesn't need to "copy" all of the transmitted signal, you can use a ±3.75-kHz IF filter with a 7.5-kHz bandwidth to copy a signal with 2.5 kHz deviation and a 12-kHz bandwidth. Now, if you take two of those 12-kHz-wide signals and put them next to each other, you've got two discrete channels in a space now occupied by one—*doubling* the current number of channels (the roll-off of the filters provides the necessary separation between the channels).

of the filter.) The most commonly used filters are designated A, B, C, D, E, F, and G.[2] Some radios have one filter and some two. There is also a double filter that's about twice as wide. They all do the same thing, though, so you just need to use the chart in Table 1 to determine which filter you have and what you need to get.

I personally use the "G" filters or ±4.5 kHz bandwidth at -6dB. This gives me the best adjacent channel rejection and still maintains the necessary bandwidth for all current repeaters. For instance, most radios have a "D" filter, or ±10-kHz



No joking. This is what the 455-kHz IF filter in a radio typically looks like. You'll need to replace it in order to narrow your bandwidth.

Table. The Basic Filter Bandwidths (at -6 dB)

A= ±17.5 kHz	F= ±6.0 kHz
B= ±15.0 kHz	G= ±4.5 kHz
C= ±12.5 kHz	H= ±3.75 kHz
D= ±10.0 kHz	I= ±2.0 kHz
E= ±7.5 kHz	

I've found that, in practice, a tighter filter than calculated can be used without noticeable deterioration of signal quality. This is probably because most conversations are not at full deviation, and the filters don't have straight slopes on there bandpass. In addition, as noted earlier, using CTCSS encode and decode all the time further eliminates adjacent, and even some co-channel, interference.

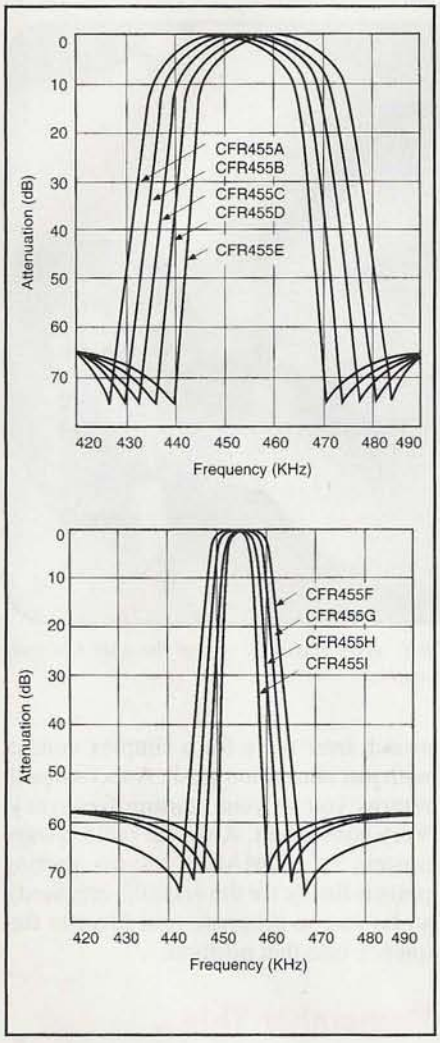


Figure 2. Typical response curves for muRata 455-kHz IF filters. Note the difference between the bandwidth of the filters in Figure 2a (bandwidths A–E; most 70-centimeter ham rigs use "D" filters) and those in Figure 2b (bandwidths F-I; the author recommends going to ±3.75 kHz "H" filters for reduced bandwidth. (Courtesy muRata)

Can You Squeeze It Tighter?

Now, if you want to experiment with *really* narrow operation, you can use the "I" filter at ± 2.0 kHz. Using this filter, you could start approaching the 6.25-kHz channel spacing the commercial operators are trying to attain. If you run 6.25 kHz through the formula, the deviation gets really narrow—1.25 kHz. I believe it's possible to use ± 2kHz at 6.25-kHz channel spacing and still have the radio work fine. One side note: when you reduce the deviation, the recovered audio will be reduced as well. So you'll need to turn up the volume on your receiver.

Done and Done

So that's all there is to it: find the 455-kHz filter and change it. Be careful, and if you're not confident doing the work, find a technician who can do it for you.

We need to continue experimenting to see what else we can work out and improve upon. If we all changed to the narrower filters, we could greatly increase the number of usable FM channels in our VHF and UHF bands—and we could all use that. Don't wait, let's all get on the narrow bandwagon now! ■

Notes

1. If your radio doesn't have a 455-kHz IF (as is the case in some commercial equipment), contact the manufacturer for possible factory modifications for 12.5-kHz operation.

2. Filter data courtesy of muRata.

3. FM and repeaters for the Radio Amateur, *ARRL, 1972.*

Resources

Narrow-bandwidth 455-kHz IF filters are available from:

muRata, 2200 Lake Park Dr., Smyrna, GA 30080: Phone: (770) 436-1300

Communication Specialists has a large inventory of IF filters for certain other frequencies, such as 3.75 kHz, 10.7 MHz, 21.4 MHz, and 21.8 MHz). If you can't find these parts locally, call them directly at (800) 854-0547.

Azden PCS-7500H 6-Meter FM Transceiver

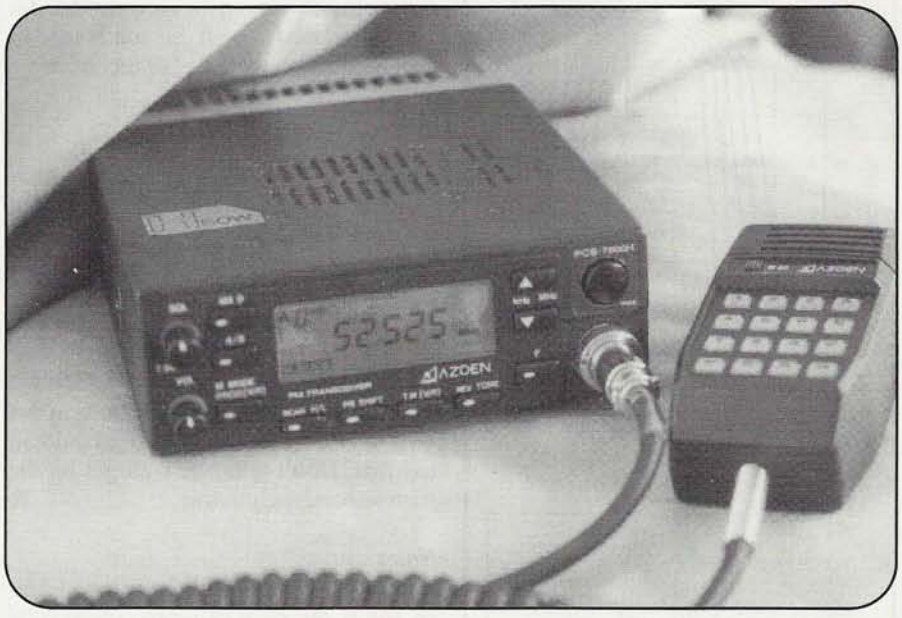
If you want to get on 6-meter FM without investing in a multimode or multiband radio, then this rig's for you.

By Rich Moseson, W2VU*

Azden's PCS-7500H isn't a particularly new radio. But many hams are discovering 6 meters for the first time, and the 7500 is just about the only FM-only 6-meter mobile rig on the market today. As such, we thought a review would be helpful to many of our readers, especially newcomers to six.

The 7500 is one of a family of five single-band base/mobile transceivers from Azden (the others are the PCS-7000H, for 2 meters; the PCS-7200H for 222 MHz; the PCS-7300 for 440; and the PCS-7800, one of the only 10-meter FM rigs in the marketplace). They all share the same case design, the same front panel design, and many of the same features. In this review, we'll concentrate on the features of the 6-meter version.

The PCS-7500H is a 50-/10-watt transceiver with 20 memory channels plus one "temporary" memory, which we'll explain later. Frequency coverage is 50 to 54 MHz transmit and 46 to 54 MHz receive, with two scanning modes, standard CTCSS encode (decode is optional), a multifunction microphone, and something called a "therm-sensor" circuit to keep things cool.



The Azden PCS-7500H is an excellent choice for 6-meter FM, and one of the only FM-only 6-meter rigs on the market.

Favorite Features

The therm-sensor is one of the "coolest" features of this radio. Most high-power (50-watt) mobile rigs today tend to run very hot, even with plenty of ventilation and heat sinks that make up half the bulk of the radio. The 7500's therm-sensor circuit keeps track of the radio's temperature and, when it exceeds a preset point, turns on the built-in fan. When the temperature drops below the threshold, the therm-sensor shuts off the fan.

My other favorite feature is the mysterious "MA0" button on the mic (there's also one on the front panel). No, it has nothing to do with the late Chinese leader. When you push it, the radio tunes instantly to *M*emory *A0* (get it?). I programmed the national 6-meter simplex frequency, 52.525 MHz, into Memory A0, so I could switch over there for a simplex contact with just one button-push. A second push returns you to your starting frequency. Very convenient. Also, the radio always powers up on MA0 (a known starting point is handy for the visually-impaired), so be sure to program your favorite frequency into that position.

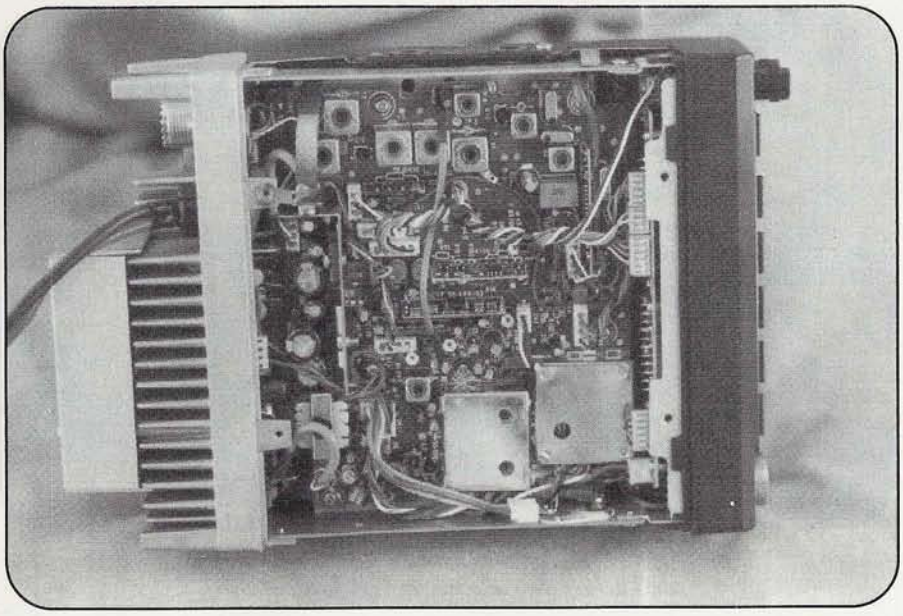
"The 7500's therm-sensor circuit keeps track of the radio's temperature, and when it exceeds a preset point, turns on the built-in fan."

Remember This...

The memory system on the PCS-7500 seems fairly complicated at first and can be best described as "klunky," but it becomes pretty easy once you learn the routine. Let's look at some memory features.

First of all, the 20 main memory channels are broken up into two "banks" of 10 each, labeled A0-A9 and B0-B9. When

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



Interior view of the PCS-7500H. The pc board is neatly arranged and well laid-out. The chassis is all-metal for good shielding.

you're in memory mode, the A/B switch on the front panel lets you choose either one or both (in this case, both *A* and *B* appear on the display and the letter of the active bank flashes). This can be very handy if you want to have two separate groups of memories.

For example, you can program local repeaters into Bank A and reserve Bank B for repeaters you're likely to use on a trip, or for distant repeaters you can access only during a sporadic-*E* opening. Then you can enable Bank A for at-home operation and switch to Bank B for a trip, or turn on both when the band is open. And speaking of programming repeater frequencies for a trip, be sure to do as much as you can before you leave home since this radio is not easily programmed "on the fly."

The memories, however, are quite versatile. Each memory holds a receive frequency, an independently programmed transmit frequency, and a CTCSS transmit tone, if required. The need to separately dial up the transmit frequency has less to do with any design/manufacturing problem than with the fact that there is no universally accepted repeater "split," or transmit/receive offset, on 6 meters. Even within the U.S., there's no standard. In the northeast, where I live, the "standard" split is –1 MHz (transmit 1 MHz below the receive frequency). In other parts of the country, the "standard" is 500 kHz, and there may even be others. Plus, as on other bands, there are repeaters with unusual splits, such as the one near me with an offset of –1.2 MHz. Separate transmit programming eliminates problems with varying standards. Likewise, the VFO offset is tunable in 5-kHz steps. The default offset is 500 kHz, but it's easily retuned for your area.

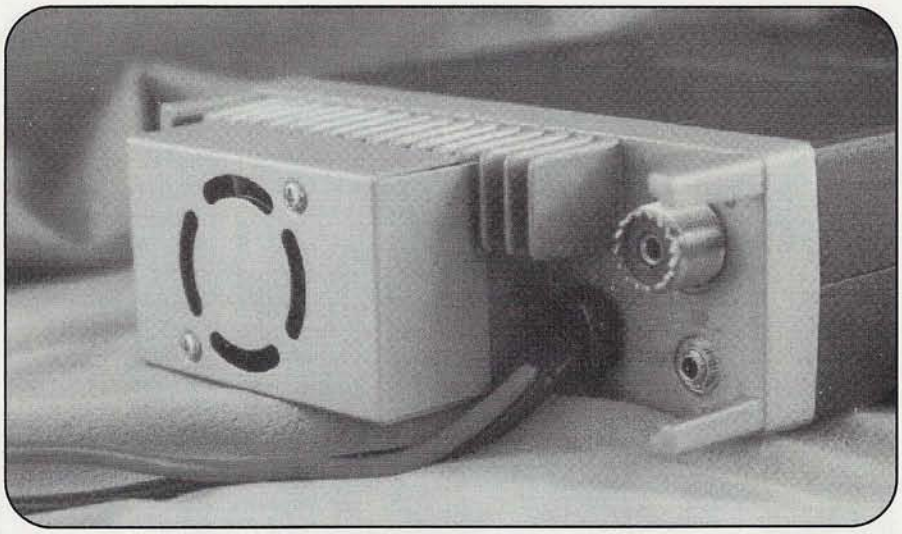
The PCS-7500 also has a "temporary memory," in addition to its 20 regular memories. Unlike the others, this one *can* be programmed "on the fly," except that the procedure gets really complicated if you want to program a CTCSS tone into the temporary memory along with frequency information. You'll need to read the manual to figure this one out (in fact, you need to read the manual to do anything except operate simplex).

A Couple of Gripes

While the steps for programming memory information are relatively easy to learn, some aspects are downright inconvenient. For example, you need to have the manual with you to program in CTCSS (PL) tones. Rather than let you directly dial up the tone frequency in Hertz, Azden has its own code numbers for each tone, and you have to refer to a cross-reference chart in the manual (example: a 141.3-Hz tone is code 22, which is what you program in). Plus, once you're in the programming mode, you need to *shut off the radio* to return to nor-

mal operation! As I said before, this radio is not easily programmed on the fly.

One other minor gripe has to do with the out-of-band receive coverage: 46 to 50 MHz. Why bother? The VHF-Low band extends from 30 to 50 MHz, and includes some public service and commercial two-way allocations, plus the 49-MHz cordless phone/walkie-talkie/baby monitor band*. This radio lets you tune in just four of those 20 MHz. Statistically, there's only a one-in-five chance you'll be lucky enough to find some activity in your area between 46 and 50. It seems to me that they should either have included all of the 30- to 50-MHz band, or made the rig ham-band-only and sharply filtered out everything else. This leads us to our next (and more positive) topic.



It has a fan! The PCS-7500 includes a "therm-sensor" circuit that controls the fan on the rear panel to keep the radio running nice and cool.

Scanning Options

There are two scanning modes on the PCS-7500 and two ways of resuming scanning once the receiver has stopped to listen on a busy frequency. If you press the SCAN button while in memory mode, the radio will go into *memory scan*, tuning through the channels in whichever memory bank(s) you have active. If you're in VFO mode (Azden calls it *Direct Tuning*) when you press SCAN, the radio goes into *band scan*, tuning between band limits that you set in two memory channels (A8 and A9).

Once the radio stops on an active frequency, you have a couple of choices of how to make scanning resume: 1) *Delay scan*, in which the receiver resumes scanning in six seconds, even if the channel is still busy; and 2) *Hold scan,* in which the receiver listens to a busy frequency until the signal drops, then waits a certain amount of time to see if a reply is coming, and then returns to scanning. You may select either a three-second or a six-second hold in this mode.

You *cannot* do a "manual scan" by pressing and holding the frequency up/down keys. While the display will cycle through the frequencies in whatever steps you've programmed in, the receiver actually stays tuned to the first frequency you tuned to before it went into fast tune operation. Only when you release the button does the receiver change frequency, going directly to the one on which you've stopped. For example, say you're on 53.470 MHz and you want to tune manually to 52.525 MHz. Assuming you're set up for 5-kHz tuning steps, when you press the down-arrow button, the VFO changes to 53.465 MHz. If you keep holding the button, the display will cycle down, 5 kHz at a time, until you release it at 52.525 MHz. *But*, if there's activity between 53.465 and 52.525, you won't hear it. This is because the receiver remains locked on 53.465 until you release the button, at which time it switches directly to 52.525. By the way, there's no tuning dial on this radio. All manual tuning is done via up/down buttons on the microphone and/or front panel.

On the Air

I received consistently good reports on QSOs made with the PCS-7500H, both from home and from the car. I wasn't

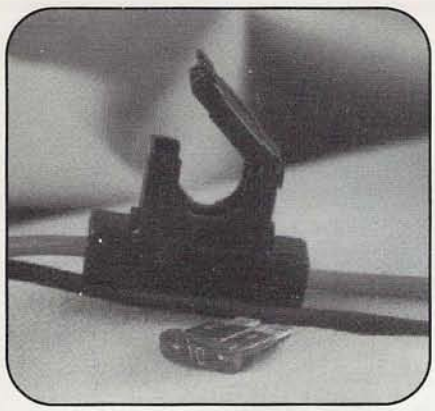
If You're New to 6-meter FM...

Unlike other VHF bands, on which FM use predominates, the greatest number of 6-meter users operate single sideband (SSB) and CW, down at the bottom end of the band (roughly from 50.000 to 50.350 MHz). This is because these modes are best for successfully making long-distance (DX) contacts when the band opens up, which it does quite regularly. Even so, there is no one mode that predominates on 6 meters.

There's a little bit of AM activity centered on 50.400 MHz, a very little bit of radio control (R/C) activity, some packet, and some FM. The national FM simplex frequency is 52.525 MHz, and most repeater outputs are between 53 and 54 MHz, with inputs generally either 500 kHz or 1 MHz below the output (see main text). Most repeaters are CTCSS (PL)-controlled, mostly because a band opening might result in interference between distant repeaters operating on the same frequencies.

You won't find as much repeater activity on 6 meters as you will on the 2-meter band. But you will find that repeaters tend to cover greater distances, even without a band opening. And when the band *does* open, you may find yourself talking to someone several hundred miles away (or even farther). Plus, on contest weekends, you'll have a great opportunity to check out your simplex range, as you'll find plenty of contest activity on 52.525.

One note of caution: For many years, 6 meters was known as the *TVI band* because of its proximity to TV channel 2 (which starts at 54 MHz). In recent years, a combination of better transmitter design and the growing popularity of cable TV has made this less of a problem. However, TV receiver design hasn't improved (at least from the RFI perspective), and you might still encounter front-end overload problems if you live in an area with a station on channel 2 and neighbors who are still using rooftop (or worse yet, set-top) antennas. Your FM audio will come through crystal-clear! If you have this problem, you can probably solve it by working cooperatively with your neighbor and using resources available from the ARRL and other sources.



In what might be an industry first, Azden has found a fuse holder that allows you to use the flat, two-pronged, fuses commonly found in automobiles today.

lucky enough to be on the air during any big sporadic-*E* openings, so I didn't work any real DX. My best distance, however, was a brief simplex QSO with someone in eastern Connecticut while I was driving across the Throgs Neck Bridge in New York City. He was right on the water, and I was right over it. Unfortunately, traffic was light and I crossed quickly, losing his signal as soon as I lost the over-water path.

Power output measured at the specified levels or higher, and I worked everyone I heard on 52.525 during last January's VHF contest (using an omnidirectional AEA Halo-6 antenna). Audio reports from the stations I contacted were consistently good, due in part to the fact that the 7500 uses true FM, as opposed to the more commonly found phase modulation or reactance modulation. Both of these work *like* FM, but lose something in terms of audio fidelity.

Overall Impressions

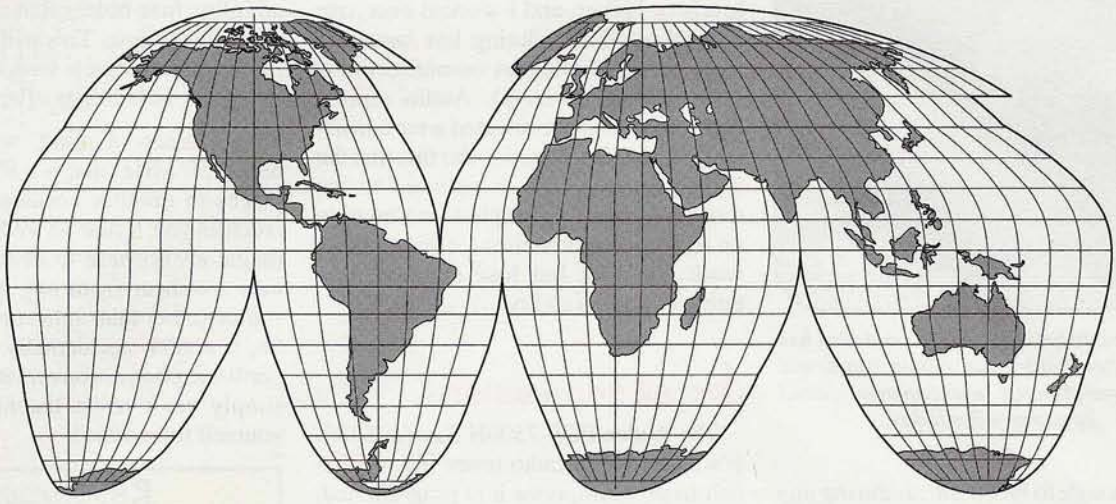
The Azden PCS-7500H lists for $389. It's an excellent radio (even if it's difficult to program, once it *is* programmed, operation is easy) with plenty of flexibility, high power, and really good audio. If your 6-meter interests lie mainly in FM and repeaters, or you want to get a feel for the band before investing in an expensive multimode or multiband radio, the PCS-7500H is certainly worthy of your serious consideration.

One final note: With the growing popularity of flat, two-pronged fuses for automotive use, Azden managed to find an inline fuse holder that uses this common style of fuse. This will make finding replacements much easier. It's a little thing, but little things often mean a lot.

*Note: Keep in mind, when listening below 50 MHz, that it's illegal in many places to monitor cordless phone calls (such as you'll find on 49 MHz), and it's illegal *everywhere* to divulge what you may overhear from any non-broadcast source (other than amateur radio or CB). So, if you *do* accidentally tune across a cordless phone conversation and you simply can't resist listening...consider yourself forewarned! ■

Resources

For more information on the PCS-7500H or any of its "cousins" for different bands, contact your ham radio dealer or Azden Communications, 147 New Hyde Park Rd., Franklin Square, NY 11010; Phone: (516) 328-7501; Fax: (516) 328-7506.



Listen for Egypt This Summer on Six!

With special permission and help from the UK Six Metre Group (UKSMG), SU1ER is activating Egypt this summer on "the magic band"—6 meters.

By Chris Gare, G3WOS*

Editor's Note: The following article is reprinted from postings to the Internet by the UK Six Metre Group between late March and early May, 1997. For up-to-the-minute updates, check out the UKSMG Web site at the address listed at the end of this article.

Like many countries in Europe and the Middle East, Egypt has been phasing out "Channel 1" TV broadcasting on 48 to 54 MHz, making the 6-meter band available for amateur use for the first time. The Egyptian government is considering a 6-meter amateur allocation and has authorized limited operation on the band this summer.

March 20 Update

Over the last few weeks, the UKSMG has been in communication with Ezzat Ramadan, SU1ER, President of the Radio Amateurs Assembly of the Radio Club of Egypt, in Cairo, for the purpose of encouraging 6-meter activity from Egypt this summer. The UKSMG has sent Ezzat much material explaining all about 6 meters, together with several back issues of *Six News* (the UKSMG newsletter), including a copy that described the 1994 UKSMG DXpedition to Jordan with the callsign

*Chris Gare, G3WOS, is Chairman of the UK Six Metre Group (UKSMG).

"Ezzat [already has] a Yaesu FT-690R II transceiver, an FL-6020 10-watt amplifier and a Cushcraft A50-3S 3-element Yagi antenna."

JY7SIX. This information has made Ezzat very keen to come on 6 in the month of June.

It turns out that Ezzat is already in possession of a Yaesu FT-690R II transceiver, an FL-6020 10-watt amplifier and a Cushcraft A50-3S 3-element Yagi antenna. The UKSMG will encourage and/or help Ezzat to obtain a 100-watt amplifier.

Ezzat's house is 140 meters (455') above sea level; the building is 25 meters (81') high with a Rohn tower 6 meters (19.5') in height, so the total height will be about 170 meters (522.5') above sea level, and 30 meters (98') off the ground, so there should be a good take-off for 6-meter signals.

Ezzat plans to put up the antenna in the next few weeks, but we should all remember that there is still "band-one" TV activity in Egypt, including a 48 MHz TV transmitter northwest of Cairo. It is not possible at this time to say how much of a problem this will be. We already know how bad it *can* be from our experience in Jordan in 1994!

The UKSMG will do everything it can to help Ezzat get going on 6, and if successful, we can all look forward to working another new country on 6 meters this summer (*even from the U.S.!—ed.*).

April 10 Update

The UKSMG has bought a Microwave Modules 100-watt solid-state amplifier for use in Egypt, plus a DRAE 24-amp, 12-volt power supply to run it. These will be presented later this month to Ezzat, SU1ER....After use, it will be passed on to the club station, SUØERA. It is hoped that, if we are successful in getting general release of 6 meters in Egypt, then any visiting amateur will be able to use the club facilities to activate Egypt on six.

"We should all remember that there is still 'band-one' TV activity in Egypt, including a 48 MHz TV transmitter northwest of Cairo. It is not possible at this time to say how much of a problem this will be."

Chris, G3WOS, and Nick, G3KOX, are going out to Cairo for two days on the 25th and 26th of April, and will be hand-delivering the equipment. During this trip, Ezzat, Chris and Nick will visit the local regulatory body, the Arab Republic of Egypt National Telecommunications Organization (ARENTO) to discuss general licensing issues.

According to Ezzat, the antenna was put up on top of the tower two days ago (horizontally polarized) and fed with 52 meters (175') of RG-214 coax cable to his shack. Everything is looking good so far.

Some Kinks to Work Out

Initial tests showed that there was a problem with the RF-actuated power amplifier, limiting Ezzat to 10 watts, at least for now. On May 6, G3WOS received the following e-mail message from SU1ER:

Dear Chris,

YES, I have copied the Italian Six on 50.150 USB; very weak signal, R3 S1; sometimes R3 S2; UTC time 1043–1057. Sure, I tried calling...and no answer. My signal was too weak. Will keep trying on both 50.110 and 50.150. Hi priority now for the Six Mtr.

Keep Listening

As of early May, efforts were under way to help Ezzat get his 100-watt amplifier working reliably. If he's limited to 10 watts, stations in Europe and other countries in the Middle East will have the best chance of working him. But if the 100-watt amp gets fixed in time, then 6-meter operators around the world will have the chance to hear—and maybe work—SU1ER. So keep those beams pointed toward Egypt and listen for Ezzat on 50.110 and 50.150 MHz

For updates on Ezzat's 6-meter operation, visit the UKSMG Web site at URL <http://www.uksmg.org/egypt.htm>.

"The UKSMG will...help Ezzat get going on 6, and if successful, we can all look forward to working another new country on 6 meters this summer."

CQ VHF would like to thank UKSMG and the Black Sheep C&DX Group European VHF DX Discussion List for the above information. ■

Alpha Delta Communications VRC Speaker System

When is an external speaker more than a speaker? When it's Alpha Delta's "Variable Response Console" speaker system. Gordo gives us the lowdown...

By Gordon West, WB6NOA*

A good external speaker will enhance the operation of just about any piece of radio equipment, but especially small mobiles and handhelds with tiny, tinny speakers. It can also do wonders for the fidelity and frequency response of received audio. And certain communication modes may be enhanced even further with audio filtering and audio frequency peaking. This is what Alpha Delta offers in its Variable Response Console (VRC) speaker system.

The front panel of the Alpha Delta VRC Speaker System contains controls to let you customize the speaker's response to the specific type of signal you're trying to hear (or to notch out).

Alpha Delta's VRC System

The Alpha Delta Communications VRC is an amplified wide-range speaker acoustically enclosed in a heavy cast aluminum cabinet. The amplifier includes front panel-adjustable filters that may precisely shape audio frequency response (see Figure). This amplified speaker system runs on 12 volts DC with a supplied power adapter and takes audio output from any speaker jack on any type of communications or audio equipment.

The front panel also features a light-emitting diode (LED) color bar graph to provide a visual display of the high frequency and low frequency control settings. The built-in amplifier gave me more than 2 watts of undistorted output, and there is also a jack for headphones. Plugging "cans" into the jack cuts out the big built-in speaker.

My first test was to see what this system sounded like in the "normal" mode. My small dualband handheld suddenly had high-fidelity output with the volume control barely turned up. If I needed more volume, I had plenty to work with!

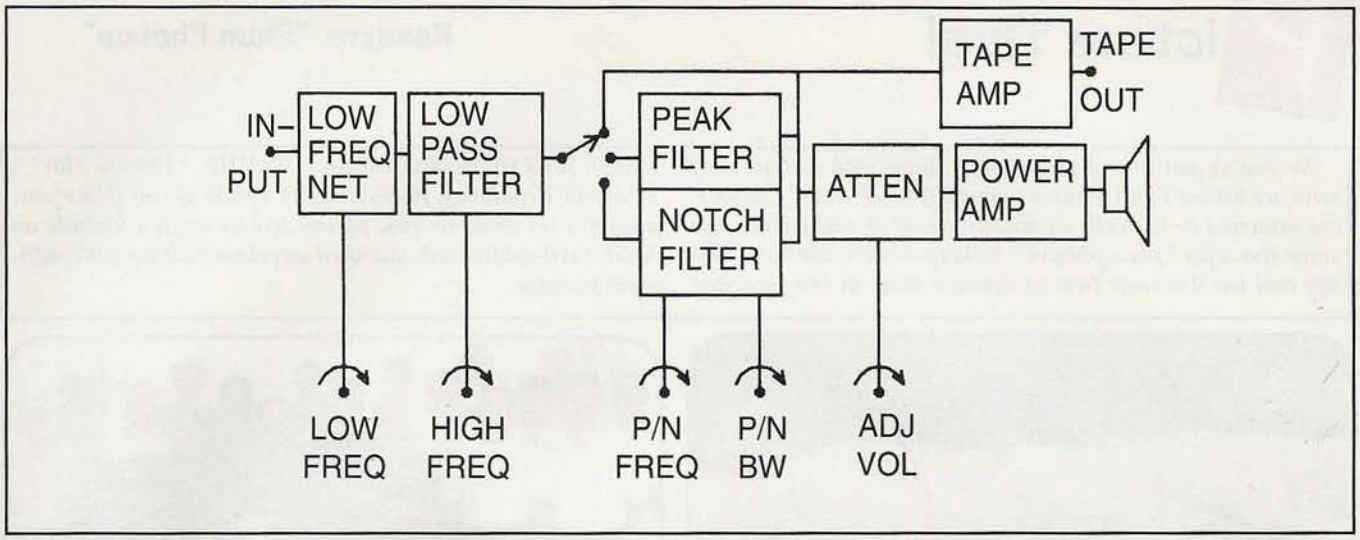
My handheld is capable of wide-band FM music reception, so I tuned in a local station on 105.1 MHz and adjusted the high and low frequency responses for excellent audiophile music reproduction.

From Music to Code

I then unplugged my handheld and redirected audio from my QRP (low-power) HF ham set into the audio system. I tuned in a noisy CW signal, minimized low frequency response, and set the high frequency response about mid-scale. I then pushed in the "peak" switch, adjusted the peak/narrow (P/N) bandwidth knob and the P/N frequency knob until the weak CW signal emerged from the

"My first test was to see what this system sounded like in the 'normal' mode. My small dualband handheld suddenly had high-fidelity output with the volume control barely turned up."

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



As you can see from this block diagram of the Alpha Delta VRC, it's much more than a fancy speaker. It also includes filters and amplifiers to shape and optimize your received signal. Note the separate tape amplifier and tape output for recording.

noise, which had been stripped away to an unbelievably low level.

As I was listening to the CW, a heterodyne whistle from another station started to creep in, making it tough to hear those dots and dashes. I pushed in the notch button, and adjusted the P/N frequency knob until the tone all but disappeared. The notch *frequency* can be moved across the audio spectrum from 400 to 10,000 Hz. In addition, you can adjust the notch *bandwidth* to restrict specific tones, as I discovered with an experiment on my VHF receiver.

Seismic Idle Tone Eliminator

I tested the sharpness of the audio notch control on my local *seismic network* station on 162.810 MHz. These are government-funded stations throughout the west coast that transmit a tone connected to earth-tremor monitoring devices. As long as the earth is steady, so is the tone. But with any kind of earth movement, the tone begins to warble, and continues to oscillate up and down until all seismic activity stops. The Alpha Delta speaker system notched the tone 95 percent out! Not quite 100 percent, but 95 percent out means you hear almost nothing coming out of the speaker at that specific frequency.

Minutes later, regular Southern California seismic wiggles blasted through loud and clear, well outside of the specific notch frequency. I'd say that the notch filtering was excellent and extremely close to more expensive digital signal processing.

"I'd say that the notch filtering was excellent and extremely close to more expensive digital signal processing."

You can also tailor the audio specifically to your listening requirements. More bass, more highs, less bass, no lows—this set can handle it. The low and high frequency audio response is achieved by an active four-pole Butterworth filter design, with a sharp upper cut-off that's adjustable from 500 to 10,000 Hz.

The audio power amplifier uses a push-pull circuit for low distortion and minimal power supply hum. However, I found that the supplied "Wall Wart" power converter still gave me a slight amount of hum, and, when I switched over to a 12-volt regulated power supply, the hum disappeared completely. This is something to consider if you're using this audio system for taping off the air. Plus, if you routinely record radio calls, there's an audio branch before the volume control that feeds the tape output jack. *(Be careful what you record off the air. While there are no restrictions on recording amateur or CB communications, the FCC prohibits unauthorized recording of most other radio transmissions.—ed.)*

No Stray RF

This unit is spectrally clean from any radio frequency (RF) emissions that could emanate from the amplifier section. This means you can run your antenna system relatively close to the box without "birdies," dead carriers, or other strange "phantom signals." This is a big advantage over some digital signal processors, which contain running oscillator circuits that create small phantom signals throughout the HF and VHF bands.

A Good Investment If Audio's Important

After 15 days of playing with this system on several different radio systems, I really began to appreciate being able to tailor the big audio output frequency response specifically to the type of radio signals I was attempting to tune in. If you're active on shortwave and interested in enhanced VHF and UHF monitoring and scanning, you'll find many uses for this variable frequency and variable bandwidth audio product.

With a suggested retail price of $249.95, it's a big investment for a good add-on accessory to your present radio equipment. But if quality audio is important to you, it may be a very worthwhile investment. Alpha Delta suggests you try to listen to the VRC system in action to help you decide if this is the speaker system for you.

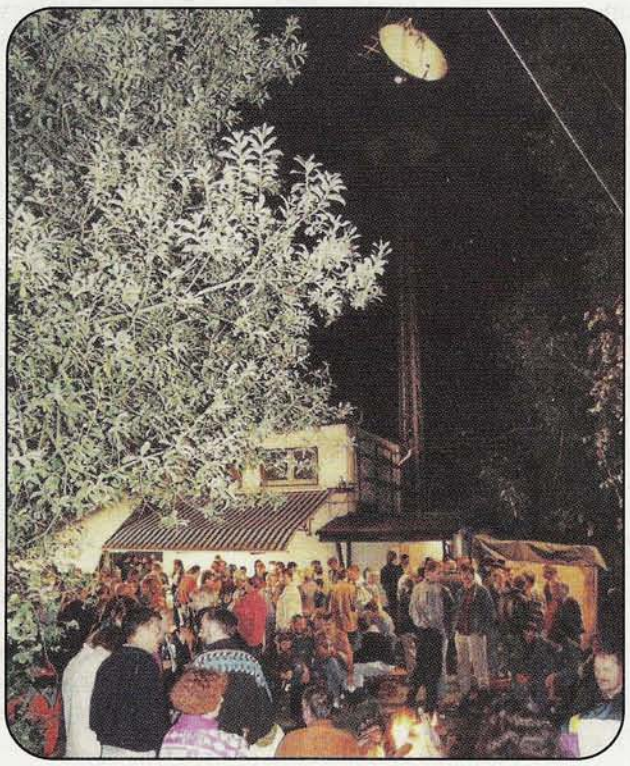
The VRC is backed by a 90-day limited warranty against defects in parts or workmanship, and by Alpha Delta's reputation of quality communication products for ham operators, shortwave listeners, and scanner enthusiasts. ■

Picture This!

Readers' "Phun Photos"

So you've got a cool snapshot to share with us but, until now, we haven't had a place to put it if there wasn't an article attached to it. Well, we finally caved in and carved out some space for "phun photos." So keep those snapshots coming and we'll do our best to squeeze them in (no pay, just glory). Send your color prints to CQ VHF, *"Picture This!", 76 North Broadway, Hicksville, NY 11801. If you'd like your photo(s) returned to you, please tell us so and include an SASE (self-addressed, stamped envelope) along with sufficient postage.*

Nice turnout for a hamfest, eh? Would you believe it's a VHF conference? This photo, and the accompanying campfire shot, are from last year's Weinheim VHF Conference in Germany, which drew 11,000 attendees (see January, 1997, CQ VHF, p. 43). For information on this year's conference (in mid-September), contact Wolfgang Mahlke, DF1GW, Im Steiles 10, 69469 Weinheim, Germany; or via e-mail: Wolfgang_Mahlke@hd.maus.de (Photos courtesy DF1GW).



South Florida 2-meter SSB operators got together earlier this year at the Fort Myers Hamfest in Cape Coral, Florida. From left to right, front to back, are: KE4NJM, W3ZR, WB4MJE, KE4KRY, KD4MZM; WA4LOX, K2OY, K9HUY, AE4DP, WB2QLP, KB8EMG, W4FF; WB2WPA, K4QXX, KE4JZT, K2RTH, N4XSE, and WB2WIH. (Photo courtesy KE4NJM)

"NOA's ARC"—CQ VHF Senior Contributing Editor Gordon West, WB6NOA, recently traded in his 20-year-old station wagon for a customized "Amateur Radio Communications" van, which he's dubbed, "NOA's ARC." The van is equipped with radios and antennas for 1.8 MHz through 10 GHz, plus a 4.5 kilowatt generator to power everything. There are three operating positions inside, one each for HF, VHF/UHF and satellite/microwave. One of the operating positions is shown. (Tnx WB6NOA)

CQ VHF Ham Radio Above 50 MHz

Reader Survey—July, 1997

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

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

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

A. About this issue of *CQ VHF*:

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

	Circle Reader Service #
Yes	1
No	2

2. If you answered "Yes" above, please indicate whether this was:

A subscription copy	3
A sample copy	4

3. If you are a subscriber, you should have received this issue in mid-June. Was it on time?

Yes	5
No	6

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

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

B. Please tell us how we're doing:

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

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

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

More high-level technical articles/projects	15
More beginner-level technical articles/projects	16
More operating-related articles	17
More news/opinion-related articles	18
The same mix of articles as in this issue	19

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

What You've Told Us...

Our April survey continued repeating questions from last year to see how *CQ VHF* readership has changed since our earliest issues. While last month's responses indicated that our audience had grown more experienced and more diverse, there is less change evident this month, in which our questions dealt with education, employment, and amateur activities.

Nearly half of you are college graduates and nearly all of you (94%) have graduated high school. Many of you are continuing your educations, mostly part-time. Fully one-third of April's respondents indicate they are still in school at some level, but in our next question, only 4% say they're full-time students.

As for employment: 30% of our readers work in technical careers, 27% are in professional/executive positions, and 16% work in government. The remaining 23% are split among educator/writer/creative types, factory workers, the unemployed, and full-time homemakers. Again, this is quite similar to last year's results.

On the ham radio front, nearly everyone operates FM at least occasionally, with SSB and CW running second and third, followed distantly by CW, ATV, and APRS. Finally, after eliminating Extras who can't upgrade, over 70% of you (down from 75% last year) are planning to upgrade in the next two years.

The winner of our free one-year subscription for replying to our March survey is Irvin Longhenry, NØWCA, of Moose Lake, Minnesota. Thanks again for all of your responses.

VE1SMU and the Beacons of Sable Island

Priest, professor, and beacon-master extraordinaire—Father Bill Lonc, VE1SMU, is all that and more. But VE1PKD reports that Bill's Sable Island beacons may be in danger.

By Gil McElroy, VE1PKD*

Sable Island is a 22-mile-long sliver of sand located about 180 miles off the coastline of Nova Scotia. It's the graveyard of scores of ships run aground over the course of hundreds of years of brutal North Atlantic storms. It's the home of wild horses descended from a herd originally brought to the island by lighthouse keepers in the early 18th century. And, for hams, it's the site of occasional DXpeditions, such as that of CYØAA, who activated the island (in the rare GN03 grid square) for two weeks in June and July of 1996.

Sable Island is also home to a tower of VHF and UHF radio beacons operated by William Lonc, VE1SMU. Actually, that's Father William Lonc, S.J. It's also Dr. William Lonc, Professor Emeritus of Physics at St. Mary's University in Halifax, Nova Scotia, and it's the person who quite possibly holds the world's record for number of amateur beacons operated: 19 in all—ranging from 50 MHz to 2300 MHz—mounted at four separate transmitter sites on Sable Island and the Nova Scotian mainland.

For hams in both North America and Europe, the beacons are invaluable indicators of propagation for contesting or in the hunt for rare DX. They're also a fascinating part of amateur radio in their own right. (See Table for a complete list of the VE1SMU beacons.)

Introducing Father Bill

Though he retired from full-time teaching in 1995, Bill maintains a university office—several rooms that include an electronics workshop with all the signs of a homebrewer—in the basement of the Physical Sciences building on the St. Mary's University campus in Halifax. But it's what's *upstairs* that's of real interest: the awesome antenna farm Bill has established on the rooftop. Yagis and dishes of various sizes are spread out across the entire roof and point off in every direction. Many of them are a part of ongoing radio astronomy experiments Bill has run for both research and teaching purposes.

Father William Lonc, VE1SMU, in front of the beacon tower on Sable Island. The six beacons on Sable are endangered by Canadian government plans to automate or shut down the weather station there. (Photos courtesy VE1SMU)

"There's always been a strong interest in astronomy at St. Mary's," he told me above the roar of the wind coming in off the Atlantic on a blustery winter day. "It must have been a good 25 years ago that I started in radio astronomy. We began experimenting in the VHF portion of the spectrum, trying to use 260-MHz antennas, and things gradually evolved from that." But this rooftop is also VE1SMU's "beacon central."

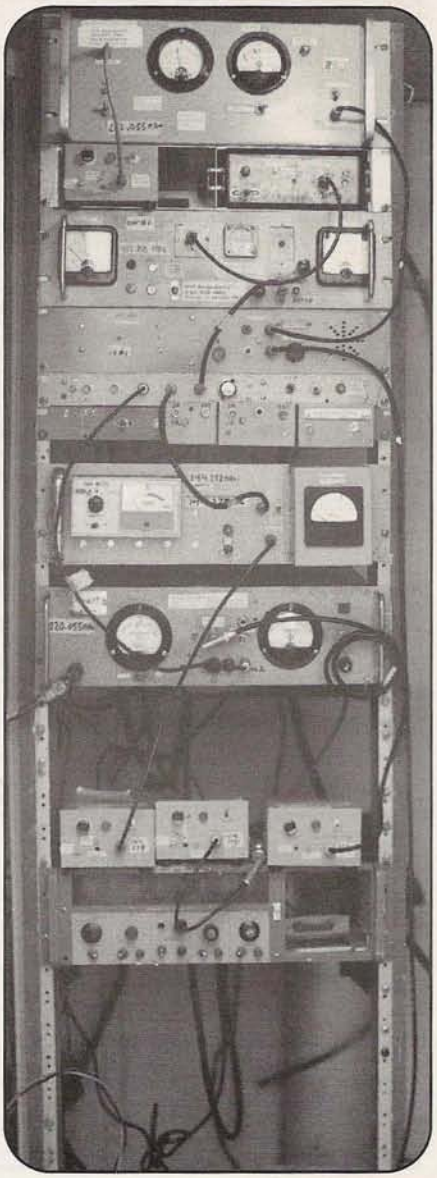
Feedlines and waveguides snake their way across the rooftop gravel and into a large nondescript shack. Inside are rooms littered with coils of cable, shelves of assorted electronic equipment, and several racks of Rockwell Collins receivers on loan to the university from the Canadian Coast Guard. Bill hit a speaker button and very slowly tuned across one of them. The band was noisy, but suddenly a weak CW identifier popped out of the QRM, signing "SI VE1SMU." It's Sable Island calling. "That's the beacon on 432 MHz," he says. "It's been doing that for about 16 years."

Father Bill's Beacons

Sixteen years dates the entire beacon project back to 1980 (our interview was conducted last year). "The whole thing started with a research contract with the federal Department of Communication [DOC]," Bill explained. "They wanted

**Gil McElroy, VE1PKD, first became interested in beacons after reading an article on the topic in* CQ *in 1992. He has previously written several articles for* QST *on ham radio history.*

Sable Island as seen from the deck of the Canadian Coast Guard vessel Edward Cornwallis.



A composite photograph of the Sable Island beacon transmitters. From the top: 222-MHz transmitter; two oscillators; 432-MHz transmitter; two keyers; HF amplifier; 144-MHz transmitter; 220-MHz transmitter; three oscillators; frequency counter; power supply and keyer for 1296-MHz beacon.

some VHF and UHF propagation studies made between the mainland and Sable Island because oil exploration was going on out there, and there was a need for a reliable communications system."

As it turned out, it was Bill's amateur radio ticket that made the project feasible. "It meant that the transmitters could be set up immediately without having to go through another DOC branch to get special frequencies assigned." So, on an unused 90-foot Coast Guard tower at the west end of the island, Bill installed a 2-meter beacon, regularly flying out on charter aircraft to service it. The beacons of VE1SMU were born.

The DOC contract lasted for seven years, at which time Bill submitted a report detailing his findings. "The communication needs they had involved a fair amount of digital data transfer," he told me, "and the radio links simply weren't stable enough. So they went to satellite communication."

But oil exploration's loss was amateur radio's gain, for, by this time Bill was hooked on beacons. "I had all this stuff out there on Sable Island," he said, laughing, "but the thought of taking it down was more than I could bear."

Over time, the list of beacons signing VE1SMU grew to its present-day number as additions were made to the Sable Island tower, and, with the assistance of another Nova Scotia ham, Bob Schultz, VE1IF, mainland sites were also established. "The thing I enjoy most is experimenting and building things. Amateur radio allows me to do all this hardware hacking," Bill explained, adding with a smile, "I like to tinker."

A Love of Tinkering

That tinkering began in 1946, when, as a 16-year-old growing up in London, Ontario, he acquired his amateur radio ticket. Bill became interested in radio during the war years, and, as part of an effort to acquire a certain Boy Scout badge, he set out to learn Morse code. "We had no Morse practice set, so I decided to build one from a circuit in a copy of the 1944 *ARRL Handbook*. That was the first thing I ever built."

In 1949, while still in high school, he began working part-time, helping to install background music systems in funeral homes in rural Ontario, and thereby stumbled into the world of television repair. Though Canada didn't have its own television network until 1952, signals from Detroit, Buffalo, and Cleveland could be picked up with high-gain Yagis. The burgeoning number of television sets meant work for 20-year-old Lonc. Eventually, he moved to Montreal, Quebec, where he began working at an RCA plant. Bored with repairing TV sets, he requested and received a transfer to a part of the plant where radar testing was being conducted. "My job was to be the project engineer's 'Man Friday'," he said, "and that meant scrounging equipment and doing tests without going through a lot of red tape." Laughing, he added, "by this time I knew how to scrounge."

The Call of the Priesthood ...and of Science

But the call of the priesthood was strong, and, in 1953, Bill joined the Jesuits, choosing the order because of its strong interest in the sciences. Thirteen years of study and training leading toward

Table. VE1SMU Beacons

Freq. (MHz)	Callsign	TX Power (W)	Emission Type	Antenna and Polarization	Antenna Orientation
Sable Island					
144.277	VE1SMU SE or SI VE1SMU	10	Keyed CW	5-element Yagi, horizontal	Toward Halifax
220.055	"	"	"	"	"
222.055	"	"	"	Dual 5-element Yagi, horizontal	"
432.40	"	"	"	8-foot dish, horizontal	"
902.345	"	7	"	2-bay phased array, horizontal	Due west
1296.344	"	6	"	4-foot dish, horizontal	Toward Halifax
Eastern Passage, NS					
50.001	VE1SMU H	25	Keyed CW	3-element Yagi, horizontal, at 60'	East
144.290	"	100	"	11-element Yagi, horizontal, at 60'	"
220.058	"	"	"	2-element collinear, vertical, at 9'	Omni
222.059	"	"	"	Dipole, vertical, at 60'	On west side of tower
432.350	"	10	"	"	"
902.302	"	7	"	"	"
1296.302	"	6	"	"	"
1296.398	"	20	"	Cylindrical paraboloid at 9'	Northwest
Wynacht Pt., Tantallon, NS					
222.051	H VE1SMU	5	Keyed CW	6-element Yagi, horizontal	Southwest
432.398	"	15	"	Dual corner reflector, horizontal	"
902.358	"	5	"	6-element phased array, horizontal	"
1296.385	"	"	"	Cylindrical paraboloid, horizontal	"
St. Mary's Univ. Roof, Halifax, NS					
2304.40	VE1SMU+ 5 dots	.5	Narrow Band FM	4-foot dish, horizontal	North

ordination as a priest followed, during which time he did graduate work in physics. His doctoral dissertation involved research into the semiconducting properties of crystalline boron. In the late 1960s, Bill began teaching physics at St. Mary's University. His radio astronomy and beacon work were a direct result of finding a local source of surplus microwave equipment that he was able to acquire for teaching and experimental purposes. "My students were able to do experiments they otherwise couldn't have done," he explained.

Active in Retirement

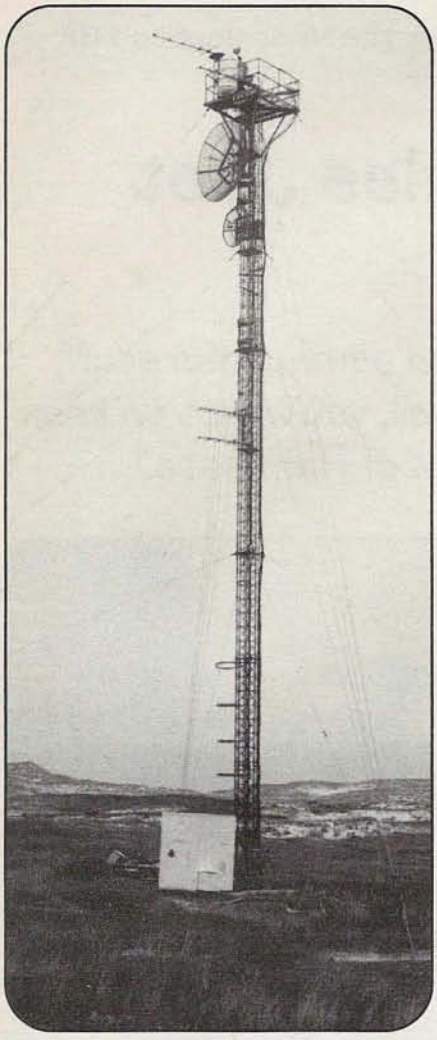
Though retired, Bill continues to teach part-time, and, with the assistance of his friend Bob Schultz, maintains and operates the beacon system. In addition to Sable Island, the three mainland sites include a 2300-MHz beacon and several receiving dishes that are a part of the antenna farm on the St. Mary's University rooftop, four beacons on a 30-foot tower atop a hill a few miles south along the coast from Halifax, and another Coast Guard tower equipped with eight beacons located on a military-owned golf course just north of the city.

"The call of the priesthood was strong, and, in 1953, Bill joined the Jesuits, choosing the order because of its strong interest in the sciences."

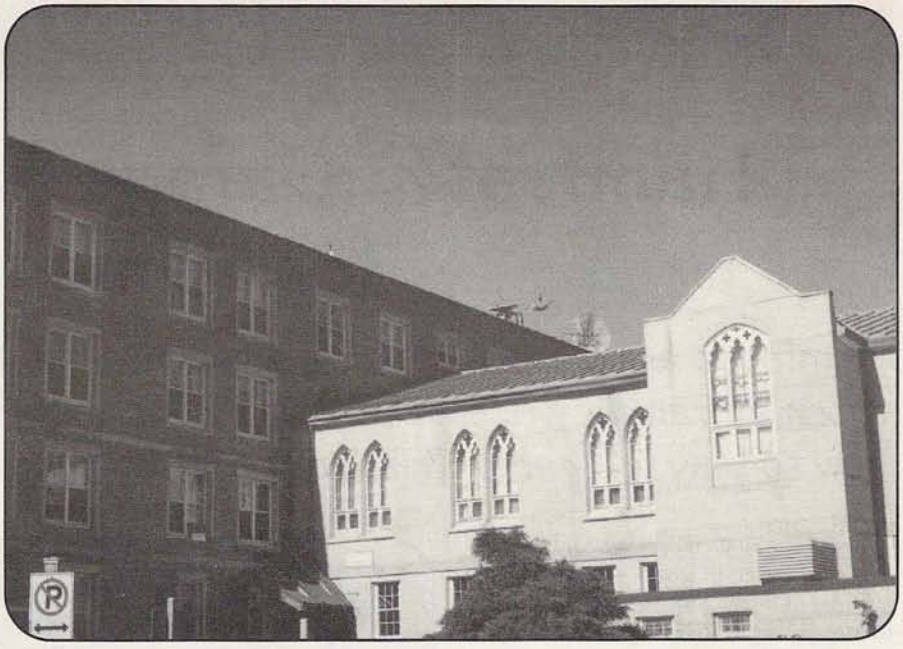
The most recent change to the VE1SMU list occurred late in the summer of 1996, when a 6-meter beacon pumping out 25 watts from a three-element Yagi was aimed toward Europe. Things happened quickly after that. "Within a few hours," Bill told me, "I had an e-mail report from Spain and, from off the back of the beam, a report from Michigan."

A Cloudy Future

The future looks good for the mainland beacon sites (all in the FN84 grid square), but Sable Island is another story. As it stands now, Bill services the beacon site by the good graces of the Coast Guard, shipping off on one of its vessels during once-a-year visits to replenish fuel supplies at the weather



Antenna tower for the VE1SMU beacons on Sable Island. From the top: 2-meter Yagi; 912-MHz phased array (in white pod); 222-MHz Yagi; 432-MHz dish; 1296-MHz dish; two more 222-MHz Yagis. The shack at the tower base contains the transmitters.



Part of the VE1SMU antenna farm at St. Mary's University in Halifax, Nova Scotia, as seen from the street. The 912-/1296-MHz receiving dish is on the right. The two smaller dishes on the left are used for radio astronomy experiments.

station located on the island. But change is afoot, as the Canadian government has plans to close the station, which has been in continuous operation for 106 years. It's still unknown whether the station will be automated or abandoned entirely. The plan has international repercussions, because the station also gathers information and maintains equipment on behalf of the U.S. National Oceanic and Atmospheric Administration (NOAA).

When the government plan takes effect, Sable Island will be without any permanent human population for the first time since the island was originally inhabited in 1598, and William Lonc will have no means of maintaining the island's beacons. "I think it will be 'game over'," he says.

So while VE1SMU will no doubt long be heard, the beacons of Sable Island may eventually be silenced. Listen for them if you can. They're worth hearing, while we still have the chance. After all, it's Sable Island calling. ■

"Change is afoot, as the Canadian government has plans to close the [Sable Island weather] station, which has been in continuous operation for 106 years."

Hamfests...Garage Sales Just for Hams

Hamfests are loaded with all sorts of useful and semi-useful stuff, often at bargain prices. But if you want to do well, you've got to know how to play the game. This month: "Peter's Rules of Hamfests."

"For sale: IBM-compatible computer in good working order. Older 386 model with 4M memory, small hard drive, and VGA board, $2.50."

Seems ridiculous, even in the quickly obsolete world of computers, right? It might be, but I just happen to have bought such a computer yesterday at a garage sale. But I did fib about the price—I only paid $2 for it. The first price from the owner just opened the negotiations. And the woman knew what she was selling. She simply didn't want it cluttering up her house any longer.

True, that computer is too slow for today's graphics-driven software market, but it is perfectly useful for word processing with an older copy of WordPerfect® or something like it. And it's perfectly useful for a packet station and for a lot of other things, too. So, both of us were happy at the end of the transaction.

I went through a lot of yard sales (I hit up to 35 in one weekend!) before stumbling across this gem. I've just moved to sunny Florida and am busily redecorating with furnishings more appropriate for this climate. I wasn't really looking to buy a cheap computer; it just fell into my lap. *(Gee, does that make it a laptop, Pete?—ed.)* I might go to 100 or more garage sales before finding a similar item for sale, particularly at this price. Too bad there isn't a garage sale just for hams....

Garage Sales for Hams

Good news! There *is* a garage sale just for hams, but it is not *called* a garage sale—it's called a *hamfest* or *fleamarket*. And the hamfest season is in full swing. At this time of year, there's a hamfest somewhere every weekend.

You never know what you'll find at a hamfest, or what kind of bargain you'll get. It's best to be prepared with a list of what you want and how much you're willing to pay.

For the latest happenings in your area, just check out the "Hamfest Calendar" in this very magazine. Other ham publications list them, too. You might also want to keep an eye out for listings coming across your local packet BBS if you're set up for that mode. And you're likely to hear other hams talking about them on the local repeater.

The people who have been around for a while have gotten to know where the good ones are, and, yes, some hamfests are better than others. On the east coast, a handful have even become rather legendary: Miami and Orlando, Florida; Shelby, North Carolina; and Deerfield, New Hampshire, just to name a few. There are similar ones on the west coast and in the midwest, too. Of course, the Dayton Hamvention® in Ohio is the granddaddy of them all.

Chances are, if you visit enough hamfests, you'll find almost anything you could possibly want for your ham station, and you'll probably pay somewhere between 10% and 50% of the "store" price for the item. That's the up-side, but there are all sorts of pitfalls to be aware of. The most obvious trap is that you're buying something that's used and probably doesn't come with any sort of warranty other than the promise of the seller that it "works fine." I have a friend who bought a 6-meter transceiver at a hamfest. The seller advertised that he had used it to win his section in the ARRL VHF Contest, which was true. What he didn't mention was that he was the only entrant from that section that year for 6 meters! And there was one minor defect with the transceiver—instead of putting out the specified 50 watts, it only produced about

By Peter O'Dell, WB2D

two! There was a major problem with the final amplifier. And the receiver had these spurs (spurious emissions)....

Do Your Homework

If you want to do well, you need to prepare in advance—on several levels. First of all, you may need to do some research on the going prices for the items you're looking for. Browse through the classified ads in *CQ VHF, CQ, QST*, the *Yellow Sheets, Nuts & Volts*, and the other ham publications that carry these ads. Even if you don't consciously know what the equipment is, your unconscious mind will set up a database of sorts. Sooner or later, you'll just "get a feel" for what things are worth. Trust your unconscious; after all, if you can't trust your unconscious, whose can you trust?

Next, start a list of everything that you'd like to have for your station—everything, reasonable and fantasy. Once you have the list reasonably complete, begin to prioritize it. Number the items or group them into sub-groups (for instance the "A" list and the "B" list) or whatever system makes sense to you. Finally, mark down some prices that you'd like to pay, say a fantasy price, an "average" price, and a limit price. The fantasy price is just that—the working computer for $2. The average price is what you think you're likely to have to pay, based on your research and your "gut feel." The limit price is your walk-away price. You have to say to yourself, "No matter how much I want this item, if I cannot negotiate a price lower than my limit price, I walk away and let someone else have it." Get these prices down on paper—and be sure to take the paper with you to the hamfest!

Next, you have to work out your budget. How much can you afford to spend at this hamfest? How much for the whole season? The day before the hamfest, go down to the bank and withdraw whatever you have budgeted for the hamfest in cash. Almost no one selling at a fleamarket is going to take plastic, and most sellers don't like taking a check. Cash simplifies things.

Set the Alarm Clock

For those of us whose bodies function best in the afternoon and evening, this is the painful part. If you're going to do well, you have to be there early. There are two prime times for bargains, and the best one by far is the opening few minutes of the hamfest. The people who organize hamfests seem to be reincarnated torturers from the dark ages. For some reason that's beyond my comprehension, they set these things up to open at 8 a.m. or earlier. In fact, 6 a.m. is not unheard of. I just came across one fleamarket that runs from "dawn to dusk." Just resign yourself to it—these people are not civilized. So be it.

Hamfest seller-type #1: The motivated seller. Perhaps he's moving or just needs cash. His goal is to get rid of as much as he can, so he's willing to bargain on prices.

You're going to want to be at the gate at least a half-hour before the scheduled opening time. The organizer probably won't let you in, but you should be relatively close to the front of the line by getting there at this time. If you are not familiar with the location, make sure that you have a good map and have marked out the route. Prepare something the night before for eating in the car on the way. You're going to get up really early to drive to the location, and you're not going to want to stop for a leisurely breakfast. If you have any respect for your stomach, forget buying any of the hamfest food. One alternative to consider, depending on the size of the hamfest and the distance from your home, is to spend the night in a nearby hotel. If you're going to do that, you have to factor that into your budget as well.

It's kind of like a feeding frenzy in the shark tank when the hamfest gates open. There's a mad rush up and down the aisles as the buyers search for that rare find. Here's where that list you prepared in advance is going to save you money, maybe lots of it. There is a tendency to start thinking that someone else might be "getting a better deal." On what? Better than what? Is it something that I really need? Having that written list will help you maintain your sanity in this situation.

Hamfest seller-type #2: The "pro." His goal is extra income and he's not worried about taking stuff home with him. Prices may be less flexible than with the motivated seller, but closer to true value.

Obviously, this scenario applies more to the large hamfests than to the small ones, but it applies nonetheless.

Know Your Seller

Who are you going to meet on the other side of the table? My experience is that you can put sellers into four or five very general categories.

The first is what I call the *motivated seller*. He wants the stuff out of his house, and he knows that the best way to do that is to mark the price down really low. Before we left the cold north, we had a couple of garage sales and were *very* motivated. We "got rid" of almost everything we had for sale because the prices were really low. And there was a minimum of haggling with people over the pricing. The dickering is usually good natured, so don't be afraid to bargain. Experienced sellers expect it. Some of the best bargains are going to come from the motivated seller—and 90% will be within the first hour of the hamfest.

The next category is that of the *professional*. This person may have a 9 to 5 job as a rocket scientist or something like that, but on weekends, he metamorphoses into Trader Joe, King of the Fleamarket. You can spot this seller by his large quantities of certain identical items, say coax connectors by the bag or cartons of SWR bridges. Trader Joe knows the market, and chances are he has his merchandise marked a little above average price. Usually, there's some room for negotiating with him, but not a lot. Sure, he wants to sell, but he also wants/needs his profit. This is more like dealing with a retail merchant than a motivated seller. Again, your list with the preset prices will be invaluable when dealing with Trader Joe.

Then you have the seller who just decided on a whim to see if he could get rid of a few things and make a few dollars. He hasn't really thought through the value of what he is selling. When dealing with this character, prices can be all over the board. Trust your list.

Finally, there is the *packrat*. This person collects everything, remembers how much he paid for each item, and figures that if someone went out to buy that same item new today he or she would have to pay a lot for it, too. He'll generously knock off 30% to 50% from the store price, but that's all. And there's no room for bargaining.

Bargaining for Bargains

How do you negotiate? The expression, "honey catches more flies than vinegar," carries a lot of weight. Be friendly. Smile. Breathe calmly. Be casual. If the asking price is higher than you think it's worth, ask the seller if he will take less (a very general question) or ask if he'll accept some specific figure that you have in mind. Smile when you ask. Make sure that the tone of voice is a friendly one. This is not the time for confrontation or for you to "educate" the seller that he is grossly over-priced on this item.

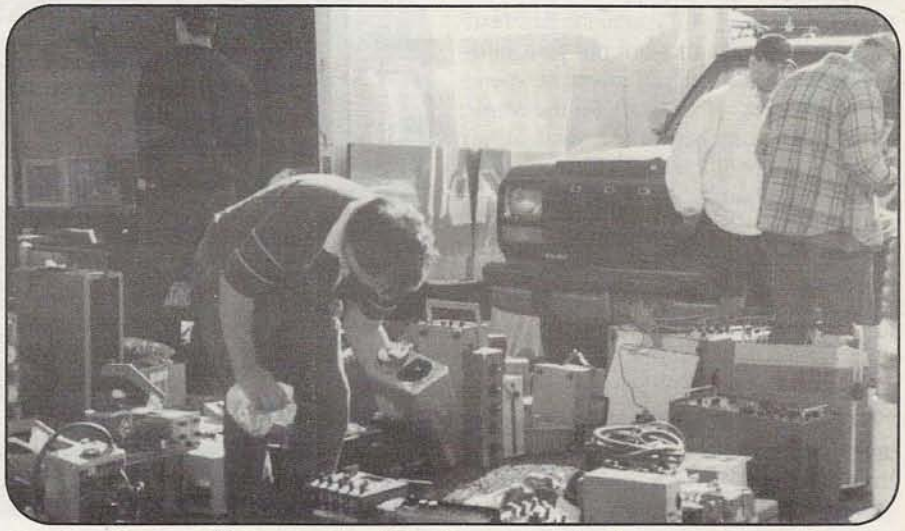
Just keep in mind that you are offering him *what it is worth to you*, not what it is worth on the New York Stock Exchange. You've done your homework, made your list, and have nothing to prove. You've simply asked him if he'll take less. You'll quickly find out who you are dealing with. If he's motivated, you'll probably settle on some figure about half way between his offering price and your first bid. If you don't come to terms, just be friendly and move on. There's more than one table to look at.

Hamfest seller-type #3: The impulse seller. On a whim, he's loaded his truck up with stuff to see if he can clear out basement space and make a few bucks for his next purchase. Prices may vary wildly (both up and down) from true value.

Last-Minute Values

The second best time for getting a good deal is just before closing time. The seller has now realized that there's a very good chance that he'll have to pack up whatever is left and take it home. Prices tend to drop. The only problem is that the merchandise tends to be picked over. But there are still great deals to be had at closing time.

The computer that I mentioned earlier was purchased at the end of the day. It had been sitting there all day with a price tag of $5. It would have been a good deal even at that price, but it was that much sweeter at $2. Happy hunting. ■



Hamfest seller-type #4: The Packrat. His selling price will reflect a set portion of his purchase price more than current market value, and there won't be much room to negotiate. But then, he might have just what you want, at a price you're willing to pay!

Reader FEEDBACK!

Water, Water Everywhere

This month, readers provide us with additional insight on keeping coax connectors dry and preventing fogged lenses.

Waterproofing Coax Connectors

Dear *CQ VHF*:

N connectors and BNCs are *not really* weatherproof (see "Beginner's Corner," April, 1997). Here's the best way to weatherproof connectors and splices:

Start off with a double-wrap of Scotch 88 or 33+ weatherized electrical tape. While not cheap, it's really inexpensive for what it does and is readily available at discount hardware stores, such as Tru-Value, ACE, etc. Make sure to go at least three or four inches (75 to 100 mm) past the connector or splice (both sides). The primary purpose of this initial layer is to prevent residue from the coax-seal (next step) from sticking to everything

Cover this with coax-seal or equivalent. Butler makes a great product, which you may be able to buy through your local cable TV tech or through a distributor who sells cable TV stuff. The Butler product is wider and stickier than coax-seal, but leaves little or no residue and can be used without the initial layer of Scotch if desired. The coax-seal should extend at least an inch or two (25 to 50 mm) past the Scotch.

Finally, cover with another double-wrap of Scotch, again going an inch or two past the coax-seal.

Using this method, two above-ground splices were covered for four years in Colorado. When removed, the cable and connectors were just as dry and clean as the day they were covered.

73,

Bob Wanderer, AAØCY

The Frosting on the Lens

Dear *CQ VHF*:

Having read your article on the Asimov balloon (May, 1997, *CQ VHF*), I can offer some insight into the frosted lenses. The lens pointed at free space (the horizon) radiated heat rapidly. The lens temperature dropped below the dew point. Once moisture condensed, you were finished. The lens pointed at the Earth (a warmer source) had a warmer balance point between radiated and absorbed heat and never fell below the dew point.

I've had some experience with this as an amateur astronomer (and radio operator). The trick is to route some power supply wires with 1-watt resistors round the lens housings to dump a bit of extra heat into the lenses to keep them from fogging.

John Hoot, N6NHP

FCC Callsign Update

Following is a list of the FCC sequentially assigned callsigns (not including vanity calls) issued as of May 1, 1997:

District	Group A Extra	Group B Advanced	Group C Tech/Gen	Group D Novice
0	ABØFH	KIØIB	++	KCØATB
1	AA1SD	KE1HP	N1ZDC	KB1CDN
2	AB2DQ	KG2LE	++	KC2BMQ
3	AA3PT	KE3ZP	N3ZFT	KB3BTD
4	AF4CV	KU4GL	++	KF4RIY
5	AC5MF	KM5IU	++	KD5AHF
6	AD6BE	KQ6OO	++	KF6KSU
7	AB7VB	KK7HK	++	KC7WFH
8	AA8ZY	KI8CD	++	KC8HEG
9	AA9UK	KG9KG	++	KB9QII
N. Mariana Is.	NHØA	AHØAX	KHØGT	WHØABG
Guam	*	AH2DD	KH2RU	WH2ANT
Hawaii	AH7V	AH6PA	KH7DW	WH6DDT
Amer. Samoa	AH8O	AH8AH	KH8DH	WH8ABF
Alaska	ALØD	AL7QT	KLØGK	WL7CUE
Virgin Is.	++	KP2CJ	NP2JQ	WP2AIH
Puerto Rico	NP3F	KP3AV	NP3MW	WP4NNB

* New prefixes are available for this block, but no callsigns have been issued.
++ All callsigns in this group have been issued in this district. (Tnx FCC/ARRL)

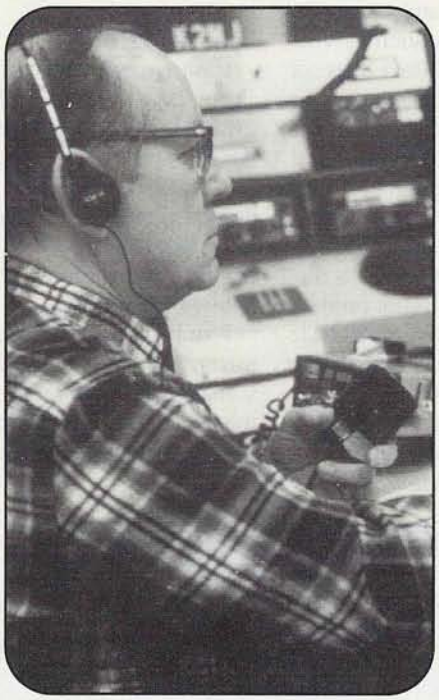
Ham Radio Public Service: A Sales Guide

Amateur radio public service remains relevant in today's world of cellphones, satellites, and the Internet. But sometimes, it's hard to convince people of that. Here's some ammunition.

Amateur radio public service has come a long way in the past 25 years. From mobile units that fit in the trunk to HTs that can fit in your shirt pocket! From simple voice communication on simplex to complex repeater networks. Today, we take some of the modern conveniences of home and bring them out in the field to provide public service communications. Now, from video cameras to computers, we as hams are continuing to provide vital communications in times of need—often, communications that service agencies cannot provide on their own.

A key point in talking about amateur radio operators is explaining who we are. There are many answers, such as volunteers or people who like to provide communications help in times of need, etc. However, one of the biggest assets we offer is our skill as trained communicators—not only are we trained in how to operate a radio, but also in how to communicate effectively. In fact, ham radio public service work doesn't always have to involve using ham radios. For example:

- A group of hams in Delaware has provided communications for a golf tournament using business band radios;
- A group of packet operators was asked to help with computer networking;
- A local police department asked for assistance in determining how their radios would work on a new stretch of highway. The local ham radio club was able to provide coverage reports based on frequency and repeater location;
- An active ham operator was able to prevent a township from outlawing the local police and fire communications tower when officials went to rewrite tower ordinances.



Every operator counts. The skill of the operators they see and hear is noticed by officials of served agencies.

In each instance, the *skills* of the ham radio *operators* were appreciated by the local community—even if ham radio itself wasn't directly involved.

In the rest of this article, we'll take a closer look at the variety of ways in which we're able to serve our communities. And remember, it won't always involve the use of a ham radio!

Be Quick, Be Accurate, Be Organized

How are we as amateurs rated by officials? One criterion could be the speed and accuracy of a message passed between two points. For example, if a hospital was receiving information on a patient being brought in by helicopter, then the information would have to arrive before the helicopter. Let's assume that the helicopter has to travel one mile. Flight time would be about a minute. If it takes five minutes to pass a message, then the patient is already at the hospital and we've failed to get the message there in time. If the message is passed before the helicopter takes off, then the emergency communications we provide look smooth and efficient.

Many management courses teach that there is an accepted ratio of one supervisor for every four to eight workers. In management-speak, each supervisor/worker grouping is called a *module*. This concept holds well in communication roles, particularly when the traffic load is heavy or has time value. For example, if

"...from video cameras to computers, we as hams are continuing to provide vital communications in times of need—often, communications that service agencies cannot provide on their own."

By Bob Josuweit, WA3PZO

an Emergency Operations Center (EOC) had to communicate with five hospitals, then one module could be set up. If more hospitals were involved, then more modules could be added. Here's an example:

Modular Disaster Response

The National Disaster Medical System (NDMS) is a federal system which supports medical care in a disaster area. It can also be activated in a city *not* affected by the disaster in order to receive patients from the disaster area and place them in local hospitals.

Recently, the Philadelphia NDMS region was put to the test as a receiving center. The NDMS Area Director contacted the local ARES (Amateur Radio Emergency Service) group to provide communications with 41 hospitals, six county Emergency Management Offices, and two major airports (Philadelphia International Airport and the Willow Grove Naval Air Station). The region used many supervisor/worker modules to maintain the ratio of 1:4 to 1:8. The communication ratio worked and the plan was copied in several other cities.

On the Radio...

While this modular management concept may appear easy on paper, this is where the radio aspect of what we do comes into play. With several "supervisors" (net control stations) operating from one Emergency Operating Center (EOC), you have to consider the effects of multiple radios operating simultaneously from the same room. You can't put them all on one band, such as 2 meters, because you'll have interference between the radios...not to mention concerns of interference from other public safety radios operating near the various amateur bands. So the ARES plan called for the use of 144, 222, and 440 MHz *(even with separation by frequency, antennas need to be isolated as much as possible to avoid front-end overload of the various receivers—ed.)*.

Different functions were assigned to different bands, based on the number of stations required for each task. Nearly everyone has a 2-meter rig, so the net that needed the greatest number of operators was placed on 2 meters. In this case, it was the net linking the EOC with the 41 hospitals. On the other hand, only a few 222-MHz handhelds were available, so that band was used for linking key officials at the two airports, the county EOCs and other locations. In addition, a 440-MHz repeater was used for passing the bulk of the traffic between the airport and the main EOC.

Amateur television, or ATV, is able to bring the action at a disaster scene to EOCs that may be miles away. Look for more about ATV in future columns.

Digital Communications —An Important Asset

Record-keeping and information retrieval can be vital in emergency communications. And the use of digital communications has been key to the success of many drills and real emergencies, whether the goal has been to relay patient information, keep track of supplies and resources, or whatever else hams are called on to do.

Southeastern Louisiana ARES is developing an emergency packet plan. The planned system will consist of approximately 15 digipeater sites with emergency power and low wind-loading antennas. Ten of these sites will be on VHF and five will be on VHF *and* UHF to allow digipeating to the New Orleans RACES station at City Hall, where hams have constructed a multi-node site with ports on 70 centimeters, 2 meters, and, on HF, 20 30, 40, and 80 meters.

When completed, this system should allow packet communications to and from anywhere in southeastern Louisiana, or across the country, with a laptop computer, HT, portable antenna, and gel cell battery. Once the packet nodes are in operation, ARES of Louisiana will begin work on a 6-meter FM system for voice operations that will consist of six repeaters with phone patches, linked by a 440-MHz backbone system. These repeaters, like the packet nodes, will be placed in areas where they should be able to remain in operation even if a Category 4 hurricane strikes the Louisiana coast.

Another digital tool that's coming into greater use by the National Weather Service and other agencies in providing critical information is APRS, the Automatic Position Reporting System (see last month's "In the Public Interest").

Demonstrating DAREN

The state of West Virginia has a packet radio system dedicated to emergency, priority, and National Traffic System (NTS) messages only. It's called *DAREN* for *Digital Amateur Radio Emergency Network*. The network has nodes/BBS

"The hams were praised for the efficiency with which they handled the traffic, allowing the emergency channels to remain free for additional dispatches and true emergency traffic to the EOC."

sites in 31 of the state's 55 counties. County nodes are identified by four letters of the county name plus WV for the state. The BBS at each node is identified by four letters of the city name plus WV. And if the BBS is located at an EOC or Red Cross facility, the ID has "ES" or "RC" following the city.

Over 100 stations regularly participate in DAREN's weekly check-in-only net. DAREN officials say part of the funding to develop the network came from state and federal emergency management agencies, which offered assistance after seeing the system demonstrated back in 1990. Only five stations took part in that first demonstration, but the government officials monitoring the traffic were impressed enough with its potential to offer partial matching funds.

When the Phones Don't Work...

Even with all of today's modern conveniences, ham radio can play a key role in supplying critical communications. Wayne Gearing, K2WG, Assistant Radio Officer for Columbia County ARES/RACES in East Chatham, New York, reports on an incident during which cellular telephones were unable to provide emergency communications.

"The NDMS Area Director contacted the local ARES...group to provide communications with 41 hospitals, six county Emergency Management Offices, and two major airports."

Last November, a brief but severe snowstorm hit Columbia County. Not much snow, but enough to make all highways very dangerous for a brief period. Numerous accidents were being reported all over the county and the county dispatch center was keeping up with the radio traffic just fine...until a multi-vehicle pileup occurred on the New York State Thruway, just a few miles from Wayne's home. The local fire department and rescue squad were dispatched, along with mutual aid from nine other ambulance services, to rush 16 injured people to local hospitals.

When the fire chief arrived on the scene, he quickly realized that with at least 15 or 20 other incidents going on in the county simultaneously, the traffic-handing capabilities of the county's emergency radio system would not be adequate. The fire chief and rescue squad captain set up a command post and tried to decide how to expedite non-emergency communications while keeping the official channels clear for true emergency traffic. The same thought came to both of them almost simultaneously: amateur radio! Columbia County ARES/RACES had trained with fire and rescue personnel on several occasions and had helped with communications during several emergencies, including a fire which took a local telephone switching office out of service for four days.

Gearing was called to the scene to coordinate communications among the various emergency service agencies. When he arrived, he noticed that the fire chief had a cellphone in his hand, but wasn't using it. Why not? Both of the major cellphone providers serving the region had towers near the site of the emergency in order to cover the Berkshire Section of the Thruway. Signal strength was not a problem, but the incident had traffic on the Thruway blocked for several miles in both directions. And the hundreds of stranded motorists were all trying to contact relatives, friends, offices, etc. to inform them of their predicament. For over an hour, Gearing said, it was almost impossible for him to get a dial tone on his cellphone!

The story does have a happy ending. No fatalities, no injuries to rescue workers, and the Thruway re-opened after about three hours. Seven tractor-trailers had been involved (luckily, none carried hazardous materials), and the State Police lost count of passenger vehicles involved when the total hit 30! Ham radio operators stationed at firehouses, rescue squad buildings, ambulance staging areas, and on the scene handled all of the logistical and most of the tactical traffic during the incident. The hams were praised for the efficiency with which they handled the traffic, allowing the emergency channels to remain free for additional dispatches and true emergency traffic to the EOC. All of this using 2-meter simplex because their local repeater was almost completely shadowed from the accident site.

Equipment Isn't Everything...

But, as we said before, the capabilities of our equipment isn't our only "selling" tool for amateur radio emergency communications. Our skills and training are at least as valuable.

In Montgomery County, Pennsylvania, local RACES members worked with emergency management officials to develop an efficient means of disseminating information to 20 municipal EOCs as expeditiously as possible. At first, this was done via a general broadcast type message. But after a few drills, it became apparent that the messages were becoming repetitive. Those hams who were familiar with the ARRL's standardized ARL messages* immediately suggested that this would be the way to go. A list of nine standard messages was developed and agreed upon by county officials. Now, instead of sending a 32-word message, the operator could shorten the text to "LGS - Alpha," greatly speeding up the flow of messages. If it hadn't been for their training and experience in traffic-handling, a lot of time might have been wasted "reinventing the wheel."

Three nets, three bands. With each operator using a different band, communications can take place with minimal interference.

Coming Up...

In this issue, we looked at an overview of amateur radio public service activity and hams' value to their communities as trained communicators. In upcoming issues, we'll explore new technology, and new applications for familiar technology, being used for public service.

For instance, amateur television (ATV) is becoming a staple of public service communications. The old cliché that a picture is worth a thousand words has never been more true. How can ATV be used? Pictures of airport activities can be relayed simultaneously to several EOCs to allow for coordination. Or a portable camera can be placed on a boat to show the other side of an island during a simulated plane crash or a remote part of a river being used for a race. It's all possible, and we'll examine ATV in public service and emergency communications in future columns.

We want to hear about your activities, whether public service or emergency communications. Let's hear about what you're doing. Send your reports to me at <bjosuweit@aol.com>.

*The ARRL's National Traffic System has condensed the texts of several dozen of the most commonly-sent messages into a standard format identified by an "ARL" number. For example, ARL ONE (the numbers are always spelled out for clarity) means "Everyone safe here. Please don't worry." For a complete listing, see the *ARRL Operating Manual* or the ARRL's *Public Service Communications Manual.*

Congratulations!

This past March, the Montgomery County, Maryland RACES organization was nominated for the Governor's Volunteer Award. The group received a certificate, which reads as follows:

The Governor's Volunteer Appreciation Certificate Recognizes Montgomery County RACES for your outstanding commitment to nurturing the vibrant traditions of caring for which Maryland is widely respected, and for faithfully maintaining a deep commitment to positively touching the lives of your fellow Marylanders, you have established a distinguished record of service which has earned you nomination for the annual Governor's Volunteer Award.

<signed>

Parris N. Glendening
Governor

The Montgomery County RACES has an active program of providing emergency and public service communications, participates in many training programs, and works with many agencies in the state.

Has your group been recently honored for its own work in public service or emergency communications? We would like to hear about your efforts and acknowledge them. Drop us a line c/o *CQ VHF* or via e-mail at <bjosuweit@aol.com>.

Tools of the Trade

Introducing a brand-new column on the art of "homebrewing"—building your own equipment and accessories. We start out with a look at the basic "tools of the trade."

Editor's Note: CQ VHF *is proud to welcome Dave Ingram, K4TWJ, to our staff. Dave is a long-time columnist for our sister magazine,* CQ, *and has written 17 books about amateur radio, including the just-published* 33 Simple Weekend Projects for the Ham, the Student, and the Experimenter. *Best known for his contagious enthusiasm and ability to explain technical concepts in plain English, Dave has also been a broadcast engineer and college electronics instructor. He's been an active ham for over 35 years, and we're pleased to have him as part of the* CQ VHF *family.*

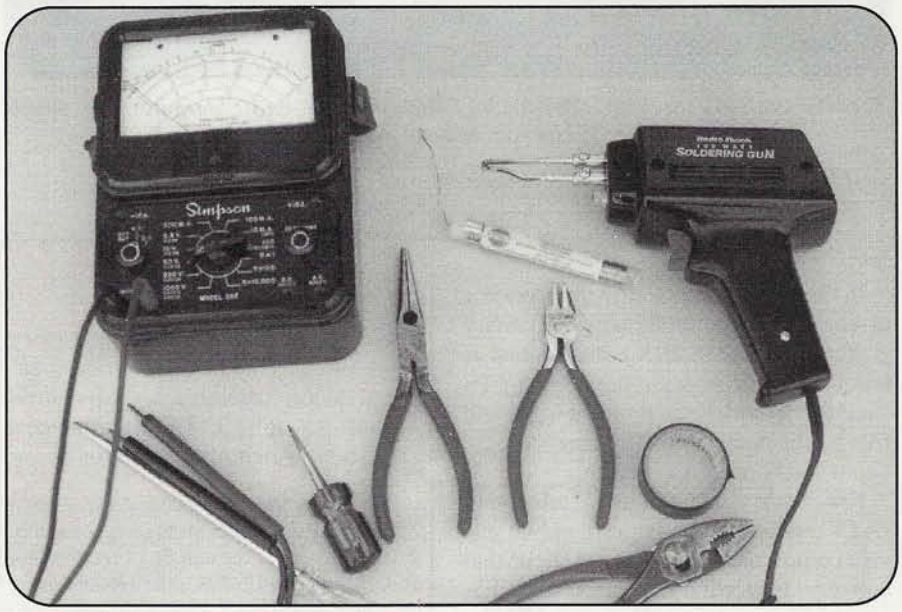


Photo A. A small collection of basic tools for assembling home projects, splicing cables, and installing connectors is always a good investment. High-quality diagonal cutters and needlenose pliers should have fine tips; soldering guns with easy-to-find replacement tips are quite desirable.

CQ VHF is proving to be a very special magazine, addressing a very special audience, and I consider putting together this new "hands-on" column a very special privilege. In my opinion, readers of *CQ VHF* represent the future of amateur radio as both an innovative super hobby and the heartbeat of preparedness communications. If you're like most *CQ VHF* readers, you want to expand your horizons, learn more, and get more involved. I want to help ensure that all your ventures are a rollicking success! Together we can have a ball!

Introducing "Project Corner"

This bi-monthly column's focus will be on neat "weekender" projects you can build and basic rig repairs or servicing you can do at home. What type of projects and repairs, you ask? We'll take our cues from your suggestions and requests, and we're open to both beginning and advanced project ideas.

Some examples of possible projects to build include unique antennas for 6 meters and satellite work and a solar-powered battery charger (several of you have already asked about that one). Aren't similar items available commercially, you also ask? Sometimes yes, sometimes no. But available choices don't always fit your specific needs. Homebrewing is the best way to get precisely what you want right when you need it!

And examples of easy-to-perform rig repairs include fixing a loose or broken mic connector, dynamic troubleshooting on a stage-by-stage basis, and reseating multipin connectors on pc boards. Are such semi-technical activities beneficial? More than most folks realize. Modern gear only *seems* complex because of all the fancy added-on features, but the actual "business end" circuitry still follows a relatively straight input-to-output path. Plus, easy-to-spot mechanical maladies often outnumber mind-bending electronic problems. So why ship a favorite rig over a long distance (and risk problems or damage in transit) if you can fix it yourself?

Have you ever been caught needing a special interface cable to complete a new packet or SSTV setup? Well, armed with the associated equipment's manuals to show pin connections on sockets and a few proper tools for the job, you can "roll your own" custom cable in short order. Why lose time hunting for an elusive item

By Dave Ingram, K4TWJ

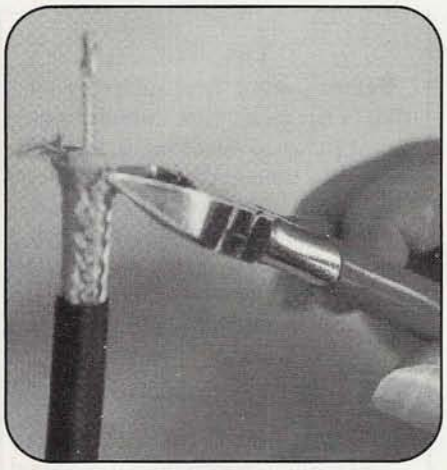


Photo B. No mistakes allowed here! Manufacturer defects or gaps in a diagonal cutter edge can allow fine strands of wire to slip by uncut and result in a hard-to-find short circuit.

"How can you judge the quality of diagonal cutters? First consider price: low means low. Next, hold them up to a light and notice if the blades meet accurately or have a gap that would allow fine wire to slip through rather than being cut."

when you can make it quickly and be having fun on the air! That is enough about the "whys" of home projects. Now let's consider some basic "getting started" and "how to" tips.

Tool Tips

Gear up with a few always-useful tools for both amateur radio and general electronic/electrical use. Even if your interest in homebrewing wanes, there are always power cables to be spliced, antenna wires and connectors to be soldered, connections/continuity to be checked, and much more. As long as you're an active ham, these basic tools will be of value.

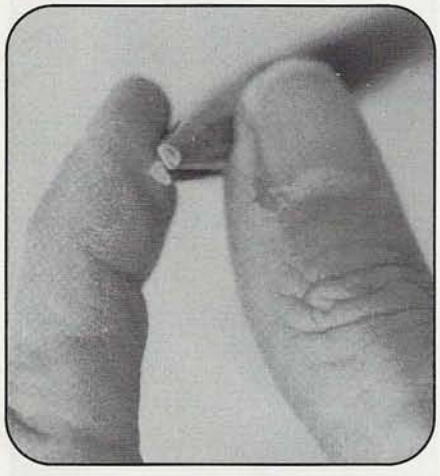


Photo C. Here, we're checking the alignment of needlenose pliers by applying light pressure toward the right on the upper tip and toward the left on the lower tip. Notice the tips meet on only part of their surface, and thus tend to slip when holding small wires or nuts.

Photo A shows the "ground-floor" essentials for medium- to large-size applications: a good pair of diagonal cutters, needlenose pliers, a 75- to 125-watt soldering gun, some solder, and a Volt-Ohm-Milliamp meter (VOM), also known sometimes as a *multimeter*. Additional items you'll want on hand include electrical tape, a few screwdrivers of different sizes, and a pair of regular pliers. If you already have half the items on this list, you're well on your way to getting started in homebrewing antennas, tuners, and other fun projects.

Medium-size tools are typically subjected to more demanding use and abuse than smaller size tools, so investing a couple of extra dollars in high-grade items is wise thinking. It also minimizes the possibility of having to stop in the middle of a special project to buy a replacement tool. The chrome-plated, insulated grip, 5-1/2-inch-long diagonal cutters shown in Photo A, for example, are 30 years old and still going strong. They have repaid their cost at least 10 times.

How can you judge the quality of diagonal cutters? First consider price: low means low. Next, hold them up to a light and notice if the blades meet accurately or if they have a gap that would allow fine wire to slip through rather than being cut. Remember that a couple of uncut strands of a coax shield can fall against a plug's center conductor and ruin an antenna project (see Photo B). A really good cutter can even trim hairs on your arm.

The "nose" sections of needlenose pliers should also mate without excess gaps, and their small, pointed ends should meet in good alignment for working with or holding small parts. To check alignment, apply finger pressure diagonally to needlenose ends as illustrated in Photo C. The tips on high grade items will meet exactly, rather than touching on only part of their surface (better described as "oops, there goes another nut sailing across the bench").

The Right Tool for the Job

Need I also mention exercising common logic in tool use? Attempting to cut super-heavy guy wire or an aluminum sheet with medium-size diagonal cutters or twisting ultra-large wire with the tip end of needlenose pliers is asking for problems. Use BIG tools for BIG jobs.

Likewise, attempting to solder antenna wires, power cables, and PL-259-size connectors with a low-wattage, pencil-type iron might seem to work, but, trust me, such poorly-heated connections will not hold together with stress and time. Using a large, quick-heating soldering gun will help ensure that critical station connections are solid and secure. When purchasing a soldering gun, I also suggest adding in a spare replacement tip and an extra roll of solder.

Solder and Soldering

Generally speaking, solder falls into two categories: the rosin-core-type used in electronic applications and the acid-core-type used in plumbing (don't ever use this in electronics as it "eats up" wiring).

The two most popular types of rosin-core solder are designated according to their percentage of tin and lead composition and are commonly referred to as 60/40 or 63/37. This designation is usually marked on the solder's supply roll or dispenser. Tin has a slightly higher melting point and a tad more strength than lead, but either mixture is fine for electronic work. Other types of solder, like water-soluble-core solder, no-clean-flux solder, activated-rosin-core solder, and lead-free rosin-core solder are listed in large catalogs, but sticking with traditional 60/40 or 63/37 types yields the best "no fumbles" results. Solder diameters between .030 and .040 are ideal for medium to large size work, and diameters between .020 and .025 are perfect for small jobs and pc board work.

How to Solder

Working with high temperature and molten solder can seem a mite touchy, especially in delicate electronics, but the technique is actually easy to master. The key is being quick and accurate rather than sloppy and hasty (see "Tin, Tin" for

Photo D. A few special tools make working with small projects and crowded pc boards a cinch. Shown here is a multirange pocket Volt-Ohm-Milliamp meter, a "third hand" jig with magnifier, a 15-watt soldering iron with fine tip, and ultra-thin silver bearing solder.

Tin, Tin

Before using a new soldering gun, iron, or tip, take a few seconds to prepare it for good soldering (commonly known as "tinning the tip"). Switch on your gun or iron, allow it to reach normal soldering temperature, then apply a coating of solder to the tip. Immediately wipe off excess solder with a dry or slightly moistened cloth or sponge.

CAUTION: The tip will be very hot, so use a thick cloth and wipe with one quick motion.

This tinning process produces a good surface for soldering and helps avoid oxides from forming on the tip. Occasionally, cleaning and retinning the tip when working on a project or building a kit is also helpful!

tips on preparing a new soldering tip). When soldering connections, place the iron or gun's flat tip section against the connection and allow the junction to heat up enough to melt solder you apply to the junction (not to the iron's tip). Then lift the tip and let the junction cool before moving wires (*don't blow on it; just wait. —ed.*). Avoid the temptation of using the tip to melt solder and then spreading it onto the junction, as this will result in a non-lasting (cold solder) connection. Remember: Let the junction melt the solder. Practice soldering a few hookup wires until you learn how much time, heat, and solder make good connections.

Working on antenna connections outdoors can also be challenging, as open air cooling competes with hot soldering. What to do? Use insulators capable of withstanding high temperatures, use a high wattage gun or iron, and avoid hurrying to complete the process. Cold days might test your patience, but, as I mentioned earlier, strive for accuracy. You can do it!

The Versatile VOM

A reliable VOM is one piece of test equipment you'll find indispensable day after day. Indeed, this pocket-size instrument will receive almost continuous use—quick-checking cables and connectors, measuring voltages (at home and in the auto), determining charge in batteries, and much more.

When shopping for a VOM, look for one with plenty of ranges and over-range protection. Generally speaking, VOMs rated at 20000 ohms per volt or greater are preferred for their accuracy. Lower ohm-per-volt meters are acceptable if only approximate value measurements and continuity checks are sufficient. The choice of an analog scale or digital readout is mainly a matter of personal preference; there's no technical difference.

If possible, before making a final choice, try using the meter you're considering to measure some low and high resistance values. If you can easily understand the readings, great! If the displayed figures are confusing or require interpretation, look for an easier-to-use model. Including a protective storage and carry case in your initial purchase is also worth considering, as the meter will probably be your trusty aid for a long time.

The Small Projects Bench

Working with small components and miniature connectors can make you feel more like a jeweler than an electronics hobbyist. Using a few special tools, however, often turns such activities into pleasantly addictive enjoyment. In fact, many amateurs become more intent on building small projects than on getting on the air!

Standard size (5-1/2-inch) diagonal cutters and needlenose pliers with fine tips can be used to assemble many small projects, but smaller (4-inch) equivalents are preferable for pc board-type projects. Some additional aids you will find immensely beneficial are shown in Photo D.

The "third hand" is a multi-swivel jig with magnifier for holding and close-up viewing of pc boards, small connectors, tiny parts, etc., while leaving your hands free for soldering. Its two "arms" are fitted with alligator clips that can be posi-

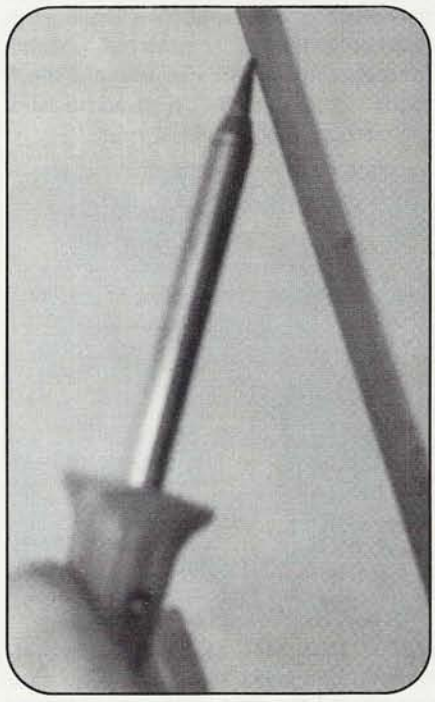


Photo E. Filing a soldering iron's tip to a small wedge-shaped point ensures maximum accuracy in fine soldering.

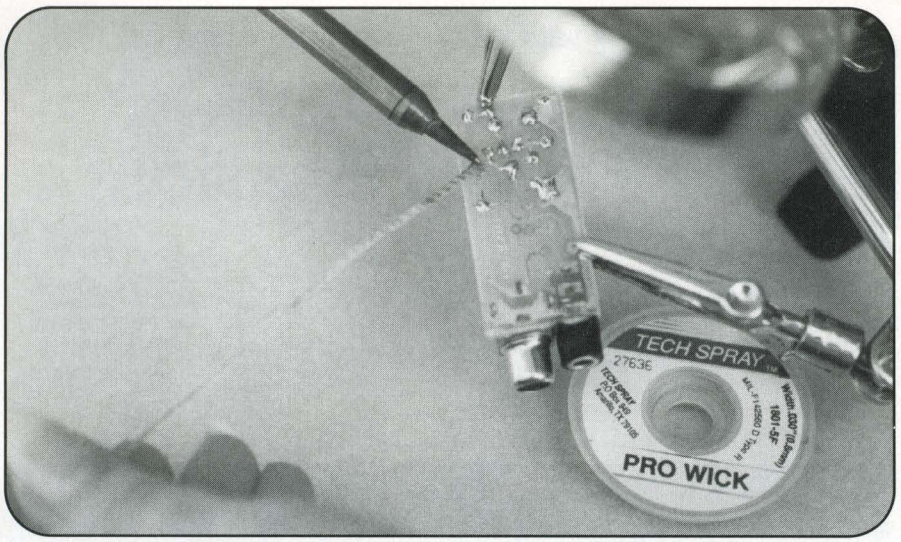


Photo F. Solder Wick is an outstanding aid for desoldering wires on connectors, components on pc boards, and more. Simply place it on a connection, heat it with an iron, and it draws up solder like a sponge.

tioned at any angle, and the magnifier is ideal for spotting pc board flaws or doing close-up soldering. "Third hands" are available from larger parts supply stores nationwide and are super-handy items for your bench.

A low-wattage, pencil-type soldering iron and ultra-thin diameter solder will also make your life easier. A wide variety of 15- to 25-watt soldering irons is available, and deciding which type to purchase can be perplexing. If you anticipate building a large kit, soldering for several hours straight, or simply prefer going first class, a thermostatically controlled "soldering station"-type iron is superb. For less stringent applications, like dinking with a small project for an hour at night, an inexpensive little iron like the one shown in Photo D is a good choice.

Avoiding Mistakes

The best way to avoid the common error of bridging (shorting) pins or solder pads on connectors and crowded circuit boards is to use a small iron tip and ultra-thin solder. Filing your iron's tip to a smaller point produces more accurate soldering. A couple of strokes with a sharp file should do the trick (see Photo E). Remember to re-tin the tip before use. For excellent results in fine-soldering applications, I heartily recommend the new .022-diameter 62/36/2 silver bearing solder (which, incidentally, is even available at RadioShack stores). This solder melts easily, flows smoothly, and produces a sparkling clean joint. It can make a home project look like the handiwork of a pro.

Two common errors made when working on tiny connectors and pc board projects are oversoldering and installing a component or wire in the wrong place. Is the project ruined? Not if you have a small roll of Solder Wick on hand. Simply place the wick over the connection, heat it with your iron's tip as shown in Photo F, and the wick will withdraw/remove the solder like a champ. You then lift off the wire or components, and start over with a fresh like-new surface. Try it!

At this point, you're probably wondering where to find a good, economical source of tools, test equipment, and small parts for home projects. One of the most consistently reliable suppliers I've found is Mouser Electronics. Literally thousands of items of all categories are listed in their free catalog. The folks at Mouser are small projects specialists, congenial, and quite helpful. Try them! Many of these tools are also available from RadioShack and other vendors.

Onward and Upward!

Oops, we overfilled this month's column space before we could squeeze in a quick project. But we covered some vital groundwork. You'll find these tips—and these tools—helpful for years to come, and that's a big benefit in itself. Hopefully, we helped fill in that mysterious gap between the "getting-started basics" and the complex technical descriptions you see in many home construction articles. Hopefully, too, even more "seasoned" amateurs picked up a tip or two that they'll find useful along the way.

Now it's your turn to tell us about your favorite project, or perhaps a project (or area) you'd like to see spotlighted. Just remember to keep your notes brief, to include a self-addressed stamped envelope (SASE) with inquiries or photos, be patient for a reply, and watch for some exciting projects in future columns. My address is 4941 Scenic View Drive, Birmingham, AL 35210.

73, Dave, K4TWJ

Resources

Most of the tools described in this article are available from a wide variety of electronics stores, such as RadioShack, and mail-order companies, such as Mouser Electronics. You can request a free catalog from Mouser Electronics, 2401 Hwy. 287N, Mansfield, TX 76063-4827; Phone: (800) 346-6873.

Dave Ingram's new book, *33 Simple Weekend Projects for the Ham, the Student, and the Experimenter*, is available at many amateur dealers or directly from the CQ Bookstore, 76 N. Broadway, Hicksville, NY 11801; Phone: (516) 681-2922; Fax: 516-681-2926.

Turbocharge Your Packet Station!

Forget 1200 baud. Forget 9600, too. N2IRZ shows you how to modify commercially available ham gear for 19200-baud packet operation!

Editor's Note: This month's installment requires experience in modifying equipment and using test equipment.

Last month, we looked at the German packet network and some of the reasons why it's so good. Since we don't face the regulatory restrictions which ensured that only serious network builders could build a network (and since it would *not* be a good idea to ask the FCC for similar restrictions), if we want to build a high-performance network, we have to look at and emulate their *other* advantage: good equipment.

Just what is "good equipment"? After discovering (along with the rest of the world) the wonderful modem designed by James Miller, G3RUH, Henning Rech, N1EOW/DF9IC, designed a 1.2-GHz full-duplex radio for 19200-baud (19k2) backbone operation. The availability and relatively low price of this radio kit, the LinkTRX, made it the most popular radio for that speed in Germany. So, in a short while, most of Germany's backbone links were running at 19k2, and, for reasons discussed last month, they were all dedicated point-to-point links.

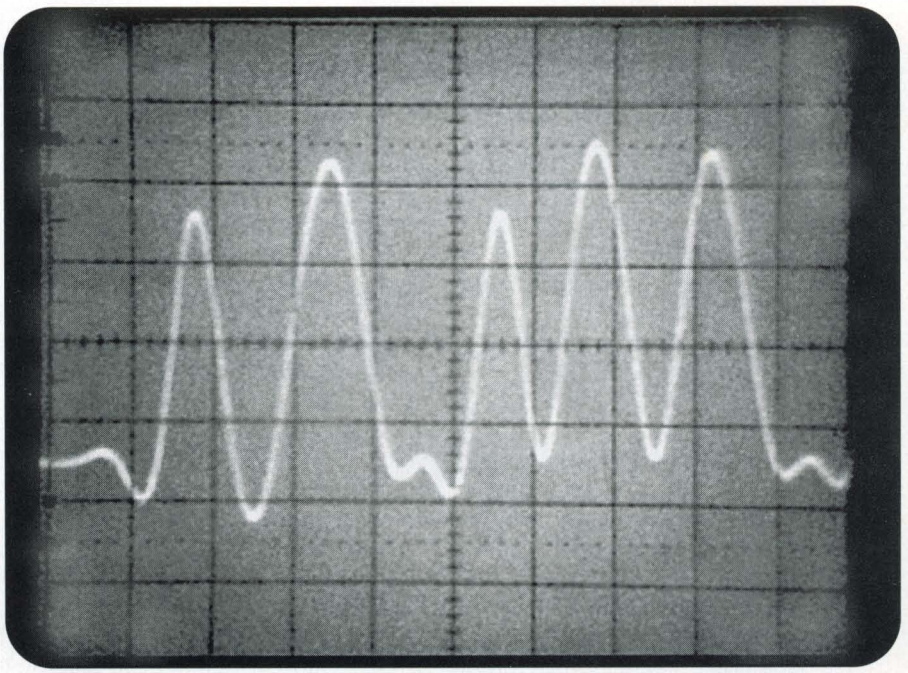


Photo A: A typical data stream. Note how the bits are rounded off, which minimizes the transmitting bandwidth. This is the same data as seen in Photo B, but at about 0.1 mSec/div.

TEKK Revisited

Last year, I discussed some suitable radios for 9600-baud (9k6) operation. Among my favorites are those cute little data-only radios from TEKK. They work reasonably well out of the box at 9k6, almost plug-n-play. However, as the baud rate increases, so do the demands upon the radios, making the TEKKs unusable at 19k2 (since they weren't designed for it). This month, we'll take a look at modifications I made to make them useful at this higher speed, specifically modifications to Model KS-900 (T-Net micro). But first, some background information so you'll understand what we're doing.

Eye Patterns

The first topic we have to discuss, albeit briefly, is *eye patterns*. We'll look at this in more detail next month, as we continue our segment on high-speed data, but, for now, here's what you need to know:

Eye patterns are a common yet powerful tool used in data transmission work. Imagine a data stream of ones and zeros, represented by high and low voltages. To reduce the bandwidth of the transmitted signal, the transitions from high to low and vice versa are rounded off somewhat, so you have a signal that looks kind of like a sine wave with a few teeth missing (see Photo A).

Using an oscilloscope, which shows voltage variations that are too fast for a meter (such as this data signal), you can put the signal on the screen so you can see one or two bits at a time. You then tell the oscilloscope to begin its display (trigger the sweep) every time the receive data clock sends a pulse. In this way, the one and zero bits, as well as the transitions between these levels, are superimposed upon each other, creating a blur of bits. The empty space between these many paths looks like an eye, a flattened oval with pointy ends. That's why it's called an "eye pattern" (see Photo B).

By Don Rotolo, N2IRZ

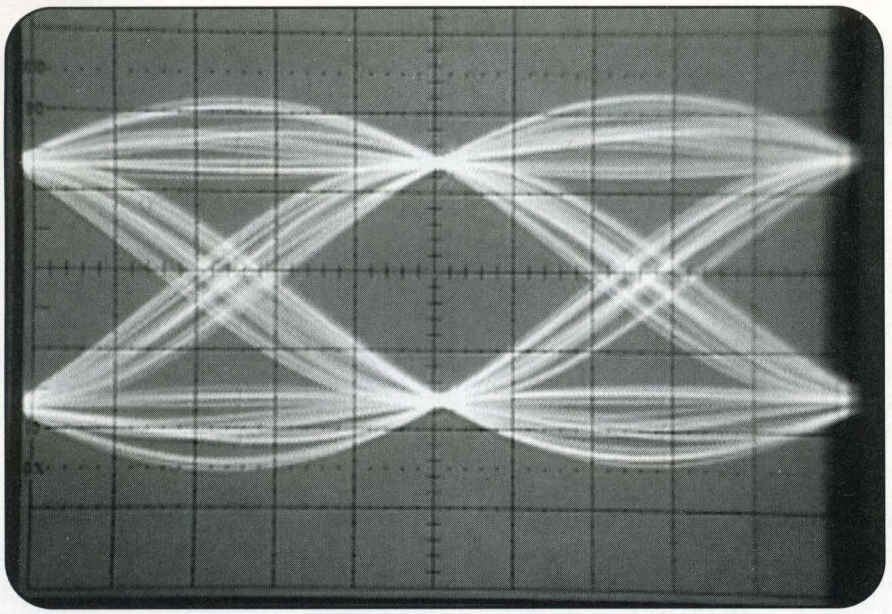


Photo B: An Eye Pattern. Note that all of the signal traces converge into a tiny point at the top and bottom of the display. These are called the decision points, and the goal is to make these as small as possible.

When everything is right, these bits all follow similar paths and converge at the two "decision" points. It's at exactly these points in time that the modem "decides" whether the received signal represents a zero or a one. If all the bits converge into a very small area, the modem has an easier time deciding, and you have very few bit errors. If the bits are spread out a lot, then you'll see more bit errors. It doesn't take a genius to figure out that lots of bit errors makes for a lousy data link.

"Eye patterns are a common yet powerful tool used in data transmission work."

When the convergence points spread out vertically, it means there's a lot of noise in the signal, which could also be caused by excessive filtering or other loss of signal. Horizontal spread means the data has excessive jitter in the time axis.

To view an eye pattern, connect an oscilloscope to the test point in the modem just before the data slicer or zero-crossing detector, which is right after the second amplifier in the receive filter. (If you don't have a scope, you're out of luck). Then, you set the scope for external triggering, and trigger off the recovered RX clock signal, which is an output signal from the modem. In a PacComm NB-96 G3RUH-type modem, it's available at TP8; in other brand modems, the operating instructions should mention the correct point.

Set the modem into *Audio Loopback* mode (usually a jumper on the modem

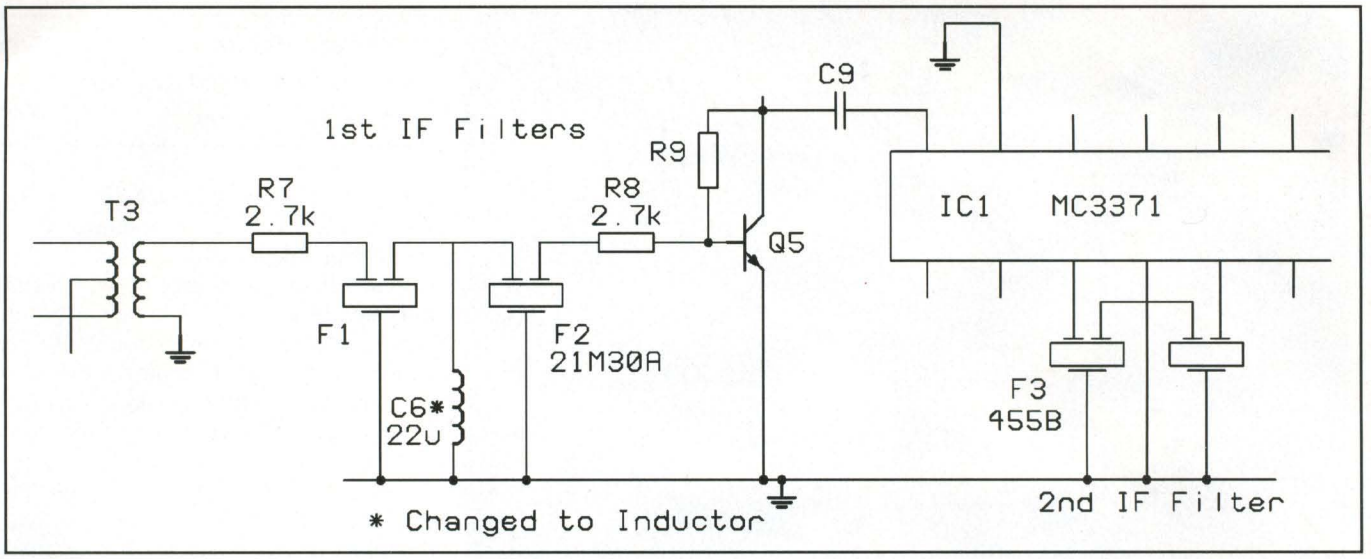


Figure 1: Partial schematic showing the first IF filters of the TEKK KS-900 data radio. Many other radios are similar. Note the input and output resistors, as well as the capacitor between the filters. See the text for the new values of these components.

board) and connect everything. As you speed up the time base to 10 mSec/div, the "eye" should take shape. If it isn't centered, change the trigger slope setting. The vertical setting should be set to whatever it takes to have the signal fill about half the screen. You should see something like Photo B.

The next topic, which is critical to understanding the modifications we're going to make, is IF filtering.

What's an IF?

A radio receiver converts a radio frequency (RF) signal to an *audio* or *baseband* signal by mixing the incoming signal with a local oscillator (LO) frequency. The mixing of these two RF signals creates a number of signals which represent the sum and difference of the two frequencies. The radio then chooses one of these new signals, which is called an *intermediate frequency* (IF), filters and processes it, then demodulates it to recover the originally transmitted signal. Often, this process is repeated one or two more times, and the resulting intermediate frequencies are known as the first IF, the second IF, and so on.

The processing and filtering in the IF stages is what lets you choose just one radio channel from many. By filtering out all the unwanted channels, you're left with what you want. When dealing with data signals, knowing the exact characteristics of any filtering is critical for error-free reception.

For a 19200-baud G3RUH-type signal, the bandwidth of the IF filters should be about 30 kHz. Narrower filters remove critical information, causing data errors. Wider filters cause more noise to enter the receiver, lowering the signal-to-noise (S/N) ratio. A low S/N ratio makes the received signal more difficult for the radio to correctly decode.

In a radio such as the TEKK, there are two IF stages, the first at 21.4 MHz and the second at 455 kHz. Some radios use other IF frequencies, such as 10.7 MHz, but the idea is the same. What you need to do is replace the original IF filters, which are 15 kHz wide (good for 9600 baud) with filters that are 30 kHz wide (for 19200). (See Photo C.)

The 455-kHz ceramic filter is fairly common, but you'll still have to search for one. Because you're using it for data, you want one with a 30-kHz bandwidth *and* with its phase delay characteristics optimized for minimum distortion. The ideal choice would be a MuRata-type SFH, which is a six-pole filter with optimized phase characteristics. A reasonable second choice would be a CFW-type, which is the same as SFH except that its phase response isn't optimized. In any case, insist upon a 30-kHz bandwidth, as anything less is just not enough for reliable operations.

The 21.4-MHz monolithic crystal filter is a little less common. Most of the major component suppliers offer something at 10.7 MHz, but I had to special-order the 21.4-MHz version. Again, you must have a 30-kHz bandwidth, and, when you order, ask what the specifications are, at least the input and output impedances, so you can change the resistors accordingly. You'll need two of these filters, but only one of the 455-kHz ceramic filters.

"For a 19200-baud G3RUH-type signal, the bandwidth of the IF filters should be about 30 kHz."

For the 21.4-MHz filters, you have to decide whether you want to use the two-pole or four-pole version. The two-pole is less expensive, and a little more forgiving of off-frequency signals, but it can't filter out adjacent signals as well. The four-pole filter costs about twice the price of a two-pole filter (which makes sense, since it's twice as much filter), but adjacent channel and out-of-band strong signal interference are better suppressed. I chose the two-pole filter because it was immediately available.

This information about IF filters also applies in general to other receivers. For example, a Motorola MITREK in the UHF band uses only a single IF frequency of 10.7 MHz and four two-pole monolithic crystal filters in its receive chain. Replacing these four parts with 30-kHz versions will help this radio work at 19k2, as long as other minor modifications are also made (bypassing *all* of the transmit audio filters, and taking receive audio directly from the discriminator). Without replacing the IF filters, it could never work at a high data rate. I haven't done this yet, but I have a MITREK on my bench and will get around to modifying

Replacement Chart

Following is a replacement guide for the components in the G3RUH modem that must be changed for 19200-baud operation.

Component (NB-96)	Original Value (9600 Baud)	New Value (19k2 Baud)
C26	220 pF	100 pF
C27	.001 µF	470 pF
C28	.001 µF	470 pF
C29	.0033 µF	.0015 µF
C30	470 pF	220 pF
C31	470 pF	220 pF
C32	1000 pF	470 pF
C18	.0047 µF	.0022 µF
C20	100 pF	47 pF
C21	.1 µF	.047 µF
R29	100k Ohm	51k Ohm

it sooner or later. I'll let you know how it turns out.

Modifying the TEKK

The first thing I looked at on the TEKK radio was the transmitter. It turns out that there are no modifications necessary for 19k2 operation. While the transmitter isn't perfect, the fraction of a decibel of improvement that might be realized from extensive changes isn't worth it. That kind of improvement can easily be offset by the loss introduced by a single connector in the antenna feedline, so I thought it best to let it be.

That leaves the receiver. When it comes down to it, all that has to be done here is to install wider filters for the first and second IF stages. As mentioned previously, the TEKK uses a first IF of 21.4 MHz and a second IF of 455 kHz.

The originally supplied first IF filters (there are two) are type 21M15B, meaning 21.4-MHz center frequency, Monolithic, 15-kHz bandwidth, and four poles (denoted by "B"). To replace them, I selected a type 21M30A, which has a 30-kHz bandwidth and only two poles (denoted by "A"). If you can find, and afford, the four-pole version (21M30B), it might be a better choice, as it has better adja-

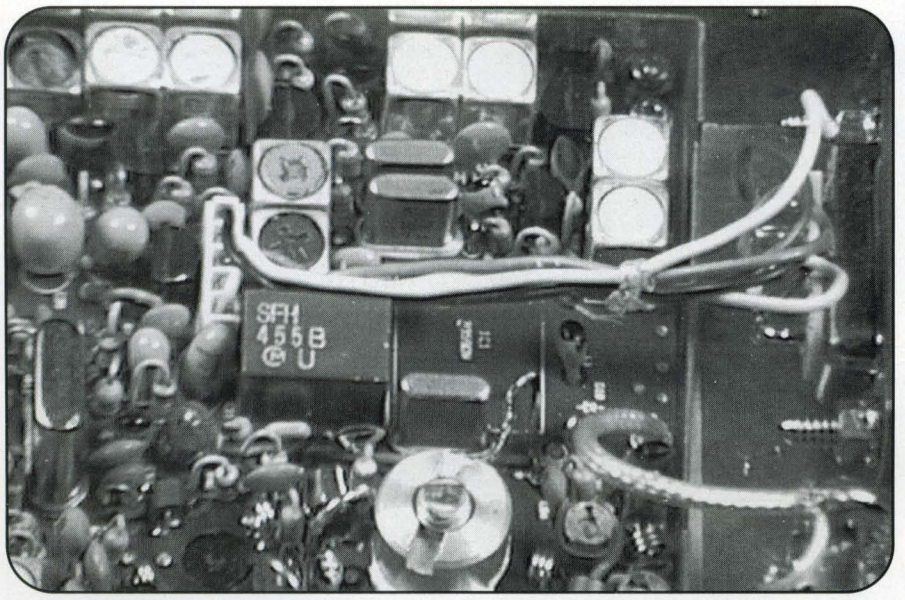


Photo C: Typical IF filters. The small metal ones that look like crystals are the first IF filters, the larger plastic one is the 455-kHz second IF filter. These are the parts that were removed from the radio.

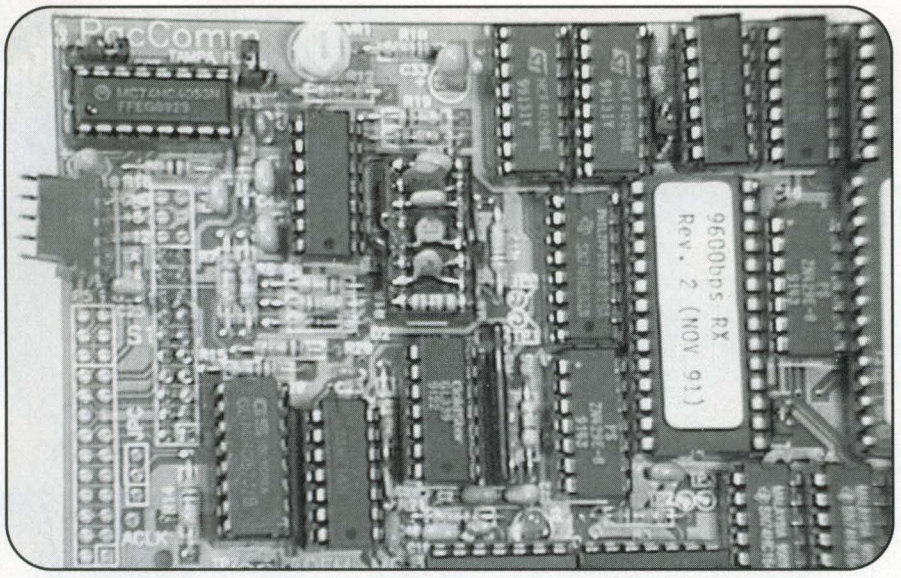


Photo D: The PacComm NB-96 G3RUH-type data modem. The eye pattern is taken from TP4 and the scope is triggered from TP8. The components that have to be changed are all shown, as is the output level adjustment potentiometer.

cent signal rejection than the two-pole version. But use whichever you can find.

Removing the first IF filters from the TEKK pc board was a bit difficult. The board is small and there's a lot of ground plane around the filters. This draws away all the heat, making unsoldering difficult. The ideal solution would be to use a vacuum desoldering station, but I don't have one since they're expensive. I ended up buying a desoldering iron from Radio-Shack (a real bargain, on sale at the time for half price, $5), which did the job wonderfully for me.

After replacing the first IF filters, it was time to deal with the second IF filter. I used a type SFH455B from MuRata. This one was a little easier to replace, but that little desoldering iron really let me do a clean job and save the old component.

After the components were changed, I tried a test transmission on the bench, looking for the ideal eye pattern. I noticed that it was much less than optimum, so, after resetting the transmit deviation and frequency, I started tweaking the matching sections near the first IF filters. Some slight improvement in the eye pattern can be achieved by readjusting the quadrature coil, the slug closest to the second IF filter, but you must keep rechecking these items as you progress. Photo D shows these components and adjustments.

Since the new crystal filters have a different input and output impedance from the originally installed filters, I had to change the input and output resistors. Unfortunately, I didn't have the manufacturer's information handy, so I had to use trial and error to come up with a value of 2.7 k. If you have the specs, the resistances should match the filter's impedance. If not, just plug in resistors until the eye pattern looks best. Refer to Figure 1.

At that point, the eye pattern wasn't all that bad, but it wasn't perfect. I tried tweaking the center filter capacitor and, when I removed it, the eye got better. After more trial and error, I ended up going with some negative capacitance (a 22-µH inductor).

It's important to understand that each crystal filter is different. While there might not be much variation within a manufacturer's lot, filters from different manufacturers can vary widely. This means that the values I used for match-

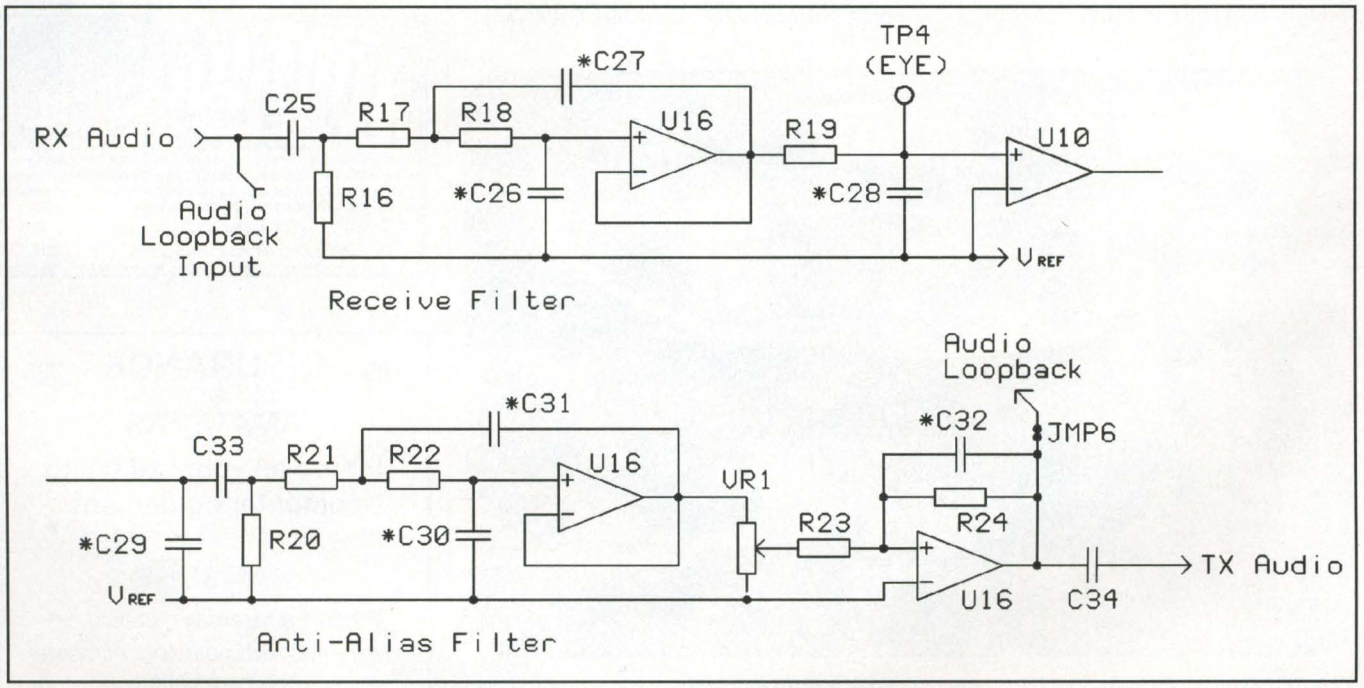


*Figure 2: Partial schematic of a G3RUH modem, with the components to be changed marked with an *. All of the values shown must be reduced by half, so it might be easier to simply put a capacitor of the same value in parallel with the original.*

ing to the filters are not universal: you'll have to determine the best value for the specific radio you're working on.

Aside from needing a good variety of resistors, inductors, and capacitors, the trial and error part went well, considering that there are only three components involved. Of course, I was constantly adjusting the deviation, frequency, and quadrature coil, always looking for the best eye pattern. The goal, of course, is to come as close as possible to a perfect eye pattern. However, that's about all there is to the modification, and the same technique applies to almost any crystal-controlled radio.

Modifying the G3RUH Modem

This whole process assumes that you already have your G3RUH-type modem modified for 19k2 operation. I happen to use PacComm NB-96 modems, though all of the modems available today work just as well. The G3RUH modem is kind of unique, in that changing the baud rate only involves changing the value of a few filter capacitors. If you don't make the change, it won't work.

The NB-96 manual states that all of the components you need to change are on a component header for easy modification. Unfortunately, that isn't entirely true: some are on the pc board. In comparing the NB-96 with G3RUH's original design, I noticed that PacComm has taken some liberties on which components needed to be changed. I suppose you could get away with only changing the components on the header, but I didn't want to take the chance.

Figure 2 shows all the components that need to be changed, and their new values (which are always half the 9k6 values) are shown in the "Replacement Chart." Don't forget to set the radio baud rate in the TNC to 19200 after changing these components! For the capacitors mounted on the board, I found it easier to just tack-solder a capacitor of the same value beneath the board. For the rest of the changes, invest a dollar in a new component header.

If you're using a different brand of modem, the owner's manual should cover this modification. If not, contact the manufacturer for help.

Ready to Try It?

So, there you have it. Even if you don't go out and modify all of your rigs for higher speed, at least you can say you know what's involved and how to do it. The two keys to high-speed packet are IF filtering and eye patterns. Once you understand the concept of eye patterns, and learn to use them to your advantage, you'll find them to be a very powerful tool for analyzing data transmissions.

If you do nothing else, find someone with an oscilloscope (or buy one, they're available used for under $200) and check the eye patterns on all your higher-speed links. Who knows, maybe you'll finally fix that flaky link once and for all! Finally, if you seem to be doing the modification right but can't get the eye pattern to look good, don't despair—we'll take a closer look at eye patterns next month.

Well, once again, I've run out of space for this month. Next month, aside from more on eye patterns, we'll describe the construction of a simple test transmitter for data signals. When you want to fool around with IF filtering, as we did this month, this handy little gizmo really makes life easier. I also want to say thanks to everyone who writes, because it really is good to hear from you.

Until next month, 73 and remember to have fun.

Resources

21.4-MHz Monolithic Crystal IF filters, 30-kHz bandwidth, are available from International Crystal Manufacturing Co., Inc., P.O. Box 26330, Oklahoma City, OK 73126-0330; Phone: (800) 725-1426.

455-kHz ceramic filters, optimized for data use, are manufactured by MuRata Erie North America, 2200 Lake Park Drive, Smyrna, GA 30080; Phone: (800) 394-5592 or (770) 436-1300. Call for the name of a local distributor.

TEKK radios are manufactured by TEKK Incorporated, 226 Northwest Parkway, Kansas City, MO 64150; Phone: (816) 746-1098. Call for the name of a local distributor.

The Oldest Operating Ham Satellite

Launched in 1984 as UoSAT-2, UO-11—and the Surrey Satellite Program—keep on rolling along.

On March 1, 1984, a Thor rocket took off from Vandenberg Air Force Base in California. Seventy-one minutes later, a satellite named "UoSAT-2" was released from the rocket over Turkey. The command station in England, at the University of Surrey, sent the commands to initialize the on-board computer (OBC) and turn on the satellite. The 145-MHz beacon instantly began transmitting telemetry, much as it does today—13 years later.

In addition to the UoSAT-2 name coined by its builders in Surrey, AMSAT assigned the new satellite the name UoSAT OSCAR -11, or UO-11. This downlink-only "bird" provides data and digital image transmissions on three bands. Before we discuss this satellite's capabilities, let's look at a little history.

In the Beginning...

The UoSAT satellite program began at the University of Surrey (England) Engineering Department in 1979, under the direction of Dr. Martin Sweeting. The group had its first satellite, named UoSAT-1 (University of Surrey Satellite #1), launched in 1981. This feat demonstrated the group's ability to design an inexpensive, yet sophisticated, spacecraft in an academic environment. UoSAT-1 was still operational in October, 1989, when its orbit brought it too far into the Earth's atmosphere and the satellite burned up.

UoSAT-2 was born when an unexpected launch opportunity presented itself to the Surrey group in October, 1983. In a period of only six months, the group responded by designing and building a new satellite, and interfacing it to a U.S. Delta rocket launching the LANDSAT-5 satellite. To get the project done on time, the group had help from both within the university and from outside volunteers. This group of dedicated people often worked 120-hour weeks. It never fails to impress me how much a dedicated group can produce...even when their only reward is a sense of accomplishment.

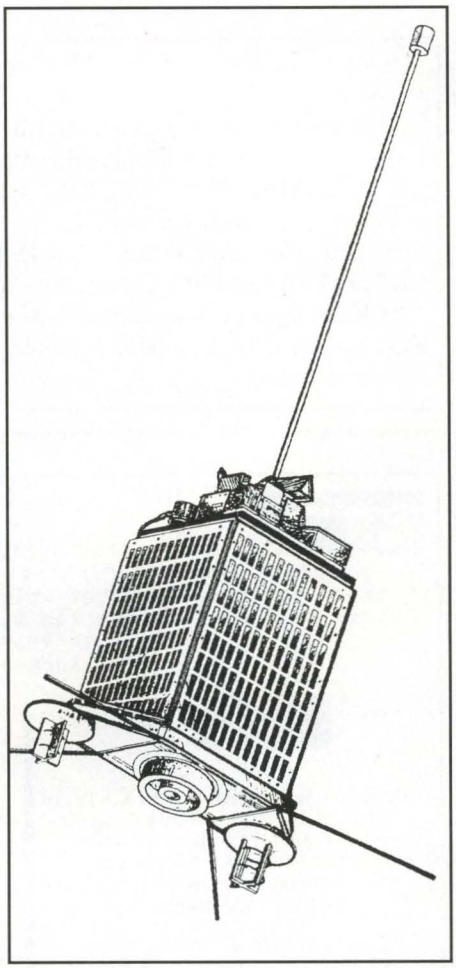


Figure 1. Drawing of the UoSAT-2 satellite, also known as UO-11.

After a flawless launch and deployment, UO-11 transmitted for three days, then shut down. The problem was apparently a component failure in the data presence detector of the VHF primary uplink. The software was reconfigured to work around the problem and the satellite returned to full operation. These software "work-arounds" have been incorporated into all subsequent Surrey satellites to provide flexibility in case of a problem.

UoSAT and SSTL

The UoSAT group at Surrey remains an academic unit of the university's Electrical Engineering Department. But satellite building has become a business for the school as well.

To build upon the successes of UoSAT-1 and UoSAT-2, the university formed a separate company, Surrey Satellite Technology, Ltd. (SSTL), in 1985. SSTL works in conjunction with the UoSAT group to produce satellites at Surrey. SSTL has provided additional income, laboratories, buildings, and opportunities for the university and its students to participate in satellite technology. Together, these groups provide one of the most advanced teaching and technology transfer institutions in the world for small satellite research, design and engineering.

"It never fails to impress me how much a dedicated group can produce...even when their only reward is a sense of accomplishment."

For the last 10 years, many of the key systems used in AMSAT satellites and in groundstations have been provided free of charge to the amateur radio community by volunteers trained at Surrey. The

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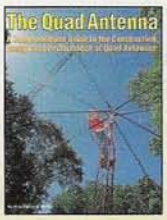

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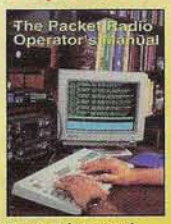

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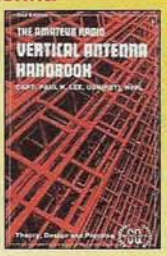

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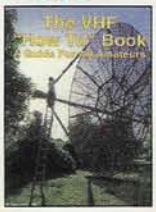

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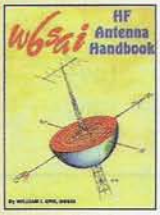

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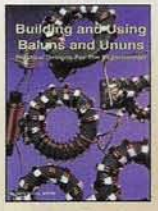

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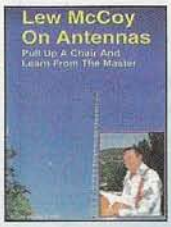

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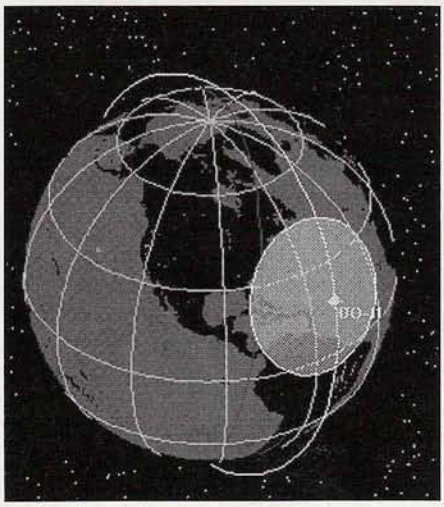

Figure 2. UO-11 orbit plane from the "Nova for Windows" tracking program.

university offers a truly outstanding, hands-on post-graduate experience to aspiring satellite enthusiasts from all over. Table 1 lists all of the satellites built either at Surrey or by people who were trained there.

Table 1. Surrey Built and Influenced Satellites

Satellite	Launch	Description
UoSAT-1	1981	(UO-9) amateur, orbit decayed, burned up on re-entry 13 Oct 1989
UoSAT-2	1984	(UO-11) amateur, operational, over 13 years in orbit
UoSAT-3	1990	(UO-14) amateur switched to commercial, supporting routine digital store-and-forward communications
UoSAT-4	1990	(UO-15) amateur, no longer operational
UoSAT-5	1991	(UO-22) amateur, supporting routine digital store-and-forward communications
KITSAT-1	1992	(KO-23) amateur, technology transfer to KAIST, supporting routine digital store-and-forward communications
S80/T	1992	commercial for MATRA-ESPACE, operational
HealthSat-2	1993	commercial for SatelLife, supporting routine digital store-and-forward communications
KITSAT-2	1993	(KO-25) built by KAIST, supporting routine digital Store and Forward communications
PoSAT-1	1993	(PO-28) commercial, technology transfer to Portuguese iNETi, some amateur operation possible
CERISE	1995	commercial, Alcatel Espace, operational
FASAT-Alfa	1995	commercial, technology transfer to Chilean Air Force, failed to deploy from the launcher

Structure of UoSAT-2

First, a terminology note: in general, I'll refer to this satellite as UoSAT-2 when discussing pre-launch events and as UO-11 for events that happened after the satellite achieved orbit.

UoSAT-2 was constructed using basically the same model as UoSAT-1. The body is rectangular (35 cm x 35 cm x 58 cm) with a *gravity gradient boom* (which we'll explain below) to keep the CCD (charge-coupled device) camera pointing toward Earth. This satellite is somewhat smaller than UoSAT-1 due to a smaller available area on the launch vehicle in which to mount the satellite (see Figure 1).

Two of the SHF antennas and two of the experiments were placed on "wings" extending 16 centimeters from the base of the satellite. The 2-meter/70-centimeter turnstile antenna is also visible on the bottom of the spacecraft. The CCD camera and the 2.4-GHz antenna both point down toward the Earth. The high-efficiency solar arrays occupy most of the satellite's rectangular body. Each side is capable of producing 1 amp at 28 volts when fully illuminated. The *navigation magnetometer* and *space dust* experiments are mounted on top of the wings above the SHF antennas. (We'll discuss UO-11's experiments in more detail below.)

Satellite Stability

The gravity gradient boom is made of a steel measuring tape material and extends 7 meters (23 feet) above the spacecraft. The combination of a 2.5-kg mass on the end of the boom and the satellite body gives the satellite a "dumbbell" configuration which causes the satellite to naturally line up with the Earth's magnetic field, the body of the satellite acting like a pendulum.

The satellite also maintains stability by using *magnetorquers* (coils of wire built into all six faces of the spacecraft). Selectively applying a voltage to these wires causes the resulting magnetic field to interact with the Earth's magnetic field, forcing the satellite to rotate. This rotation gives the satellite rotational stability and keeps the sun's heat equally distributed. Magnetorquers have become a standard feature in amateur satellites. They are effective, reliable, and cheap, and the energy to operate them is renewable—not to mention they're a shrewd concept.

VHF	145.825 MHz beacon using AFSK(Audio Frequency Shift Keying) on a NBFM (Narrow Band Frequency Modulation) carrier.*
UHF	435.025 MHz Beacon, using either AFSK or phase shift keying (PSK) modulation.
SHF	2401.5 MHz Beacon, using either AFSK or PSK modulation

** most common transmitter, although all three downlinks are still operational.*

Figure 3. UO-11 frequencies and reception modes.

Orbit

UO-11 was initially in a 9:00 a.m./9:00 p.m. sun-synchronous polar orbit about 700 kilometers above the Earth. A sun-

ASCII status	210 seconds
ASCII bulletin	60 seconds
Binary SEU	30 seconds
ASCII TLM	90 seconds
ASCII WOD	120 seconds
ASCII bulletin	60 seconds
Binary Eng data	30 seconds

Figure 4. The UO-11 Data Transmission Schedule, as of April 16, 1997. See text for an explanation of what all this means.

synchronous orbit means that the satellite spends a great deal of its orbit in the sun, which is very good for a satellite since the batteries can keep charging as power is used. If a satellite stays in eclipse (out of the sun) too long or gets used too much while in eclipse, the battery voltage can get too low. When this happens, the satellite shuts down the transponder to conserve energy.

The orbit of UO-11 is higher than that of most other amateur satellites so much less atmosphere is present to interact with the satellite. The higher orbit also gives UO-11 a wider footprint (coverage area) and longer reception window. Typical passes last about 12 minutes. You can see from Figure 2 that the orbital plane of UO-11 is not perpendicular to the equator. The angle, called *inclination* in the Keplerian elements, is actually 97.8 degrees. This is the angle formed with the equator as the satellite crosses the equator going south to north.

A Little Orbital Math

Curiously, UO-11's evening passes are not *exactly* 12 hours after the morning passes, despite its sun-synchronous orbit. Can you figure out why? Here's a little orbital math...

$$\frac{360^\circ \text{ Earth rotation per day}}{24.5^\circ \text{ rotation per UO-11 orbit}} = 14.6938 \text{ UO-11 orbits per day}$$

14.6938 UO-11 orbits per day * 98 minutes per UO-11 orbit = 1439.999 minutes per day

$$\frac{1439.999 \text{ minutes per day}}{60 \text{ minutes per hour}} = 23.9999 \text{ hours per day}$$

Therefore, a UO-11 "day" is slightly shorter than a "day" here on Earth, meaning that each succeeding group of passes will be just less than 12 hours after the previous set. I love it when theory is confirmed by real life measurements.

Currently UO-11's orbit is 660 kilometers, still high enough for atmospheric particles to have little effect upon the spacecraft. So little, in fact, that it's necessary to update the Keplerian elements only every few months. (Keplerian elements, by the way, are statistics used to calculate a satellite's position at any given time and to predict when and where it will be visible from your station.) UO-11 is expected to orbit the Earth for about 40 more years.

Orbital Mechanics

UO-11 has a *period* of 98 minutes. This means that it takes 98 minutes for the satellite to make a complete orbit. The satellite orbits in the same plane in relation to the Earth, while the Earth turns under it. Each time the satellite makes a complete orbit, the Earth has moved 24.5 degrees to the east. Most locations in the mid-latitudes will get three passes each evening and three each morning. The satellite footprint generally includes your QTH in one pass to your east, one pass close to you, and one to the west.

If you look at Table 2, the UO-11 Visibility Chart, you'll notice that about every third day, there are only two passes. This is because the passes occur about 13 degrees east and west of your QTH.

Table 2. UO-11 Daily Visibility Schedule (from the "InstantTrak" Program)

Satellite Schedule
Satellite: UO-11
Station: WA4SXM
Hour - UTC

```
          0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
04/21/97 ____________________*____*____________________*____*____
04/22/97 ____________*___**___**____________________*___**___**___
04/23/97 ____________**___*____*____________________*____*____*__
04/24/97 ____________*___**_____________________**___**_____
04/25/97 ___**___**___*____________________**___**___*___
04/26/97 ____*____*____*____________________*___**___**__
04/27/97 ____________**___**____________________**___**_____
04/28/97 ____*____*____*____________________*____*____*___
04/29/97 ____________**___**___*____________________**___**___*___
05/01/97 ____*___**___**____________________*___**___**___
05/02/97 ____________**___**___*____________________**___*____*___
05/03/97 ____________*____*____________________*___**_____
```

```
** UoSAT-OSCAR-11  NBC **
Diary Operating System V3.7

  Date: 28/3/97(FridBy)
  Time: 21:34:56 UTC
  Auto Mode is selected
  Spin Period: - @338
  Z Mag firings:  144
  + SPIN firingr: 1
  - SPIN birings: 58
  SEU coent  -22192
  WOD commenced 22 /2 /97 at 0 :0 :5
  with channels 40,50,52,63,
  Last Command: 109 to 0, 0
  Attitude control initiated, mode3
```

Figure 5. Sample 7-bit STATUS from UO-11 (with errors as received).

The footprint of the pass before the visible one and the pass after the second visible one are just out of your area. These two visible passes will both have high elevations and last longer than two consecutive passes during a three-pass day.

Think of the satellite as always moving in a counter-clockwise direction around the Earth while the Earth is moving under it. Since it takes 24 hours for the Earth to make one revolution, about 12 hours after the first pass of the day, your QTH is on the opposite side of the Earth in relation to the orbit of UO-11. So the satellite presents another set of three visible passes because your QTH moves into the other half of the satellite plane.

For the morning passes, your QTH will see UO-11 moving from north to south. The evening passes see the satellite moving from south to north, because each spot on Earth passes through the satellite's orbit plane (refer again to Figure 2) about the same time each day. Since the orbit is sun-synchronous, the satellite appears at about the same sun time each day (*see "A Little Orbital Math" to learn why the time varies slightly each day.—ed.*). The Earth rotates 24.5 degrees in the 98 minutes it takes UO-11 to orbit the Earth. This means that the footprint of each succeeding pass is 24.5 degrees west of the previous one.

UO-11 Experiments

Even though there was limited design time for UO-11, a number of experiments aboard have provided data to students and the amateur world. There is a *Particle Detector* experiment on board to measure the energy of particles encountered in space. A *Wave Correlator* experiment measures the magnetic fields in the *D*, *E*, and *F* regions of the ionosphere as the satellite passes through them. The *Space Dust* experiment measures the momentum of the impact with space particles. The most notable though are the *Digital Communications Experiment (DCE)* and the *CCD camera* experiment.

The DCE was built in 1985 by AMSAT and VITA (Volunteers in Technical Assistance) groups in the U.S. and Canada and used 128 kilobytes of RAM (*quite a lot back in 1985—ed.*) to store uplinked messages and later download them. This experiment was designed to investigate techniques in digital "store-and-forward" communications. Lawrence Kayser, WA3ZIA/VE3, Harold Price, NK6K, and Jeff Ward, K8KA, worked on versions of the software that was to perform the first amateur store-and-forward communications. Harold and Jeff went on to develop the *PACSAT Protocol Suite* for digital store-and-forward operations now used on AO-16, LO-19, UO-22, KO-23, and KO-25 (*see "Orbital Elements, April, 1997,* CQ VHF—*ed.*). Since this was the initial space version, only a limited number of amateurs participated in the experiment. These experiments provided invaluable information that refined the development of the PACSAT Protocol Suite.

The CCD (Charged Coupled Device) camera used on UoSAT-2 was much improved over the one flown on-board UoSAT-1. The digital pictures taken from space were 384 x 256 pixels in size, using 128 gray levels. In addition to the improved picture resolution, several downlink data rates and error detection

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Satellite News 15th March 1997 from AMSAT-UK
=============================================

* UK Colloquiem *
The 12th AMSAT-UK Colloquium will be held at UoSat from 25th to 27th July with
three days of technical and operatiOnal matters only (NO "political" subjects).

Amsat-UK invite authors to submit papers for this event and for the
"Proceedings" document which will be published at the same time. We prefer authors
to present the papers themselves rather than having someone else read them in the
authors' absence, but we also welcome "unpresented" papers for the document.

Abstracts should be submitted as soon as possible; the final date for
acceptance is likely to be 15 June 1997 so that the "Proceedings" document be avail-
able to participants.

Submissions should be sent *ONLY* to G3RWL, via the following routes:
Internet e-mail:        g3rwl@amsat.org
Packet Radio:           G3RWL @ GB7HSN.#32.GBR.EU
Satellite:              AO16/19/22/23/25
Terrestrial mail:       R W L Lhmebear G3RWL
                        60 Willow Road
                        Enfield EN1 3NQ
                        United Kingdom.

(I have no fax)

Informapion about the Colloquium will shortly be available on the World Wide Web
pages at the University of Surrey on:
http://www.ee.surrey.ac.qk/CSER/UOSAT_amateur/collkq97.html

NGTE. SEND ALL ODHER INQUHRAES ABOUT COLLOQUIUM TO THE
AMSAT-UK OFFICE:
AMSAT-UK
LONDON
12 5EQ
```

Figure 6. Excerpts of 7-bit bulletin data from UO-11 (with errors as received).

We apologise for t(e lack od news recently; this was due to communications problems between G3RGL and UoSAT.

* Keplers *
SBtellite: UO-11
Catalog numqer: 4781

Epoch time:	97069.43999179
Element Set:	956
Inclination:	97.8238 deg
RA of node:@	54.6777 ddg
EccentriFK#K:	0,00115
Arg of perRGee:	325.#596 deg
Mean anomaly:	34.6656 deg
Mean motion:	14.69531065 r%v/daq
Decar rate:	1.36E-06 rev/day^2
Epoch rev:	69675

* Feedback RequEsted *
We are always interested in YOUR #omments on the serfice but few people tell us. What would you like to see included ?
NB each bulletin is limited to 3000 bytes.

Please reply to:
UoSAT Command & Control Centre
Centre fob Satellite Engi\eering Rdsearch
Unitersity of Surrey
Guildford, Surrey GU2 5XH
United Kingdom

or send a message to G3RWL via Internet at g3rwl@amsat.org or via terrestrial packet radio (@ GB7HSN.#32.GBR.EU) or on Oscars 16/19/22/23/25

If you place this bulletin on a terrestrial packet netwnrk, please use the bulletin identifier $BAD UO11.102

73 dE Richard G3RWL fo2 Amsat-UK and UOSAT

and correction schemes were tested to provide the best possible pictures. These pictures may seem elementary by today's standards, but they offered quite a challenge 14 years ago.

Tuning in UO-11

To all but those stations participating in the DCE experiment, UO-11 is a receive-only satellite (see Figure 3 for frequencies). The equipment necessary to receive UO-11 digital data is a 2-meter FM receiver and antenna, a terminal or a computer running a terminal program, and a suitable modem/decoder. One of the most common of the latter is a modified 1200-bps Bell 202 modem (the signal polarity to the computer is reversed). The Bell 212-type modems used several years ago by most personal computers will not work for UO-11 reception because they use phase-shift modulation, while the 202 modems—and UO-11—use audio-shift modulation. There is a simple three-IC (integrated circuit) demodulator circuit found in the August, 1984, *QST* that will work during the strongest part of each satellite pass.

You can also receive UO-11 with a PK-232-type TNC, after making a simple toggle switch modification described in a 1990 *AMSAT Journal* article and AMSAT's *Decoding Telemetry* book. In

"The satellite footprint generally includes your QTH in one pass to your east, one pass close to you, and one to the west."

```
00469B01434202239A03339A0404110503060601700704120803 6D090339
10512711294F12000313058F14199415608A16192D1742331836 4819465F
20511721229A22662223000124000625000726088427402328412D29423E
30149F31033232286D33589434006135219C36278837363238402D39436B
40748F411141426462430610441625450001460002474142484338493 99E
50579E51126152654053659C54705355622656190B57422658356D59424E
60A20E615FC1625F4A633350644402651E0C66084C67F00E68000E69000F
-UOSAT-2          9703305214432

00436101424302237403342604041105030606017007041208036D090339
10512711294F12000313058F14178B15609B16192D1742221836 5919465F
20510621229A22662223000124000625000726088427402328413C29423E
30156131033232286D33586B34006135221736279937363238402D39436B
40748F411141426462430601441625450001460002474142484338493 99E
50581951126152655153661754700655622656190B57422658356D59424E
60A286615FC1625F4A633350644402651E0C660BE567F00E68000E69000F
-UOSAT-2          9703305214437
```

Figure 7. Sample 7-bit ASCII TELEMETRY from UO-11.

addition, UO-11 guru Clive Wallis, G3CVW, says you can use a Baycom-type modem with *no* output inversion required (simply connect its output to "RXD" instead of "CTS"); or, if you don't mind tying up two serial ports on your computer, using a HAMCOM interface instead of a modem will also work. More information is available on Clive's World Wide Web site, which is referenced under "Resources" at the end of this article.

UO-11 Digital Data

The ASCII data transmitted by UO-11 is decoded using a special modem (see above) with terminal settings of 1200 bps, 7 data bits, EVEN parity, and 2 STOP bits. To make life interesting, some of the data transmitted is in 8-bit format. This data can cause some strange behavior with most terminal programs because some of the information is interpreted as control characters or sequences. These often instruct the terminal program to perform certain operations that the user didn't anticipate. I mention this because it's the rule rather than the exception to have most terminal programs lock up or go into an unusual mode while receiving UO-11 data.

If you watch the decoding while listening to the signal for a time, you can pick out which data format is being transmitted by the beat of the received signal. This is a very interesting exercise, but not entertaining for everyone. The best way I've found to cope with this is to record the signal on an audio cassette, play it back while decoding the data in 7-bit mode, then play it back again in 8-bit mode.

"It's the rule rather than the exception to have most terminal programs lock up or go into an unusual mode while receiving UO-11 data."

The data transmission schedule changes periodically, but is similar to the one found in Figure 4. The data from UO-11 provide a range of information, from bulletins to telemetry to *WOD* (Whole Orbit Data) and experimental data. Figures 5, 6, and 7 offer examples of the type of data you can expect to receive from UO-11. Bulletins are self explanatory. Telemetry describes the state of the satellite systems; for example. temperatures, voltages and current. WOD provides historical data for certain areas. Rather than just getting a glimpse of how the satellite is performing for the small amount of time that it is overhead, WOD stores the data at five-second intervals for many orbits. This data is invaluable in actually knowing how the satellite is performing throughout an orbit.

Hook up Your "Telemeters"...

This month's introduction to some of the housekeeping data transmitted by UO-11 provides a perfect segue to next month's column on amateur satellite telemetry. Round up your pencils and calculators, it will be a fun exercise. ■

Resources

A great deal of information about the University of Surrey, SSTL, and the UoSAT program can be found on the university's World Wide Web site at <http://www.ee.surrey.ac.uk/CSER/UOSAT>.

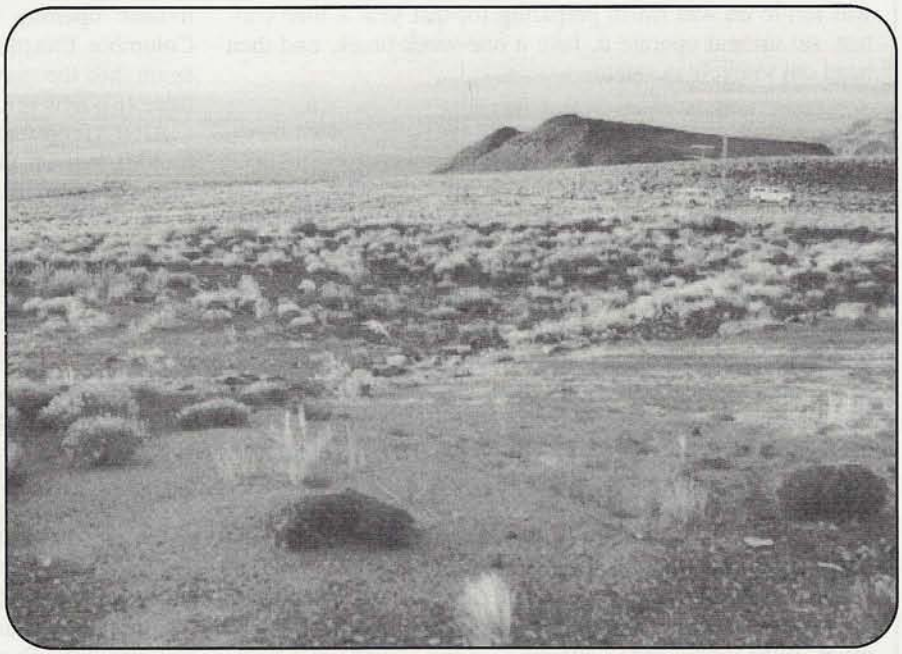
Clive Wallis, G3CWV, often writes about UO-11 in the AMSAT-UK publication *OSCAR NEWS*. In addition, Clive maintains a UO-11 Web site with current information, bulletins, sample data files, and decoding programs. It's at <http://www.users.zetnet.co.uk/clivew/>.

For general information about amateur satellites and the *Decoding Telemetry* book, contact AMSAT, the Radio Amateur Satellite Corp., at P.O. Box 27, Washington, DC 20044; Phone: (301) 589-6062; Internet: <http://www.amsat.org>.

The Lure of the DXpedition

Whether it's a remote Pacific Island working Europe on 80-meter SSB or a rare Nevada grid square working pileups on two, the thrill of "being there" just can't be beat!

With summertime temperatures and 50-MHz *Es* (sporadic-*E*) both nearing peak levels, life is good! Many evenings and weekends are consumed by the passion to find and work a new state, grid, or country. Many hams (including myself) take it upon themselves to activate rare grids near their homes with mini DXpeditions known as *GRIDXpeditions*. Here's a chance to be "REAL DX" with all that it entails—travel, portable operation, big pileups, hundreds of QSL requests, notoriety, etc. It can be extremely addicting (I speak from experience)!



The view looking south from Booker Mt., Nevada. This was one of Tim's many stops during "The Great Nevada Grid Grab of 1995" and was also his operating location for last year's ARRL June VHF contest. (K7XC photos)

DXpeditions and Contesting

I was bitten by the DXpedition bug back when I was still into HF DXing. On a warm summer's evening back in 1980, Jim, KF7E, showed me his DXpedition slides to the islands of Tokelau, Tonga, American Samoa, and Western Samoa. During that presentation, I thought to myself, "If he could do it, why can't I?" That first spark of enthusiasm has grown to be a constant fire within me.

I began researching the requirements to pull off a successful DXpedition on a shoestring budget. It became almost immediately clear that Tonga (A35) was the logical choice: relatively rare, very economical travel costs, and a new international airport. I made it there for the 1986 ARRL CW DX Contest, had a wonderful time, and got hopelessly hooked on DXpeditioning! What a thrill to call CQ just once and run a pileup for the next eight hours! Or to work into Europe on 80-meter SSB using only a barefoot ICOM 730 and a Butternut HF6Vvertical, with just 15 feet of sand and two palm trees between it and the Pacific Ocean!

Back home, I dove into HF contesting, consistently placing well in the ARRL and CQ World Wide DX contests. But it never was as exciting as 100 watts on the beach in Tonga. By 1991, I was up to 18 contests a year, still doing well but feeling the strain of trying to be competitive on a shoestring budget.

Discovering VHF

On a whim, I borrowed a 10-watt IC-211 2-meter all-mode rig, grabbed a straight key, hooked it up to the 5/8-wave vertical on the car and gave the 1991 June VHF QSO Party a try. Wow! It was truly amazing what 10 watts would do! I drove all the way to Sacramento, California, that day—activating three grids and making 24 QSOs ("Qs" in "contest-speak"). I felt like a novice again! I'd found something completely new and different to explore and make mine!

Soon, I realized just how rare the surrounding grids were. There are 18 grids

"Here's a chance to be 'REAL DX' and all that it entails—travel, portable operation, big pileups, hundreds of QSL requests, notoriety, etc."

By Tim Marek, K7XC

The Great Nevada Grid Grab of 1995

During the winter of '95, I was planning our multi-op GRIDXpedition to DM19 for the June contest and wondered what other sites in the state were available. That's when "The Great Nevada Grid Grab of 1995"—circling the state, hitting as many grids as possible in nine days, and helping those who needed them for VUCC—was born. I've seen several others disappoint many by planning too large a trip and fail to pull it off, so I vowed not to do the same. It took a full two weeks of planning, using every map I could find, before I had a route and timetable I felt I could live up to.

Next, I had to determine the best time to go. Reviewing my logs of the past four years, the week surrounding June 22nd looked like it would yield several good *Es* sessions. All that was left to do was finish preparing for that year's June contest, set up and operate it, take a one-week break, and then head out to circle the state.

Going Grid-Hopping

I took the tower trailer, along with some decent Yagis, and planned to visit 11 grids in nine days. QRV (operational) at the 100-watt level on 6 meters, 2 meters, and 432 MHz, I planned to use a lot of CW for the greatest distances.

On Saturday, June 17, my 15-year-old dog, Lucky, and I were on the road by 8:00 a.m., heading to Booker Mt. in DM18. It took nearly the whole day to get there. Along the way, I contacted plenty of hams from northern California on 2 meters. We reached the top and got set up by 02:15 Z. Moderate *Es* for the first hour was encouraging. As the sun set, the folks in southern California faded in on 144 and 432.

The next morning, I was up at 12:30 Z to chase the "random rocks" (meteors) with limited success. By 17:00 Z, Lucky and I were on the road to Peoche, Nevada (DM27) via State Route 375, known locally as "The Extraterrestrial Highway." This is quite a lonely place with no services for its entire 127 miles. But Lucky needed attention, so we stopped at a roadside rest in the middle of nowhere. What a beautiful place! Shade trees, picnic tables, and a babbling brook! I didn't want to leave. It was so quiet....I don't think two cars went by in the hour we were there.

"That's when 'The Great Nevada Grid Grab of 1995'—circling the state, hitting as many grids as possible in nine days, and helping those who needed them for VUCC—was born."

There'd been very little *Es* so far, but as we passed through the northeastern corner of DM17, I was rewarded with a 30-minute opening into Washington, Oregon, and British Columbia. Exactly one hour later, in DM27, 6 meters opened again into the northwest for 30 minutes, giving many hams there two new grids.

After a food/fuel stop, I headed off to find the road to 9,500-foot Mt. Wilson, in DM28. As daylight faded, I took the wrong road and ended up at a spring in the middle of the valley. Quite pretty, really, with all the wild horses and range cattle, but nowhere near where I wanted to be. With twilight's last rays, I found a small knoll and set up for the night.

"Rocks" and Snow

I didn't work a soul on Sunday night, but the Monday morning rocks produced several Qs into the Northwest. Jim, NW7O, and Bill, W7TVF (both in DM26), filled me in on where I should have turned. Before long, I was packed up and headed to Peoche (DM27) for supplies. This time, I found the correct road and, 19 switchbacks later, was on top. Boy, *what a view*!

There was still snow in places, keeping the daytime temperatures in the 60s while the valley floor baked in the 90s. An hour later, I had the antennas up and began working folks. Still very little *Es* on six, but the tropo into northern California in Nevada and there is resident activity in only two of them. My first jaunt to DN00 was as if I had returned to Tonga! Since then, I have activated all the northern Nevada grids at least three times and all of them (except DM25) at least once.

After completing my own 2-meter VUCC (VHF-UHF Century Club award) in 1993, I began to contest from one rare grid or another, always exploring, looking for new sites to use in the future. I would be remiss if I didn't thank Larry, K6AAW, in CN80 and Jim, NW7O, in DM26 for their guidance and encouragement in the early years. Larry and I exchanged grids for a couple of years, giving each other quite a few new ones, while Jim provided me with the wisdom of one who has traveled the state activating rare grids since 1983.

My biggest GRIDXpedition—so far—was two years ago: a six-day, eight-grid trip I dubbed "The Great Nevada Grid Grab of 1995" (see sidebar).

"There are 18 grids in Nevada and there is resident activity in only two of them. My first jaunt to DN00 was as if I had returned to Tonga!"

Activity Reports

From Thomas Meng, N2DKP FN13bh:

3/28/97—I just worked N4P Z in EN52 at 2116 on 144.200. The Au seemed to peak from the west then shifted toward the east when I worked Ray W1REZ in FN55.

From Ken, NØYGM DM78ov:

30 March 1844 Z—6 m opened into DM04 and CN84. Initially heard USB phone on 50.125 MHz then moved up to 50.130 MHz and up to 50.145 MHz due to increasing activity. Heard NØXX/7 and others.

From Lee, WA7HQD DN31xa:

At 1358 UTC Sunday morning, N7ML came blasting through on 50.125 MHz calling CQ. By the time I fumbled around on my desk for my mic the burn was over, but it lasted for 30 seconds. My heart is still pounding over that one!

From Graham, F/G8MBI:

4/9/97—BBC World Service is giving out a news bulletin relating to a "Major storm from the sun approaching" This is the first time I have heard them do this. They say that

was wonderful! Signals started out 20 over S9 on SSB and by 1:00 a.m., all I could hear was weak, torn, shredded CW just above the noise floor (almost EME quality). Fun stuff!

A Change of Weather

Tuesday started at about 13:30 Z. Banging away on 6-meter rocks was the same northwest crowd that looked for me every morning before going to work. If it weren't for the rocks, 6 meters would have been a total disappointment. An hour and a half later, after giving NW7O three new band grids, I packed up and headed north.

After six-plus hours of driving, I made it to DM29 and Dan, KE7OI, in DN31, answered my 2-meter mobile CQ and spread the word. Meanwhile, the weather began to change. No longer hot and sunny, the clouds and wind started building and heading my way. Tired and behind schedule, I abandoned Success Summit Loop above Ely, Nevada (10,000-plus feet) and tried to work my up Taylor Ridge.

One of the hardest lessons I've had to learn is to know when to turn around. Discretion is the better part of valor, and, this time, I almost went too far. It cost me two hours of precious daylight to get turned around without falling off the mountain. Trying to find my way to the top, I became so turned around I again had to settle for a high spot on the road. I set up in the last rays of daylight, but hardly worked anyone, so Lucky and I curled up and called it a day.

A Change of Heart

I woke up Wednesday morning at 2:00 a.m., sore and shivering. It was sooooo COLD. It snowed overnight, leaving 1/4-inch of ice on everything. Blocked to the northwest, I was lucky to work anyone on the 6-meter rocks. Under way by 8:30 a.m., I decided to skip DN21 and head straight for Elko, our first real city in five days. Once in town, I replenished our supplies, washed some clothes, got Lucky a few treats, and then headed for Adobe Summit (DN20), just above town. A local ham, Jim, N7WVZ, stopped by for a visit and helped set up. On the air by 02:00 Z, this was the third-most productive stop of the trip, as I worked many folks in Utah, Nevada, Idaho, and California on all three bands. This was Jim's first exposure to 2-meter CW/SSB, and he was amazed at what 100 watts will do.

"I took the wrong road and ended up at a spring in the middle of the valley. Quite pretty, really, with all the wild horses and range cattle, but nowhere near where I wanted to be."

On Thursday morning, the rocks were falling fairly well, and, as I finished packing up, some *Es* finally began to make an appearance. I worked a handful of stations while mobile, heading for Mt. Moses in DN10. This was by far the most remote site yet, over 50 miles from the nearest pavement. The road was really rough and the tower trailer was having one hell of a time negotiating it. Whether from the heat, fatigue, or whatever, halfway up, I snapped, "To hell with this!"

I was on day number six of constantly pushing and operating, and boy was I beat. With nowhere to turn around, I abandoned the trailer, drove to the upper plateau, took a photo of Mt. Moses (still eight miles away) and went back down to reconnect the trailer and head for civilization.

Looking at my watch, I realized we could be home in five hours. Back on the highway, I locked the throttle at 70 mph and didn't stop till we arrived home at 10:00 p.m. Not quite what I had planned, but not bad for a lone VHFer with a geriatric dog. We traveled 1,342 miles, activated eight rare grids on three bands, and saw some of the best scenery Nevada has to offer.

I cataloged several contest sites. Booker Mt. in DM18 was successfully used in June 1996, and Mt. Moses in DN10 was our contest destination this June. Main lesson from the trip: I'd planned too many grids and too many bands in too short a time. Next time, I'll run two bands max, with much larger antennas, and spend a couple of days in each grid. Such is the life of a VHF GRIDXpeditioner!

NASA has issued a warning to satellite operators of possible damage to satellites. Sounds like this must be a big one.

From NØJK:

4/9/97—Heads up! N8ZAT 144201.0 K9DTB Calling CQ Aurora CW 2003 Z.

From Terry, WA3LTB EN92:

4/9/97—Some fairly good Au signals, worked EN41, FN55, EN52, FN23; nothing spectacular but some action on 144 MHz for a change....

From Ken, N8CGY EN74oh:

4/10/97 0040 Z—Aurora still going strong on 2 m. I've heard a few bits of Au on 432, but not enough to get a call and no answer came back after that. Still waiting for my first 70-cm Au QSO...who's it gonna be?

From John, WØLER:

4/10/97 0245 Z—Got into the aurora late. Did manage to work W2AH & KØGU in DM78 and DM70. Lots of W8s and W9s. Was looking for new grids. Sure wish I could have been on earlier.

From Steve, WA9JML:

4/10/97—I made my first aurora contacts tonight. I worked MI and IL, heard NY, MN, and SD. Didn't catch the grids on most of these. Signals were generally weak, but copyable. I guess I need more power and better antennas. I called quite a few stations, but was not heard by most. I was working on my homework in the computer lab tonight, and decided to check the e-mail. I saw the posts about the opening, finished the assignment in record time, and bolted for home.

From Ken, N8CGY EN74oh:

4/10/97—Here is a page from my logbook, 2244 Z 144.2 KAØRYT EN34, 2331 144.2 N4PZ EN52, 0052 144.2 K9MRI EN70, 0110 144.2 AC8W EN82, 0120 50.1 NØUSG EN34, 0130 50.1 N8ZJN EM79, 0200 144.2 KAØRYT EN34 (We tried 432.1 unsuccessfully, darn!), 0258 144.2 W1REZ FN55, 0305 50.1 VE3SXE FN25, 0308 50.1 VE3FIT FN03, 0312 50.1 VE2VAT FN45, & 0313 50.1 AA2QM FN34.

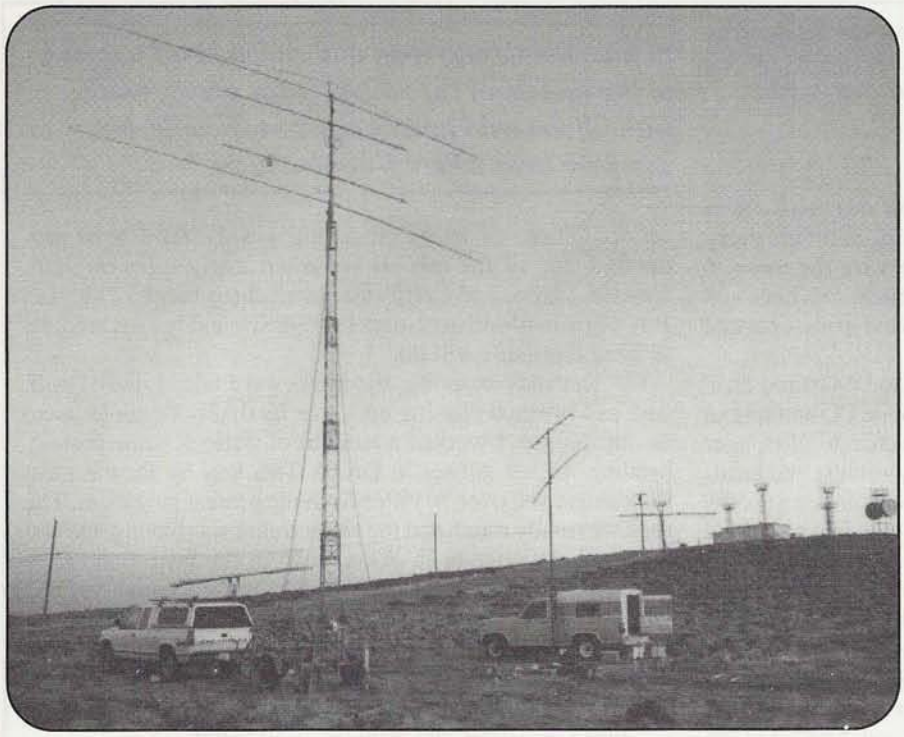
When I went to bed at 0400 there was still Au and plenty of stations to work. I could easily have made 100 contacts on 2 meters, but I was concentrating on making my first 432 Au contact. Didn't happen this time, though.

From Ed Fitch, WØOHU EN34oa:

4/11/97—Without much time or effort worked following on Au between 0130–0535 Z, Freq. 144.2 +/-, EM19, FN13, EN74, EN81 & EN82. Lots of loud signals and QRM. Only heard locals on 432.1.

From Barry, VE6MK DO33im:

4/11/97—The good Au condx brought on some auroral-*E*. Heard a number of stations out east. Couldn't catch anyone's attention until W2DRZ FN02 heard me. Also worked KB8MBC EN73. Right after that, KL7FZ and



The author's antenna setup atop Booker Mt. for the 1996 ARRL June VHF QSO Party. When he stopped there during "The Great Nevada Grid Grab," Tim was by himself and operated on only three bands.

KL7Y, both in BP51, called me off the back of my beam. Worked a few other KL7s, VE7s, and W7s. All this between 0516 Z and 0600 Z on 50.125.

From Barry, K8SD EN12:

04/11/97—Wow! Best time was between 01:30 and 03:30, running on 2 meters. 150 watts 12 el. @ 35 ft. States worked, CO, ND, MN, WI, IL,L MI, IN, MO & KS. Grids worked DN70, DN86, EN31, EN34, EN35, EN41, EN52, EN70, EN82, EM09, EM43 & EM49. I heard VE3FOD. It lasted until 05:00 or 06:00 Z.

From Jay, KØGU DN70mq:

4/11/97—Caught my first Au opening last night. Didn't sound quite like I expected, more like loud white noise, guess I was expecting a buzz or something. I worked the following, 0212 WBØSOK 55A EN34, 0214 WYØV 55A EN12, 0215 WB9SNR 55A EN62, 0218 NØLL 54A EM09, 0219 KØKD 56A EN31, 0233 KBØPYO 59A EN24, 0235 KAØRYT 52A EN34, 0237 K8SD 55A EN12, 0241 WB9HLM 52A EN52, 0246 WA9KRT 52A EN61, 0251 KØMQS 55A EN31, 0258 KAØZYD 53A EN34, & 0303 WØLER 55A EN35. Heard W7HAH, big signals KBØPYO and KØMQS. Heard nothing after 0315 but I kept CQing till after 04 Z

From Jon, NØJK EM17:

4/11/97—Heard aurora buzz on 1s and 2s on the RS-12 145-MHz downlink during the 0230–0245 pass. Listened on 144 MHz and copied KØMQS EN31, NØLL EM09, and KØGU DN70, on a 4-el. Yagi up 15 feet, all about 55A. The Boulder K-index was 7 at 0318 UTC.

From Dave Bernhardt, N7DB CN85:

4/11/97—Finally have an aurora to report. Yesterday I did notice a dip in electron flux levels on the satellites and suspected something was coming. I took off for awhile and when I returned, Dave, K7RWT, informed me of the aurora. It began around 0230 Z. I worked N7ML DN45 @ 0258 Z 53A on six. Worked KJ7Y CN87 55A @ 0304 Z, W7OE DN17 59A @ 0318 Z, heard W7HAH around this time on 2 m. Worked WB7DHC CN97 52A @ 0323 Z on six, sigs had really dropped by this time. Aurora came back some and tried VE7HCE CN99 @ 0430 Z and did work VE7MDL CN89 52A @ 0517 Z on six. No visible aurora here. This was a typical aurora for us: OR, WA, BC & western MT heard.

In Conclusion...

The Au of April 10 and 11 never made it this far south, but if it had, I'd have been there! Au is pretty rare at my latitude and longitude, occurring only about three or four times a year. Thanks to everyone for all the FB reports!

Now that we're into prime *E*s season, I expect the e-mail and fax machine to get real busy! Tim Marek, K7XC, 360 Prestige Ct., Reno, NV 89506; Phone: (702) 972-4722; Fax (702)972-5011; e-mail: <K7XC@vhf.reno.nv.us>.

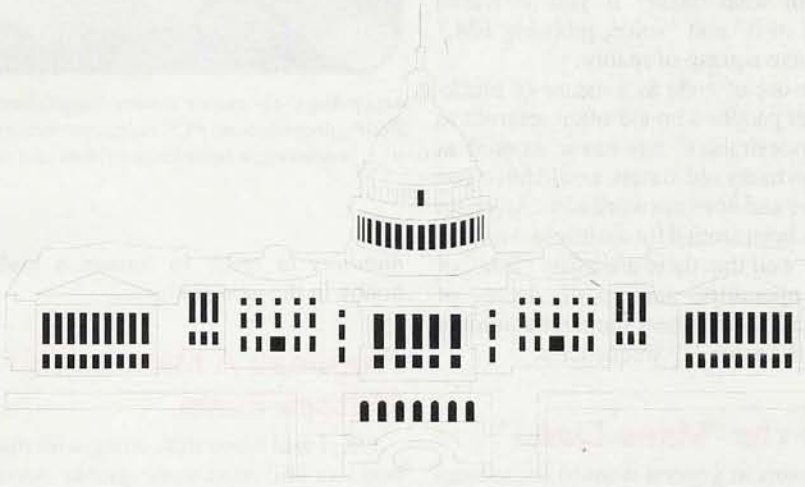
73 from DM09bp de Tim K7XC

A Mode of Operating Should Be a Choice, Not a Barrier

This month, we present the first of several responses to our May editorial, proposing changes in amateur licensing, from hams with proposals of their own.

Author's Note: This was originally written in response to *CQ VHF*'s April, 1997, editorial on an ARRL committee proposal to restructure "low-end" amateur licensing. Between the time I wrote my first draft and the issue in which this piece is published, *CQ VHF* came out with some proposals of its own. Some of them dovetail with mine in many respects, others—maybe not.

Keeping in mind that what I am writing is an opinion piece and *only* that, you may, of course, make your own judgments. I'd like to think that I have some valid ideas on the course that amateur radio should be taking, but I also recognize that unless *all* interested parties can work up a truly good compromise proposal, *and soon*, the FCC may act unilaterally and possibly upon interests other than just those of amateurs.



Will current requirements for increasing code proficiency as the "price" for greater privileges end up costing us the numbers of active hams we'll need to protect our bands from Washington "bean-counters"?

A good friend of mine and fellow ham who *is* an ARRL member has referred to code testing as a means of keeping out "undesirable" persons whom he believes would have an overall negative effect on the hobby. As you might expect, he was *not* a supporter of the No-Code Technician, or "Tech-Light," license, as he calls it.

I have been a Technician class licensee since 1976 and was a Novice for the two years prior to that. Now, that's over 22 years as a licensed ham, but, you know, I get quite a lot of grief from Generals, Advanceds, and Extras. In fact, more than I used to because many of them seem to have forgotten that *some* Techs didn't get in via the No-Code route. Since I started as a Novice, I passed a five-wpm code requirement and spent my two years foundering amidst a sea of QRM, much of it deliberately aimed at Novices by older ops.

In spite of that treatment, I hopped up to what was then referred to as "Technician (C)," which was an exam by mail given by a ham with a higher class of license. At that time, I took exactly the same written exam as the General class but only needed five wpm of code. Some years later, when the No-Code ticket came out, the Technicians previously existing became "grandfathered" into the Tech-Plus class and were given that lovely little sliver of voice privileges on 10 meters: 28.3 to 28.5 MHz. *(Actually, that "lovely little sliver" came first, along with voice privileges on 222 and 1296 MHz, in the "Novice Enhancement" proceeding of the late 1980s.—ed.)*

Now that I have dispensed with the personal introduction material, I'd like to more directly address the main issues from my perspective:

The Charade of Code Proficiency

First, I do not see how continuing to maintain the charade of a mandatory code proficiency really contributes much to amateur radio as a hobby or to our obligation regarding public service communications (in my opinion, we have such an obligation in exchange for having access

By Duane P. Mantick, WB9OMC*

**Duane Mantick, WB9OMC, lives in Lafayette, Indiana. He has been a ham since 1974 and holds, as he has since 1976, a Technician class license. Duane is active on 10, 6, and 2 meters.*

"Today's reality is that our ham spectrum needs desperately to be used, before some Washington bean-counter decides that we are not using it efficiently enough and takes it away from us."

According to the author, a more comprehensive written exam—emphasizing knowledge of radio theory, propagation, FCC rules, operating practice, etc.—would prepare new hams better than requiring a knowledge of dots and dashes. (Photo by Gordon West, WB6NOA)

to the spectrum). What percentage of public service communications is done on 2 meters and on 440 as opposed to all the rest of the ham spectrum combined? And in what mode? If you answered "most of it" and "voice, probably FM," you have a grasp of reality.

The use of code as a means of blocking out people who are often referred to as "undesirables" has never worked as well as many old-timers would have you believe and does not work now. Any ham who's been around for a while knows perfectly well that there are many "lids," or poor operators, among *all* classes of license. One can hear them on a number of well-known HF frequencies.

End the "Mass Class"

If hams in general want to try to keep the hobby clean, then one practice that needs to be terminated immediately is that of "mass-class," in which a large number of people are dragged through the No-Code process, licensed, and then dumped onto the airwaves with little or no *real* preparation. If we are going to "Elmer" new hams, then let's do it *right* and *not* just assume that the process ends when the license is issued. It should continue for some time, because the testing is totally inadequate when it comes to operating practice and procedure. Spend some time with new Tech-Plus licensees on 10-meter USB, and have a few of them tell you what "59" really means. You'll get the point.

Those old-timers who want to be selective on who gets *into* the hobby are thinking in the past—today's reality is that our ham spectrum desperately needs to be used, before some Washington bean-counter decides that we are not using it efficiently enough and takes it away from us. We have already lost 220 to 222 MHz, and we still face the threat of "Little LEOs" booting us off of 2 meters. Do you get the point, folks? Amateur radio needs *numbers* in order to remain a viable hobby in the next century.

Proposal: A Meaningful Written Exam

OK, I will agree that, along with numbers, we still need some *quality operating* to prevent utter chaos, like we saw on 11 meters a number of years back at the peak of the "convoy" days. But an excessively simple written exam plus a mandatory code requirement isn't going to protect us. My suggestion is that, if we want to lobby for something effective, then let us lobby for a much more comprehensive written exam at the entry levels. New hams need to know what they are *doing*—radio theory, propagation, FCC rules, operating practice, etc.—more than they need to know dots and dashes. And they need to be learning it a lot better than they currently are.

Still, none of this will prevent a strongly determined jerk from getting licensed. But combined with a more positive and organized Elmering system, it should result in a large number of better-trained hams joining the ranks and helping us defend the hobby by spreading out across the spectrum and *using* it effectively. My personal opinion is that the ARRL (of which I am *not* a member) should quit whining about the code and start using its time, talent, and cash to push for more stringent written tests as well as using its infrastructure to create, operate, and maintain a positive Elmer system to get new hams truly off to the right start and not just dump them onto the air and forget about them.

Proposal: A Single Code Test for HF

As for reducing the General class code test from 13 to 10 wpm, I propose a single five-wpm code requirement for all license classes that permit HF operation. After that five-wpm minimum proficiency is met, that should be the *end* of any further *required* code testing. Once the basic five-wpm code proficiency is demonstrated, all further upgrading should be accomplished via written exam.

A mode of operating should *not* be a barrier, but a choice. Those who like to operate code should be allowed to do so as they wish within the bands or subbands where it is allowed. And if those ops feel the desire or need to transmit code at more

"My suggestion is that, if we want to lobby for something effective, then let us lobby for a much more comprehensive written exam at the entry levels."

than five wpm, then let it be their *option*, their *choice*, to do so. But I think the time for *requiring* such proficiency has come, been here, and *gone*.

Proposal: Novice Class for HF Entry

Dump the Novice Class? I don't see that part of the ARRL committee's proposal as any kind of a solution. Rather, I think a two-pronged system of entry level licensing makes sense. However, the groups who would run classes should learn to use that system and make the distinctions clear to prospective hams, so that each license candidate can make his or her own choice about how to start out.

Keep a five-wpm code requirement for a Novice ticket, and make *that* entry point a means of accessing the HF bands—but with limited voice privileges on multiple bands *below* 50 MHz. Also keep the Technician class as a no-code entry for 50 MHz and up, where there is not a lot of code anyhow, but *dump* the Tech-Plus ticket, making General the next step. My personal preference would be for a whole new General class test that had *no* code requirements beyond the basic five wpm, but maintained the higher testing standards on the written exam, and perhaps even included additional testing on the subjects of law and operating practice.

Take all of us "Technician/Old" licensees who passed the General written and just grandfather us to General class. For the few of us who have been Technicians as long as I have, I suspect that the vast majority have demonstrated the ability to perform as good hams in spite of our disinterest in code. Many of us have some pretty good QSL cards on the wall and certificates of achievement to show that we are not only qualified but motivated to do it and do it *right*.

As for the argument that we should then learn code to be "real hams," again, I see no reason for *one* operating mode to be turned into an artificial barrier. We aren't lazy and we aren't stupid because we don't want to go to 13 wpm or higher. We are simply *not interested*.

Proposal: Require "Time in Grade" for Upgrading

If the Novices who have passed a five-wpm code exam wish to move up to General, then let them do so—but *first* make them serve out a specified period of time as Novices. Make them show proof that they have actually operated at an entry level for some time before being allowed to take the General written. Upon successful completion, they'd achieve a General class ticket. Then, instead of the limited access to the HF spectrum I mentioned previously, they would gain what we now think of as "standard General class privileges."

If the Technicians wish to go to General and operate the HF bands, they, too, should be required to serve a specified "apprenticeship" with logbooks to prove it. At that point, to be fair, they will be required to pass the five-wpm code exam, as I have suggested the Novices should. (*Until about 20 years ago, the FCC required both "time in grade" before upgrading to certain license classes, and minimal operating requirements in order to renew.—ed.)*

Finally then, everyone who aspires to become a General class licensee will have been required to pass a simpler code test, at five wpm, to help satisfy those who just cannot stand the thought of no-code HF licensing. At the same time, instead of using Morse code as a "barrier," the written exam will be more comprehensive, and—with the resources of the ARRL (and heck, why not other ham organizations as well?)—we will finally establish a true Elmer system to create a higher quality of new ham, not just a mill for turning out *quick* new hams.

Isn't that really the point? Let's get our quality *up* and keep it there, but *not* by requiring levels of code competency which no longer have the relevance that they once did, but rather by putting more emphasis on training new hams to be better operators *regardless* of what mode of communications they use.

"...the ARRL...should quit whining about the code and start using its time, talent, and cash to push for more stringent written tests as well as using its infrastructure to create, operate, and maintain a positive Elmer system...."

Response to CQ's Proposals

In his editorial in the May 1997 issue, Rich, W2VU, proposed (*on behalf of CQ Communications—ed.)* some improved Elmering and proof of operation, similar in some—but not all—ways to what I have suggested above. But I think he and I are at least barking up the same tree by suggesting that the quality of new hams *is* an issue and that more emphasis should be placed on operating practice than on dots and dashes.

Personally, however, I would approach the suggestion of the "Basic Amateur Permit" with *extreme* caution. I think that the possibility of abuse is quite high, and a means of closing down such an operation *immediately* needs to be incorporated in the event of such abuse. This method needs to be totally *fail-safe* and virtually guaranteed before I can truly support such a permit.

In the "Op-Ed" column of the same issue, K7MW wrote "Sometimes you have to suffer...." in the same paragraph in which he also wrote that "....those who favor a codeless HF license buckle down and learn the code." With all due respect to his article and opinions, I say that amateur radio has suffered enough under the yoke of excessive reliance on code as a means of licensing, initiation, or whatever this attitude can still be rightly called. Enough is enough! ■

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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.*

Q & A

Questions and Answers About Ham Radio Above 50 MHz

Q: I am new to amateur radio and am in the market for equipment. But before I buy, I would like to find out some more about radios and equipment for my needs.

I am thinking about purchasing a 2-meter or dualband VHF/UHF HT to use while I am traveling in Alaska, camping and backpacking. There are quite a few 2-meter repeaters in the area where I plan to be operating (as long as I am close to a mountaintop), but there might be a few transmission problems in some areas.

My first question. I am looking for an antenna that would be a good improvement over the small antennas now put on HTs. I have seen a J-pole antenna in a catalog that looks like it may work. I met someone at an airport who mentioned that the Cushcraft Ringo 2-meter antenna would work also (you could hang it in a tree?). I am not familiar with either of these antennas. What would you recommend that would have a large improvement over the stock HT antenna and portable enough for backpacking?

Second question. Since I could spend up to a week away from civilization, I would like to be able to charge the HT batteries in the field. Is there a homemade or commercial setup that could charge HT batteries in the field, i.e., solar power? Do you have any suggestions?

Thank You

Brad Husberg, KLØER
Eagle River, Alaska

A: A J-pole is a good idea since it has definite gain over a rubber duck and it can be made out of wire which can be coiled up in a backpack, then uncoiled and hung in a tree. The Cushcraft Ringo, while an excellent antenna, is a large base station antenna and not suited for backpacking. One possibility for your application is the "coax antenna" described by CQ VHF *"Beginner's Corner" columnist Peter O'Dell, WB2D, in his June, 1996 column.*

This antenna is basically a piece of RG-58 coax with a BNC connector on one end (this plugs into your HT). At the other end, you strip off 19.5 inches of the outer jacket, carefully peel back the braid and spread it across the preceding 19.5 inches of cable, and strip off the inner insulation from the first section. This gives you a center-fed dipole. If you hang it vertically in a tree (tying on some nylon twine and a fishing weight so you can toss it up), it'll be a definite improvement over the rubber duck, although it won't have as much punch as the J-pole. I'd suggest you get a copy of the June '96 issue of CQ VHF *for details (back issues are available from our office for $3.50 each, postage included).*

Your question about a solar charger is especially interesting, since it's the second one we've gotten this week. I'm not aware of anything on the market, but I have already passed along the suggestion to Dave Ingram, K4TWJ, who's starting a homebrewing column for us (the first installment is elsewhere in this issue), as a good future project.

In the meantime, a good supply of alkaline AA cells would probably be your best bet (make sure whatever radio you get has provision for using AA alkalines as well as NiCds). Good luck in your travels!

Q: I read the article in the November, 1996, issue re: duplexers and triplexers. I found it very informative, but have the following question:

I wish to set up a packet nodestack that runs on 144, 220, and 440 MHz. If I purchase a triband antenna and the appropriate triplexer, will this scenario work? I will be running separate monoband radios for this. If two or more of the transceivers "key up" at the same time, will this cause any adverse affects? I have felt a little leery about trying this without asking around first. Any help would be greatly appreciated. Tnx es 73.

Douglas Engelhardt, N3NKA
Gettysburg, Pennsylvania

A: The duplexers and triplexers described in our article last November are designed for only one transmission at a time. For simultaneous transmissions using the same antenna, you need a specialized (and expensive) duplexer known as a "cavity." The filters in a cavity are custom-tuned to your exact operating frequencies and are generally used on repeaters to allow them to receive and transmit simultaneously, using the same antenna. I'd go with three separate antennas, spaced as far apart as possible, and, if you're running single point-to-point links on any given band, make the antenna for that band directional. This will minimize overloading and other potential interference between your three stations.

Q. I am interested in developing antennas for 50 MHz and up. One concept I have in mind is to build "Circular Quads" or "Loop Yagis," what I call "Pi-quads" or "Quad-pi's." My conception of these antennas is to use what I have learned of building bicycle wheels to fashion a mechanically sturdy antenna utilizing light-weight spring steel from the bands discarded from large shipping cartons or carpenter's flexible tapes for elements and dacron cord for "spokes" to add rigidity to both boom and the circular elements. However, I cannot find any formulas to determine the basic dimensions for driven, reflector, and director elements.

For example, the *ARRL Antenna Book* (1991) states on page 18-28, second paragraph "Based on several experimentally determined correction factors related to the frequency of operation and the wire size, optimum design dimensions were found to be as follows." The article then goes on to give formulas for a Cubical Quad using aluminum ground wire. While it is a simple matter to calculate the equivalent circular elements using Pi, they don't work well at 144 MHz with a carpenter's flexible tape in a simple two-element Quad.

What I am looking for are some formulas like those in *J.L. Lawson's Yagi Antenna Design* (1986), Chapter 7, Section 3, on radius scaling, but applied to flat elements, not wire cylinders. I realize antennas are a trial and error field, but I an no longer 12 and do not have a lifetime to experiment. Can you be of help?

In addition to my general frustration in solving this problem, I have some more specific questions: 1) How does the orientation of the radiating surface (obviously this is a no-brainier with wire, but of significance with a flat tape?) change the intensity

of the radiated electro-magnetic fields? 2) How does the orientation of the radiating surface change the pattern in vertical and horizontal planes? 3) How would concentric "Pi-Quads," say one for 2 meters and one for 70 centimeters effect the intensity and pattern of the radiated electro-magnetic fields? 4) How does this change if the elements are concentric (i.e. offset on the boom so not in the same plane)? 5) How can a matching stub (I have tried a simple gamma match without success) be determined? Any formulas? (I remember my HP 41CX had a stub program in the EE module "Nodal Net Analysis" program, but, alas, the 41 has ceased functioning). I have a fair understanding of math and physics, but I am short on practical experience in radio communications.

And, lastly, might I add my disappointment at Peter Coffee's dropping his column. I found him as to the point in *CQ VHF* as in *PC Week,* and as soon as I get these antennas built I look forward to getting Coffee's "Java" book and learning something new. 73 to Peter and you all.

Sincerely,

Ernie Frank, KF4IFE
Fort Collins, Colorado

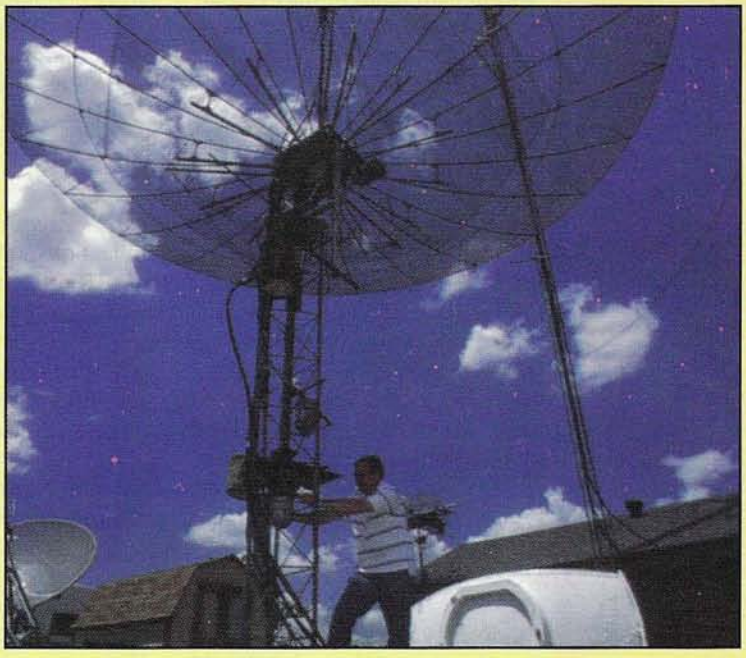
A: Your interest in quads for VHF is certainly worth pursuing. My favorite 2-meter antenna is a quad I built from a 1981 QST *article. Loop Yagis are already in commercial production for 902 MHz and higher, but your concept of using flexible metal tape is something I've never seen referenced.*

In addition to the ARRL Antenna Book, *which you've already read, you might find some useful general information in CQ's* The Quad Antenna, *by Bob Haviland, W4MB; and Joe Carr, K4IPV's* Practical Antenna Handbook, *from Tab Books. But neither of those gets into the questions of a flat radiator. I'd suggest you get in touch with one of the manufacturers that specialize in VHF/UHF antennas and discuss your concept with one of their engineers. You can choose from one of the "majors," such as Cushcraft or HyGain, or some of the smaller and more specialized manufacturers, such as M², Olde Antenna Lab, or C3I Antennas. You'll find ads for all of these manufacturers in* CQ VHF.

Finally, we were also sorry to lose Peter Coffee from our staff. The "In the Public Interest" column is continuing, though, with Bob Josuweit, WA3PZO, at the helm. And, from what I've seen in his first two columns, we're in good hands.

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, 76 N. Broadway, 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."

On the Cover



1997 Dayton honoree Al Ward, WB5LUA, is an accomplished and well-known VHFer. He has designed countless circuits for VHF, UHF, and microwave applications and is a regular participant at VHF conferences, often demonstrating low-cost, practical methods of building equipment and antennas. Al holds world distance records for EME (Earth-Moon-Earth, or moonbounce) contacts on 3456 and 5760 MHz—that's his EME dish antenna on our cover—along with North American distance records on several VHF and UHF bands. He has earned the ARRL's Worked All States award on 6 meters, 2 meters, 222 MHz, and 432 MHz, and he's working on working them all on 1296!

Al lives with his family in Allen, Texas, and works as an electrical engineer for Hewlett-Packard. Recently, he was honored by the Dayton Amateur Radio Association with its 1997 Technical Excellence Award, recognizing his many accomplishments in amateur VHF, UHF, and microwave technology.

Interviewed by the "Newsline" radio program soon after the awards were announced, Al said VHF has been his main interest ever since he became a ham in 1965, "back in the days of 2-meter AM." And he explained his interest in designing new circuits and equipment. "As you go higher in frequency, signals get weaker," Al told Newsline, "so you find you have to build bigger antennas and lower-noise receivers and higher-power amplifiers." Al has not only done all of that, but has shared it with the rest of us.

CQ VHF congratulates and salutes Al Ward, WB5LUA, on this well-deserved recognition. (Cover photo by Larry Mulvehill, WB2ZPI)

Basics

Emergency Communications

Staying on the air in emergencies and getting messages into and out of disaster areas is probably the single best-known aspect of amateur radio. When all else fails, ham radio gets through. But how do we stay on the air when no one else can? And how do we know what to do when the need arises? The answer is simple: preparedness and practice.

Preparedness includes knowing your equipment and its capabilities (as well as its limitations), having what you'll need for extended operation in less-than-ideal circumstances (batteries, antennas, etc.), and training in how to set up and use your equipment effectively and efficiently in an emergency. Once you've learned how to set up and operate under emergency-type conditions, you need to *practice* those skills by helping out at public service events, such as parades, walk-a-thons, bikathons, etc., and by participating in formal "nets," or on-air networks, to learn procedures.

Amateurs in Utah assist in search and rescue operations. Proper training before the emergency is vital if we are to be truly helpful. (Photo courtesy Utah County SCATeam)

Who Provides the Training?

Ham radio emergency communication is generally conducted under the umbrella of one or more emergency service organizations. These may be totally within ham radio or may be part of larger organizations. Most often, hams are trained by other amateurs who have gone through the process before and want to share their skills with others. Let's take a brief look at some of the best-known groups in the U.S.

ARRL Groups

ARES stands for the *Amateur Radio Emergency Service* and is the emergency communications arm of the American Radio Relay League (ARRL). Usually organized by county, an *Emergency Coordinator,* or *EC*, runs local ARES operations. You may register with ARES (through your EC) whether or not you are an ARRL member. Most ARES groups hold regular training nets and participate in drills and public service activities.

NTS, an abbreviation for the *National Traffic System,* is the ARRL's message-forwarding network. If you've ever been to a fair and seen a sign that says "Free Messages By Ham Radio," chances are these messages are sent through the NTS. Generally, non-emergency messages into and out of a disaster area are also routed through NTS. Most NTS nets meet daily, handling routine "traffic," or messages, giving participants plenty of opportunity to learn and practice their skills in handling written message traffic.

Off to the RACES

RACES is the *Radio Amateur Civil Emergency Service* and is actually a separate radio service established under Part 97 of the FCC's Rules and Regulations. RACES is operated on a national basis by the Federal Emergency Management Agency (FEMA) and locally by state and local Offices of Emergency Management (or whatever they happen to be called in your area). Under FCC rules, hams participating in RACES are limited to one hour of practice each week, and may speak only with other RACES-registered stations when operating in a RACES net. RACES emergency nets may be activated only at the formal request of an authorized government official and must shut down when an emergency is declared to be over.

(The ARRL recently petitioned the FCC to relax some of these restrictions. The League requested authority for RACES groups to conduct up to five hours of training each week, which would allow participation in long-term drills, and for RACES stations to communicate with any other ham "working" an emergency, even if that ham isn't a RACES member. This would enable RACES and ARES groups to exchange messages, or a RACES station at an emergency management facility to contact a ham at a Red Cross shelter without having to worry if that other ham is also a RACES member.)

CAP, MARS, and SKYWARN

Three non-amateur services in which many hams participate, and which also are active in emergency communications, are *CAP*, the *Civil Air Patrol*;

MARS, the *Military Affiliate Radio System*, and *SKYWARN*, the National Weather Service's corps of volunteer weather "spotters."

CAP is the U.S. Air Force Auxiliary and is heavily involved in search-and-rescue and other emergency operations. CAP communicators—many of whom are hams—use frequencies just outside the VHF amateur bands. Most VHF ham rigs can be modified to operate on these frequencies once you show your dealer or the manufacturer your authorization to operate there.

There are three separate MARS organizations: Army, Air Force, and Navy /Marine Corps. Hams who join MARS are issued separate MARS callsigns and also operate on frequencies immediately adjacent to both HF and VHF amateur bands. Most often, MARS members are involved in handling messages and "phone patches" to and from members of the U.S. Armed Forces, no matter where in the world they may be. (Phone patches are connections between radio and telephone, so that a serviceman or woman overseas may be hooked up with a ham back in the U.S., who then phones a family member and "patches" the two together.) MARS members may also be called on to provide emergency communications, especially if the armed service has also been called in to help deal with a disaster or other situation.

When severe weather threatens, the National Weather Service (NWS) relies on *SKYWARN* volunteers to report conditions and observations in various places. Many of these trained weather spotters are hams, and there are many SKYWARN nets in operation around the country. Hams who are SKYWARN spotters generally use amateur frequencies to report their observations, and some NWS offices have permanent ham stations installed in order to monitor SKYWARN reports.

Served Agencies

Most ham radio emergency groups don't operate in a vacuum, talking only among themselves. To be most useful, hams are sent to places where their communication skills can be put to use in keeping disaster response organized and functioning smoothly. These places typically include hospitals, Red Cross shelters, etc. Organizations such as the Red Cross, the NWS, and emergency management agencies are often referred to by hams as *served agencies*, since they're the agencies for whom we commonly provide communications services. Served agencies also include the sponsors of various non-emergency events through which we get much of our "on-the-job training," for instance, the March of Dimes, the American Diabetes Association, etc.

Most of these organizations don't operate their own communication networks (which is why they ask us for help), so ham radio participation is usually through an amateur group, such as a local radio club or ARES group. Generally, the served agencies provide us with the *opportunities* for training, while our own groups provide the actual training.

Getting Involved

Most emergency communications activity on VHF/UHF is conducted on FM and packet. The best way to get started is right in your home area. Ask for information from other hams you meet on the air. Listen on your local repeaters for NTS traffic nets, ARES training nets, etc. Try to get a feel for the net procedure. Check in if you feel comfortable doing so; otherwise, wait until after the net is over and call the Net Control Station and ask for information on participating in the net. You can expect to be welcomed and invited to join the next session. For more general information, see the "Resources" box accompanying this article.

You Must Remember This...

Hams' ability to provide emergency communication—and our record of doing so successfully time after time—is a critical reason for our continued existence and our continued access to frequencies that could easily bring billions to Uncle Sam on the auction block. It's equally critical that every ham have at least a passing understanding of how to provide useful communications during an emergency. Consider it your "rent" for the use of the frequencies. And the time to learn is *before* the tornado or hurricane hits, not *after!* ■

Resources

For more information about the various organizations described in this article, we recommend the following:

ARES—Contact your local ARRL Emergency Coordinator, Section Emergency Coordinator or Section Manager (SMs' names and addresses are listed in every issue of *QST* magazine and on the ARRL Web page, <http:www.arrl.org>, or contact ARRL Headquarters at 225 Main St., Newington, CT 06111; Phone: (860) 594-0200. Ask for field service.

CAP—Request an information package from CAP National Headquarters at 1-800-FLY-2338; write to HQ CAP/ DPM, 105 S. Hansell St., Maxwell AFB, AL 36112-6332; or connect to the CAP World Wide Web site at <http://www.cap.af.mil>.

MARS—Look for MARS tables at local hamfests, ask about it at club meetings, or visit the Army MARS Web site at <http://members.aol.com/aat6fv/>.

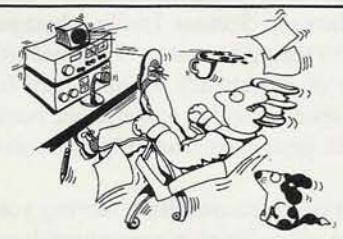
NTS—Contact the Net Control Station, Net Manager, Section Traffic Manager, Section Manager or ARRL Headquarters (see ARES listing for contact information).

RACES—Contact your local or county Office of Emergency Management (or whatever it's called where you live). If there's no specific listing in the phone book, call your town, city, or county clerk's office, or the police department's *non-emergency* number.

SKYWARN—Contact the National Weather Service forecast office serving your area. If there's no listing in the phone book (or the office listed in your phone book is closed!), tune in NOAA Weather Radio (162.400, 162.475 or 162.550 MHz, depending on where you live) and listen for the location of the forecast office from which your local broadcast originates. Then call directory assistance for the phone number, and ask for the meteorologist in charge of SKYWARN.

Advertisers' Index

It's easy to advertise in CQ VHF. Let me know what I can do to help. Arnie Sposato, N2IQO. Tel: 516-681-2922, Fax: 516-681-2926, e-mail:arnie cq@aol.com.



If you have a product or service to offer, join us and get your classified message out to all the hams who ply their craft on VHF with *CQ VHF*'s Ham Shop.

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(516) 681-2922 or Fax: (516) 681-2926.

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Closing Date: The 1st day in the third month preceding date of publication (example: Jan. 1 for the March issue). Because the advertisers and equipment contained in Ham Shop have not been investigated, the Publisher of *CQ VHF* cannot vouch for the merchandise listed therein. The publisher reserves the right to reject any advertisement. Direct all correspondence and ad copy to: CQ VHF Ham Shop, Attn: Bernadette Schimmel, 76 N. Broadway, Hicksville, NY 11801.

J-POLE PVC ANTENNA'S 2 METER, 440 AND 6 METER PRETUNED $39.95-59.95. JIM WA3DUX, 1-800-837-2038.

ELECTRON TUBES: All types Bought and Sold. Daily Electronics, 10914 NE 39th St., B-6 Vancouver, WA 98682, (800) 346-6667; Fax: (360) 896-5476; <daily@worldaccessnet.com>.

RC-740X, band expansion for **KENWOOD** 741/742 series, **ScannerWEAR WINDOWS** software for **ICOM, AOR, OPTO** receivers see all at **<http://www.radioscan.com>. R.C.S.I.** M-F 9-4 PST 1-800-560-7234.

Join the **LAMBDA AMATEUR RADIO CLUB** (Larc) 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. Write LARC, PO Box 24810, Phila., PA 19130-2405 or e-mail: <LARC@net-quest.com>.

FOR SALE OR TRADE: 126' spool of RG-225 teflon coax (high-power, high-temperature, good for ***indoor*** use up to 450 MHz). Will sell for $200 + shipping (or you pick up in Metro NYC/NJ area). Prefer to trade for 6/2-meter transverter of similar value. Rich Moseson, W2VU, c/o *CQ VHF*, 76 N. Broadway, Hicksville, NY 11801.

WANTED: Older model bugs, unusual bugs, and miniature hand keys. State price, condition. Dave Ingram, K4TWJ, 4941 Scenic View Drive, Birmingham, AL 35210

Learn Code by Hypnosis—http://www.qth.com/cweasy/ or 1-800-425-2552.

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Radio Astronomy Projects, a book by William Lonc, $23 shipped in USA. Other radio astronomy books and software from Radio-Sky Publishing, P.O. Box 3552, Louisville, KY 40201-3552. <http://www.win.net/~radiosky> or e-mail to: <radiosky@radiosky.win.net>.

HAM Location, beautiful all brick rancher, 4700 sq. ft. home includes home office, HAM shack (radio room), antennas, 3 tiled full baths, 3 or more bedrooms, 3 dens. The 3 car garage and smoking room are not included in the 4700 sq. ft. Sturdy quality construction. Type of heat is great for sinuses and very warm. Acre lot, back fully fenced and very quiet and private, secure gates, separate dog kennel, Olympic size well kept swimming pool. Located on mountain ridge, quiet prestigious neighborhood, nice homes all around, great schools. Located 55 miles from Baltimore and Washington, DC. Ideal location to work in DC, with easy accessibility by train. House and property will be inspected, one year warranty. Pictures, property plan, layout, amenities list, and features in a booklet available to serious buyers for $5.00 cash, check, or money order. Contact: W3BAG, Box 609, Braddock Heights, MD 21714, or call (301) 473-5825.

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*:

- "902 FM—UHF's Final Frontier," by Dave Page, KD3NC
- "Ham Testing in Mexico," by Gordon West, WB6NOA, Bob Wood, KC6UGF, and Sally Wood, KC6PBT
- "A Short History of Spread Spectrum," by Steve Bible, N7HPR
- "Build a 25-Amp, 12-Volt Power Supply," by Chuck Pearce, K3YWY

Plus...

- "An Outboard Noise Blanker for 6 Meters," by Bob Witmer, W3RW
- "Is Anyone Out There?—Hams and Project Argus," by Denis Jakac, VA3ZXN
- "How Ham Radio Saved the Movie," by David L. Bowles, N1MZZ, and Chester S. Bowles, W1CSB

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 with an SASE (self-addressed stamped envelope) to *CQ VHF* Writers' Guidelines, 76 N. Broadway, Hicksville, NY 11801.

It means that you've developed an understanding of the concepts involved in radio communication—increasingly complex concepts with each higher license class—but not that you've mastered the application and use of those concepts. You can only learn that by *doing*. But in order to advance to the second phase of ham radio knowledge, that is, learning by doing, you must first understand the basics (things like Ohm's Law and the formula for determining antenna length). You don't have to memorize them (except for the exam)—you have to know where to look things up—*and you have to understand what you're reading when you do*. These basic underpinnings are what you need to learn to earn your license. And if you haven't done that, then you can never move on to the second step...you can't learn by doing if you don't *understand* what it is you're doing.

Yes, we need more hams. But we need hams who are willing to use their licenses to learn, for lack of a better phrase, "the ways of the Force." And if a 924-question pool for a 65-question exam is going to scare away those license candidates who haven't the slightest clue of what it's all about and who aren't willing to learn, then so be it.

In This Issue

Hams have been told for years—even in these pages—to avoid using 75-ohm feedline for their 50-ohm impedance radios and antennas because the mismatch will more than swallow up in wasted watts your savings in cash investment. Well, one of our friends in Cuba, where 50-ohm cable can be next to impossible to find, says "go ahead and use that 75-ohm cable." And CO2KK provides us with an easy-to-make matching device to keep the SWR meter happy.

Plus, you may have wondered about using those "memory-free" nickel metal hydride (NiMH) batteries, so popular for cellphones, in your HT, but heard reports that they'll blow up your radio. Well, WB6NOA reports that the secret to safely using NiMH cells lies in making sure you're using the right charger: a temperature-sensitive "smart charger."

Finally, we welcome our second new columnist in two months—Dave Ingram, K4TWJ, and his "Project Corner" column, a bimonthly feature devoted to the art of homebrewing, or building your own gear. Actually, "new" isn't quite right. Dave's first article in *CQ VHF* was in our very first issue. And he's been a well-known ham radio writer for many years. You'll find a more detailed introduction in his column. But let me just say this: I've never met anyone more enthusiastic about whatever he's doing than Dave Ingram. Every phone conversation we have turns into a brainstorming session, as idea builds upon idea. His excitement is contagious, and I hope it rubs off on all of you. Welcome to the staff, Dave.

Until next month,

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 76 N. Broadway, 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.

CQ VHF HAM SHOP ORDER FORM

Mail this form with payment to: CQ VHF Ham Shop, 76 N. Broadway, Hicksville, NY 11801 ATTN: Bernadette Schimmel.

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Payment may also be made by MasterCard, Visa, Discover or American Express by providing the following information:

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Hamfest Calendar

The following hamfests are scheduled for July, 1997:

July 4, Firecracker Hamfest, Monagahan Fire Hall, Dillsburg, PA. Talk-in: W3UU, 146.16/76 MHz. For information, contact HRAC AnswerLine at (717) 232-6087. (exams)

July 5, Ontario Hamfest, Milton Fairgrounds, Milton, Ontario. Talk-in: VE3 RSB 147.21 & Simplex 146.52. For information, contact 23rd Annual Ontario Hamfest, c/o Burlington Amateur Radio Club, P.O. Box 85037, Burlington, Ontario, Canada, L7R 4K3.

July 6, Columbiana County Hamfest & Computer Show, Columbiana Co. Fairgrounds, Lisbon, OH. Talk-in: 146.70 and 146.805. For information, contact Dick Sisley, K8JKB, 1218 Northside Ave., E. Liverpool, OH 43920 or call (330) 385-1245.

July 9, Swapfest, K-Mart parking lot, Iowa City, IA. For information, contact Jon Poulton, WØCK, 729 Alpine Dr., Iowa City, IA 52245, or call (319) 354-1735 after 6:30 p.m.

July 12, 28th Annual Swapfest, American Legion Post 434, Oak Creek, WI. Talk-in: 146.52. For information, call (414) 762-3235. (exams are pending)

July 13, 1997 Batavia Hamfest, Alexander Fireman's Recreation Grounds, Batavia, NY. Talk-in: 147.885/7.285. For information, call (716) 786-3622 or e-mail to: <carlson@frontiernet.net>.

July 13, Valley Forge Hamfest, Kimberton Fire Co. Fairgrounds, Kimberton, PA. Talk-in: 146.835/- and 443.80/+ CTCSS 131.8. For information, contact Bob Haase W3SA, (610) 293-1919 voice and (610) 293-7688 fax or e-mail to: <wb3joe@voicenet.com> or write to: MARC, P.O. Box 352, Villanova, PA 19085.

July 13, Fox River Radio League Hamfest, Waubonsee Community College, Sugar Grove, IL. Talk-in: W9CEQ, 147.210 (+600) (PL103.5/107.2) - AFAR. For information, contact Diana Skube, WD9API, c/o FRRL, P.O. Box 673, Batavia, IL 60510 or call (630) 293-7485. (exams)

July 13, 12th Annual Hamfest, Northland Public Library, Pittsburgh, PA. Talk-in: 149.09, W3EXW. For information, contact Bob Ferrey, Jr., N3DOK at (412) 367-2393 or e-mail to: <bferrey@nauticom.net>.

July 19, NOARSFEST, Lorain County Fairgrounds, Wellington, OH. For information, contact John, KC8AOX, 528 2nd Street B, Elyria, OH 44035 or call (216) 322-0081; e-mail to: <kc8aox@qsl.net>; WWW page: <www.ohio.net/~noars>. (exams)

July 19, Hamfest/Swap Meet, North Bend Junior High School, Coos Bay, North Bend, OR. Talk-in: 146.61 - K7CCH repeater. For information, contact Hugh Mac Donald, N7OKM, P.O. Box 1822-Bandon, OR 97411 or call (541) 347-7019.

July 20, Sweatfest '97, MARC Train Station, Brunswick, MD. Talk-in: 147.06, 448.125. For information, contact MADRA Sweatfest '97, 230 N. Potomac St., Suite #2B, Hagerstown, MD 21740 or call (301) 416-8447 Box #109. (exams)

July 20, Tailgate Fleamarket, Albany and Main St., Cambridge, MA. Talk-in: 146.52 & 449.725/444.725 -PL2A - W1XM/R. For information, call (617) 253-3776.

July 20, 10th Annual Hamfest, Van Wert County Fairgrounds, Van Wert, OH. Talk-in: 146.850/.250. For information, contact Bob High, KA8IAF, 12838 Tomlinson Rd., Rockford, OH 45882 or call (419) 795-5763. (exams).

July 20, 19th Annual Hamfest, Sussex County Fairgrounds, Augusta, NJ. Talk-in: 147.300 and 224.50 on repeaters and 146.52 on simplex. For information, contact Daniel Carter, N2ERH, 8 Carter Lane, Branchville, NJ 07826 or call (201) 948-6999.

July 25–26, Ham Holidays '97, Oklahoma State Fair Park, Oklahoma City, OK. Talk-in: 146.82. For information, contact Ham Holidays '97, P.O. Box 95942, Oklahoma City, OK 73143 or e-mail to: <n1lpn@swbell.net>. (exams)

July 25–27, ARCA Fort Tuthill Hamfest and Arizona State Convention, Coconino County Fairgrounds, Flagstaff, AZ. For information, call Amateur Radio Council of Arizona at (602) 440-2039. (exams)

July 26, Rockford's Hamfest and Computer Fair, Winnebago County Fairgrounds, Pecatonica, IL. Talk-in: 146.610 pl 114.8. For information, contact Chairperson, Marsha, KB9NGN, (815) 399-9233 or write to Club, P.O. Box 8465, Rockford, IL 61126-8465.

July 26, 22nd Annual Western Carolina Hamfest, Haywood County Fairgrounds, NC. Talk-in: 146.91 W4MOE and 146.76 WA4BVW repeaters. For information, contact Tommy Queen, K4BNP (704) 258-2639 or e-mail to: <K4BNP@juno.com>. (exams)

July 27, BRATS Hamfest and ComputerFest, Timonium Fairgrounds, Baltimore, MD. Talk-in: 147.03 abd 224.96 MHz repeaters. For information, contact BRATS Hamfest, P.O. Box 5915, Baltimore, MD 21282-5915 or call/fax: (410) 467-4634; e-mailto: <brats@smart.net>. (exams)

July 27, Racine Hamfest '97, South Hills Country Club, Racine, WI. Talk-in: 147.270. For information, contact Dave Voss, WB9USI, at (414) 554-7565.

VHF Conference

July 25–26, Central States VHF Society, Clarion Resort on the Lake, Hot Springs, AR. For information, see the CSVHFS Web page at: <http://csvhfs.org/CSVHF97.HTML>.

Operating Notes

For July 1997:

July

5–6 IARU Region 1 (Europe, Africa) VHF Contest; various European national contests.

12–13 **CQ World Wide VHF Contest** (see rules, June *CQ VHF, p.28*)

22 Moon Perigee (closest to Earth)

More contest info is available on the CQ VHF Web page at: <http://members.aol.com/cqvhf/navhfcom.htm>.

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- **Alphanumeric memory capability allows you to recall up to 180 memory channels by name. Frequency, memory channel number, and name (up to 7 characters) are displayed simultaneously. Store call signs, repeater names, cities, etc.**

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