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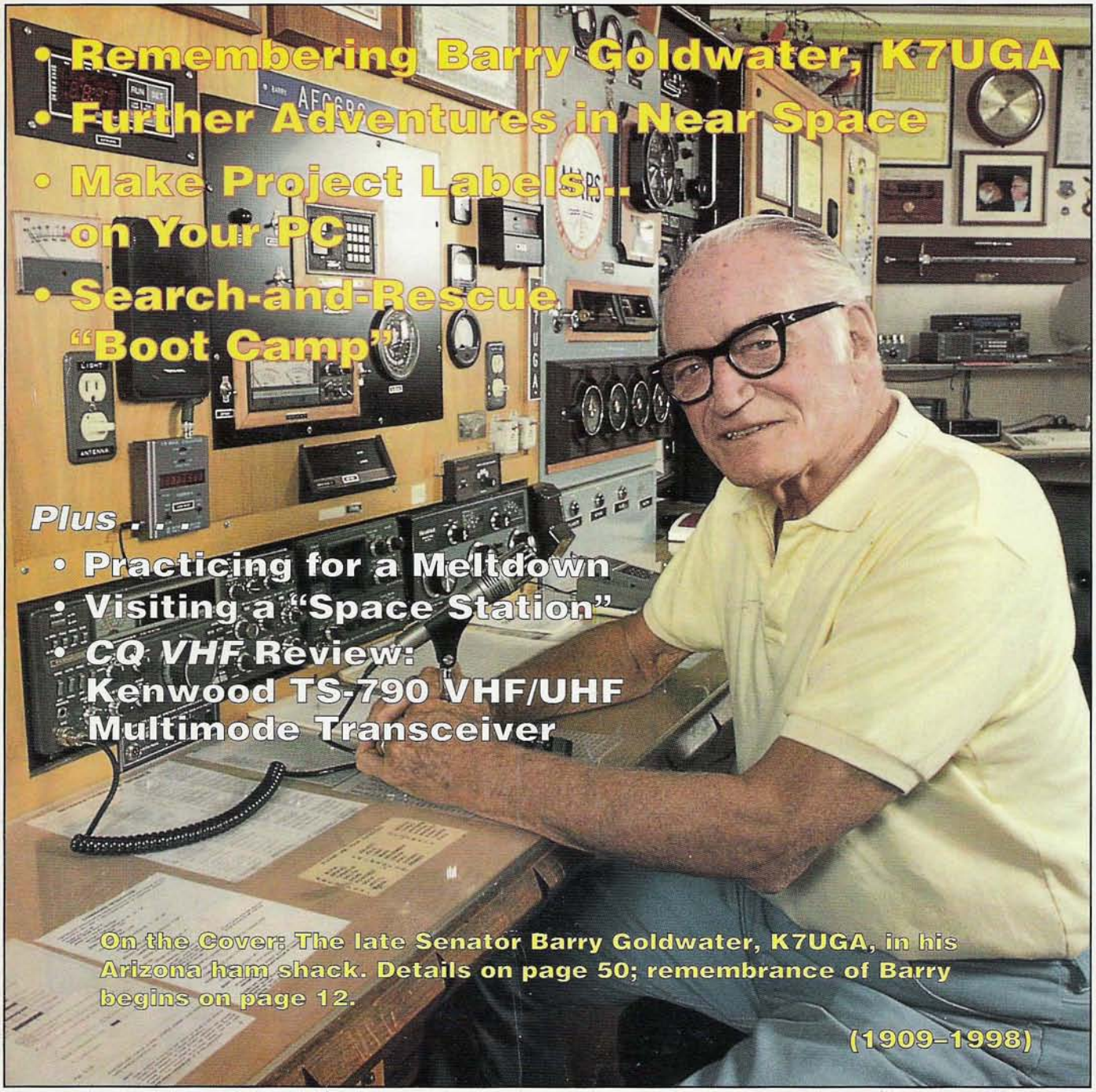
CQ VHF

Ham Radio Above 50 MHz

August 1998



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- Visiting a "Space Station"
- *CQ VHF* Review: Kenwood TS-790 VHF/UHF Multimode Transceiver

On the Cover: The late Senator Barry Goldwater, K7UGA, in his Arizona ham shack. Details on page 50; remembrance of Barry begins on page 12.

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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
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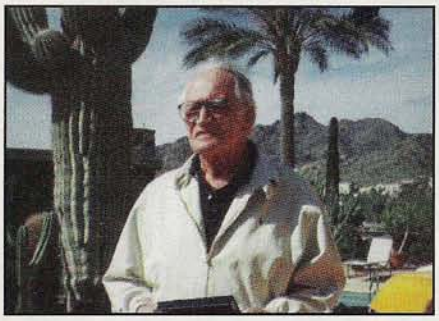
Volume 3, Number 8—August, 1998



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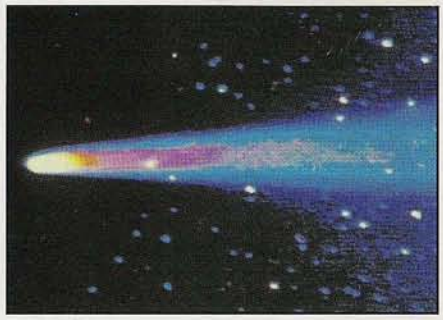

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FEATURES

COLUMNS

BASICS

DEPARTMENTS

Next Month: "A Repeater-Internet Interface," by John Hansen, W2FS

MIRAGE...160 Watts on 2 Meters!

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

B-5016-G
$299
Suggested Retail

Power Curve -- typical B-5016-G output power								
Watts Out	*130*	*135*	*140*	*145*	*150*	*155*	*160*	*165*
Watts In	*20*	*25*	*30*	*35*	*40*	*45*	*50*	*55*

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

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

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

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

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

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

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

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

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

More 160 Watt, 2 Meter Amplifiers . . .

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

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

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

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

100 Watts for 2 Meter HTs

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

Power Curve -- typical B-310-G output power							
Watts Out	*25*	*50*	*75*	*95*	*100*	*100+*	*100+*
Watts In	*¼*	*½*	*1*	*2*	*4*	*6*	*8*

- *100 Watts out with all handhelds up to 8 watts*
- *All modes: FM, SSB, CW*
- *Great for ICOM IC-706*
- *15 dB low noise GaAsFET preamp*
- *Reverse polarity protection/SWR Protection*
- *FREE mobile bracket* • *Auto T/R switch*
- *FREE handheld BNC to B-310-G cable*
- *Ultra-compact 4¾x1¾x7¾ inches, 2½ pounds*
- *One year MIRAGE warranty*

***Boost** your 2 Meter handheld to 100 Watts!* Ultra-compact all mode B-310-G amp is perfect for *ll* handhelds up to 8 watts and multimode SSB/CW FM 2 Meter rigs. *Great for ICOM IC-706!*

35 Watts for 2 Meter HTs

B-34-G
$89.95
Suggested Retail

Power Curve -- typical B-34-G output power								
Watts Out	*18*	*30*	*33*	*35+*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*

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

MIRAGE RUGGED!

35 watts, FM only . . . $69.95

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

MIRAGE Dual Band 144/440 MHz Amp

BD-35
$159.95
Suggested Retail

MIRAGE RUGGED!

Power Curve -- typical BD-35 output power							
Watts Out (2Meters)	*30*	*40*	*45*	*45+*	*45+*	*45+*	*45+*
Watts Out (440 MHz)	*16*	*26*	*32*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*

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

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

6 Meter Amplifier (50-54 MHz)

FCC Type Accepted

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

70cm Amplifiers (420-450 MHz)

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

Amateur TV Amps

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

Remote Control Head for Amps

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

Repeater Amps

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

Low noise GaAsFET preamps

KP-1

KP-2

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

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

1¼ Meter Amps (223-225 MHz)

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

Commercial Amps ($199 to $395)

FCC Type Accepted

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

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Line of Sight — An Editorial

Friends in High Places

Amateur radio has always benefited from influential friends who have helped protect our hobby/service. We've lost some of these "friends in high places" recently, and it's time to start growing the next generation.

Ham radio has recently lost some friends in high places—both figuratively and literally—and, since our frequencies seem to be under continuous assault by commercial interests, we need to take a look not only at who our friends are today in the "real world" (and in Washington), but also at how to build the next generation of influential supporters...or at how to *become part* of that next generation.

"We need to educate our state and local officials about the value of amateur radio to our communities and about the need for strong support from state and local governments."

A View from Above

One of the more consistent sources of good publicity and visibility for ham radio in the past few years has been the presence of hams aboard the Mir space station, and the ability of hams on the ground to make contact. More than once during Mir's many recent trials and tribulations, ham radio provided the only way of getting personal messages back and forth between the crew members and their families. And many school groups were able to schedule chats with the astronauts and cosmonauts aboard the Russian space station.

The U.S. presence on Mir ended in June with the return of Astronaut Andy Thomas, KD5CHF/VK5MIR. And while the ham station is still up and running, the lack of a native-English-speaking crew member to contact will limit non-ham interest here in the U.S. Mir itself is scheduled to be shut down by the end of next year.

Furthermore, very few shuttle flights this year have been scheduled to carry SAREX (the Space Amateur Radio Experiment) into orbit, so the visibility provided by ham-shuttle contacts is dropping off as well.

On the plus side, many astronauts are continuing to get their ham licenses, especially after seeing how valuable ham radio was to their colleagues aboard Mir (see this month's "Beginner's Corner" for an inside perspective); and ham radio has been assigned a permanent presence on the soon-to-be-built International Space Station. In fact, the ham station is scheduled to be installed before the first permanent crew arrives!

We need to do all we can to assure that ham radio remains a viable personal communication tool (and educational tool) for our fellow hams who happen to be "out of this world"!

Barry

Back in 1964, there were hams with visions of a triband beam rising over the White House. Arizona Senator Barry Goldwater, K7UGA, was the Republican nominee for President of the United States. He didn't win that election, of course, but he was later re-elected to his Senate seat and served until 1987, wield-

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

ing great influence in government on a variety of issues, including amateur radio. When Barry died in late May, the ARRL obituary quoted former FCC Chairman Mark Fowler as saying that "the Amateur Radio community was lucky to have Goldwater as its 'elder statesman' in government." (see "The Senator from Amateur Radio," elsewhere in this issue for more on K7UGA).

At the moment, there are no hams in Congress. And, as FCC staffer Bill Cross, W3TN, pointed out at the Dayton Ham-vention, ham radio influence within the FCC is waning. None of the commissioners are hams, Cross noted, and commissioners who used to have hams on their personal staffs are gone. Even the number of hams in the division that regulates ham radio can be counted on one hand.

No Friends Left?

Does this mean we have no friends left in Washington? Far from it. But what it *does* mean is that since fewer hams are themselves in positions of power and influence, we must work harder than ever to educate and inform those who *are* in those positions to be supportive of amateur radio. Not only that, we also need to encourage more hams to get involved in government. Let's look at a few ways to approach this:

First, we need to keep doing what we're already doing—only more of us need to do so, more regularly. By this, I mean filing comments with the FCC on matters of concern to amateur radio, contacting members of Congress to share those concerns and seek their support on ham-related issues, and making use of the campaign process to identify and support those candidates who are supportive of amateur radio. One of our reader surveys (back in October, 1996) asked about your level of political activity in this regard and the vast majority of you are politically aware and active in support of our hobby. We need to keep it up and more of us need to get more involved.

Second, we need to build up that same type of support on the state and local levels. Frankly, threats to ham radio today are as likely to come on the state and local level as they are on the federal level. We need to educate our state and local officials about the value of amateur radio to our communities and about the need for strong support from state and local governments. And here is a great opportunity for hams to get personally involved. I know of several amateurs around the country who are members of their city councils, planning boards or zoning boards. Some even are state legislators, and at least one governor—George Pataki of New York—is a former ham (ex-K2ZCZ). People who understand amateur radio are not likely to go along with proposals that will harm the service, and they'll make sure that "our side" is properly represented.

"...you, the constituent, have one thing that no special interest group has—and it's the one thing that any elected official needs more than anything else: a vote. And you have friends with votes."

Third, we need to strengthen our ties with organizations that we help and that work with ham radio on a regular basis. This can pay off big time. For example, amateur comments on RM-9267, the Land Mobile Communications Council's petition for additional frequencies, including two-thirds of the 70-centimeter band, will carry a significant amount of weight with the FCC (believe it or not). Comments by APCO (the Association of Public-Safety Communications Officials-International), a member of the LMCC, will carry even more weight. And APCO, responding to the concerns of hams on its Volunteer Resource Committee, filed comments with the FCC generally supporting the LMCC petition but *opposing any reallocation of amateur spectrum at 420 to 450 MHz.*

In a letter to APCO VRC Chairman Tom Gibson, W3EAG, APCO President Joe McNeil says, "I hope this shows the commitment that the APCO Board of Officers has for public safety including our very necessary friends in the Amateur Radio Service." It certainly does, and we thank APCO for its support. We need to cultivate this same level of support for ham radio with other organizations that we support through ham radio.

Grass-Roots Involvement

There's an old saying that democracy is the worst possible form of government...except for all the others. And it's true. Despite all of its shortcomings (what they are depend on where you stand in the political spectrum), our system of government is still the most responsive of any to citizen comments and opinions. Comments filed with the FCC are read, are taken seriously, and are taken into consideration in the decision-making process.

Letters from constituents to Congressmen, Senators, and state legislators are read and are taken seriously. Many constituent letters on the same subject (but not form letters) are taken very seriously. This is because you, the constituent, have one thing that no special interest group has—and it's the one thing that any elected official needs more than anything else: a vote. And you have friends with votes.

According to our political activity survey in 1996 (we'll repeat it this month to see if the numbers hold up), an astounding 95% of *CQ VHF* readers consider themselves regular voters, and 70% of you have contacted your lawmakers at least once to express your opinion. Numbers like this give us tremendous clout with our elected officials. We need to use that influence to elect representatives who support us, to educate those who don't know much about us, and to encourage them to keep watch in Washington and our state capitals to protect our interests.

If we want to continue having friends in high places, we need to keep reminding them that we're here, and, perhaps most importantly, we need to continue providing the service to our communities that has earned us this position of respect among government leaders. ■

Help Wanted

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

VHF News

End of an Era

Former U.S. Senator and Republican Presidential nominee Barry Goldwater, K7UGA, passed away in late May at his home in Scottsdale, Arizona. Goldwater had been a forceful proponent of amateur radio in Washington during his long career in the Senate, and he was responsible for legislation that, among other things, extended license terms to 10 years, established the volunteer examination system, and created the Amateur Auxiliary to the FCC. For more on Barry and his impact on hams and ham radio, see "The Senator from Amateur Radio," on page 12 of this issue.

End of a "Mir-a"

The departure of Astronaut Andy Thomas, KD5CHF/VK5MIR, from the Russian Mir space station in June marked the end of an era for both the U.S. space program and for amateur radio. Thomas was the seventh and final astronaut to live and work on Mir in the past three years, and he made many ham radio contacts while aboard the space station, especially with school groups. While Russian crew members will remain aboard Mir for at least another year, there's been no indication as to whether they have any plans to continue the school contacts (somewhat doubtful for U.S. schools due to language difficulties). The last school-Mir QSOs were on May 29, according to the *ARRL Letter*, and involved students from the Burbank School near Chicago and Santa Rosa Junior College in California.

Ham operations from U.S. shuttles are expected to be quite limited in coming months, but a permanent amateur station is slated for installation aboard the International Space Station, construction of which is scheduled to begin late this year or in 1999.

At Least One Ham Among New Astronauts

NASA released the names of the 1998 class of astronaut trainees in early June, and the list includes at least one ham—Timothy Creamer, KC5WKI. A SAREX (Space Amateur Radio Experiment) official suggests that number may grow, noting that after the new trainees arrive in Houston sometime this month, "we'll be pressing them about the virtues of becoming licensed."

Hams Get Support on 70 Centimeters

More than 300 comments were filed with the FCC on the Land Mobile Communications Council (LMCC) petition to reallocate several frequency segments, including two-thirds of the 70-centimeter ham band, to the Private Mobile Radio Service (PMRS). Two of those comments are of particular interest:

Former FCC Private Radio Bureau Chief Ralph Haller, N4RH, said he supports the LMCC's goals, but that the PMRS ought to look somewhere other than the 70-centimeter band to satisfy its immediate spectrum needs. Haller is now a communications consultant and two of his clients are LMCC members, according to the *ARRL Letter*, which quoted Haller as saying, "If I had my druthers, I would not go after amateur spectrum...I certainly support the goals of the LMCC petition, but I would recommend that they look to other spectrum to satisfy that need."

Additional support came from APCO, the Association of Public-Safety Communications Officials-International, Inc. APCO is a member of LMCC, and, like Haller, expressed support for the petition's goals, but opposed the reallocation of 70 centimeters.

APCO said in its comments:

> There is a long history of cooperation between public safety agencies and the amateur radio community, especially in coordinating disaster relief and other emergency efforts. Amateur radio operations on 420-450 MHz often provide the most effective and reliable on-scene and wide-area communications in the immediate aftermath of a major emergency such as an earthquake or hurricane. Adding substantial numbers of new non-Federal primary users on the 420-450 MHz band, as proposed by LMCC, would significantly reduce the availability of that spectrum for amateur radio operations in emergency situations. Therefore, notwithstanding its general support for other aspects of the LMCC Petition, APCO strongly opposes any reallocation of the 420-450 MHz band.

In addition, the ARRL—as expected—filed comments in opposition to the LMCC proposal. The League cited the "substantial personal investment" in equipment by individual amateurs using the band, along with continuing federal use of the frequencies (the federal government holds the primary allocation there). According to the League comments, the National Telecommunications and Information Administration (NTIA), which manages federal spectrum, "has made it quite clear that there is no possibility of additional sharing of the 420-450 MHz band." The ARRL also said the "unique relationship between Federal radiolocation uses and the Amateur Service cannot be duplicated by PMRS users."

The deadlines for comments and reply comments have already passed. The next step is for the FCC to issue (or not issue) a Notice of Proposed Rule Making, which will be based on the initial petition and the comments received. Check the *CQ VHF* and ARRL Web pages for updates at <http://members.aol.com/cqvhf/> and <http://www.arrl.org/news/bandthreat/RM-9267>, respectively.

ARRL: FCC Misunderstood, Mishandled, Band Plan Petition

The ARRL took the FCC to task for treating as a petition for rule making its request for a "declaratory ruling" equating observance of voluntary band plans with good amateur practice. The FCC assigned a rule making petition number to the request (RM-9259) and put it out for public comment. In its comments, the League said it had asked for no changes in the FCC rules, but sought only "to have the FCC interpret and clarify the scope of 'good amateur practice' as the term is used in Part 97 of the Commission's rules," according to a report in the *ARRL Letter*.

It seems the League has good reason to be concerned. According to the *W5YI Report*, the FCC's Bill Cross, W3TN, noted at the Dayton Hamvention that "we have already received many comments on this petition. None of them support it."

Compiled by the CQ VHF Staff

League Seeks More Special Calls

The ARRL is asking the FCC to broaden the choices available to groups requesting special event callsigns. Currently, 750 so-called one-by-one callsigns (such as W4B) are available for temporary assignment to groups operating special event stations, on request to a Special Event Call Sign Coordinator, of which the ARRL is one.

In a petition to the FCC, the ARRL is asking that two-digit callsigns, such as W98A or K99USA, also be made available, along with extending the reach of the special event callsign program to include areas under FCC jurisdiction that do not have U.S. mailing addresses. According to an ARRL bulletin, this would include potential DXpedition sites, such as Desecheo Island near Puerto Rico, or Kingman Reef in the Pacific. At press time, the Commission had not responded to the ARRL request.

Germany OKs "Learner" Stations

Hams in Germany may now apply for special instructional licenses that will permit on-air operation by prospective hams before they pass their license exams. According to the *ARRL Letter*, the instructor to whom the station is licensed would be responsible for making sure it was operated according to the rules, but would not necessarily need to be present when the station was on the air. Operators of an instructional station, which would have a distinctive DN callsign prefix, would have the same operating privileges as the licensed operator. The goal, according to the report, is to give aspiring hams an opportunity to try out ham radio while preparing for their license exams. The program is similar to one that was used successfully for years in the former East Germany.

"APRS Experiment Days" on AO-16

Wilderness hikers, truckers, and other travelers using APRS (Automatic Position Reporting System) to report their locations now have an additional option: the AO-16 satellite. The *SpaceNews* newsletter quotes APRS pioneer Bob Bruninga, WB4APR, as reporting that AO-16 command station Jim White WDØE, has OKed the experimental use of APRS on the satellite every Tuesday (0000 to 2359 UTC). APRS users are asked to uplink only on 145.940 MHz and must use Manchester-modified TNCs, which Bruninga says is a $3 modification.

According to Bruninga:

> The intent here is only to provide a channel for mobile travelers or wilderness position/status reporting (1 or 2 packets per station per day). Existing users of AO-16 need not fear a deluge of activity, since almost 99.99% of APRS users are already connected nationwide via VHF, UHF, HF and Internet gateways. Comparing this 24-hour-a-day connectivity with the potential of only a few packets a day via AO-16 will certainly limit activity to only those truckers, RVers and cross-country mobile travelers in the wilderness, willing to make the TNC mod.

For additional information on APRS via AO-16, contact Bruninga via e-mail at <wb4apr@amsat.org>.

Repeater Stolen in Colorado

Thieves in Colorado made off with an entire repeater system, according to a report on "Newsline" recently. The equipment was stolen from the KDØNU repeater site on Lookout Mountain, above Glenwood Springs, Colorado, and included a GE Master II VHF "M" 40-watt mobile unit, a "Nasty Hackers" R-C M-2 digital voice repeater controller, an Astron 20-amp power supply and other accessories. All equipment is marked as property of KAØDOE. Anyone who sees this equipment is encouraged to contact Tracy Dillingham, KAØDOE, at 128 Hopi, Carbondale, CO 81623, or by e-mail to <ka0doe@juno.com>.

New York/New Jersey Declare June "Amateur Radio Month"

The governors of New York and New Jersey issued proclamations in late May, declaring June as "Amateur Radio Month" in their respective states. This is the third consecutive year in which hams have been recognized in New York, and the first time such a proclamation has been issued in New Jersey, according to a report in the *Hudson Loop* newsletter.

Both proclamations recognized amateur radio's dedication to emergency communications, international goodwill, and educational opportunities, and the New York State proclamation made special note of ham radio assistance during the ice storms that virtually shut down upstate New York last winter.

Tandy Responds on License Notice

Tandy's TechAmerica division has promised to include an amateur radio licensing disclaimer on all future advertisements for the ham gear that it sells. Responding to heavy "bashing" on the Internet after a flyer featuring the Alinco DJ-190TD on its cover ran without a notice that a ham license is required in order to transmit with the radio, TechAmerica spokesman Alan Benoit, WQ5W, said in a letter to David Donnelly, KF6XA (which Donnelly posted on the Internet), that it is normally company policy to include a licensing notice with any ads for ham gear, but that this unit "was a special front cover item and in the excitement of offering such a special price, we did not run the notice."

"Our management team has reviewed this issue," Benoit continued, "and we intend to run an Amateur Radio licensing disclaimer in ALL future advertising media where amateur radio products appear, including our web ads, magazine ads, catalogs and flyers." (*To the best of our knowledge, this makes TechAmerica the only amateur radio dealer or manufacturer to adopt such a policy.—ed.*)

Listen to Six on the Internet

In yet another blending of ham radio and the Internet, Chris Gare, G3WOS, says he's hooked a Yaesu FT-650 6-meter transceiver to the UK Six Metre Group's Web site, and that visitors will be able to control the radio from the Web page! The link is controlled by a timer and is active daily from 0700 to 2200 UTC.

Gare says the rig will be fed by a Diamond 5/8-wave vertical antenna if he's on the air...but if he isn't, it'll be hooked up to his stacked six-element beams. In addition, says Gare, he's considering hooking up his video camera and "WebCam" software to provide a "live" display of the rig's front panel, rather than using a static GIF image. You'll need a sound card, of course, to hear what's going on. You can listen to 6 meters in the UK by pointing your Web browser to <http://www.uksmg.org/50110live.htm>.

Letters

Your Spot to Speak Out

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

Thanks Pete!

Dear *CQ VHF*:

Peter O'Dell's article in the April Issue of *CQ VHF* was excellent. For some reason I think the article will work for me. My code speed seems to be stuck around 12–15 WPM. Thanks.

Vollie Miller, W4TDB
Dickson, Tennessee

Faster, Faster!

Dear *CQ VHF*:

I have recently returned to radio, with a Tech class amateur license, after an absence of 20+ years. After reading three issues of *CQ VHF*, I have found almost nothing of any substance regarding one of my other main interests, data at speeds greater than 9600 bps. I would think many others share this interest, particularly as it related to high speed Internet access, etc. Thanks for your attention.

Jay, KC2CSH

Jay—Thanks for your letter and welcome back to ham radio. Our "Digital Data Link" column regularly covers all aspects of ham radio digital communications, including high-speed data. One difficulty with providing significant coverage to ham radio data communication at speeds higher than 9600 baud is that there is so little of it actually going on here in North America. If you're doing it, I'm sure Don would love to hear all about it from you. But basically, there's not a whole lot going on above 9600-baud (it's something we'd like to change and have editorialized on more than once, but it's not happening yet, at least not on this side of the Atlantic).

What About Us Kids?

Dear *CQ VHF*:

I have read some of your magazines and I am very impressed. I am only 15 years old and am not into all of the stuff that *CQ* and *QST* and those magazines offer. I don't subscribe to *CQ VHF*, but if I buy one at a newsstand I read it cover to cover many times over.

Considering the nature of your magazine, I think one section that you should give some thought to would be a section for young (age-wise) hams. I know there are not enough hams under 18 to make a separate magazine, but I think that it would be a good addition to your magazine. It might help spark some interest if parents who got the magazine showed the articles to their children. It would show them that their are other hams out there who are kids. It's just an idea that I think would be worth considering. Thanks.

Jonathan Bausman, KC2BRN
Wilmington, New York

Jonathan—Your suggestion is one that I've thought about many times since the earliest days of the magazine. At the moment, we don't have the space for another regular column. However, I'd certainly be willing to consider one or more feature articles—by you or anyone else out there—about things young hams are doing, etc....especially if they're doing special things that go beyond just joining in with the "old folks" in their activities. You'll find our writers' guidelines on our Web site <http://members.aol.com/cqvhf/> or we'll be happy to mail you a printed copy if you send us a self-addressed stamped envelope and a request for CQ VHF *writers' guidelines.*

"Real Hams"

Dear *CQ VHF*:

I can't say that I know what makes a "Real Ham" ("Line of Sight," May, 1998, CQ VHF) any more than you have described. Bravo!

I can offer an analogy that holds on multiple levels, though. A private pilot license is seen in the aviation community as "a license to learn." Yet the holder is a full-fledged pilot. We have, I fear, lost the "license to learn" (and experiment) perspective in the current licensing debate.

The person holding a ticket is a full-fledged ham. A Real Ham. Period. But that person has (I believe) an obligation—to society and self—to learn. Perhaps we should be prepared to demonstrate competency in our chosen operating modes to "stay current," much as the pilots have to maintain their certification through periodic demonstration with an instructor.

Marty Watt, KM7W
Franklin, Tennessee

Dear *CQ VHF*:

Your column "Are You a 'Real Ham,'" 5/98 compelled me to write. These types of articles are a waste of ink and paper. The question is ridiculous! Why do licensed ham radio operators waste such time asking these types of questions, real ham, code, no-code, who cares? Are the only real hams Extra class, is like asking if you're a real baseball card collector, only with a particular rare baseball card. Do any No-Code Techs want to learn code so they can get on HF, to talk to operators that feel like this. Well not me, I'd rather talk on CB 19.

Michael T. Kersnowski, KC2AXD
Andover, New Jersey

Dear *CQ VHF:*

I really enjoyed your June Beginner's Corner, "Can you Really Do That?" by Peter O'Dell, WB2D. And, Line of Sight, "Battling Band Bigotry" by Rich Moseson, W2VU.

I liked your historical notes about the old rules. I got my license in the early 70s and know of what you speak. It is too bad that you need to write articles to protect the newcomers from the some oldcomers.

Back in the sort of Olden and Golden days of yore, it got so bad that one night, when I was driving into El Paso, I was late and had the talk-in station for the hamfest call my motel to let them know I was running late. Someone who was a charter member of the *OFN*, Old F...s Network, called me to let me know I violated an FCC rule, because the motel was going to make money on the deal. I guess he forgot that Ma Bell must have made at least $.25 on it, too!

Another example: We used to get all the new Novice and Technician hams to our club Field Day each year so they could

get some HF voice operation in and see some DX on 6 and 2 meters. This was with a control operator of General class or higher on HF. It was a great way to get the newcomer fired up about ham radio.

One year we had a new Novice who was in his teens, who came over from a nearby town and afterwards, he called one of the OFNs back home and told him about Field Day. The kid returned in tears because the OFN had told him he was going to lose his license because he had operated on 40 voice, even though it was under the direct control of a General class ham. He is no longer a ham and we all know why. I have seen the enemy and it is US.

I teach ham radio classes and I flat out tell the newcomers that they will find some bigoted hams in the OFN group, but I remind them that their license will be printed with "Amateur Radio License," not "Almost Amateur Radio License." I do not teach the Morse code in my classes, but only because they have so much new stuff to learn that I do not want to add Morse code to the list. I do encourage them to add the code with on-the-air 2-meter classes, if they want to do so.

I see so much of what you speak, we are infighting so much that we are unaware of the war outside our ranks. And then we have someone say, "what happened to packet radio?"

Again thanks so much for your article, I enjoyed it. Highest regards,

Ric Sohl, KK5RIC
Odessa, Texas and
Ruidoso, New Mexico

Ric—I agree it's too bad that we need to write articles like these, but your letter confirms that we do. Along the same lines, be sure to check out my article, "Repeater Timed Out," in last month's issue, about the real *reason that repeaters have timers on them! I think you'll be surprised. I know I was.*

RF Exposure Idea

Dear *CQ VHF*:

All I hear about these days is the dangers of RF exposure. In the interest of the safety of hams as well as "ordinary citizens," I think we should abandon all of our dangerous existing frequencies and start using the cellular phone frequencies. The cellphone companies (and their lobbyists) have made it very clear that their frequencies, unlike all other frequencies, are absolutely harmless and therefore it is OK to forcefully place their towers in the middle of residential areas.

Tony Melton, KD4MRS
Cleveland, Tennessee

Tony—You're correct up to a point. Recent unpublished research (completed last April) has shown that cellular frequencies are safe primarily because the law requires all radio receivers to block them out. A frequency that cannot be received cannot pose a hazard. However, since the cellphones themselves are capable of receiving on cellular frequencies (is this legal?), additional shielding is required for complete protection. Automobile bodies are known to provide additional shielding, and a little-known corollary to the laws of motion states that resistance to RF energy increases with speed (if you go fast enough, you can duck under the peaks and jump over the valleys of the radio waves). For this reason, the study recommends using cellphones only while in a vehicle, and only at speeds of 60 mph or higher! (And now you know why the research is unpublished!)

[And for all of you folks out there who take all of this much too seriously, no,

(Continued on page 84)

Product Update

"Teletec Tough" RF Linear Amplifiers

Teletec has introduced a new line of linear amplifiers housed in a die-cast aluminum heat sink. The amplifiers operate in all modes without the necessity of manually switching between SSB, FM, CW, and AM. They offer TR switching, over/reverse voltage protection, ATV tuning, repeater tuning, pre-amp disable, and keying wire kit. The DXR series of linears offers the same features but with a 100% duty cycle in either the rack mount or desktop version.

For more information, contact Teletec Corp., 10101 Capital Blvd., Wake Forest, NC 27587-7788; Phone: (888) 323-6888; Web: <www.teletec-usa.com>.

Circle 100 on reader service card

1998 Hamtronics Catalog

The 1998 Hamtronics®, Inc., catalog contains 40 pages of kits and wired units for amateur radio, two-way shops, scientific and industrial users, and OEMs (original equipment manufacturers). Several new frequency-synthesized transmitter and receiver products have been added to the company's lineup of VHF and UHF products.

The new T301 Exciter and R301 Receiver provide high-quality NBFM and FSK operation. Models for amateur frequencies are available for 144 to 148 MHz and 220 to 225 MHz. Features include dip switch frequency selection, low-noise synthesizer for repeater service, commercial grade TCXO (temperature-controlled crystal oscillator) for tight frequency accuracy in a wide range of environmental conditions and fast delivery with no wait for channel crystals.

The T301 Exciter has exceptional modulation for voice and subaudible tones. It also uses direct FM modulation, which allows FSK transmission of data up to 9600 baud. Power output is 2 to 3 W, and it is rated for continuous duty in demanding applications, such as repeater service. The R301 Receiver has the same sensitivity, selectivity, and squelch as other Hamtronics receivers.

To request the 1998 catalog, contact Hamtronics, Inc., 65-V Moul Rd., Hilton, NY 14468-9535; Phone: (716) 392-9430; e-mail: <jv@hamtronics.com>. You can also view the entire catalog at their Web site at <http://www.hamtronics.com>. Please tell them you saw this announcement in *CQ VHF*.

Alinco DJ-S46 FRS Transceiver

Alinco is now offering a Family Radio Service (FRS) version of its DJ-S41 amateur handheld. The DJ-S46 is Alinco's first entry into the growing FRS market. The unit features all 14 FRS channels, and, using AA batteries, transmits with an output power of 340 milliwatts.

Like the DJ-S41, the DJ-S46 has a pivoting "swing up" antenna. The flexible design allows the radio to remain compact in a pocket or a purse without detaching the antenna. It also does away with the risk of misplacing a detached antenna. Additional features include rechargeable NiCd battery and the option to use AA cells in place of the NiCd, large illuminated display, pager "alert" alarm, hi/low transmit power setting, and a programmable auto-power-off feature. The radio comes with a belt clip and carry strap.

Suggested retail price for the DJ-S46 is $149.95. For additional information, contact Alinco Electronics, Inc., 438 Amapola Ave., Lot #130, Torrance, CA 90501; Phone: (310) 618-8616; Fax: (310) 618-8758; Internet: <http://www.alinco.com>.

Circle 101 on reader service card

MFJ GIANT Display Clock/ Calendar/Thermometer

Glance across the room and immediately know the month, date, day, and temperature with MFJ's new GIANT display™ Calendar Clock.

Choose from 12- or 24-hour time format, and Fahrenheit or Celsius (indoor) temperature scale. This white and silver

speckled clock (8-1/2 x 9 inches) has a "giant" easy-to-read LCD display. Display as a digital calendar with year, month, date, and temperature showing, or as a UTC or local time clock with time, month, date, and temperature displayed. Long-life "AAA" batteries are included, along with mounting hole for display on the best wall of your shack.

MFJ's GIANT display 24/12 Hour Calendar Clock comes with a one-year limited warranty. Suggested retail price for the GIANT display is $49.95.

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

Circle 102 on reader service card

Morse Code Software

Brad's Software has released Morse Code Made Easy, a menu-driven learning tool that allows you to set your own pace when learning Morse code.

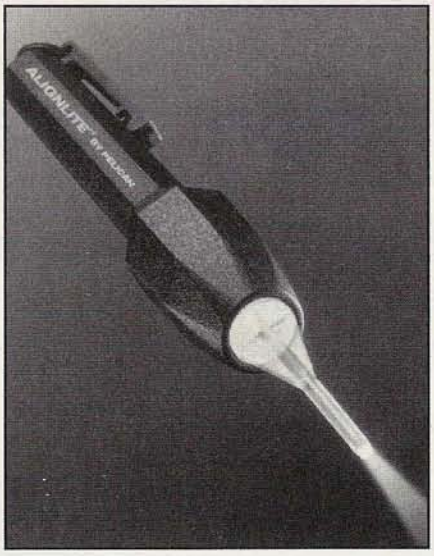
The three main modes are LESSONS, PRACTICE, and WORD LIST. You can switch between sound card and internal speaker, change the tone, words per minute rate, number of characters sent at a time, and whether the characters displayed as the dits and dahs are sounded through the computer's sound system. The program tracks your progress and displays a score at the end of each lesson, based on level of difficulty. You can run the lessons in any sequence you choose. You can use the "Ctrl" key as a telegraph key and even send text files.

Separate versions are offered for DOS, Window 3.1, and Windows 95. Morse Code Made Easy for Windows is available for $25 plus $4 shipping and handling from Brad's Software, 4969 Wyoming Dr., Dallas, TX 75211-7843; Phone: (214) 339-6920; E-mail: <brads_s @compuserve.com>. You can download a free trial version of the software from <http://ourworld.compuserve.com/homepages/brads_s/codedown.htm>.

Circle 103 on reader service card

AlignLite, Alignment Tool with a Light

"A tweaker with light for electronic calibrations and adjustments" is how Pelican Products describes its new tool, which makes it easy to see and access small electronic components in limited light. The 6000 candlepower xenon beam lights up the darkest areas of electronic equipment chassis. When the AlignLite™ tool is detached, you can use it as a pocket light (its light is 600% brighter than ordinary flashlights). It's submersible to 500 feet and is FM, CSA, and CENELEC approved. Made of chemically resistant Xenoy®, the AlignLite includes two different size alignment tool screw tips, two-AAA Energizer® batteries, and two vision aid lenses (red and blue/green). Color is black; catalog number is 1975.



For additional information, contact Pelican Products, 23215 Early Ave., Torrance, CA 90505; Phone: (310) 326-4700; Fax: (310) 326-3311; Web: <www.pelican.com>.

Circle 104 on reader service card

Heavyweight Russian Keyer

Milestone Technologies of Aurora, Colorado, is now distributing the Russian-built ElectroInstrument Key-8 CW paddle/keyer. Its unique styling includes a polished chrome body, silver contacts, and a solid brass base plate that—with a total weight of nearly 3-1/2 pounds—keeps the keyer where you put it.

Paddle tension and spacing are independently adjustable, and there is a small amount of "tactile feedback" in the all-mechanical movement. Speed range is adjustable from 5 to 50 wpm, and a sidetone oscillator is included. There are provisions for bypassing the keyer so the paddle can be used with a different keyer. All connections are via a five-pin DIN socket on the base; a matching DIN plug and English wiring instructions are included. List price is $129.95. For more information, contact Milestone Technologies, 3140 S. Peoria St., Unit K-156, Aurora, CO 80014-3155; Phone: (800) 238-8205 or (303) 752-3382; e-mail: <nlfn@mtechnologies.com>; Web: <http://www.mtechnologiews.com>.

Circle 105 on reader service card

The Senator from Amateur Radio

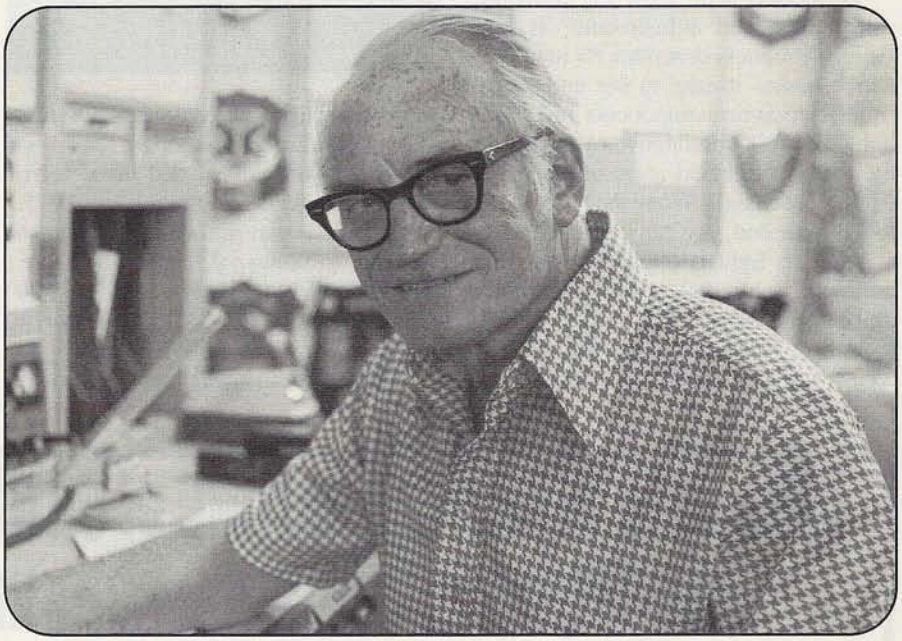
Barry Goldwater was a United States Senator, a candidate for President, and—perhaps most importantly to hams—"one of us." Here's a look back at some hams' recollections of "Barry, K7UGA."

By Rich Moseson, W2VU*

When former U.S. Senator Barry Goldwater died at the end of May, the news reports attached many labels to the man, all of them relating to his life in politics. The Associated Press, for example, called him a "Republican Icon" and an "uncompromising defender of conservatism."

As the Republican Party's candidate for President in 1964, Goldwater lost to Democratic incumbent Lyndon Johnson, but set in motion the philosophical change that shifted his party's power base from northeastern moderates, such as New York Governor Nelson Rockefeller (whom he defeated for the GOP nomination in 1964), to southern and western conservatives, such as Ronald Reagan. He is perhaps best remembered for one line in his acceptance speech at the 1964 Republican National Convention: "Extremism in the pursuit of liberty is no vice....Moderation in the pursuit of justice is no virtue."

But amateur radio operators knew a different Barry Goldwater, a ham who loved to play with radios, who wasn't afraid to pick up a soldering iron, and who—during the Vietnam War—organized MARS (Military Affiliate Radio System) volunteers to staff his home station virtually around the clock to provide phone patches from soldiers in southeast Asia to loved ones at home. He was a man who moved in the highest echelons of American political life, but once he knew you were a ham, he always introduced himself simply as "Barry, K7UGA."



The late Barry Goldwater, K7UGA, in his Scottsdale, Arizona, ham shack. Ham radio's "senior statesman," Goldwater was a U.S. Senator from Arizona from 1953 to 1965, and again from 1969 to 1987. He was the Republican nominee for President in 1964. (File photo)

Remembering Barry

We asked a variety of hams to share with us their recollections of encounters with Barry, both on and off the air. Virtually all of them echoed the same theme: that ham radio created an instant bond of friendship, that we (all of us) were Barry's friends and he was our friend.

John Watrous, K6PZB, recalled a typical experience: "I worked K7UGA once from southern California, as a teenager just starting out. He treated me just like anyone else...nicely."

Jim Shorney, NUØC, had a similar on-air experience:

I had the pleasure of talking with Barry on 20 meter phone on June 6, 1988....The only thing noteworthy about the contact, I suppose, was my luck that day. I had just turned the rig on and hadn't even touched the tuning dial when I heard K7UGA in QSO. I waited till they signed clear and called him, and he came right back to me. Barry was most cordial and gentlemanly, and we had a pleasant QSO about his visits to the Omaha, Nebraska, area where I grew up. I had no sense at all that I was talking to someone who moved in the most powerful circles in the world, Barry was just an "ordinary joe" on the radio. There are a few times in every ham's life, if he or she is lucky, when you get a huge rush from your hobby. My contact with Barry ranks right up there with the best of them.

There is a digitized image of my QSL from Barry on my Web pages at <http://homepage.usr.com/j/jshorney/51196.shtml>.

And Lee Wical, KH6BZF, wrote:

I was in the Kaiser Hospital in Honolulu and in bed for two weeks. My XYL brought me my mail daily, and one day there was a QSL card from Barry with "Well wishes for a speedy recovery" written on it, and it was signed "Barry, K7UGA." (It just doesn't get better than that!) I don't know how he found

** Rich Moseson, W2VU, is Editor of* CQ VHF *magazine. This article is also appearing in* CQ *magazine.*

"I spied the thick crowd of humanity parting, as if by command. People were moving away and giving wide berth for the Senator from Arizona. It was just Barry going for a short expedition to the closest Home Depot."—David Wilcox, KC8CC

out I was laid up, but it is one of my favorite QSL remembrances.

Instant Friends

The bond of ham radio friendship extended to in-person contacts as well. David Wilcox, KC8CC, lives in Phoenix and relates this tale of Barry at the hardware store...

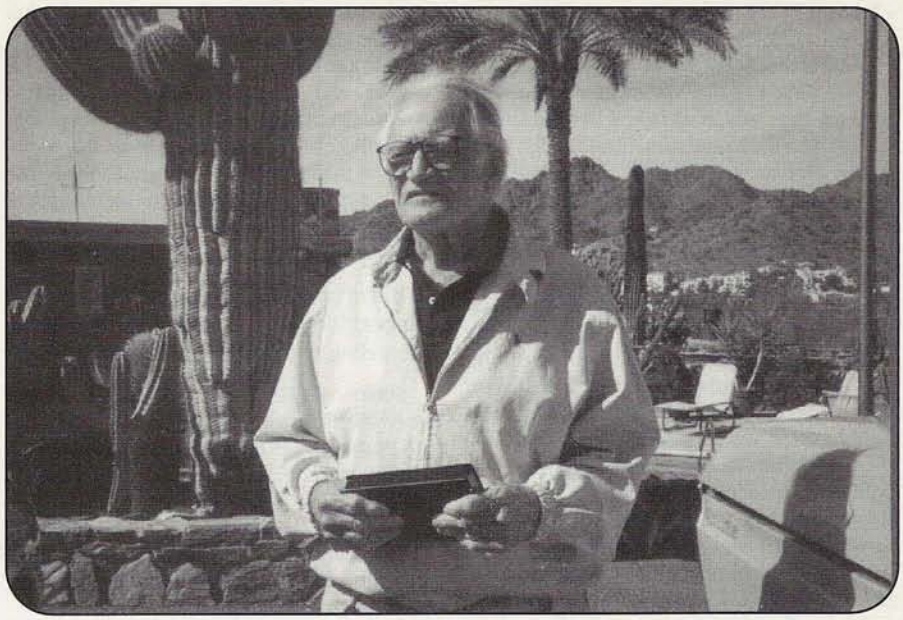
I spied the thick crowd of humanity parting, as if by command. People were moving away and giving wide berth for the Senator from Arizona. It was just Barry going for a short expedition to the closest Home Depot. The crowd was whispering and averting eyes as he passed down the lumber aisle.

Having visited his shack once with a Scottsdale amateur radio tour, and having briefly met the Senator, I felt no need to slink away. Rather I walked right up to the delighted personage and shook his hand, announcing, "Dave, KC8CC." Having a chance to exercise the natural politician's urge, he intoned "Barry, K7UGA." We slapped each other on the back and grinned, although he could not have remembered me. We then proceeded to talk about propagation and the weather. Glancing over his shoulder, the patrons of the store were watching it all from afar with wide eyes. Not required...Barry was a people person...especially with other hams.

A similar experience was recalled by Kent Tiburski, WA6TBO. However, his encounter with Barry was at a Fourth of July parade...

Many years ago when I was on active duty in the Navy and assigned to Navy Recruiting District San Diego Public Affairs, I was introduced to Senator Goldwater. I was at a parade on the 4th of July, 1983, in Showlow, Arizona, where the state's largest 4th of July celebration took place. I was driving a 40-foot flatbed tractor-trailer carrying an aircraft carrier mockup built of plywood.

The parade participants were at a park in the staging area prior to the parade and I spoke with the parade military coordinator and asked if there was a chance of being introduced to the Senator if wasn't a problem. Minutes prior to the parade, Skip Peabody (the military coordinator) came over with Senator Goldwater and said "I've had a young man wanting to meet you." Senator Goldwater, hand outstretched, introduced himself as Barry Goldwater. I shook his hand and instead of giving him my entire name, I introduced myself as "Kent, WA6TBO." He smiled widely and said, "Barry, K7UGA." I was pretty excited and we began to talk about radio. It seemed like a long time before the parade coordinator said it was time to get me staged inline. I said goodbye to Barry and went back to my vehicle.



Barry Goldwater, "The Senator from Amateur Radio," outside his home. Asked about restrictive antenna ordinances on the now-defunct "Ham Radio and More" radio program, Goldwater said: "I believe anything from the roof of my house to Heaven is free open space. I want to see somebody remove my antenna." (Photo courtesy Bill Pasternak, WA6ITF)

Just as I started the engine, he was at the passenger side window asking, "Can I ride a little ways with you?" You can be sure what my answer was—YES! We continued to talk about radio, I asked him about MARS and the station he ran during the Vietnam war, running countless phone patches back to the states. We chatted for about 20 minutes before he had to leave and I took off in the parade.

It was a unique experience for me. I returned that next week from my trip to be greeted by a "thank you" letter from the Senator sent via my Commanding Officer. Barry Goldwater was an interesting man and a pleasure to converse with, and will be missed by many of us.

Washington Contacts

Gabe Romero, K7NOK, is a TV news cameraman in Washington. His job brought him into contact with the Arizona Senator several times over the years. His recollections...

First came across the man on film at the projection room at ABC when he held a news conference outside the White House saying he had just talked to Nixon and he was a goner, he should quit. That was Goldwater, no BS about him.

Second memory: I was shooting (TV talk for filming or taping) a Senate Armed Services committee of which he was chairman, believe it was with the Joint Chiefs and Secretary of Defense. On a whim, I went up to him before he gaveled it to start and whipped out my "new" ICOM μ4 A/T. We talked for 10 minutes as he played with it, brought up our repeater, the patch, all the while the senators and witnesses were waiting to start. Had his priorities straight.

Third memory: You would never forget if you ever saw his car. Radios ranging from low band to aircraft to CB to VHF telephone to 2-meter. All kinds of gauges, even a temp. gauge on his exhaust pipe—well he was a pilot after all.

Final memory: We were chasing him across the street as he walked from the Senate to his office in the Old Senate Office building. The reporters were shouting, "Tell us Senator, are you going to run again?" To which he gruffly replied: "No, Goddamm it! I'm too old!" And off he went. That was Barry, telling it like it was.

We need more of his kind back here.

Gabe wasn't the only ham who found that Barry was a ham first, Senator second. Neil Lauritsen, KA3DBK, relates this story:

My "elmer" told this story to me in 1979 while I was studying for my novice exam. My "elmer" worked as a lawyer to the Senate and belonged to the Senate Office Building Ham

club (*W3USS—ed.*). Senator Goldwater slipped up to the club station whenever he could and was as always the consummate ham.

One day, Senator Goldwater noticed an antenna coax which appeared to need finishing off with the installation of an SO-239 connector and set immediately about that task, and when he finished the soldering job, he cleaned up the antenna run by cutting the few extra feet off the cable to make it neater in appearance. Senator Goldwater, having completed his good deed, then left the shack and was returning to his own offices as my "elmer" returned from the roof—trying to figure out how he had ended up a few feet short of the coax run he had so meticulously measured a short time before! It wasn't until he went back into the shack and saw the neatly-soldered connector that he realized what had happened. My "elmer," being the good lawyer that he was, and in appreciation of the Senator's efforts, never had the heart to mention it to him. We will miss this good friend to ham radio.

A Good Friend to Ham Radio

K7UGA was not only a friend to hams as individuals, but an influential friend to the hobby of ham radio as well. In fact, he came to be known to many as "The Senator from Amateur Radio." The ARRL bulletin announcing Goldwater's passing (see full text elsewhere in this article) quoted former FCC Chairman Mark Fowler as saying that the commission had often asked the senator to review ham-related proposals before it acted on them. And Barry was directly or indirectly responsible for the Volunteer Examiner program, 10-year license terms, and the Amateur Auxiliary to the FCC, all of which were included in a bill—now a law—that also gave the FCC the authority to get tough with home-entertainment equipment manufacturers in RFI (Radio Frequency Interference) matters. Longtime ham and *CQ* author Ted Cohen, N4XX, who was involved in the effort to get that legislation passed, told us:

In the early 1970s, Vic Clark, W4KFC (SK) and I formed the ARRL RFI Task Group. One of the early actions I took was to write an RFI Bill for submission to the House of Representatives (and, eventually, to the Senate as well). The purpose of the bill was to place the burden of fixing RFI problems on the manufacturers of electronic home entertainment equipment (it gave the FCC the authority to require that circuitry be included in equipment designs to reduce the susceptibility to RFI). The bill I wrote was introduced by Congressman Teague of Ohio into several sessions of the House. Later, other Congressmen introduced the legislation. But it wasn't until the 1980s, when Barry put his weight behind it, that the bill was passed into law. Regrettably, while the FCC never was up to the challenge of exercising the provisions of the legislation, they are on the books and, someday, may even be applied. Regardless, we owe a debt of gratitude to Barry for pushing this through on our behalf.

Barry was also provided significant support for the amateur satellite program, according to the AMSAT News Service:

Senator Goldwater was a longtime friend of AMSAT, having appeared in a number of ARRL and AMSAT-sponsored videos about satellites over the years. In the early stages of the Phase 3-D effort, he appeared with Roy Neal, K6DUE, in an AMSAT-sponsored fund-raising video for the project. The video was filmed in his well-appointed "shack" at his home in Scottsdale.

"I had the good fortune to be there with the Senator during the filming of portions of our video," said Keith Baker, KB1SF, AMSAT-NA's Executive Vice President. "He was genuinely enthusiastic about what the Phase-3D satellite would offer to the world's Radio Amateurs, and that enthusiasm really showed in his on-camera comments. There is no doubt in my mind that we have now lost one of our most ardent supporters of Amateur Radio, Phase 3-D and AMSAT," said Keith.

And Len Winkler, KB7LPW, host of the now-defunct "Ham Radio and More" radio program, recalls that Barry had no patience for restrictive antenna ordinances:

As the host of "Ham Radio & More," I had the honor and pleasure to interview Senator Goldwater on two different occasions, two hours at a time. As well, I had the pleasure of being at his home many times, and brought many students and others to his shack for an unbelievable historical experience. (*Len lives in Arizona.—ed.*)

Many of his remarks were priceless. One thing I particularly remember was his response to my question about what we hams can do about all the antenna restrictions in the new housing developments. The Senator responded, "I believe anything from the roof of my house to Heaven is free open space. I want to see somebody remove my antenna." (You can listen to one of these interviews at <http://www.tapr.org/hrm/hrmdigital.html>.)

He was truly a great man, and will be sorely missed.

Barry Behind the Scenes

But perhaps Barry's greatest contribution was the one he spoke least about—his efforts during the Vietnam War that resulted in hundreds of thousands of phone patches being placed through the MARS station in his home between soldiers, sailors, and airmen overseas and their loved ones at home.

"Just as I started the engine, he [K7UGA] was at the passenger side window asking, 'Can I ride a little ways with you?' We chatted for about 20 minutes before he had to leave and I took off in the parade."
—Kent Tiburski, WA6TBO

Art Goldman, WA3CVG, provided us with the following story from a non-ham friend of his:

I attach a story related to me by a co-worker, Al Hamilton. Al is not, and was not a ham, but as the story relates, he accompanied his friend Dwight, who was. Al often manned positions at the K7UGA MARS station with Dwight. I have enjoyed these stories on other occasions, and thought your readers would also.

73, Art, WA3CVG

From Alan Hamilton:

During the late 70s, it was my pleasure to be associated with a member of the MARS radio club established by Senator Barry Goldwater in Tempe, AZ. My access to the club was through a Mr. Dwight Pringle who I met while working as a government representative on a contract performed by Motorola, Mr. Pringle's employer. On each Thursday evening, Mr. Pringle would man the station and provide phone patches to stateside locations for service men on duty in Southeast Asia. I went along whenever I was in town.

Because Senator Goldwater did not want to capitalize politically on this generous gift he was making, there was a standing rule that no one was to be told from where the phone calls originated or who was responsible for providing the service. While I never met the Senator personally, his spirit was always present in the radio room. His annual Christmas present to the men and women involved was there were no phone charges to the recipient's of the calls during the weeks around Christmas and New Year's. His generosity also extended to the men and women who manned the station as well as he provided soft drinks and coffee for all the operators year around.

One of the most poignant examples of the service provided by Senator Goldwater's radio club was related by Mr. Pringle. It was one of those Thursday night sessions when he was working the station alone. During the course of his shift, the caretaker at the Goldwater home notified Dwight that a

A Farewell

Here is the full text of the ARRL Bulletin announcing the passing of former Senator Barry Goldwater, K7UGA:

QST de W1AW
ARRL Bulletin 39 ARLB039
From ARRL Headquarters
Newington CT May 29, 1998
To all radio amateurs

SB QST ARL ARLB039
ARLB039 Sen Barry Goldwater, K7UGA, SK

Former US Senator, onetime presidential candidate, and noted radio amateur Barry Goldwater, K7UGA, died May 29. He was 89. Goldwater had suffered a stroke in 1996 and had been in failing health.

A staunch conservative, Goldwater was the 1964 Republican presidential nominee and served five terms in the US Senate. He also authored the book Conscience of a Conservative. Goldwater retired from politics in 1986. His home was in Scottsdale, Arizona.

As a Senator, Goldwater's legacy included several pieces of Amateur Radio-related legislation. In 1964, Goldwater's bill to allow reciprocal operating agreements between the US and other countries was signed into law. It was his work on the bill that prompted the Arizona Senator to renew his interest in ham radio after a long absence.

Goldwater's 1964 presidential campaign tried to tap into his ham radio connections with a "Hams for Barry" fundraising effort. He took time out of the campaign to address the ARRL National Convention in New York City, on the occasion of the League's 50th anniversary. In his remarks, Goldwater reminisced about his youthful foray into Amateur Radio as 6BPI. He was first licensed in 1921, and joined the ARRL in 1923. "You can't imagine what a relaxation ham radio is for me," the campaign-weary Goldwater told the gathering. He related how, during the GOP Convention earlier that summer, he'd made several hundred contacts from his hotel room using a borrowed Collins S-line. The convention presented Goldwater with a certificate of appreciation for his work on behalf of the hobby (see *QST*, Oct 1964, p 80). Goldwater lost the 1964 election to Lyndon Johnson.

While serving as chairman of the Senate Communications Subcommittee in 1981, Goldwater introduced landmark legislation proposing several changes to the Communications Act affecting amateurs. In 1982, Congress finally approved and President Reagan signed what came to be known as the Goldwater Amateur Radio legislation, enacted as Public Law 97-259. The measure established the Amateur Auxiliary and the volunteer examination programs, permitted 10-year license terms, and exempted Amateur Radio from the secrecy provisions in the Communications Act. The Goldwater bill also ended years of Congressional wrangling and authorized the FCC to set RFI susceptibility standards for home electronic devices.

A year later, President Reagan signed into law a bill including a Goldwater amendment that allowed the recovery of costs in the Volunteer Examiner program (the FCC didn't authorize the plan until months later, however).

At one point in his ham radio career, Goldwater operated as K3UIG from his Senate office and as K7UGA when he was home in Arizona. He called his Arizona ham shack "bash-hal-ne-ae," which he said was Navajo for "music from iron" or "metal that talks."

Goldwater was a life member of the ARRL. He was elected president of the Quarter Century Wireless Association in 1971. A pilot during World War II, he held the rank of General in the Air Force Reserve and was an active member of Air Force MARS. During the Vietnam War era, Goldwater handled hundreds of thousands of phone patches. He also held a pilot's license and occasionally operated aeronautical mobile.

In 1983, Amateur Radio paid homage to Goldwater as "its governmental protector and advocate" by establishing the $5000 ARRL Scholarship to Honor Barry Goldwater, K7UGA. In announcing the scholarship, then-ARRL Washington Area Coordinator Perry Williams, W1UED, said that Goldwater's Amateur Radio involvement had "brought joy to thousands of members of the armed services stationed overseas, and through his professional career, he has exemplified the principles of commitment and service to one's country and fellow citizens."

Then-FCC Chairman Mark Fowler said the Amateur Radio community was lucky to have Goldwater as its "elder statesman" in government and noted that the FCC often had Goldwater review ham-related proposals before it took action on them.

The Goldwater scholarship, administered by the ARRL Foundation, is awarded each year to a deserving radio amateur to encourage a spirit of achievement and dedication in the field of communication.

ARRL Executive Director David Sumner, K1ZZ, said that of amateurs in the public sector, Goldwater was "without peer." Southwestern Division Director Fried Heyn called Goldwater "a super ham" who was "concerned about the future of Amateur Radio."

Goldwater's first wife, Peggy, died in 1986. The couple's two sons and two daughters and Goldwater's second wife, Susan, are among his survivors.

woman was at the gate and wanted to speak to the "radio man." Despite all precautions, this local woman knew that there was a MARS station at Goldwater's and that she had received a call from her husband over its facilities. Because she was in a very distraught state, Dwight agreed to speak to her. She produced a telegram that indicated that her husband had been wounded and was being flown to Japan for treatment. Her plea was whether there was any way the "radio man" could find out what was going on.

Doubting the possibility of success but recognizing her concern, Dwight called the net and was able to contact the station at Ton Son Nhut. Relaying the situation, the identity of the individual and his parent outfit, Dwight asked if there was any way to get further information for the wife. After some period of time, the distant end called to advise that there would be a need to "wait one" while they set up a link. Imagine the joy felt by the woman when she was able to speak to her husband from his stretcher before he was loaded on the aircraft to fly to Japan.

The link was HF to Vietnam and then VHF-FM via a PRC-25 to the flight line. How they found the party involved, got the link established and then were able to interconnect the two was never defined. Suffice it to say that the lady left the radio room with the knowledge that her loved one was alive and had a good prognosis. As for Dwight, he could never tell anyone that story without getting emotionally tied up. As for me, I just never asked any more questions about how it could have occurred but accepted it as fact and put it away in my memory of stories from AFA7UGA (*Barry's MARS call—ed.*).

And Finally...

To end this remembrance on a somewhat lighter note, but still one that illustrates Barry's essential humility, we conclude with this note from Stephen McCallum, W2ZBY:

I had a brief 75-meter QSO with K7UGA shortly after he lost the election in the '60s. The conversation has always stuck in my mind. After I told him my name and occupation (publicity writer for GE), he said, "My name is Barry. I'm unemployed." I didn't have the guts to tell him I knew very well who he was and why he was "unemployed."

Even those of us who never knew "Barry, K7UGA," should be aware of his importance to our hobby in the second half of the 20th century. And we should all wish him "73." Ham radio has lost a very good friend. Thank you to all who contributed to this article. ■

Further Adventures in Near Space

The ham radio balloonists of the Kansas Near Space Project keep launching—and learning—even after one flight ended with mass fatalities (of bugs)...

By Lloyd Verhage, KD4STH*
(verhage@humec.ksu.edu)

After our most excellent adventure in 1996 (see "Flight of the Isaac Asimov," *CQ VHF*, May, 1997), the Kansas Near Space Project (KNSP) built a new near space capsule in 1997. With the help of the Manhattan Area Amateur Radio Society (MAARS) and hams from Salina, Emporia, and Wichita, Kansas, we completed four successful missions last year with this new capsule.

In this article, I'd like to tell you about our capsule, its four flights, and our latest capsules and plans for 1998.

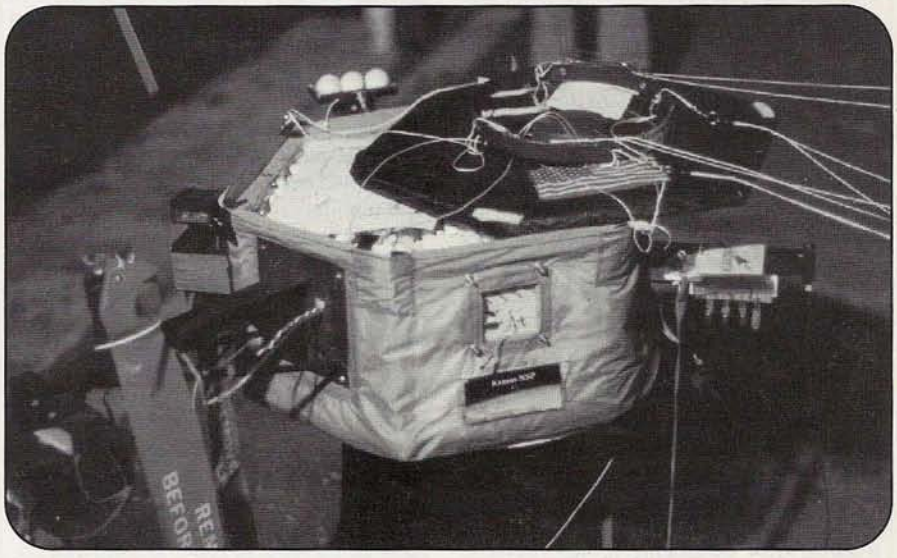


Photo A. The Isaac Asimov II capsule being prepared for flight. Note the side panels that allow access from outside to insert or adjust experiments and equipment without disassembling the entire capsule. (All photos by the author)

The Asimov II

After our experience with our first capsule, the Isaac Asimov (and because of the damage it incurred landing in a tree), I decided to make a new near-space capsule. I wanted it to be more durable and easier to load than the original. The result was the Asimov II (see Photo A).

It's designed around a six-sided Kevlar *bus*, or frame, making it resistant to cracking and breaking (a big thank you to Mr. Jon Held of the Mechanical Engineering Department of Kansas State University for his help with this). On its exterior are three layers of aluminized Mylar and scrim (space blanket and wedding veil material) for insulation and an outer jacket of ripstop nylon to protect the mylar. Each of its interior faces is covered by a layer of polystyrene foam for additional insulation and protection from the rough Kevlar surface.

Five of Asimov II's six sides have open ports. These allow people to design experiments which can be bolted to the side of the capsule. If a port is not used during a flight, it's covered over with a panel of thin plywood and polystyrene foam. The sixth side of the capsule has a power and communication panel in place of the open port. With the capsule closed and readied for flight, we can still access the on-board microcontroller and switch power on and off without opening everything up. This allows us to do a final assembly and test the night before launch—it's amazing how much less rushed and more enjoyable the final assembly is when you're not trying to launch within the hour.

1997 in Review

Last year gave us a number of firsts. We attempted amateur television (ATV) from near space, made observations of the Earth's surface when it was covered in snow, performed a 67,000-foot glider release, launched student experiments, and made high quality videotape from 85,000 feet. It was also our first launch of passengers ("roachonauts"), into near

**Lloyd Verhage, KD4STH, is Project Manager and Chief Engineer of the Kansas Near Space Project (KNSP). This is his second article for* CQ VHF.

Photo B. "Roachonauts" (in glass jar) prepare for near-space travel. Unfortunately, they made the ultimate sacrifice in the pursuit of scientific knowledge—specifically, that roaches don't do well at 85,000 feet...in an unheated, unpressurized container!

space. Among the notable failures were a blown fuse, camera failures, and tragic, "buggy" fatalities.

Flight 97A (June 7)

Our first flight of the year sent up a glider, camera, Geiger counter, yeast samples, a toy, several six-legged passengers, and a color CCD (charge coupled device) camera. In front of the CCD camera, but outside the capsule, was a mirror mounted at a 45-degree angle. This mirror was rotated by a servo (a remotely controllable motor) and controlled by the IHU (Integrated Housekeeping Unit, see "Housekeeping in Near Space"). The mirror could be rotated 180 degrees, giving ground crews ATV images of the ground, horizon, and balloon. Because of the amount of bandwidth ATV requires, we noticed a degradation in image quality within a short distance. The film in the 35-mm camera did not advance properly, so the flight failed to return any ground pictures.

The glider was programmed to be released during the ascent, at 50,000 feet, and the ATV camera was to transmit its release. Unfortunately, the servo did not pull back far enough and the glider was not released until after the balloon burst. At every attempt to release, the CCD camera would look down at the glider, so we missed recording the balloon burst. The glider was eventually released 11 miles north of the town of Cottonwood Falls, at an altitude of 67,000 feet. Instructions for calling my office were printed on the glider, but in seven months' time, no one has yet reported finding the glider.

Experiments on 97A

Mounted to a boom over one of the capsule ports were samples of UV (ultraviolet)-sensitive yeast. Since the capsule flies into the atmosphere's ozone layer, we can use the yeast to determine UV levels. Alas, none of the millions of yeast cells that we launched survived the cold, pressure, and UV radiation to which they were exposed on the flight.

A similar fate befell our first passengers, the roachonauts, who flew in a plastic bottle (Photos B and C). These explorers were carried to 85,000 feet, to bravely go where no roach has gone before. Apparently cockroaches don't like near space. The roachonauts experienced temperatures of -61 degrees F and pressures of only 2.5% of surface pressure. Unfortunately our roachonauts returned to us on their backs and with their tiny little feet curled up. Nonetheless, the media loved this aspect of the flight. If you want your balloon project to get local attention, carry cockroaches into near space.

The bacteria samples we sent up didn't appear to be harmed by their flight. They were lofted inside of petri dishes velcroed to the top of the capsule where they were fully exposed to the sun.

The mission commander for this flight was Major Matt Mason. Some older readers may remember him from the late 1960s. He was Mattel's "Man in Space," a sort of astronaut GI Joe doll. It turns out that 1997 was his 30th anniversary, so we carried him up into near space in celebration. The fatalities on flight 97A should not be viewed as a reflection on the Major's leadership abilities.

Flight 97B (July 12)

Five weeks later, we launched our second flight of the year. This one attempted to use a single camera to return still pictures of both the ground and horizon. A mirror mounted in front of the camera was flipped up and down by the servo. Photographing through a mirror would return reversed images of the ground, of course, but I assumed this would be no problem as film processors could just reverse the negatives in their machine. Boy was I surprised to learn they couldn't! So we have a few reversed photographs from this flight.

Flight 97B carried more insects (june bugs), a photometer to measure sky brightness, and a different strain of yeast cells. The photometer worked well and did detect an increase in overall sky brightness as the capsule ascended (see Figure 1). The june bugs suffered the same fate as the cockroaches, but our second strain of yeast cells was more hardy that the first and survived the flight just fine. In the future, we'll need to find an in-between strain of yeast if we want to make a biological assessment of UV.

This flight also carried ATV. Amateur television on balloons attracts a lot of attention in ham radio clubs so, if you're looking for more help with launching and

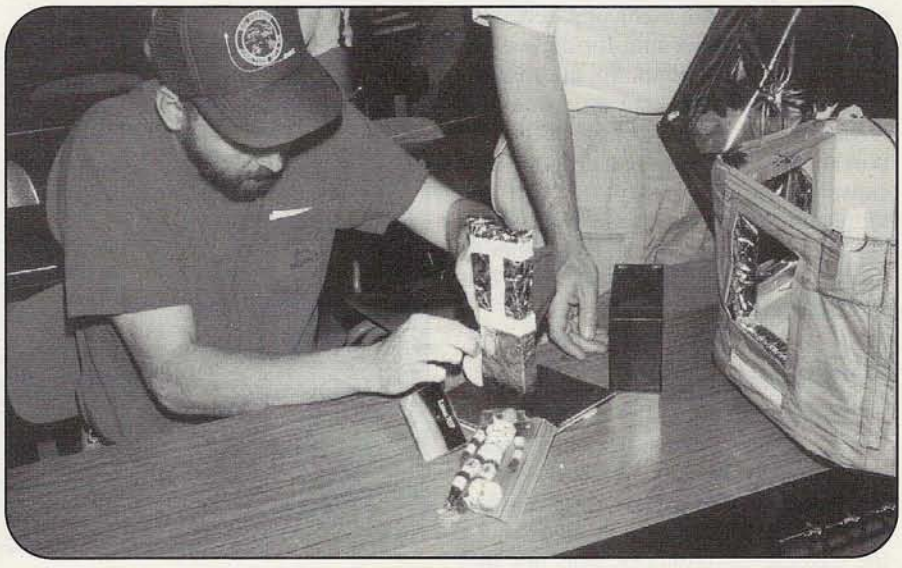


Photo C. The doomed Roachonauts being loaded into the Asimov II. The author says future flights will test life-support systems for roaches in near space.

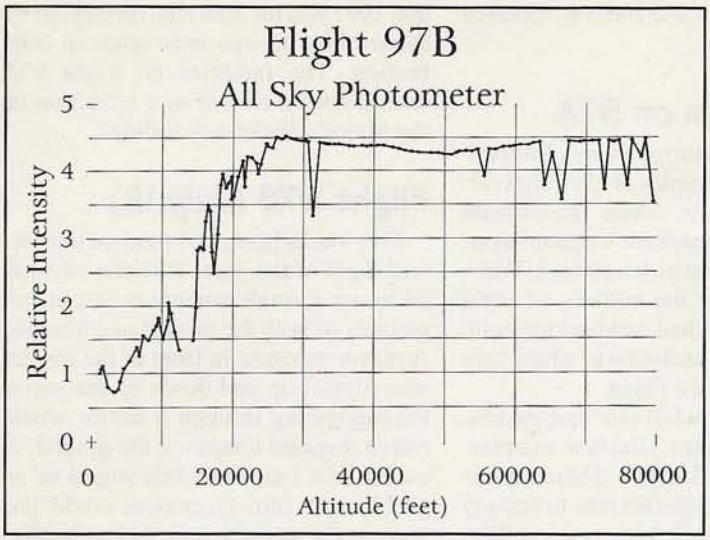


Figure 1. The All-Sky Photometer flown on KNSP's Flight 97B showed a marked increase in sky brightness between 15,000 and 20,000 feet, followed by a leveling off.

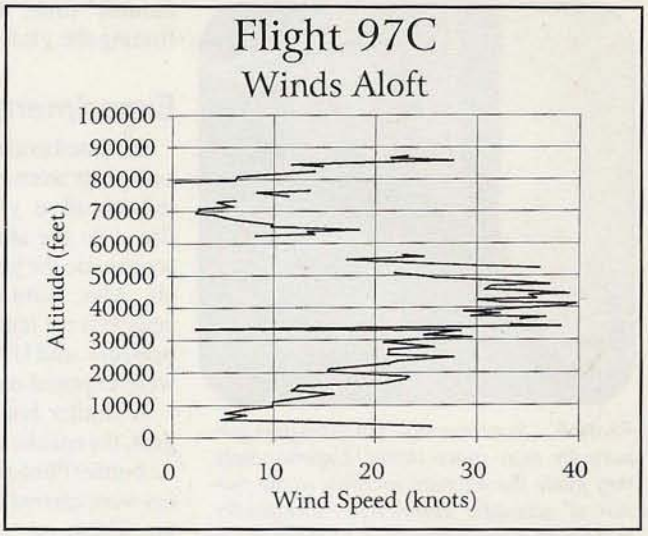


Figure 2. This graph from Flight 97C clearly shows the altitudes at which the balloon and its payload passed through the jet stream, as the wind speeds shot up at around 35,000 feet, then dropped off at about 55,000 feet.

recovering balloons, send up ATV. The ATV mirror was programmed to rotate up to watch the balloon burst when the capsule reached 82,000 feet. Imagine my disappointment when the balloon burst at 79,000 feet! During descent, we got good images of the Missouri River below. I was certain I'd be going for a swim to recover the capsule. Fortunately, the winds shifted direction during the descent and we avoided a watery landing. The actual landing turned out to be much more interesting.

This flight was predicted to land only some 20 miles away, but two things conspired against that morning's prediction. First, the upper-level winds had picked up speed during the night, and, second, I had forgotten to account for the weight of the capsule's beacon. So, after inflating the balloon, we had only one-half pound of positive lift instead of the one pound we were supposed to have. The capsule rose at a paltry 300 feet per minute instead of the normal 600 to 700. It took the capsule about five hours to reach 79,000 feet, in which time it had traveled 120 miles.

"Branching" Out

The slow ascent led to another problem. Our launch site has a few trees nearby. Normally these trees aren't a problem because the capsule rises quickly enough and there isn't much wind to push the capsule horizontally. But not this time. To the strains of "George of the Jungle," we watched the capsule collide with a tree branch. The ATV antenna (a mini-wheel from Olde Antenna Labs—thanks for the advice, Bill Brown) was slightly bent in the collision. Apparently, we aren't immune from the same kinds of accidents that they experience on the Mir space station!

One of the most wonderful moments of all of our balloon flights occurred at landing. A farmer and his wife had just finished their lunch and were looking out the window. Lo and behold, a half mile away, they saw a strange object parachuting into their cornfield (this was in Nebraska). The farmer drove his lawn tractor out to investigate and render assistance if necessary (there's an airfield nearby where skydivers practice). But instead of finding a stranded skydiver, he found a beeping box sprouting several antennas. He picked it up and carried it back to his home on the lawn tractor. When he returned, he found eight vehicles parked in his driveway waiting for him. The chase and recovery crews were within a few miles of the capsule during its descent. The farmer was very good-natured about the whole incident and his family seemed to enjoy the notoriety. We gave his family a bumper sticker that had been carried up in the capsule and autographed by the KNSP crew. Later, we

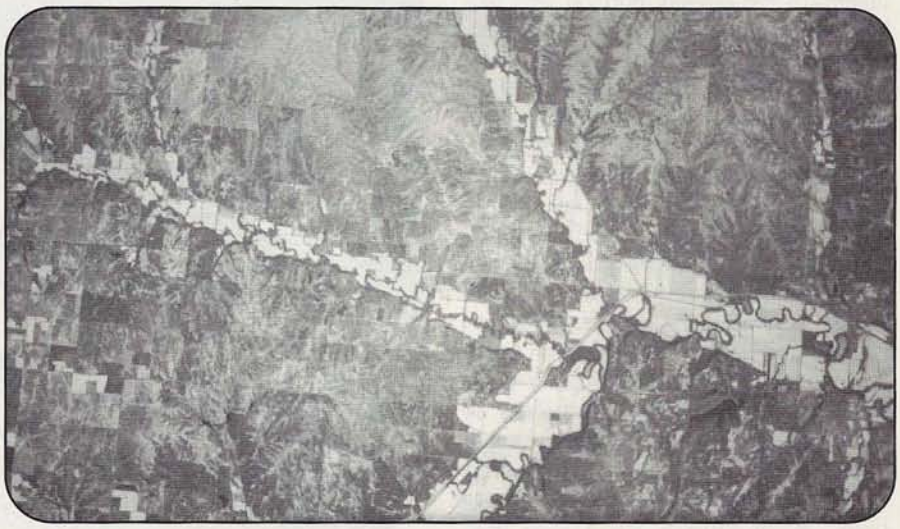


Photo D. The view from 85,000 feet...looking down. KNSP's final flight of 1997, in December, produced excellent views of the snow-covered Earth on the Great Plains.

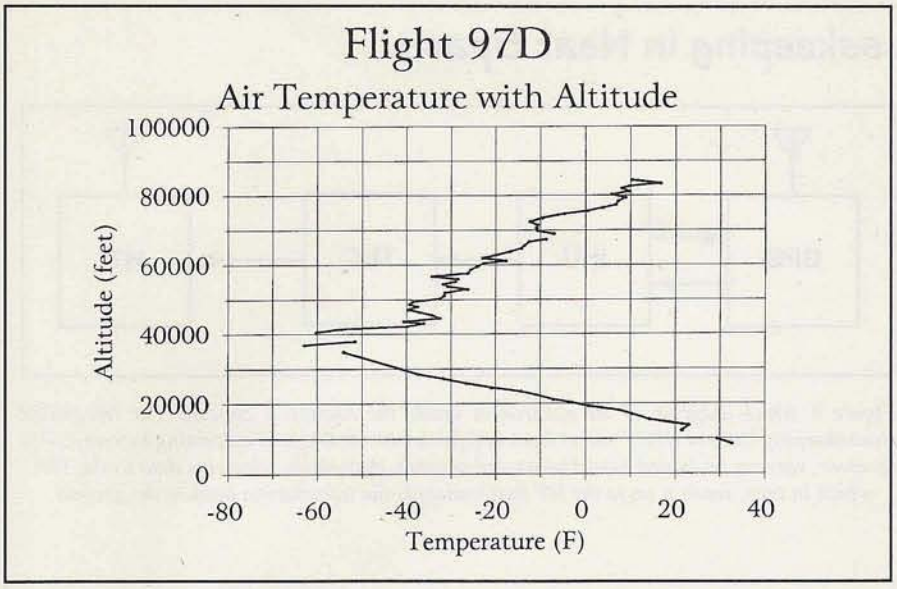


Figure 3. The boundary of the stratosphere—the point at which air temperature begins to rise with increasing altitude—is clearly visible in this graph at about 40,000 feet.

sent him copies of the photographs taken and graphs of the data collected.

Flight 97C (October 18)

On our third flight, we flew student experiments, tested rocket ignitors (again), and transmitted ATV. We ran into a new problem on this flight (we don't make the same mistakes twice, we only make new ones): The rocket ignitor experiment shorted out and blew a fuse. To guard against this kind of failure ending a mission, the capsule electronics, transmitters, and experiments are all on separate batteries. On this flight, the ignitors shared batteries with the video camera and ATV transmitter. When ATV transmissions stopped, telemetry reported 0 volts on the auxiliary bus, so we were certain there was a localized power failure, but we didn't know why. Since the internal temperature hadn't risen we knew there was no on-board fire (from a long-term short circuit). Thank goodness for the telemetry, through which we were also able to track and record the wind speed at various altitudes (Figure 2).

Photo E. The view from 85,000 feet...looking straight out. At this altitude, the sky is black and the Earth's atmosphere is visible in color as a blue line hugging the horizon.

This flight carried two experiments for North View Elementary School. When I went to visit the students before the launch, they were, for the most part, very interested in the flight. If you want to excite young people about science, give them dinosaur bones or (near) space science. The fourth and fifth grade classes each designed an experiment for the flight. One exposed plant seeds to near-space conditions and the other exposed rubber bands. After the flight, the exposed seeds sprouted just like the control group left on the ground. The exposed rubber bands held up to the near space environment without breaking. I now use rubber bands for near space flights, thanks to the work of the fourth graders.

Flight 97D (December 13)

The final flight of the year had three goals: use our last balloon, test a camcorder, and get photographs of the snow-covered Earth. It's recommended that latex balloons be used within one year of purchase, and our last balloon was

Housekeeping in Near Space

To make the Asimov II function, there's an array of electronics inside. Specifically, the Asimov II contains:

1. The IHU (Integrated Housekeeping Unit)
2. A Yaesu FT 203 handheld
3. A Kantronics KPC3 TNC
4. A Motorola OnCore GPS receiver

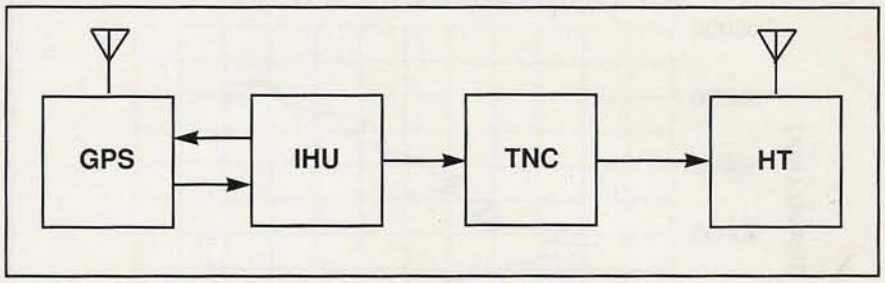


Figure 4. Block diagram of the electronics inside the Asimov II capsule. The Integrated Housekeeping Unit, or IHU, "talks" back and forth with the Global Positioning System (GPS) receiver, various on-board experiments and sensors, then sends telemetry data to the TNC, which in turn, sends it on to the HT that transmits the information back to the ground.

Inside the IHU

The main board is called the Integrated Housekeeping Unit (IHU) and contains the brains of the Asimov II. The IHU was designed and built with the help of Mr. Steve Kelly in the Physics Department of KSU (Kansas State University). The IHU collects an assortment of data and communicates with the GPS receiver. This data is telemetered to ground stations via packet radio using the TNC and Yaesu. The block diagram (Figure 4) illustrates the relationship between these components. The arrows represent the direction of data flow.

The IHU is a 6 X 6-inch etched pc board and has the following components (*Remember all of these abbreviations—there's gonna be a test!—ed.*):

1. A Parallax Basic Stamp 2 (BS2) microprocessor
2. A Scott Edwards Serial Servo Controller (SSC)
3. A Scott Edwards Stamp Stretcher (*does the Post Office know about this?—ed.*)
4. An NJU6355 real time clock (RTC)
5. Two MAX186 12-bit, 8-channel analog-to-digital converters (ADC)
6. A 74LS08 "AND" gate (for data multiplexing)
7. A ULN2803 (high power driver)
8. A MAX233 (TTL, Transistor-Transistor Logic)-to-RS-232 voltage level converter)
9. Various voltage regulators and dividers

What Everything Does

The BS2 controls every aspect of the capsule during flight. It's responsible for collecting data from the ADCs, operating servos, telling the GPS when to send position data, and operating experiments at the correct time or altitude. The BS2 is manufactured by Parallax, Inc., and was chosen for its ease of programming.

The IHU uses an NJU6355 RTC to keep track of mission elapsed time (MET). The BS2 sets the RTC at startup and consults the clock throughout the flight. This MET can be used to initiate experiments or determine ascent rates. We have less of a need for the RTC now that we can get the time directly from the GPS receiver.

The IHU uses two MAX186 ADCs for digitizing voltages. Each IC is capable of measuring eight different voltages with 12 bits of resolution. The ADCs convert a 0- to 4.095-volt signal into a digital value. Since it has 12 bits of resolution, it converts voltage levels into a value ranging from 0 to 4095. This gives the capsule a $^1/_{1000}$th of a volt resolution. In practice, though, there's enough noise on the lines to make the last $^1/_{1000}$th of a volt resolution useless.

To extend the capabilities of the BS2, we've included the SSC and Stamp Stretcher. Both of these require just a single I/O pin from the BS2. So with two BS2 I/O pins, we can control up to eight servos or 16 additional I/O pins. The servos are used to do things like operate camera shutters, position mirrors, and release gliders. Eight of the additional I/O pins drive the inputs of a ULN2803 (eight Darlington pair transistors in an IC). With the ULN2803 we can switch devices off and on that require greater voltages or currents than the BS2 can handle directly.

The TNC accepts either position data from the GPS or telemetry from the BS2. The TNC can only receive data from a single serial line, hence the data streams must be multiplexed together. The "AND" gate combines the separate GPS data and telemetry into a single line. Since the TNC is set in transparent mode, any serial data it receives is converted into audio tones and sent to the HT.

For the TNC to hear the GPS and BS2 data, the data must first be converted from its original TTL levels into true RS232 levels. Digital electronics typically have 0 volts represent a "0" bit and 5 volts represent a "1" bit. This 0 to 5 volt range is referred to as TTL (transistor-transistor logic) level. The TNC can only hear a true RS232 signal, where a "0" bit is +10 volts and a "1" bit is -10 volts. Notice the RS232 levels are greater in voltage swing and opposite in sense to TTL. To do the conversion we send the TTL signal through a MAX233 IC. Both the MAX186 and MAX233 are manufactured by Maxim.

To provide the correct voltage to operate components on the IHU, we use an LM2940T-5, a low dropout voltage regulator. By using the 2940 in place of a more typical LM7805, we can provide 5 volts to the IHU with as little as 6 volts input. The 7805 would require an input of at least 7 volts to provide the necessary voltage. The voltage dividers on the IHU drop battery and other sensor voltages below the 4.095 volt limit of the ADCs.

This briefly explains the construction of the Asimov II. Please check out the KNSP Web site (see "Resources") if you'd like more detailed information or a copy of the PCB pattern for the IHU.

already six months old. If we didn't fly now, I felt we wouldn't fly again until its storage life had expired. I wanted to fly a camcorder because we'd had only partial success with the ATV. If we could successfully fly a camcorder, we should be able to return spectacular images. Finally, by flying in December, we could compare images of the snow-covered ground to our previous images. I also wanted to compare the atmosphere of winter to that of summer.

This was our most successful flight to date (I think we finally got it down pat, or we just ran out of available mistakes). After launch, we drove to a town called Strong City and waited for the balloon to burst. At Strong City, the balloon was some 25 miles away, line of sight. Looking up we could see a small white dot in the sky. We would talk to each other and keep looking back up at the balloon. Finally, we could no longer see the balloon. Consulting the laptop, we saw the capsule's report of balloon burst.

When the capsule was recovered, I checked the videotape through the camcorder viewfinder. The video was spectacular! At 85,000 feet, the capsule was rotating at 5 to 6 RPM. The horizon was some 300 miles away. We were looking into Nebraska, Oklahoma, and Missouri. It was interesting to note that, to the north, the Earth was covered in white snow (Photo D), whereas to the south, the snow had mostly melted, leaving a blue-gray ground. Cities show up on the videotape as gray patches in the snow. The sky was black and the sun an intense spot of light. The Earth's atmosphere was a blue band riding on the horizon (see Photo E).

At launch, the camcorder's motor could be heard on the videotape but at 85,000 feet, it was dead silent. Unlike in space, though, where no one can hear you scream, in near space everyone can hear a balloon burst. At balloon burst, the camera recorded a double boom as the expanding bubble of helium passed over the capsule. A second later, the capsule began to tumble. It was a wild ride down!

This attempt was our closest yet to a perfect flight. The only two problems we encountered were concerns about having properly contacted the FAA (Federal Aviation Administration) and communications between the chase and recovery crews. Six separate phone calls to the FAA are required for every high-altitude balloon flight (see "Starting Your Own Near Space Program"). To handle the FAA calls, I've exchanged my home phone for a cellphone. And as for the communications problem, well, you're going to love one of my *new* near space capsules, the Clarke (see below).

Photo F. The "Sagan," first of two new KNSP projects for 1998. This capsule is designed specifically for carrying a camcorder into near space, and providing great flexibility in aiming the camera lens.

Results of Last Year's Flights

We found that the altitude of the stratosphere lowers in the winter. The stratosphere begins where the air temperature starts to rise with increasing altitude (Figure 3). In summer this occurred at 50,000 feet and in winter it lowers to 40,000 feet. The photometer we sent up determined that the overall sky brightness increases 4.5 times by the time you reach 30,000 feet. However this result doesn't take into account that the sun's elevation is also increasing during the flight. GPS data can return capsule speed and heading (via the $GPRMC string; consult your GPS receiver manual if you don't know what that is). Since the balloon moves with the wind we can use the GPS data to determine wind speed and direction at different altitudes. We have detected the jet stream at altitudes between 40,000 and 50,000 feet. East central Kansas is covered with prairies and hills (which are frequently used for pasture land since it can't be farmed economically). The tall grasses hide most of

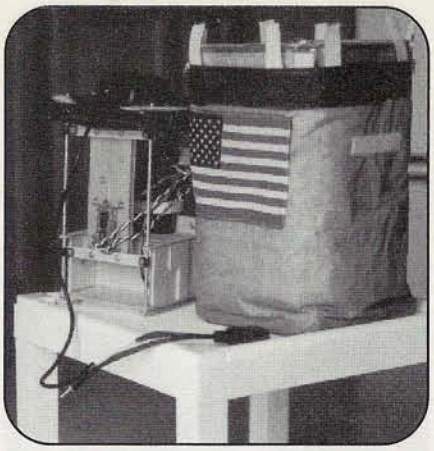


Photo G. The "Clarke," KNSP's second new capsule for 1998. This one carries a 2-meter repeater. Stay tuned for updates on flights planned for 1998.

the snow when viewed from near space. However the snow remains well exposed on the open farm fields. Snow is excellent at distinguishing between fields and pasture lands.

The Future

What's in the future for KNSP? Well, more fun to start with. The camcorder worked so well (but is so heavy) that I've designed a capsule just to fly it. This capsule is called the "Sagan," after the late Dr. Carl Sagan (see Photo F). It's designed in a "U" shape with the camcorder between the arms of the "U." A 130 inch-ounce torque servo can rotate the camcorder through a 180-degree arc, so we avoid the reversed images inherent with using mirrors (smoke and mirrors in near space?). It also flies a 35-mm camera aimed at the ground. The capsule collects no physical data, and its telemetry consists solely of internal temperatures and battery voltages. The only changes that need to be programmed into the Sagan before each flight are the times to record video and the positions of the camcorder.

A flight may want to concentrate video recording for particular events. The camcorder (a compact VHS) is only capable of recording for two hours, so an entire flight cannot be recorded. The Sagan uses a Garmin GPS25 board for its GPS receiver, a Yaesu FT 203 HT for a transmitter and a MIM (Micro Interface Module) for a TNC (see "What's a MIM?").

The Clarke

I've always wanted to simulate a communication satellite, so I'm also building a 2-meter repeater capsule (Photo G). It's named Clarke, after the science fiction writer, Arthur C. Clarke. In 1945, Clarke wrote an article describing the design for geostationary communication satellites. Today dozens of communication satellites orbit the Earth in the "Clarke Belt," some 22,300 miles above the Earth.

The Clarke capsule uses an Agrelo voice recorder and Kenwood TH22 AT handheld to record and retransmit voice and data. It uses a second transmitter (also

Starting Your Own Near Space Program

If you wish to start your own near space program, some of the basic requirements for it will be:

1. Keeping the capsule weight less than six pounds for a single capsule or 12 pounds for two capsules.
2. Keeping the breaking strength of the line connecting two capsules to 30 pounds or less.
3. Filing a NOTAMS (Notice to Airmen System) notification three days in advance. A NOTAM is simply a phone call, and a toll-free one at that. (Check with your local airport for the NOTAMS number.)
4. Notifying local your FAA airspace control center a few days in advance. Again, contact your local airport for the number if there's no listing in the phone book (under federal government agencies). *Note: If your balloon weighs more than four pounds, you may need to file paperwork with the FAA. Contact them for general information well ahead of your planned launch date.*
5. Launching outside of airports. This way you won't need their permission.
6. After launch, notifying the FAA (Airspace and your NOTAMS point of contact).
7. Calling the FAA again when the capsule passes 60,000 feet (on both ascent and descent).
8. Asking for permission before walking into private property. Land owners seem to be very understanding.

What's a MIM?

The Sagan capsule communicates with the ground via a device called a MIM, or Micro Interface Module. The MIM, designed by Dr. William Clement of Clement Engineering, is a tiny (1 x 2-inch) board containing a PIC microcontroller programmed to act as an APRS-compatible TNC. You hook up a radio, power, a GPS receiver, five analog voltages and an 8-bit digital cable, and you're ready to go. It reports the position, the digitized voltages, and the state of your eight digital lines. It can also beacon and send a CW callsign. It's programmed via a PC, and the settings are stored in an EEPROM (Electrically Erasable Programmable Read-Only Memory), so it doesn't forget them when the power is shut down.

by Agrelo) to transmit telemetry. For a TNC, it uses a MIM module, just like the Sagan. Its telemetry consists of temperatures, pressure, and battery voltages. The reason we transmit pressure data is that the Clarke's GPS (a Garmin GPS20 board) will not function above 60,000 feet. An increase in the pressure lets us know that the balloon has burst. The Clarke is designed to be a turnkey system. We merely load the batteries and turn it on.

Launch Plans

Well, if we have three capsules, then we just have to meet the challenge of launching them all at the same time. The Asimov II will perform our science, the Clarke will keep all KNSP personnel in contact, and the Sagan will record the results. I'm hoping to record video of these near space capsules above the Earth's horizon.

This year's plan of amateur science and engineering includes flying more student experiments, testing life support systems for cockroaches, additional work with photometers, testing a tethered (near space) satellite, and recording the sunrise at 90,000 feet. The first set of flights is scheduled for early May—the same time as the deadline for this issue. So check out "VHF News" and the KNSP Web page (see "Resources") for up-to-date information.

What About You?

I encourage other groups to get involved with ballooning. You can make an impact on science education in your local schools and get media attention for your club. Check our the KNSP Web page for technical details and advice. Feel free to e-mail me with any questions you may have.

Well that does it for another year. You'll find ham ballooning very addicting and its possibilities are almost unlimited. To near space and beyond (apologies to Buzz Lightyear)! ■

Resources

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

Agrelo Engineering, P.O. Box 231, Pattersonville, NY 12137; Phone: (518) 864-7551; Fax: (518) 864-7553; WWW: <http://www.agrelo.com>.

Clement Engineering, 1261 Dogwood Rd., Arnold, MD 21012; Phone: (410) 518-6591; Fax: (410) 518-6597; WWW: <http://www.agrelo.com/clement.html>.

Maxim, 120 San Gabriel Dr., Sunnyvale, CA 94086; Phone: (408) 737-7600 or (800) 998-8800; WWW: <http://www.maxim-ic.com>.

Parallax Inc., 3805 Atherton Rd., Suite 102, Rocklin, CA 95765; Phone (sales): (888) 512-1024; Fax: (916) 624-8003; WWW: <http://www.parallaxinc.com>

Scott Edwards, 2700 E. Fry Blvd., Suite A4, Sierra Vista, AZ 85635; Phone: (520) 459-4802; Fax: (520) 459-0623; WWW: <http://www.seetron.com/>

Further information on KNSP projects and ham radio ballooning in general is available from the following Web sites:

Kansas Near Space Project (KNSP): <http://www.ksu.edu/humec/knsp/>
Bill Brown, WB8ELK: <http://fly.hiwaay.net/~bbrown/>

Finally, the author can be reached via e-mail at: verhage@humec.ksu.edu.

Kenwood TS-790A Multimode Transceiver

This tri-band multimode radio has been on the market for over a year now, but favorable exchange rates and its appearance on the used equipment market brings it within reach of many more hams.

By Gordon West, WB6NOA*

The Kenwood TS-790A is an all-mode, tri-band VHF/UHF transceiver in which 2 meters and 70 centimeters come standard from the factory, and the 1270 MHz band can be added by simply plugging in an optional band module. I've been operating the 790 for over a year, having bought it new for around $2,300. That included the base station microphone, as well as the UT-10, the 10-watt plug-in module for 1.2 GHz. The 790 was recently seen selling new for $1,599, minus a $200 Kenwood coupon, plus $549 for the 1.2 GHz module.

What has prompted this one-year review of the 790 is its rock-solid performance, *and* the appearance of this equipment at flea markets selling for $1,000 (with some used units even including the 1.2-GHz module to boot!). I saw three on the selling block at the Dayton Hamvention™, and most everyone mistook them for some sort of HF transceiver. Nope—the Kenwood 790A covers only 2 meters, 70 centimeters, and the 1.2-GHz band, multimode. No high frequency. The equipment is designed for satellite work as well as weak signal VHF/UHF DXing.

The massive (23-pound) Kenwood TS-790A on the test bench. No, it's not intended as a mobile rig even though it runs on 12 volts DC. It's built for home or portable operation where its excellent receiver can really be appreciated. (Photos by the author)

A Heavyweight Champion

The 790 is one heavyweight VHF/UHF transceiver! With a 1.2-band unit installed, it tips the scale at 23 pounds. Luckily, Kenwood supplies a carrying handle along with the radio. And while this heavyweight equipment may *seem* like it has an AC transformer built in for base station use (it's so heavy, it must!), *it doesn't*! The equipment plugs into the common 6-pin power cord, and runs *only* on 13.8 volts DC. If you want to run it from house power, choose a power supply from Kenwood or an after-market supply supplier, such as Astron.

Power output on 2 meters is a modest 40 watts, and a little less—around 35 watts—for whistling up a peak reading wattmeter on 70 centimeters. On 1.2 GHz, power output is 10 watts. All of these power outputs were measured on a Bird peak reading wattmeter, and the word "FFFOOOUUURRR" was spoken to see how much juice we were going to get out of the three individual antenna connectors. On 1.2 GHz, Kenwood employs an N-receptacle, and on 2 meters and 440, each band its own SO-239 "UHF" connector.

So right now you're probably wondering why anyone might spend a kilo-buck for a used 790…in fact, why would anyone want to spend this kind of money, new or used, for a massive radio that's so heavy it has absolutely no place in a mobile installation? Why?

Why? I'll Tell You…

I'll tell you: this radio is not designed for under your dash, but rather for your field day or home station operating

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

desk—and where the radio turns into one big heavyweight performer is in the *receiver*. It's great!

You see, I'm addicted to mountaintop weak-signal operation and I need a VHF/UHF radio that can take the hammering of out-of-band repeaters, powerful paging transmitters, and other nearby ham stations operating slightly higher or lower in frequency, and still let me hear those weak signals I want. Much of the 790's weight is from copper compartments within the band units and the PA (power amplifier) to keep this equipment as tight as possible on the desired frequency. If you look over the specifications, single conversion is used for the 2-meter band on CW and upper sideband (USB), with dual conversion on the 70-centimeter band for CW and USB. Up on the 1.2-GHz band, triple conversion heterodyne is employed on both CW and USB. Kenwood also chose an intermediate frequency (IF) complement that would add to the capabilities of the receiver to function under strong out-of-band and in-band interference situations (see Table).

When I took the 790 up to several repeater sites where intermod is at an all-time high, it was outstanding on 2 meters, 430 MHz, and 1296 MHz where we had amps and pre-amps running on each output jack. There's enough shielding and RF isolation within each compartment in the 790 that intermodulation from out-of-band signals was just about zero.

Sensitivity Training

Sensitivity was listed in the specifications as a nominal 0.16 microvolts, but actually measured much better—0.09 microvolts on all three bands (at 10 dB, S+N/N). These measurements were for weak-signal work using USB and CW. Yes, the transceiver works quite nicely on FM; but, if I want FM, I'll use my small mobile unit or handheld.

Receiver sensitivity beyond the ham bands remains *very good* until you approach 1 MHz from the receiver band edges, where the voltage controlled oscillator (VCO) drops out. Sorry, no AM aircraft reception, but plenty of good public safety and marine band VHF reception above and below the 2-meter band. On UHF, I heard plenty of police calls up at 460 MHz, and, up at 1.2 GHz, I was beginning to hear some incoming satellite datastreams just outside of the 1.2-GHz band edges. Remarkable! When dialing around on FM, you'll probably prefer to put the big channel knob in the click-click-click position (more on that later).

The frequency readouts are bright and colorful...as long as you're inside and the room isn't too brightly lit! You'll need to whip up some sort of sun screen for operating outdoors.

Selectivity is -60 dB at 4.8 kHz, -6 dB at 2.1 kHz for upper sideband. When you switch in the narrow CW filter, selectivity improves to -50 dB at 2 kHz, -6 dB at 500 Hz.

The venerable 790 also allows for intermediate frequency shift, with adjustments of ± 1 kHz. There's also receiver incremental tuning, which is important for satellite work, with an adjustment of ± 2 kHz.

Squelch Flexibility

The squelch circuit features fast-attack and slow-delay, which is important while monitoring for distant beacons coming in at the bottom of each band. When tropospheric ducting kicks in, you want your receiver to unsquelch when the signal begins to appear out of the noise. The squelch action is *good* with the 790, but unfortunately not half as good as the squelch found in Kenwood's mobile TR-751. On the 751 hooked up to a big long-boom Yagi, you'll regularly hear wisps of noise open up the squelch, and the squelch slowly decay after about 2 seconds remaining in the noise—perfect for monitoring for a band opening.

On the 790, I measured squelch sensitivity at .3 microvolts, which means the signal needs to be well out of the noise before it's going to open up the squelch circuit. Plus, the 790's squelch stays open for about 1 second after a signal disappears, and I'd rather have seen it stay open for 2 or 3 seconds—slow hysteresis—and I imagine there's probably a capacitor on the inside of the squelch circuit that I could change to make this possible. But the 790 squelch is much more sensitive and, thankfully, slower-closing than some of the squelch circuits found on other brand multimode transceivers. So, overall, I'm happy.

Get Out the Sunscreen

So how does the unit work? *Great* inside your Field Day tent, but if you plan to operate the equipment out in direct sunlight, better rig up some sort of sunshield that will let you see the blue digits used for the main frequency readout. And you're *really* going to need a sunshade for the subband receive (sub-RX) readout because the same blue letters appear to have a yellow filter on them, further reducing their contrast out in the open. But, if you have some shade, you're all set after you have positioned the equipment so that the very reflective front plastic doesn't catch light coming in from behind you.

The main frequency readout has resolution to 100 Hz on all three bands. For instance, the 2-meter band might read out 144.240.0. The equipment actually tunes down to 20 Hz; and, if you listen real carefully, you can hear five distinct changes in an incoming CW signal when you

slowly rotate the main dial. The 100-Hz display readout is just right for me, though, and there are few weak-signal operators who would ever need any more precise tuning than this. What the heck—most weak-signal operators usually position themselves right on the even kilohertz, not even the 1/10th of a kilohertz that the display will read out.

Cool Controls

There are some unique controls on the front panel that make it easier for you to tune around the bands. One is called **CH Q.** It pulls in a mechanism to give the big VFO tuning knob distinctive FM channel changing "clicks." This is handy if you're operating FM simplex and someone wants you to go up or down 10 kHz. You can do it by the clicks. But for tuning upper sideband or CW, push the button again to get out of the click-type VFO to a smooth-spinning knob. There's no mistaking when you go into the click mode: there's a big "clunk."

The **MHz** switch is handy to let you zoom around the ham band that you've dialed up, including receive-only capabilities on the following frequencies without modification:

135 MHz–172.0 MHz
422 MHz–462 MHz
1220 MHz–1305 MHz

The built-in keyboard is great for not only key-entering frequencies into the 59 memory channels, but also for setting standard and non-standard splits as well as the built-in CTCSS encoder. To decode tone, you'll need to purchase and install the optional TSU-5 board, and I'm having a hard time trying to find one because this equipment has been out for a couple of years.

Other things you might do with a keypad would be to set FM tuning steps at 5, 10, 12.5, 20, 25, or 50 kHz. Each band has its own step register, so you might select 5-kHz steps for the 2-meter FM band, and 25-kHz steps for the 440- and 1270-MHz band. Keep in mind that the step mode is for FM, not CW/USB weak-signal work for which the radio is truly designed.

The **signal strength ("S") meter** is a conventional needle movement, and I somehow prefer this over the new LCD displays found on much modern equipment. But what a shame there isn't the capability to run this meter into the discriminator so you can use it on FM for analyzing incoming frequency errors. The discriminator meter is my favorite on my multimode Yaesu base station, and it's sorely missing on the 790.

The big tuning knob can be switched between free-spinning for USB/CW contacts or satellite work to a "stepped" control, complete with clicks, for FM operation.

Subband (Dive!)

On the right-hand side of the 790 is a smaller frequency display for the subband. This will come into play when you are working a satellite, or just want to keep track of signals coming in on one band while you're operating on another. It's also handy for comparing conditions on different bands. For example, when I'm monitoring the distant Hawaiian propagation beacon coming in on 2 meters and 440, I can listen to (and almost watch) two simultaneous signals on two bands, dispelling the myth that tropospheric ducting may sometimes improve on higher bands while fading away on lower bands. In all my monitoring of long-range VHF/UHF beacons, they both go up, and they both go down in signal strength in unison. On the subband receive display, signal strength is illustrated by a horizontal electronic bar that shows S0 to S9 in white, and any reading over S9 in red. The subband only displays when you have taken the main band and put it on a completely different ham band than the subband. The subband has neither RIT nor pass-band tuning. Keep this in mind when thinking about satellite communications with the 790.

Satellite Operation

The TS-790A is capable of allowing the uplink and downlink frequencies to track simultaneously in the main and subbands by storing the sum of the two frequencies in memory. Memory channels 0, 1, and 2 are programmed by the factory for offsets corresponding with satel-

Table. TS-790 Intermediate Frequency Complement

Band	1st IF (MHz)	2nd IF (MHz)	3rd IF (MHz)
2 meters	10.695		
70 cm	75.925	10.695	
23 cm (1.2 GHz)	287.175	41.415	10.695

Table. Arrangement of the TS-790's intermediate frequency (IF) complement, designed to help minimize interference from undesired signals.

lites FO-12 and AO-10. But what's set for AO-10 won't necessarily get you up on an instant duplex with AMRAD-Oscar 27, nor many of the Russian satellites. Here's where you will use the remaining memories to quickly set up on the satellite up and down frequencies.

One way of programming your favorite satellite uplink and downlink frequency is to add the two frequencies together and place the sum in the satellite memory channel. You would then recall the desired satellite memory channel, select the sub-function, and use the tuning knob to select the desired downlink receive frequency. Next press the satellite key. The main display will shift to the correct uplink frequency.

Each time you change the sub-frequency, press the SAT key twice in order to update the main display. The first time the SAT key is pressed, the transceiver goes out of the satellite mode. The second time it's pressed, the transceiver goes back into the satellite mode and updates the main display. I prefer to do the alternate method and press and hold the satellite key while going into the satellite mode. This allows the tuning knob to be rotated and both displays will track simultaneously. This is the way I operate so I can simultaneously lock in on a juicy CQ and double-check that my transmit frequency is clear of other stations. After awhile, you'll get the hang of working satellites with this transceiver.

So...Should I?

I checked with several large ham radio dealers who indicated that there are still new 790s on their shelves, and they still have access to bringing in the 1200-MHz module, too. But, chances are, you're going to pay top dollar for a piece of equipment that is now three years old in technology, and may soon be outdated by new dual-and tri-band multimode units. But you very well might spot one of these sets out on a swap table; and if you do, see what you might put together. I strongly recommend the 1200-MHz module as part of the package. There is plenty of satellite work up here, plus plenty of weak-signal operation, too. But if you buy it used without the 1200-MHz module, you'll pay top dollar for a new module, and the chances are next to none you will ever find a module by itself selling used.

And you must *feel* the 790 to really appreciate just what a rock-solid rig this is. Weighing in at over 20 pounds, every single thing you turn or adjust has a positive feel behind it. Just be prepared for the big CLUNK when you snap in and out of the VFO smooth-tuning or click-click-click mode!

"...when I'm monitoring the distant Hawaiian propagation beacon coming in on 2 meters and 440, I can listen to...two simultaneous signals on two bands, dispelling the myth that tropospheric ducting may sometimes improve on higher bands while fading away on lower bands."

Manuals and More

I checked on the Kenwood home page on the World Wide Web, and the 790 instruction manual is now available for downloading. Both Leo and Raul at Kenwood Tech-nical Service are posting new equipment owner's manuals on their Web site, and they told me they recently finished scanning in the TS-790A manual. If you're interested in looking at that or any other new Kenwood equipment manuals, check out the Kenwood home page (see "Resources"). You'll need an Adobe Acrobat reader to view the files.

Oh yes—right now I am wiring up the new Kenwood VC-H1 visual communicator to the 790A, and I hope to be first to send slow-scan pictures from here to Hawaii and receive their pictures with the Kenwood VC-H1, all on the 2-meter band during the California/Hawaii tropo duct that forms up every August and September. If we're able to make the contact, you'll see the pictures here first in *CQ VHF*.

So keep your eyes open for a 790 out on the swap table—it's a big radio with heavyweight features that you must hear and feel to appreciate. ■

Resources

For more information on the TS-790, see your favorite Kenwood dealer or contact Kenwood Amateur Products Group, P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745; Phone: (310) 639-5300; Internet: <http://www.kenwood.net>.

Hamfest Calendar

The following hamfests are scheduled for August, 1998:

August 1, Annual Hamfest, National Guard Armory, **Denison, TX**. Talk-in: 147.00 (+600). For information, contact North Texas Hamfest, P.O. Box 1933, Sherman, TX 75091-1933; Web: <http://www.herriage.com/hamfest/nortex. html>. (exams)

August 1–2, 25th Annual Amateur Radio & Computer Show, Osborn Convention Center, **Jacksonville, FL**. Talk-in: 146.76 repeater. For information, write Greater Jacksonville Hamfest, P.O. Box 27033, Jacksonville, FL 32207; Web: <http://www.pobox.com/nw4ue/hamfest.html>. (exams)

August 2, 7th Annual HAMNIC, Wildwood Park Shelter, **Marshfield, WI**. Talk-in: 147.180. For information, contact Guy Boucher, KF9XX, 107 West Third St., Marshfield, WI 54449 (715) 384-4323; e-mail: <guyboucher@tznet.com>; or packet: <KF9XX@W9IHW.E5.AI.WI.USA.NA>.

August 2, Hamfair, Portage County Fairgrounds, **Randolph, OH**. Talk-in: 145.39 - .600 MHz. For information, contact Joanne Solak, KJ3O, at (330) 274-8240.

August 2, 48th Annual Winchester Hamfest & Computer Show, Clarke County Ruritan Fairgrounds, **Berryville, VA**. Talk-in: 146.820 - W4RKC. For information, call Tom Martin, KF4TNX (540) 539-4301; e-mail: <hamfest@Vvalley.com>; or P.O. Box 139, Winchester, VA 22604. (exams)

August 2, Hamfest, Steuben County 4-H Fairgrounds, **Angola, IN**. Talk-in: 147.180 PL 131.8, 444.350. For information, contact Theresa Limestahl, KB9NNR, P.O. Box 346, Fremont, IN 46737; (219) 495-5403; Fax: (219) 495-1675; e-mail: <TJLimestahl@DMCI.NET>. (exams)

August 8, Hamfest, Decatur Township Fire Company grounds, **Lewistown, PA**. Talk-in: 146.91. For information, call WB3COB at (717) 242-1882.

August 8, Hamfest, Yankee Air Force Museum, Oscoda Airport, **Oscoda, MI**. Talk-in: 146.640, 146.900. For information, send an SASE to ICARE, P.O. Box 271, Oscoda, MI 48750; Bruce Summers, KB8BZI, (517) 739-3129, Ray Knuth, KB8ZYY, (517) 739-2896; or e-mail John Hanley at: <ka8aip@centuryinter.net>. (exams)

August 8, Hamfest & Computer Show, Veteran's Memorial Field House, **Huntington, WV**. For information, contact Bernie Mays (304) 743-5459; e-mail: <WB8ZER@JUNO.com>; or call Georgia Overby (304) 522-1811.

August 9, Hamfest, St. Cloud, MN. For information, contact St. Cloud Radio Club, WØSV, 104-N. 4th Street, Waite Park, MN 56387; or e-mail: <jmaus@cloudnet.com>; Web: <www.wøsv.org>. (exams)

August 9, Annual Hamfest, Western Hills High School, **Frankfort, KY**. Talk-in: 145.390 (Frankfort) and 146.760-(Lexington). For information, contact John Barnes, KS4GL, (606) 253-1178 eves; e-mail: <KS4GL@juno.com>; or send SASE to John Barnes, KS4GL, 216 Hillsboro Ave., Lexington, KY 40511-2105. (exams)

August 15–16, 3rd Annual Memorial Hamfest & Craftfair, Waseca County Fairgrounds, **Waseca, MN**. Talk-in: 146.94 WAØCJU repeater. For information, contact Lloyd L. Schlaak (507) 465-8319; e-mail: <nøvfh@smig.net>. (exams)

August 15, Hamfest '98, Burford Fairgrounds, **Burford, ONT, Canada**. Talk-in: VE3TCR 147.150+. For information, contact Brantford Amateur Radio Club, P.O. Box 25036, Brantford, ON. N3T 5K5; e-mail: <ve3ba@bfree.on.ca>.

(Continued on page 29)

VHF/UHF Conference

August 21–23, 24th Annual Eastern VHF/UHF Conference, Harley Hotel, **Enfield, CT**, immediately off I-91 Exit 49. Informal gathering on Friday; registration, talks and technical sessions, lab demonstrations, noise figure measurements, and banquet on Saturday; VHF+ flea market and antenna gain measurements on Sunday. Tentative session topics include moonbounce on 144 and 903 MHz, microwave antennas and operating, and VHF contesting, followed by a meeting of the North East Weak Signal (NEWS) Group on Saturday afternoon.

Special conference hotel rate of $59/room at host hotel. Call (800) 321-2323 or (260) 741-2211 for Harley Hotel reservations and mention Eastern VHF/UHF Conference. For general conference info, contact Chairman Bruce Wood, N2LIV, 3 Maple Glen Ln., Nesconset, NY 11767-1711; Phone: (516) 225-9400 (work); (516) 265-1015 (home); e-mail: <bdwood@erols.com>. For flea market info, contact Mark Casey, K1MAP, 303 Main Street, Hampden, MA 01036; Phone: (413) 566-2445; e-mail: <map@map.com>. For updates, check out the NEWS Group Web page at: <http://uhavax.hartford.edu/~newsvhf>.

Operating Notes

For late July and August, 1998:

July

26	Good EME Conditions
28	Delta Aquarids meteor shower peak

August

1-2	ARRL UHF Contest (see rules, this issue)
9	Good EME Conditions
12	Perseids meteor shower peak
15–16	ARRL 10-GHz Cumulative Contest 1st weekend (see rules, this issue)
31	Alpha Aurigids meteor shower peak

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

August 15, 7th Annual Ham Radio, Computer, and Electronic Equipment Swap Meet, Cowlitz County Fairgrounds, **Longview, WA**. Talk-in: 147.26+, pl 114.8. For information, contact Bob Morehouse, KB7ADO, at (360) 425-6067 (evenings), or write to LCARA Swap Meet, P.O. Box 906, Longview, WA 98632; e-mail: <KB7ADO@aol.com>.

August 16, Tailgate Electronics, Computer, and Amateur Radio Flea Market, Albany & Main Streets, **Cambridge, MA**. Talk-in: 146.52 & 449.725/444.725 pl 2A-W1XM/R. For information, call (617) 253-3776.

August 22, Hamfest, Somerset County 4H Center, **Bridgewater, NJ**. Talk-in: 448.175 (-5) PL 141.3, 147.135 (+.6) PL 151.4. For information, contact Pat, N2CQM, at (732) 873-3394; Fax: (732) 873-0052; or write to SCARS, P.O. Box 742, Manville, NJ 08835; e-mail: <scars@qsl.net>; Web: <http://www.qsl.net/scars>.

August 22, 2nd Annual Hamfest and Computer Show, Kosciusko County Fairgrounds, **Warsaw, IN**. Talk-in: 146.985-. For information, contact Loren Melton, WB9OST, (219) 858-9374 eves after 6 p.m. CDT; e-mail: <WB9OST@WAVEONE.NET>. (exams)

August 23, Hamfest/Computerfest, Yonkers Municipal Parking Garage, **Yonkers, NY**. Talk-in: 146.865, 440.150 MHz. For information, contact YARC, P.O. Box 378 Centuck Sta., Yonkers, NY 10710-0378; call John (914) 963-1021 or Jim (914) 969-5182.

August 23, Hamfest/Computer Show, Hearthstone Manor, **Depew (suburb of Buffalo), NY**. For information, call Luke (716) 634-4667; e-mail: <lcalianno@aol.com>; Web: <http://hamdate1.sunverie.edu/~larc/greaterbuffalohamfest.html>.

August 23, Annual FleaMarket, Millard Social Hall, **Omaha, NE**. Talk-in: 146.94 (KØUSA). For information, contact Dave Kline, WJØZ, 5055 South 87th Street, Omaha, NE 68127; (402) 592-4930; Web: <http://www.qsl.net/køusa/>.

August 29, Annual Summer Hamfest, La Porte County Fairgrounds, **La Porte, IN**. For information, contact Rich Dugger, WD9ARW, 4977 W. 150 N., La Porte, IN 46350; or call (219) 326-6672; e-mail: <1pcea@hotmail.com>.

August 29–30, Campfest/Swapfest, Colorado Lions Club Camp, **4 miles north of Woodland Park, CO**. Talk-in: 146.820 repeater. For information, call Judy, KBØWGN, at (719) 836-0271; or <dsrtflwr32@aol.com>; or write to MARC, P.O. Box 1012, Woodland Park, CO 80866.

August 30, Woodstock '98 Hamfest & Computer Extravaganza, McHenry County Fairgrounds, **Woodstock, IL**. Talk-in: 146.52. For information, contact Tri-County Radio Group, Bob Grosse, N9KXG, P.O. Box 3107, Skokie, IL 60077-6107; (708) 944-0500; e-mail: <TCRG@quality-enterprises.com>; Web: <http://quality-enterprises.com/TCRG/>.

August 30, Hamfest, Radiofest & Computer Expo, Dubuque County Fairgrounds, **Dubuque, IA**. Talk-in: 147.84/24. For information, contact Jerry Ehlers, WØSAT, at (319) 583-1016; or write to GRARC, P.O. Box 546, Dubuque, IA 52004-0546; e-mail: <kbølcj@mwci.net>; Web: <http://grarc.mwci.net/>. (exams)

August 30, Summer Radio and Electronics Hamfest, Yonkers Raceway, **Yonkers, NY**. Talk-in: 147.060 MHz, PL 114.8. For information, contact WECA info-line at: (914) 741-6606; Web: <www.weca.org>. ■

Make Project Labels with Your PC...on Paper

Here's an inexpensive way to lay out and print a superior looking front panel for that project you carefully and meticulously put together. After all that work on the inside, why not make the outside something you can also be proud of?

By Raymond J. Schneider, W6JXW*
e-mail: w6jxw@bellatlantic.net

I was recently working on an amateur radio project, something I really spent a lot of time thinking about, designing, and finally putting together. I thought how nice it would be to give the front panel a finished look, like a commercial product. My Dymo® label maker just wouldn't do, and other methods make a lot of work out of it and are expensive, especially if you want just one copy. The newer electronic label makers are nice. However, when labeling a full-panel, they still look like what they are: pasted-on labels.

Some amateurs, instead of pasting several separate labels onto the front panel, have used a computer and a laser or ink-jet printer to make a full-panel paper label. That seemed to be the answer for me, and the process I came up with for doing it is what the rest of this article is about (see Photo A). Yet, how do you make a piece of paper look like a professional looking control panel instead of just some paper glued on a scrap of metal? This was my challenge.

I fired up the computer and used Microsoft Word for Windows® to lay out the dimensions of the panel first by designating the top, bottom, left, and right margins in *Page Setup*. Then I used the drawing subprogram within Word® and drew various size holes, round and square, where I wanted to mount the meters, switches, and pilot lights—a CAD or computer drawing program would have made it easier, but this works, too. (*For more on drawing in Word, see "Drawing Circles, Boxes, and Dial Faces with Word"—ed.*) Under the holes, I placed an identifying text that described the function of each component and typed a line at the bottom of the label to explain what this contraption did—a good idea, not only for others looking at my masterpiece, but also for when I pick it up and look at it a few years from now and can't figure out what the thing did! Finally, either to get fancy or to satisfy my vanity, I put my callsign at the top. (I was thinking about making my own logo with my picture on it. No, on second thought, *that* would be vain.) When I felt is was about right, I printed it out and temporarily mounted it on the panel with double stick tape, and then into the case it went.

Photo A. This is my wife Sheryle, KF4NYE, with examples of the various steps in the label-making process. She was a big help to me in this project, as usual. (Photos by the author)

Making Corrections

It looked terrible! Things were not in the right place. A word was misspelled. The font was not very readable and, besides that, it was too big in some places and too small in others. In addition, I left out one of the most important switches of all: the power switch. Now, if this had been one of those expensive one-shot labels, that would have been a big problem. Not with this method. First, it was just paper and not a lot of work went into it. But best of all, anything could be changed in just a few minutes by going back to the computer and rearranging the label. Actually, I found that several prototype labels and panel mountings had to be made before I got it just the way I wanted it. Here's where the advantage of this system shows up. Think about this: What

**Raymond J. Schneider, W6JXW, comes from a ham family. He and his wife live in Big Stone Gap, Virginia, where Ray is a minister and also runs a bookbinding business. He holds a General class amateur license.*

Basic Supplies

You'll need the following items to get started making your own panel labels. I've listed the brand names that I chose, but feel free to substitute equivalents from other manufacturers if they work better for you.

1. Computer with word processing, CAD (computer-aided design), or drawing program
2. Laser or ink-jet printer
3. Extra-white 24-pound laser or ink-jet paper (try other kinds, too)
4. Krylon ColorWorks® clear lacquer spray
5. True-Test spray lacquer, white
6. Sanford Super Sharpie permanent markers
7. Sanford Major Accent highlighting markers
8. Duro All-Purpose Spray Adhesive
9. 3M photo mount spray adhesive
10. Rubber roller or towel
11. X-Acto knife, sharp point

if I had a silk screener make that panel and it was not right?...$$$$.

There was something else wrong with the label. I don't particularly like black letters on white backgrounds. Somehow, this seems very "unhamlike." There was another problem: too much bare paper was showing, making it look too much like...paper. Fortunately, with Word, you can reverse the text from black to white and the background from white to black, eventually ending up with a black panel with white letters. Now that was more like it. Bold 10-point capital letters, in a sans serif font like *Univers*, look nice and are very readable.

Finishing the Label

I progressed to the point where I felt the label looked neat and refined, but it still was just a piece of paper. If I simply glued it on the front panel now, it would be subject to smudging, yellowing, and scratching. Something was needed to counteract this. Well, some hams have heat-laminated the paper in plastic at this point. This is a nice touch, but there are disadvantages. First, you end up with a rather thick label to glue on the panel. It sometimes comes out a little wavy from the heat of the laminator and, something I don't like, you get a lot of glare from the shiny surface, making it hard to read.

Photo B. After printing out the label, you will need to spray the front of it with several coats of clear lacquer finish. Make sure you have good ventilation when you're spraying.

Self-adhesive laminating sheets also have this problem. In addition, in the case of the heat laminating system, you have to buy a laminating machine or have it done by someone else. More $$$$.

The only other thing I could think of was to apply a clear hard finish to the paper label. I first tried an acrylic finish in a spray can. What a disappointment! Something happened that I did not foresee: The solvents in the acrylic finish made a mess out of the paper label. The laser print dissolved, bled badly, and the fine edges blurred. Where's my Dymo label maker? (Interestingly, this does not happen on labels printed by ink-jet.)

If at First You Don't Succeed...

Not one to give up, I tried something else. Krylon® has a product called Workable Fixatif 1306. I tried this on another label. It worked. It didn't bleed. It even gave an interesting raised appearance to the label and seemed to blacken

Photo C. Here, the label is now lying facedown with adhesive already sprayed on the back. The metal panel, with holes cut out, is lined up on the marks and is being lowered onto the sticky label.

Drawing Circles, Boxes, and Dial-Faces with Word

If you're used to using Microsoft Word just for, well, words, then you might not be familiar with the drawing tools that the program offers. Here's a "sketch."

How to Make a Circle or a Box

1. Right-click any empty space in the tool bar, then choose **Drawing** from the box that appears. The Drawing tool bar will appear at the bottom of your screen.
2. Choose either boxes or circles and draw one on the panel.
3. Right-click the box (or circle), then choose **Format AutoShape** from the box that appears.
4. Go to the **Wrapping** tab and choose "**none**" for Wrapping Style.
5. Now go to the **Size** tab and, in the case of the circle, make the **Height** and the **Width** the same. Click **OK**.
6. Left-click the box (or circle) and hold down to move it where it is desired.

How to Put a Scanned Dial-Face on Your Panel

Sometimes you might want to put a dial on your control panel. With some tweaking, you can generate a dial-face with Word for Windows. Just follow these steps:

1. At the tool bar go to **Insert**, **Picture** and then **From File**.
2. In the box that appears, choose the picture file (in .bmp or .tif format) from a previously scanned drawing. Click **Insert**.
3. Right-click the picture. A box will appear, choose **Format Picture**, another box will appear.
4. Under the **Wrapping** tab, select "**none**" for wrapping style. Click **OK**.
5. Left-click the picture to move it where you desire.

How to Make a Dial-Face

1. From the toolbar, go to **View**, **Toolbars**, and choose **WordArt** (the WordArt toolbar will appear at the top).
2. Click the big "**A**" then from the WordArt Gallery. Choose the example on the top row, third from the left.
3. Edit the WordArt Text as follows: a. **Font**: choose a San serif (Univers); b. **Size**: 10 points; c. **Text**: put in a series of capital "I"s and/or a combination of periods and spaces (the more you add, the shorter the "I"s will become).
4. Left-click **OK**. (You will see a flattened dial-face appear on your panel. Put the cursor directly on the dial face and right-click it. A box will appear. From the box choose **Format WordArt**.
5. From the Format WordArt box choose the **SIZE** tab and put in the following numbers: a. **Height**: 1 inch; b. **Width**: 1 inch
6. Then choose the **WRAPPING** tab and under Wrapping Style choose "**NONE**." Click **OK**.
7. Now, by putting your cursor on the dial face and holding down the *right* mouse button, you can move it anywhere you want to put it.

the blacks. However, there was one problem, it scratched a little more than I preferred and was a rather thin coating material. Well, what else could I try?

I remembered my father-in-law, Frank, an expert cabinetmaker, telling me that clear lacquer was one of the hardest finishes he had ever worked with. Would this hard coating work with my laser-printed front panel label, without dissolving it? I got some True-Test® spray lacquer and gave it a try. It worked! In fact, it worked remarkably well. It even seemed to saturate the paper, giving it more strength. It was scratch-resistant and sealed the label against smudging and yellowing. I put two coats on the front and one coat on the back (Well, actually, my wife did; see Photo B). If you want to cut down on glare, use semi-gloss lacquer instead of high-gloss. I found, though, that the texture of the paper actually gives high-gloss lacquer a somewhat semi-gloss appearance.

I discovered something else, too. You can make multicolored lettering, even if you don't have a color ink-jet or a color laser printer (who does?). Before you apply the lacquer finish to the paper label (or even if you have already applied one coat), take a felt-tipped pen and color in the white lettering you want to make another color. Red, orange, and yellow stand out well. I've used Sanford Super Sharpie® permanent markers and their Major Accent® highlighting markers for this purpose. If you don't want white lettering to begin with, then print your label out on colored paper. The color of the paper will dictate the color of the lettering if, of course, you go with the black background I previously described. I found fluorescent yellow and orange paper very interesting.

Sharing Panel Designs with Others

Many times, I see projects I'd like to build in amateur radio magazines. Wouldn't it be convenient to be able download the author's exact control panel design from the Internet? All you would have to do after downloading is reproduce it with the methods described here. Maybe a database of panel designs could be maintained. Something to think about. Anyone interested?

Mounting the Label on the Panel

Mounting the label and cutting holes in the panel were next. I printed out another label to use as a pattern. This pattern was centered on the panel. The panel was then marked where the different compo-

8. You may want to take the dial face from 180 to 360 degrees or the other direction from 180 to 90 degress or less. Just click the dial-face then notice the yellow diamond on the left. Put your cursor on the yellow diamond (it will change to an arrow). Hold down the *left* mouse button while you move it, either up or down in an arch. When you reach the desired number of degrees for the dial-face, just let go.

Is the dial-face too small? Repeat step 5 and put in a larger height and width. Remember the more capital "I"s, spaces, and periods you put in the WordArt Text Editor, the shorter each incremental indicator will become. You will have to experiment with this variable to make the face look exactly as you want it. This really seems convoluted, but once you get the hang of it you can do quite well. Alternately, scan a dial face and insert it (see above).

Do you want letters or numbers on the dial face? If so,

1. Go to **INSERT**, **TEXTBOX**, and draw a box with the cursor.
2. Right-click the box and choose **Format Text Box**.
3. In the Wrapping tab close "**through**" and "**both sides**."
4. Go to the **Text TAB** and set all margins to "0."
5. Go to the **Colors and Lines** tab set Line Color to "**no line**." Click **OK**.
6. Select the box then hit **copy**. Now unselect the box and hit **paste** for each box you need. They will come out in a diagonal line. Now arrange them around the dial-face and put values in the boxes. See the Figure for a look at some dial-faces that I came up with.

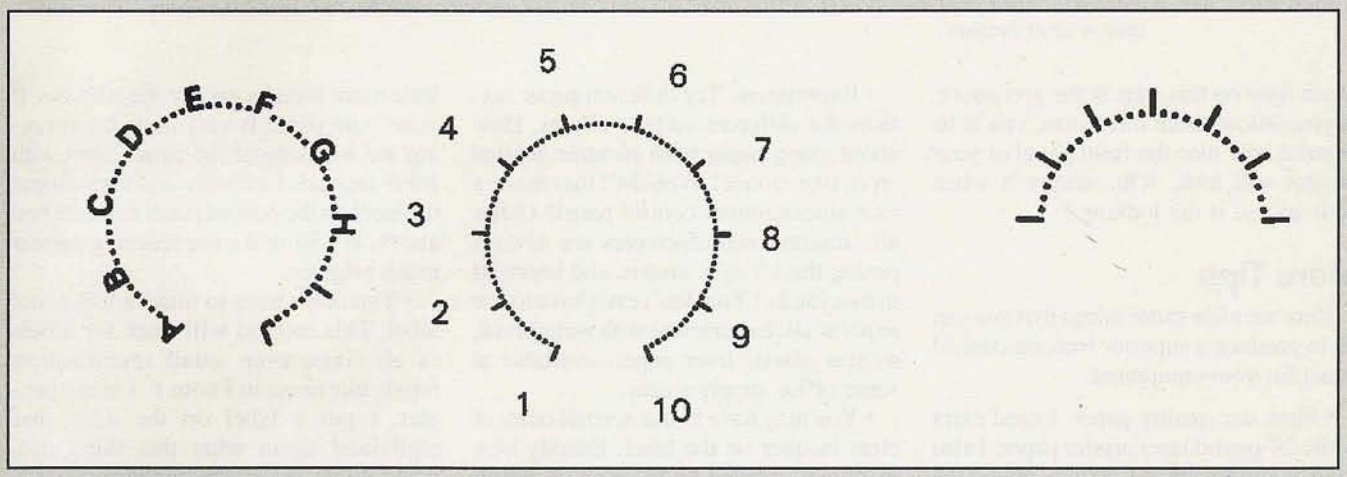


Figure. Here are a few examples of dial faces that you can make in Word, using the program's Drawing and WordArt features.

nents would be going. After I removed the pattern I was able to drill, nibble, and cut to my heart's content, knowing that everything would eventually line up. Next, I smoothed out the burrs I created to make sure the panel was reasonably flat around places that were drilled, nibbled, and cut.

Now came the part that was going to make or break me. I was going to glue the paper label to the panel. I had to be very careful here. (I really didn't worry *that* much. If I messed up on this step, I could always make another label.) It helped to have some marks on the back side of the label and on the panel, to line up, when I took this step. I also made sure the panel was free from dirt and grease. Now before cutting out any of the holes on the label, I laid it facedown on a flat surface and sprayed the back with glue. I used 3M Photo Mount Spray Adhesive®. Another one to try is Duro® All-Purpose Spray Adhesive. Just follow the directions on the can (most tell you to let the sprayed surfaces dry about one minute or until tacky before bonding).

Next, I carefully lined up one edge of the panel with the label using the marks I made and then let it down slowly (see Photo C). Everything lined up—edges, holes, and lettering. The instructions on the spray adhesive tell you to go over the surface of the label with a rubber roller to ensure proper contact of the adhesive and to get out all the air bubbles. I didn't have a roller, so I just put a piece of paper over the label and used a towel to thoroughly rub it down. If you have a large meter hole, be careful not to push through the hole. If you do, you could pull on the paper and wrinkle it.

Next, I used an X-Acto® knife with a pointed blade to trim the excess paper around the outside edge and cut out the holes on the mounted label. You might find that some white shows around the outside edge of the black panel after trimming. Just take a black felt-tipped pen and fill in the irregularities. I sprayed on another coat of lacquer and my panel was finished (see Photo D). I mounted my switches, meters, and pilot lights into the panel and screwed it into the case. I stood back and admired my creation (Photo E) —my XYL thought I spent entirely too

"I got some spray lacquer and gave it a try. It worked! In fact, it worked remarkably well. It even seemed to saturate the paper, giving it more strength. It was scratch-resistant and sealed the label against smudging and yellowing."

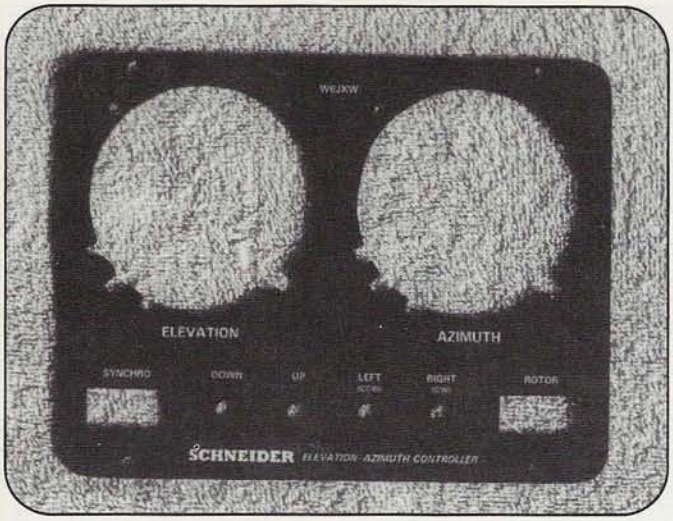


Photo D. Here is the finished front panel. It's been trimmed of excess paper, edged with a black felt-tipped pen, and sprayed with a final coat of clear lacquer.

Photo E. Here's the finished label glued to the panel. The meters and switches are installed and the front panel is mounted in the case.

much time on this step in the procedure. If you follow these directions, you'll be amazed how nice the front panel of your project will look. (Oh, admire it when your spouse is not looking.)

More Tips

Here are a few more things that you can do to produce a superior looking control panel for your equipment:

• First, use quality paper. I used extra white 24-pound laser printer paper. I also tried a glossy paper, which made the sharpest and brightest print I have ever seen on a laser printer.

• Experiment. Try different paper textures for different surface effects. How about using paper with pictures printed on it, like clouds? Wouldn't that make a nice antenna tuner control panel? (After all, antenna manufacturers are always posing their Yagis, beams, and boomers in the clouds.) You don't even have to use paper at all. Experiment with waterproof, no-tear plastic laser paper, available at some office supply stores.

• You may have to use several coats of clear lacquer on the label. Exactly how many will depend on the type of printer and the quality of the paper that you use.

• Clear lacquer can make some paper a little more translucent, by the way. So, if your front panel is very dark, try spraying the backside of the paper label with *white* lacquer. Let it dry and then mount the label on the control panel as described above. It will make the lettering appear much brighter.

• You don't have to make a full-panel label. This method will work for labels of all sizes, even small specification labels like those in Photo F. On my project, I put a label on the back that explained again what this thing did, when it was made, the operational voltages and amp-erages, and who the brilliant guy was who made it. (How vainglorious can a person get? I guess as much as a label can hold!)

• If you make the smaller labels, say about one-half to one inch wide, try using double-stick tape instead of the spray adhesive. It is less messy and works just as well for small stuff. Remember, after you cut out the label (assuming you're making a black label with white lettering), take a black felt-tipped pen and go around the edges to fill in so no white will be seen when it's mounted.

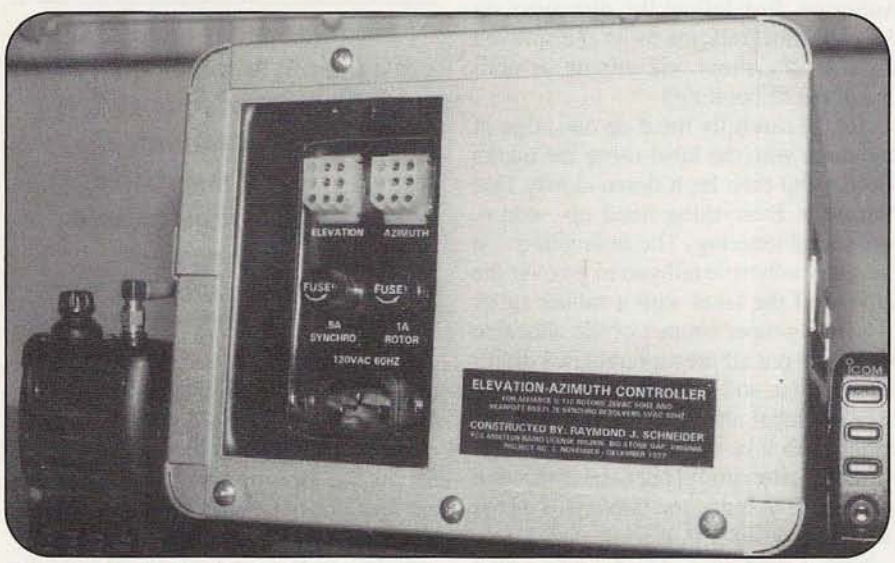


Photo F. Small specification labels can also be made, such as these on the back of my project. The label on the left identifies the connectors and fuses. The one on the right has details about the project.

Learning and Sharing

If you're like me, part of the fun of amateur radio is trying to figure out how to do something. The other part is sharing what you've learned with others. I hope I've contributed something you can use, experiment with, and improve. Have fun making paper labels for your ham radio projects. And, make it look good. ■

ARRL UHF Contest August 1–2, 1998

If the bands above 2 meters are your "thing," then the annual ARRL UHF Contest will give you a chance to compare your skills and station to those of other hams.

Here are the complete rules for the 1998 ARRL UHF Contest, courtesy of the ARRL Contest Branch:

1. Object: To work as many amateur stations in as many 2 degrees by 1 degrees grid squares as possible using authorized amateur frequencies above 222 MHz and all authorized modes of emission.

2. Date and Contest Period: First full weekend of August. Begins 1800 UTC Saturday, ends 1800 UTC Sunday (August 1–2, 1998). Entrants may use as much of this time as they wish.

3. Entry Categories:

3.1. Single Operator.

3.2. Rover.

3.3. Multioperator.

4. Exchange: Grid-square locator (see April 1994 *QST*, page 86).

4.1. Exchange of signal report is optional.

5. Scoring:

5.1. QSO points:

5.1.1. Count three points for each complete 222- or 432-MHz QSO.

5.1.2. Count six points for each complete 902- or 1296-MHz QSO.

5.1.3. Count 12 points for each 2.3-GHz-or-higher QSO.

5.2. Multiplier: The total number of different grid squares worked per band. Each 2 degrees by 1 degree grid square counts as one multiplier on each band it is worked.

5.3. Final score: Multiply the total number of QSO points from all bands operated by the total number of multipliers for final score. Example: W1AW works W3CCX in FN20 on 222, 432 and 1296 MHz. This gives W1AW 12 QSO points (3 + 3 + 6) and also three grid-square multipliers. Final score is 12 QSO points X 3 multipliers, or 36.

5.4. Rovers only: The final score consists of the total number of QSO points from all bands times the sum of unique multipliers (grid squares) worked per band (regardless of which grid square they were made in) plus one additional multiplier for every grid square activated (made a contact from).

5.4.1. Rovers are listed in the contest score listings under the Division from which the most QSOs were made.

6. Miscellaneous:

6.1. Partial QSOs do not count. Both calls, the full exchange and acknowledgment must be sent and received.

6.2. A transmitter, receiver or antenna used to contact one or more stations under one callsign may not be used subsequently during the contest period under any other callsign (with the exception of family stations). The intent of this rule is to accommodate family members who must share a rig, not to manufacture artificial contacts.

6.3. All equipment and antennas used by entrants must be owned and operated by amateurs. Use of non-amateur-owned gear is not prohibited, but use of such equipment places the entrant in a separate category, ineligible for awards.

6.4. Contacts made by retransmitting either or both stations, whether by satellite or terrestrial means, are prohibited. Frequencies regularly occupied by a repeater in a locality may not be used for contest work, even if the repeater is turned off.

7. Awards: Certificates will be awarded in the following categories:

7.1. Top single-operator score in each ARRL Division.

7.2. Top single operator on each band (222, 432, 902, 1296, and 2304-and-up categories) in each ARRL Division where significant effort or competition is evidenced. (Note: Since the highest score per band will be the award winner for that band, an entrant may win a certificate with additional single-band achievement stickers.) For example, if K2SMN has the highest single-operator multiband score in the Atlantic Division and his 432-MHz score is higher than any other Atlantic Division single-operator's, he will earn both a certificate for being the single-operator Division leader and an endorsement sticker for 432 MHz.

7.3. Top multioperator score in each ARRL Division where significant effort or competition is evidenced. (Multioperator entries are not eligible for single-band awards.)

7.4. Additional certificates, such as for Novices, may be awarded where significant effort or competition is evidenced.

8. Other: See rules for All ARRL Contests and for VHF Contests.

Reader Snapshot!

Meet CQ VHF Reader... Doug Robertson, VA3DGR

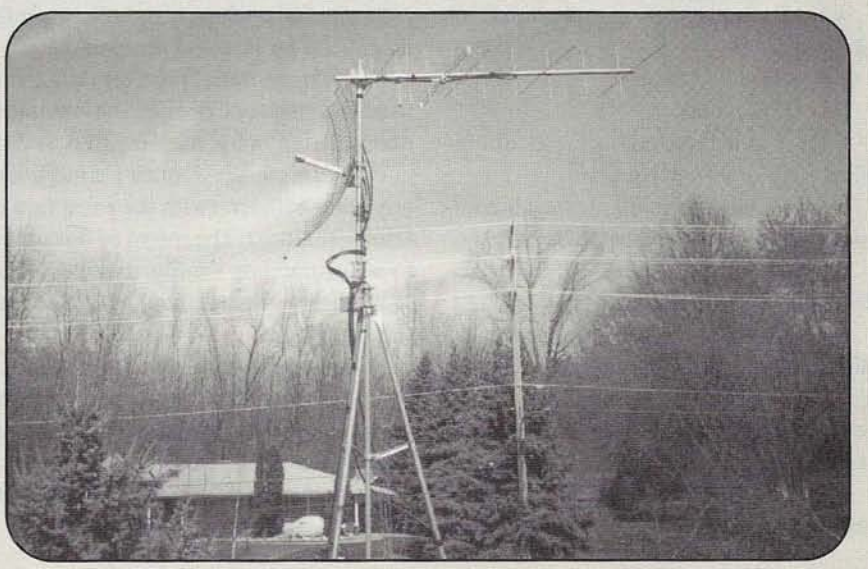
Doug Robertson, VA3DGR, of Windsor, Ontario, enjoys working satellites with his budget antenna system. Everything is mounted on a 7-foot tripod on Doug's roof, permanently tilted at a 25-degree angle and turned with a RadioShack TV rotor.

The Yagi antenna is an M^2 2M5-440XP, which combines a five-element 2-meter beam and a 10-element 70-centimeter beam on a single 5-foot, 8-inch boom. The two element sets are cross-polarized, and Doug keeps the 2-meter portion horizontal so he can also use the antenna for terrestrial SSB work. Doug says he's had many European contacts with this antenna on the FO-20 satellite, and that it also works well on RS-12 and FO-29.

The dish antenna below is for 2.4-GHz receive, to tune in the downlinks from DO-17 and UO-11. It will also be useful for Phase 3D's 2.4-GHz downlink when that satellite is finally launched (*although Doug may need to point it in the same direction as the other antennas!—ed.*).

Inside the shack, Doug uses an ICOM IC-820H transceiver for 2 meters and 70 centimeters, plus a Drake 2880 downconverter for 2.4 GHz. Doug says he also has two larger antennas on a tower, with an elevation rotor and a 70-centimeter preamp, but that he can switch between the two and the smaller system is sometimes just as good as the bigger, more expensive one!

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



Reader Survey—August, 1998

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

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

As an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to CQ VHF. *This month, in light of the threats to our frequencies, we'd like to get a picture of how politically-active you are as a group.*

	Circle Reader Service #
1. Please indicate whether you are registered to vote	
Yes	1
No (eligible but not registered)	2
Not eligible (under age 18, recently moved, not a citizen, etc.)	3
2. If registered, please indicate how often you voted in the past 5 years.	
Every/nearly every election	4
Most elections	5
Some elections	6
Have not voted in past 5 years	7
3. If registered, please indicate type(s) of elections in which you regularly vote.	
General elections (November)	8
Primary elections	9
School elections	10
Not a regular voter	11
4. Please indicate whether you have ever been a candidate for public office.	
Yes	12
No	13
5. If yes, did you win?	
Yes, currently serving	14
Yes, no longer in office	15
No	16
6. Please indicate whether you have ever contacted your U.S. Congressman/ Senator to register an opinion or to request assistance/action.	
Yes	17
No	18
Not sure	19
7. Please indicate whether you have ever filed comments with the FCC on an amateur-radio-related proposal.	
Yes	20
No	21
Not sure	22
8. Please indicate whether you have filed comments with the FCC regarding the Land Mobile Communications Council's petition (RM-9267) to reallocate the 70-centimeter band for business use.	
Have filed comments	23
Have not filed, but plan to	24
Not aware of the situation	25

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

What You've Told Us...

The responses to our May survey contained a few surprises among our questions about education, employment, and on-air activity. Our readers continue to be very well-educated (no surprise here), with 45% holding college degrees. In addition, 28% are high-school graduates and 20% are technical school grads; 3% are in college and 1% have not yet finished high school. Among the college grads, 44% hold bachelor's degrees, 29% have associate degrees, and 27% hold advanced (masters or doctoral) degrees.

Our first surprise came in the employment category, in which the largest percentage (25%) are retired (surprising because, in our March survey, only 38% of the respondents said they were age 55 or older). Among those readers still working, 21% are in technical jobs, and the bulk of the rest are split among professional/executive (17%), government (14%) and service-industry (10%).

On to the ham questions...59% of you plan to upgrade your license class in the next two years, and another 15% already hold Extra class licenses and cannot upgrade. Finally, we asked which modes you like to operate. It was no surprise that 91% of you are active on FM, but a big surprise that 55% of you operate single-sideband (SSB)—a number that has more than doubled since we first asked about it in 1996! Finally, 32% of you operate packet, 9% are active on each of APRS and ATV, and another 5% are not active on any of those modes.

This month's winner of a free one-year *CQ VHF* subscription is W. Conlon of Litchfield, Illinois. As always, thank you for sharing your views with us.

Search and Rescue "Boot Camp"

With ham radio's links to search-and-rescue (SAR) units growing stronger, here's a glimpse of what's involved in joining your local SAR unit. Hint: It's tougher than your ham radio exam!

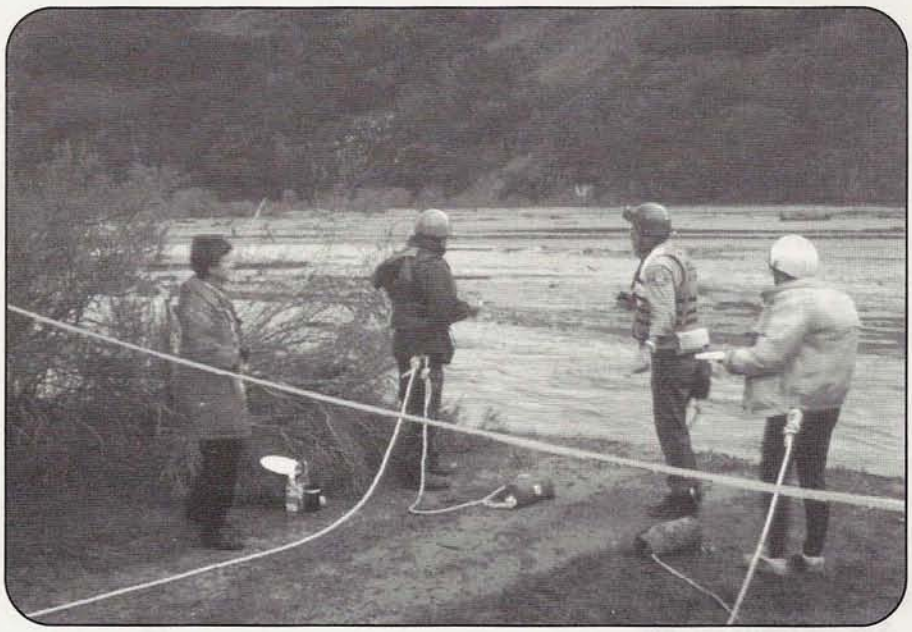
By Sam Vigil, WA6NGH*
(LVengr@aol.com)

The mud was ankle-deep as I trudged along the Cuyama River, near Santa Maria, California, with two other hams and a dog...reflecting on how I, a 52-year-old college professor and ham, had become part of a search-and-rescue (SAR) team. At that point, of course, my motivation didn't matter. There we were...March 1, 1998...searching for Michael Tye, a motorist swept off the road by a raging river—writing the final chapter in a drama which had begun five days earlier.

Tuesday, February 24

At about 0230, Tuesday morning, the California Highway Patrol (CHP) received a call indicating that Highway 166, a two-lane state highway connecting Santa Maria and Bakersfield, was "totally washed out." A CHP car, manned by veteran officers Rick Stoval and Britt Irvine, was dispatched to check on the situation. When radio contact with them was lost, an additional CHP car was sent out. The second car found that a 300-foot section of the highway had washed into the rain-swollen Cuyama River, taking the first CHP car with it. In addition, a semi-trailer truck, pickup truck, and sedan had also been swept away.

At 0530 that morning, San Luis Obispo County Sheriff's Search and Rescue (SLOSAR) team members were paged awake by SLOSAR Board Chairman Vern Halterman, N6RAN. As team members arrived at the scene, they set up a command post and prepared to assist as directed by the Incident Commander. Eventually, 10 public safety agencies would be involved.



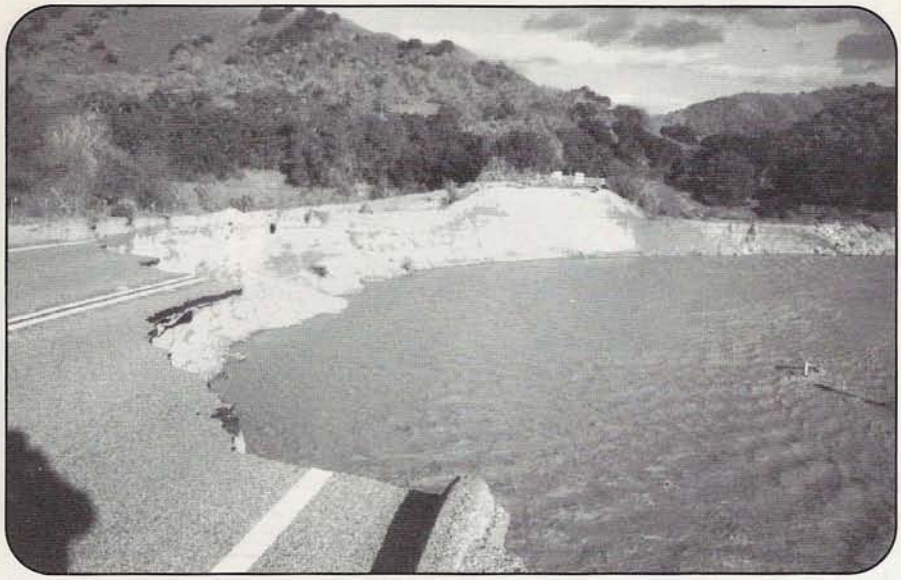
Search and rescue team members set up a "downriver saftey team" downstream from efforts to recover the bodies of two California Highway Patrol officers who drowned after their car was swept off the road by floodwaters. This group is on standby to save any rescuer who might be pulled away by the waters as well. (Photos courtesy of the author)

The Beginning

My XYL Eve, KF6NEV, and I joined SLOSAR (San Luis Obispo Search and Rescue) in October, 1997. I was recently retired from the Navy Reserve after 29 years, and I missed the camaraderie and sense of purpose that I found in the military. I also wanted to get involved with public service at a local level, with a group of highly motivated people. The San Luis Obispo County Sheriff's SAR unit fit my requirements perfectly.

But joining SLOSAR wasn't as easy as joining a radio club. Prospective members must complete Red Cross CPR (cardio pulmonary resuscitation) and Basic First Aid certifications *prior* to applying. Then, a Sheriff's Department background check must be completed, and, finally, there are two personal interviews by the SLOSAR Board of Directors. New members are "on probation" for six months to a year as they complete rigorous classroom and field training sessions.

**Sam Vigil, WA6NGH, is a probationary member of the San Luis Obispo County Sheriff's Search and Rescue Unit. He is also a Professor of Environmental Engineering at California Polytechnic State University, and the co-author of a college textbook and numerous technical articles and reports. This is his third article for* CQ VHF.



Washout on Highway 166 near Santa Maria, California. The author helped search for two police officers and others who were pulled into the floodwaters.

SLOSAR is a volunteer unit of the County Sheriff's Department and members are considered non-pay employees of the county. This status provides us with Worker's Compensation if any of us are injured in our official capacity as SAR members. SLOSAR (like many other SAR teams) is organized as a not-for-profit corporation with an elected board of directors.

The Search Continues

At sunrise, Highway Patrol, U.S. Coast Guard, U.S. Air Force, and Sheriff's helicopters combed the river looking for survivors. Miraculously, two people—truck driver James Rowan and commuter Steve Miller—had survived after having been swept downstream almost one-half mile from the washout. While the two survivors were being rescued by helicopter, SLOSAR and Santa Barbara County SAR teams were deployed along the riverbanks to search for possible additional survivors.

The missing Highway Patrol car was found partially buried on a sandbar in the middle of the river. Helicopters ferried the Sheriff's Dive Team and California Division of Forestry Technical Rescue Team to the sandbar to recover the Highway Patrol Officers who, sadly, did not survive. As these dedicated rescuers performed their dangerous mission, SLOSAR and Santa Barbara County SAR team members formed downriver safety teams. A safety line was rigged across the river by helicopter and several handline teams were deployed to assist if needed. (Downriver safety teams are a backup to the primary teams for the recovery of rescuers or victims swept downriver from the primary rescue site.) Eve and I assisted one of the safety teams.

It was almost dark when the sandbar rescuers completed their solemn task. But our work was still not finished. An empty pickup truck was also found buried in mud of the sandbar. It had to be assumed that the driver had been swept downstream.

SAR Team 7 on the Banks of the Cuyama River (left to right: Sam Vigil, WA6NGH; Randy Martin, KE6SID; Lynn Diamond, KC6UHE; and Scout, front right).

"Prospective [SAR team] members must complete Red Cross CPR...and Basic First Aid certifications prior to applying. Then, a Sheriff's Department background check must be completed, and finally, there are two personal interviews...."

"Probies"

As Probationary members, or "probies," our training includes the following elements:

Ground Team and Basic Operations: Map, compass, and GPS (Global Positioning System) proficiency, ground search and tracking techniques, search participation, overnight operations.

Command Post Operations: Basic communications, setup of command post.

Climb Team: Basic orientation and training.

Medical Team: CPR refresher, California Title 22 advanced first aid, medical report taking, assisting unit Emergency Medical Technicians.

Vehicle Team: Orientation on unit-owned vehicles (communications van, rescue truck, medical trailer), basic 4-wheel-drive training.

Search Dog Team: Working with dog teams in the field.

Communication Team: Introduction to the unit-owned HTs, communications van, and portable cross-band repeater, SAR dispatch operations.

Until the Highway 166 Search, the unit had not had a real search mission since we joined. Thus, our training was held in formal classroom sessions and field exercises. In the classroom, we focused on communications techniques, basic map and compass reading, and first aid training. Our field exercises have included several all-day hikes in nearby mountainous areas known for prior searches. We also had a joint training exercise at Vandenberg Air Force Base with Santa Barbara County SAR, our neighbor to the south. This included a map, compass, and GPS course; a field exercise; and an orientation to Air Force rescue helicopters (which were to later play a major role in the Highway 166 search).

As avid campers and hikers, Eve and I really enjoyed the field training. We also go on our own day hikes to practice our map, compass, and GPS techniques. I make it a point to take my HT along and work a few distant repeaters that I can't normally hit from the "flatlands." Although our local mountains are only 1,500 to 2,000 feet high, even those relatively low elevations do wonders for VHF propagation.

Thursday, February 26, 1998

Only air searches were performed on Wednesday because the river was still too high. By Thursday, the water had receded and exposed more of the river bottom and SLOSAR got back into action with riverbank ground searches. My teammate, Tim Williams, KF6DMH, and I soon discovered that our access to the river was still blocked by knee-deep mud. In three hours, we were able to search less than a quarter-mile of riverbank. The other search teams were also having trouble making their way through the quagmire.

Because of this, it was decided to focus on air searches for the next two days until the river subsided some more and the banks stabilized.

Advanced SAR Training

There are numerous opportunities for advanced SAR training. For example, the Bay Area Search and Rescue Council, an organization of 20 SAR units in the San Francisco Bay Area, sponsors an annual SAR training weekend called the Bay Area Training for Search and Rescue (BATSAR). At last year's BATSAR, I focused on SAR technology including GPS, the application of computers and APRS to SAR, and radio direction-finding (RDF) training with the Civil Air Patrol (CAP). Eve took courses in tracking and land navigation.

SLOSAR itself provides a broad range of monthly advanced classroom and field training in all of the SAR specialties. Continuous training is part of every SAR team member's responsibility. The National Association for Search and Rescue (NASAR) has established national standards for SAR team training, and offers a certification program called SARTECH III and SARTECH II for SAR team members (see "Resources" for the NASAR Web site).

Bob Stadtherr, KI6WO, dispatching from the SLOSAR communications van. The van is able to simultaneously monitor and communicate on all police, fire, aircraft, and amateur frequencies in use for a search and rescue mission.

The Role of Communications and Ham Radio

Many SLOSAR members are hams. Most of the members are interested in the use of ham radio as a backup to the public service frequencies used in SAR missions. The role of SAR communications is to keep the teams in the field in contact with the command post at all times. VHF simplex on public safety frequencies is the primary mode of communications. In some cases, county-owned repeaters are also used, or our own portable cross-band repeater. Ham frequencies provide additional backup.

During the Highway 166 Search, the portable SAR repeater was airlifted by helicopter to a nearby hilltop where it provided continuous coverage to teams operating in the Cuyama River valley, out of range of both county and ham repeaters.

During missions, Communications Team members set up the SLOSAR mobile communications van and 5-kW generator trailer. The van has multiple VHF and UHF radios (including a dual-band VHF/UHF ham rig). The van is able to simultaneously monitor and communicate on all police, fire, and aircraft frequencies in use for the mission. At the Highway 166 search, it was the only communications unit capable of operating on all of the multiple frequencies being used by the ten agencies involved.

SLOSAR Communications Team Leader Bob Stadtherr, KI6WO, and Assistant Team Leader Kirk Smith, KD6RCT, designed and built the communications van and cross-band repeater.

"Miraculously, two people—truck driver James Rowan and commuter Steve Miller—had survived after having been swept downstream almost one-half mile from the washout."

The SLOSAR portable cross-band repeater. This operates on VHF and UHF public service frequencies used by the SAR teams.

They also supervise periodic work parties to keep the gear up and running.

Sunday, March 1, 1998

"Team Seven to SARBASE. We have arrived at the riverbank. UTM coordinates 497 easting 786 northing. Pro-ceeding to search our sector." After hearing the acknowledgment from the command post, I clipped the Motorola HT back on my belt and followed my teammates Randy Martin, KE6SID, and Lynn Diamond, KC6UHE. We were being led by Scout, Lynn's search and rescue dog. Lynn and seven other California Rescue Dog Association (CARDA) dog teams had just driven hundreds of miles from San Diego and Auburn, California, to answer San Luis Obispo County's mutual aid request for additional search dogs. Our SAR unit provided two additional dog teams for a total of ten teams.

"SLOSAR Communications Team Leader Bob Stadtherr, KI6WO, and Assistant Team Leader Kirk Smith, KD6RCT, designed and built the communications van and cross-band repeater."

Despite the concerted efforts of SLOSAR, the CARDA dog teams, and

Map and GPS Training (left to right: Neal Hadsell, KE6MNQ; Tim Williams, KF6DMH; Sam Vigil, WA6NGH; and Claudia Hayner).

two air support helicopters, the search for missing motorist Michael Tye was ultimately unsuccessful.

Is SAR for You?

Becoming a member of a search and rescue team takes commitment of time and money. You will have to learn a broad range of new skills above and beyond the communications skills you already possess as a ham. Although you may ultimately chose to specialize on the communications aspects of SAR, most units will require you to be a generalist as well. You will need to obtain and outfit a 24-hour ready pack, containing survival and first aid gear for a sustained mission. You should enjoy hiking and being outdoors, as this is the essence of SAR. You should be willing to maintain a level of physical fitness that will allow you to hike for several hours at a time in difficult terrain. You must be willing to accept the fact that, while some SAR missions have a happy ending, others do not. In some cases, the role of SAR is to bring closure to a grieving family.

Epilogue

After the Highway 166 Search, SLOSAR member Richard Hannibal eloquently expressed the feelings of all SLOSAR members in his Editorial in the Unit newsletter:

After a long dry spell of no missions, SLOSAR was hit by a challenge that caused us to experience every human emotion. Tuesday's tragic loss of two California Highway Patrol officers and possibly one other civilian, brought us face-to-face with reality and our reason for being. Throughout that day we experienced satisfaction, frustration, happiness and anger....

I think I was touched most by the wetsuit-clad rescue workers who stood at attention as the lifeless officers were removed from the twisted metal. Then there was the long line of Highway Patrol officers that stood at attention, stretching from the transporting helicopter to the awaiting white van that accepted the precious cargo. Night was falling, but the tears could still be seen. Slowly, in a solemn escort of eight Highway Patrol cars, the van was led away into the night. The procession passed us as we looked on, into a blurred world, our vision obscured by the tears. The world became quiet as the slow moving procession of red lights passed....The California Highway Patrol was bringing their brothers home.

We go on now, those of us who did not know these heroes. We go on in their light, hoping that we as a group, can continue the promise of these men. The promise that perhaps this old world will be a better place, because we have lived. ■

Resources

The best source of information about Search and Rescue is your local Sheriff, Fire, or Police Department. They can direct you to a local unit. You can also check out the following for additional information:

San Luis Obispo Telegram-Tribune: Photos and news stories about the Highway 166 search. Use the search function with keywords Highway 166 (look for stories in February and March, 1998); Web site: <http://www.sanluisobispo.com/>.

The National Association for Search and Rescue: Information on SAR training standards, many links to other SAR Web pages; Web site: <http://www.nasar.org/>.

The Search and Rescue Society of British Columbia: One of the best SAR information sites in North America: Web site: <http://www.sarbc.org/homepage.html>.

The Bay Area Search and Rescue Council: Training information and discussion on ham radio and SAR; Web site: <http://www.basarc.org>.

The California Rescue Dog Association: Information on the training and use of rescue dogs; Web site: <http://reality.sgi.com/csp/carda>.

Additional Resources

Josuweit, Bob, WA3PZO, "Operation Goodearth: Minnesota Hams Join Search and Rescue Drill," *CQ VHF*, February 1998, pp. 53–56.

Josuweit, Bob, WA3PZO, "Lost and Found—Hams Helping Search & Rescue," *CQ VHF*, March 1998, pp. 58–61.

Wellman, Jerry, W7SAR, "Search and Rescue Communications," monthly SAR column in *Worldradio* magazine.

ARRL 10-GHz And Up Cumulative Contest

August 15–16/September 19–20, 1998

The ham radio microwave bands are heating up, and two of the hottest weekends for activity each year are the weekends of the ARRL 10-GHz And Up Cumulative Contest.

Here are the complete rules for the 1998 ARRL 10-GHz And Up Cumulative Contest, courtesy of the ARRL Contest Branch:

1. Object: North American amateurs work as many amateur stations in as many different locations as possible in North America on bands from 10-GHz through Light.

2. Date and Contest Period: Third full weekend of August and September. From 8 AM to 8 PM local Saturday and 8 AM to 8 PM local Sunday (August 15–16, and September 19–20, 1998).

3. Entry Categories:

3.1. 10 GHz only.

3.2. 10 GHz and up.

4. Exchange: Six-character Maidenhead Locator (see April 1994 *QST*, p 86).

4.1. Signal report is optional.

5. Miscellaneous:

5.1. Scheduling contacts is both permissible and encouraged.

5.2. Stations are encouraged to operate from more than a single location. For purposes of the contest, a change of location is defined as a move of at least 16 km (10 miles). A station may be reworked on each band for additional credit by either end of the contact moving to a new location.

5.3. Contacts may not be duplicated on the second weekend (that is at least one end of the QSO must be from a different location).

5.4. Contacts must be made over a minimum distance of 1 km.

5.5. A transmitter used to contact one or more stations may not be used subsequently under any other call during the contest period. The intent of this rule is to prohibit "manufactured" contacts.

5.6. Contacts with aeronautical mobiles do not count.

6. Scoring:

6.1. Distance points: The distance in km between stations for each successfully completed QSO is calculated. Distance = distance in km.

6.2. QSO points: Count 100 QSO points for each unique callsign worked per band. Portable indicators added to a callsign are not considered as making the callsign unique.

6.3. Total Score: Equals distance points plus QSO points.

6.4. There are no multipliers.

6.5. In making the distance calculations, a string (or ruler) and map may be used. However, calculations by computer program are preferred. Several such programs are available in the commercial market, including a basic program listing in The ARRL World Grid Locator Atlas ($5). For purposes of making calculations, stations are defined as being located in the center of the 6-character locator sub-square (most computer programs make this assumption).

6.6. Scoring example: On the first weekend, W9JJ operating from Mt Greylock, MA works W1VD (distance 97 km) and W1LJ/1 (distance 107 km) on 10 GHz; and W1LJ/1 (distance 107 km) on 24 GHz. On the second weekend, W9JJ operating from Pack Monadnock, NH works the following stations: W1VD (154 km), W1VT (205 km), W1LJ (157 km), and K1RO (147 km) on 10 GHz; and K1RO (147 km) on 24 GHz.

Distance points = 97 + 107 + 107 + 154 + 205 + 157 + 147 + 147= 1121

QSO points = 100 X 6 = 600

(10 GHz: W1VD, W1LJ, W1VT, K1RO; 24 GHz: W1LJ, K1RO)

Final Score = 1121 + 600 = 1721

7. Scheduling and Reporting:

7.1. Schedules may be set up by use of the HF calling frequency of 3818 kHz on the evenings of Tuesday, Wednesday and Thursday before the contest weekends starting at 7 PM local. Also, 144.230 and 146.55 MHz can be monitored during the contest to arrange schedules with other stations. Paired stations should move off these frequencies once contact has been made.

7.2. Official forms are available in the *ARRL Contest Yearbook*.

7.3. Logs should indicate band, date, time, call sign, the exchange information plus distance of contacts in km.

7.4. Logs must be submitted no later than 30 days after the end of the contest to ARRL Contest Branch, 225 Main St, Newington, CT 06111.

8. Awards: Suitable awards will be presented.

9. Other: See General rules for All ARRL Contests.

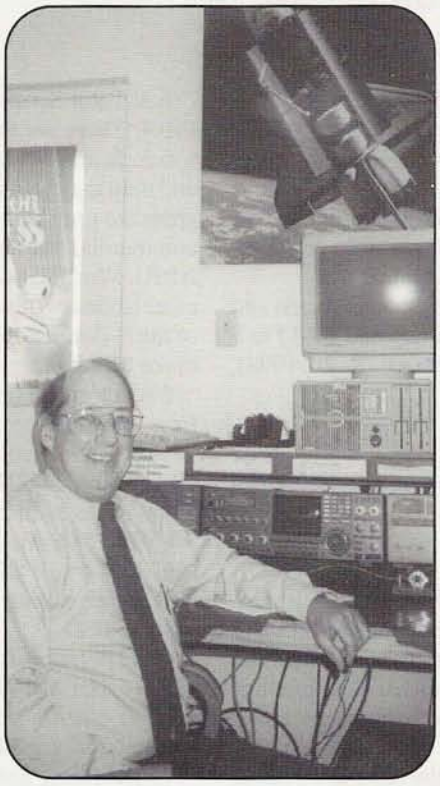
Visiting a Real "Space Station"

Let's go with WB2D for a tour of the ham station at the home of "hi-tech," the Johnson Space Center Amateur Radio Club—W5RRR—in Houston, Texas.

Some people say ham radio is dead. Others say that it's some sort of antique that has survived the computer revolution, but has lost all relevance. Some say that it's pretty boring compared to the Internet and Web.

The people saying these things obviously have not taken notice of what goes on about 20 minutes out of downtown Houston on the road to Galveston...at W5RRR, the station of the Johnson Space Center Amateur Radio Club (JSCARC). JSC is an adult's Disney World, a place where dreams are made. It's the epitome of rational man's attempt to break down the universe into small enough pieces to control it. On a more down-to-earth level, JSC is also the training base for U.S. astronauts and "Mission Control" for all U.S. manned space flights—many of which carry ham radio into orbit.

In the early days of the space program, ham radio was pushed aside. But once hams got a semi-official foot in the door, they showed the NASA managers just how valuable a tool ham radio could be, primarily in the areas of public relations and crew morale.



If we could just get them to sell this SAREX poster on QVC....This is Dale Martin, KG5U, at one of the five separate operating positions (three HF, two VHF/UHF) at the Johnson Space Center Amateur Radio Club, W5RRR.

"It's almost like a pep rally in here sometimes [when we're talking with Andy Thomas on Mir], with everybody cheering him on, saying that he's doing a great job, which he is."
—Dale Martin, KG5U

A Conversation with KG5U

Dale Martin, KG5U, is a past-president of JSCARC. He has worked at JSC for over 20 years, primarily as an electronics technician. Recently, he was hand-picked for an elite crew that's gluing tiles onto the prototype "lifeboat" for the International Space Station (ISS). In early May, Dale was kind enough to take us on a tour of club station W5RRR and to talk about its pivotal role in SAREX, which, as he tells us here, recently took on the new name of *Space* Amateur Radio Experiment. (In addition to the VHF/UHF equipment that Dale will tell us about, W5RRR also has three top-of-the-line HF stations and often provides HF bulletins on the progress of SAREX-equipment missions.)

CQ VHF: *Tell us about the VHF installation here at W5RRR.*

KG5U: Our VHF installation consists of ICOM VHF and UHF single-band transceivers. We have two pair: the IC-271/IC-471 pair, which is our terrestrial setup. It is what we use for point-to-point communications here on the ground. Over on the right, we have our satellite station, the IC-275/IC-475 pair. Of course, we use that for communicating with and through orbiting spacecraft. We use the Graf Trak computer tracking system, not only to track the vehicles that we're interested in, but also to control the antennas out at our antenna farm. The satellite station uses Mirage amplifiers on the 2-meter and 440 bands. We have preamps mounted up on the antennas, which are mounted on a 20-foot Rohn-45 tower in back of the shack. We have cross-polarized multi-element Yagis for both bands. Of course, we have full computer control of the az-el (*azimuth and elevation—ed.*) rotators for both bands. That makes operation pretty simple compared

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

Here, KG5U operates the computer at the W5RRR satellite station. It's the primary station for contacting astronauts aboard the shuttle and Mir.

to attempting to manually follow the spacecraft across the sky.

We also have a couple of television monitors. We're hooked up to the JSC TV distribution system, so we are able to watch NASA television while missions are going on. Sometimes we can actually see some of the people that we're communicating with on board the spacecraft. Or if we can't see them, we can at least see the craft that they are on while we are talking to them.

A New Name for SAREX

CQ VHF: *What are the main uses of your VHF stations here at the club?*

KG5U: We've had these stations here for a number of years now. We use them mainly to communicate with the *SAREX* program—they've changed the name recently from *Shuttle* Amateur Radio Experiment to *Space* Amateur Radio Experiment because SAREX is now to be incorporated into the International Space Station as a permanent fixture.

SAREX is primarily for the Shuttle and the International Space Station, but we also use this station to communicate with U.S. astronauts who spend time on board Mir, the Russian space station. And we stay in contact quite frequently with Andy Thomas (KD5CHF/VK5MIR), who is currently on Mir and won't be returning to Earth until sometime in June. (*Thomas, the last American scheduled to serve on Mir, returned home in early June. — ed.*)

CQ VHF: *What sorts of conversations do you have with the people on Mir?*

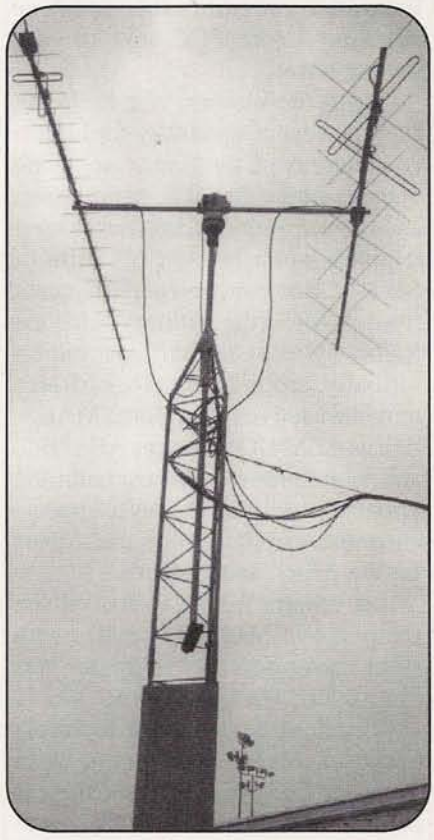
KG5U: A lot of the conversations with Andy are just to keep him connected to the people that he is close to here at Johnson Space Center. For instance, his fellow astronauts come out here and talk to him. A lot of the people who support him—his support team—his coach or, for lack of a better term, his physical therapist. She monitors his on-board activities through official circuits, but she likes to come out here and talk to him personally on a one-to-one basis in addition to the regular official channels. And the other astronauts come out here and talk to him. It's sort of a morale booster for him. It's almost like a pep rally in here sometimes with everybody cheering him on, saying that he's doing a great job, which he is. He's having a good time up there and being very effective representing the United States on board Mir. He's doing all the jobs that he went up there to do.

Family members of astronauts who have been on Mir have come out to the amateur radio club here and have communicated with their fathers, husbands, brothers, sons, daughters, mothers, or whomever may have been on board at that time. And we've run phone patches here to family groups as well.

CQ VHF: *What about personal need items for the Progress cargo ships? (These are unmanned supply ships regularly launched to Mir by Russia.—ed.)*

KG5U: One of the things Andy's support team does is—when there's a Progress supply ship going up to Mir sometime in the near future—they start making up their list of things that need to be gathered and shipped over to Russia to be placed on the Progress vessel. When it goes up to Mir and docks, the cosmonauts and astronauts open it up and take out all the supplies and new stuff. Some of that is personal effects, stuff of a personal nature that they may need. Quite often in that, you have books, other reading materials and video tapes—movies that the astronaut wants to see. It's proven to be a big morale boost to the astronaut in that regard.

Also, back when Shannon Lucid was on board, she had a personal preference



The impressive satellite antennas at W5RRR are completely computer-controlled, allowing hams at the station to concentrate on communicating with the orbiting astronauts rather than pointing antennas.

"Family members of astronauts who have been on Mir have come out to the amateur radio club here and have communicated with their fathers, husbands, brothers, sons, daughters, mothers, or whomever may have been on board at that time."
—Dale Martin, KG5U

On the Cover

The late Barry Goldwater, K7UGA, at his station in Scottsdale, Arizona. The former U.S. Senator, Republican Presidential nominee, and "elder statesman" of ham radio died on May 29 at age 89. Among other notable achievements, Goldwater was responsible for passing legislation that established the Volunteer Examiner program, the Amateur Auxiliary to the FCC, and 10-year license terms.

During the Vietnam War, his home station became a pathway for literally hundreds of thousands of phone patches home for U.S. servicemen and women overseas. In order to keep it going while he was off being a Senator, Barry organized volunteers from MARS (the Military Affiliate Radio System) to staff the station virtually around the clock. Barry remained active in Air Force MARS, first as AFA7UGA, then as AFA7BG, and helped promote amateur radio and amateur satellites through appearances in a variety of films and videos for the ARRL and AMSAT.

But despite his celebrity, on the radio and in personal contacts with other hams, Senator Goldwater was always just "Barry, K7UGA." We've collected some personal recollections of hams' encounters with Barry in "The Senator from Amateur Radio," elsewhere in this issue, and you will see that the theme of friendship and humility runs through every single one of those recollections. Ham radio will miss you, Barry. 73. (Cover photo by Larry Mulvehill, WB2ZPI)

Each SAREX mission has provided W5RRR with a commemorative plaque in recognition of the club's participation. SAREX was recently renamed the Space *Amateur Radio Experiment in recognition of ham radio's inclusion on the International Space Station.*

for some particular kinds of candies—I think they were M&Ms—but there were a lot of references made by amateur radio and assurances given by amateur radio that those candies, indeed, were going to be on the next Progress supply vessel. Mir just does not have the communications capability to handle that sort of personal communications for the astronauts and cosmonauts. But it's very important to the individual to maintain morale.

Giant Steps for Ham Radio

***CQ VHF**: This is quite a difference from the early days.*

KG5U: Quite a difference. We've gone from days when the astronaut simply sat there with the handheld in his hand and called CQ, and tried to filter out a call-sign or two through the pile-up of call-signs being thrown up at him. Now we have amateur radio contacts from the Orbiter spacecraft—the shuttle—to school groups where 10 or 15 kids might get an opportunity during that pass to pose a question to an astronaut and get an answer. All this in an eight- to 10-minute pass. There have been as many as 15 to 20 questions answered during one pass with one school group. We've grown quite a bit, and I think the change is very beneficial both for ham radio and for the space program.

And we've seen the Mir on-board amateur radio station grow from voice-only capability to also include packet, a store-and-forward BBS. The growth has been very beneficial for all involved.

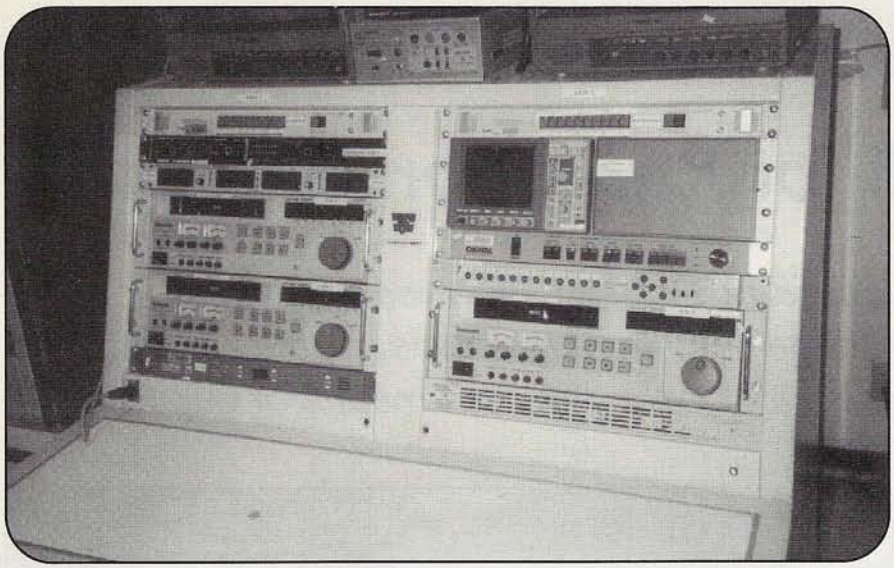
***CQ VHF**: What does the future hold for W5RRR and the JSCARC?*

Digging Deeper

We also asked Dale what resources were available if someone wanted to know more about W5RRR and the JSCARC. He supplied us with some Web addresses that readers may find interesting. Dale says they'll give you some insight into the activities of W5RRR and the club:

JSC Amateur Radio Club: <http://www.phoenix.net/~mbordel/>
JSC SAREX Page: <http://www.phoenix.net/~mbordel/jscarc/shuttle/index.html>
JSC Home Page: <http://www.jsc.nasa.gov/>
NASA Home Page: <http://www.nasa.gov/>
Clear Lake ARC Home Page: <http://clarc.org/> (astronauts' testers/licensers!)

Dale also suggests that you check out his home page at:
<http://www.hal-pc.org/~kg5u>.



This is a fast-scan ATV station that's currently being rebuilt in anticipation of use with the permanent ham station to be installed on the International Space Station. Construction is currently scheduled to begin later this year.

KG5U: We have a berth on board the International Space Station. The first elements of the space station are going to start going up towards the end of the year. Sometime in 1999 or 2000, we'll see the first permanent presence of amateur radio on board the space station. Soon to follow behind that will be a permanent presence of humans on board the space station. And you'll see a lot of amateur radio operations coming out of the International Space Station as it orbits around the Earth.

The SAREX working group is deciding on the equipment and preparing it now. I'm not sure, but I would think that there will be dual-band and perhaps even tri-band capability.

Ham radio becomes even more important for morale of the crew as the assignments get longer and longer. And we'll be there.

More Than Just a Station

CQ VHF: *Does JSCARC do anything beyond giving the astronauts a link for personal communications?*

KG5U: The club does a lot more. We have licensing classes on a regular basis, which is how many of the astronauts get their ham tickets. Some of them are long-time hams, but most are new to the hobby. They see the value of the license, and we do everything we can to encourage them to get their licenses. Like I said, it is good for everyone concerned.

Thank you, Dale, for talking with us about W5RRR. Next month, we'll continue with an interview with Matt Bordelon, KC5BTL, the vice president of JSCARC and the new Principal Investigator for SAREX. ■

Hams Drill for Radiation Safety

Several months ago, we looked at Philadelphia-area amateurs supporting emergency management during a nuclear power plant exercise. This time, we take a look at a different means of support.

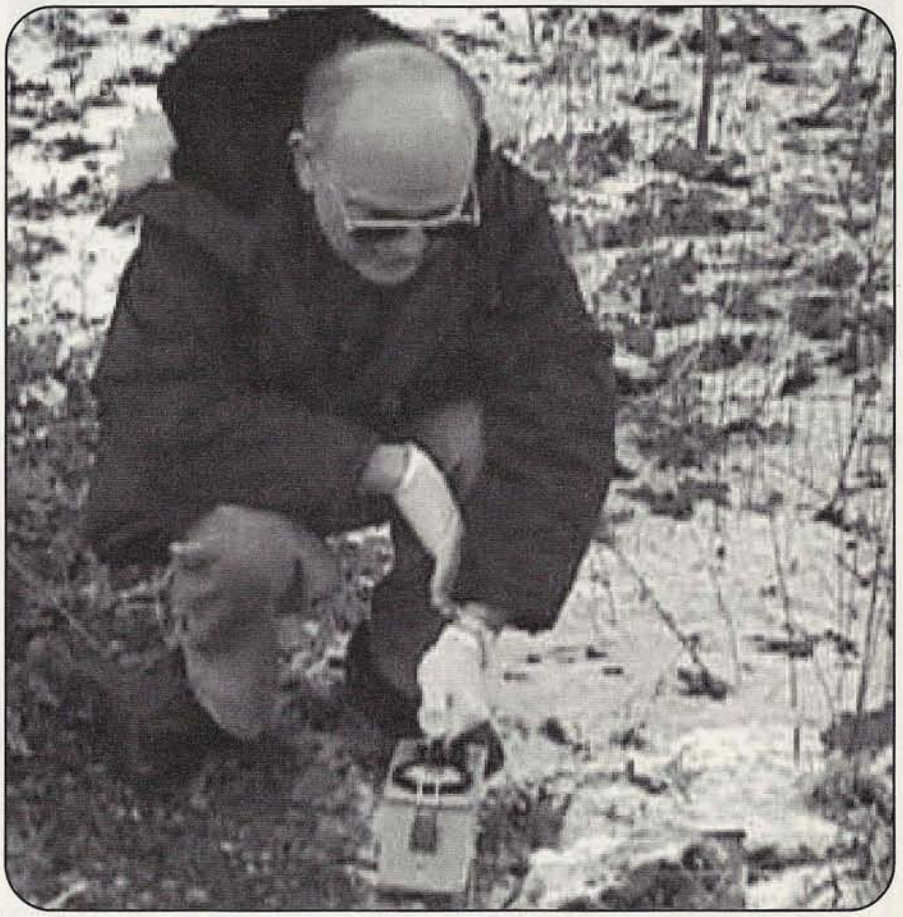
While there's been only one serious nuclear power plant accident in this country, federal rules require that regular drills be conducted at every plant to ensure that emergency procedures are in place and well-practiced in the event of a "radiological accident."

To help put the dimensions of this task into some perspective: nearly five million Americans live within 10 miles of an operating nuclear power plant, and 35 of the 50 states either have commercial nuclear power plants or are within the emergency planning zones of plants in adjacent states.

Radiation Danger

By definition, a radiological accident is an event that involves the release of potentially dangerous levels of radioactive materials into the environment. This release, usually in the form of a cloud or "plume," could affect the health and safety of anyone in its path, so the monitoring of radiation levels is critical. The area that may be affected by the radioactive release is determined by the amount of material released from the plant, wind direction and speed, and weather conditions (i.e., rain, snow, etc.) which might quickly drive the radioactive material to the ground.

If a release of radiation occurs, the levels of radioactivity are monitored by authorities from federal and state governments, as well as by the utility, to determine the potential danger in order to protect the public.



This photo shows a radiation rate reading being taken with an RO-2A ionization chamber meter (since this was only a drill and there was no release of radiation from the nuclear power plant, the state observer supplied the values of the readings reported in the simulated release). Readings are taken at 3 feet and 3 inches above the ground. In order to differentiate between beta and gamma radiation, readings are taken with the window open and closed. Notice that protective gloves are used to avoid contamination. Amateur radio is used to send the readings observed to the Emergency Operations Center. These pictures were taken at the November 19, 1997, Indian Point drill. (Photos courtesy of Dave Ballard, N2MUG)

Minimizing Radiation

According to the Federal Emergency Management Agency (FEMA), there are three factors that minimize radiation exposure to your body. These are time, distance, and shielding.

Most radioactivity loses its strength fairly quickly. Limiting the time spent near the source of radiation reduces the amount of radiation exposure you'll receive. Obviously, the greater the distance between you and the source of the radiation, the less radiation you'll receive. In the most serious nuclear power

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

"Reading" an air sample. A fan in the Radeco H-809C air sampler draws air through a fiberglass filter and a cartridge to trap any airborne radioactive particles or gases. The radiological field monitoring team then moves to a radiation-free location to read the sample for signs of radioactivity. Here, both the filter holder and cartridge holder have been removed from the air sampler and placed on a plastic bag to prevent contamination of the area where the samples are read. The readings are sent via amateur radio to the Emergency Operations Center, which then relays instructions on where to go next.

"Although it was a drill, great care was taken to prevent possible ingestion of any radioactive particles. The ventilation systems of the vehicles in use were turned off, which meant there was no heat or air conditioning. Smoking, eating, and drinking were not allowed."

plant accident, local officials will likely call for an evacuation, thereby increasing the distance between you and the radiation. Heavy, dense materials between you and the source of the radiation will provide shielding from the radiation and reduce exposure to the radiation. This is why local officials may advise you to remain indoors if an accident occurs. In some cases, the walls in your home or workplace would be sufficient shielding to protect you for a short time.

Following an accident, local authorities will monitor any release of radiation, determine the level of protective actions required, and decide when the threat has passed. And hams may be called upon to help, so they had better be prepared.

"This Is a Drill"

As part of its compliance with federal safety rules, Consolidated Edison, the power company serving New York City and some of its suburbs, holds regular disaster exercises at its Indian Point Nuclear Power Plant, located some 50 miles north of New York City. According to Dave Ballard, N2MUG, a RACES (Radio Amateur Civil Emergency Service) operator in New York's Putnam County, many people think of these drills as simply a test of warning sirens, but they're really much more than that. As we'll find out, the Putnam Emergency and Amateur Radio League (PEARL), which comprises the Putnam RACES, provides critical communications and other services in times of need. Westchester County RACES is also a major "player" in the Indian Point drills, and we'll discuss their involvement later, too.

This was the scenario for a recent drill at Indian Point: At 8:53 a.m., an "unusual event" was declared as a result of an unplanned, monitored release of radioactive gas. It was a small release that posed no threat to the public's health and safety. As conditions worsened, an "alert" was declared at 9:19 a.m. due to the failure of the plant to automatically shut down when a reactor cooling pump failed. The operators shut it down manually. At 10 a.m., the Joint News Center (JNC) was activated. The JNC provides information to the news media and general public, and is staffed by officials from the four counties within 10 miles of Indian Point (Putnam, Westchester, Rockland, and Orange counties).

The Putnam volunteers staffed the Emergency Operations Center (EOC). Ballard explained that the EOC comprised a Net Control Station (NCS), packet operator, several amateurs to supply communications for the county radiological officer, and several people to answer telephones and provide backup when needed. They established packet radio links to the JNC and the nuclear power plant. In addition, two communicators were sent to the Emergency Operations Facility (EOF) at the nuclear plant. They were to guarantee communications between the EOF and the EOC in case of telephone failure.

Conditions Deteriorate...

As the drill continued, conditions deteriorated further at the plant, and more PEARL volunteers were called in to form radiological field monitoring teams. Each team consisted of three or four amateur radio operators: a driver, a communicator, an equipment operator, and a navigator/helper.

All members of the team were trained in the use of the equipment, setting and reading dosimeters (radiation exposure monitors), and preventing contamination. The teams reported to the EOC to obtain their dosimeters and TLD badges (thyroid gauges, which also reflect radiation exposure), checked out the monitoring equipment, received a briefing from the county Radiological Officer, and headed out to predetermined locations.

After arriving at the field location, radiation readings and/or air samples were taken by PEARL members, with dosimeters being read every 15 to 30 minutes. Since this was a drill, the state observer gave the drill readings that were radioed to the EOC. New instructions were then received from the EOC, telling the team the next location to monitor. Other communication services included radiological decontamination and school evacua-

Public Service at Dayton

The big news at the Dayton Hamvention was the discussion of the Land Mobile Communications Council's attempt to take part of the 440 band. Ideas on how to fight the threat against one of our most important bands were discussed. While initial comments were due June 1, it's always important to let public officials know that you are serving in the public interest. Here are some tips that came out of the discussions on how to keep the public and elected officials informed.

• Invite government representatives to various training sessions. If your group is having a Skywarn training session, invite key officials to the session. Don't be upset if they don't come; just be satisfied that you put a letter in front of the individual saying that amateur radio operators are "trained communicators." In addition, send a press release to the local papers saying that so many members of your club successfully completed severe storm spotter training by the National Weather Service. Describe in some detail the work that goes on when the Skywarn program is activated. This same approach could be used for other training sessions or drills as well.

• David Greer, N4KZ, publisher of a local Kentucky newspaper, said a key point to remember is not to overload the reporter or the public with ham jargon. Something like "10 members checked into the net" should be rephrased as "10 members participated in a weekly training exercise."

• If a disaster is happening in other parts of the country, send a note to the local papers indicating your group trains regularly in severe storm spotting or disaster communications to be ready to serve the local community in times of need.

• Ohio Section Emergency Coordinator Larry Solcik, WD8MPV, stressed the need to report your activities to your ARES/RACES leadership, stating that it's often necessary to tell the government and others the value of the free communications that we as hams provide. One way of being counted is to report the number of operators participating in the event, the number of hours worked, and the cost of the gear used to provide the service. For example: Ten operators provide communications for a five-hour walk-a-thon. Each operator has a dual-band HT that costs approximately $300. Here's the calculation:

10 ops X 5 hours = 50 man hours X $10/hour (wages) = $500
10 ops X $300/ HT = $3000 + $3000 (repeater used*) = $6000

*Repeater costs vary considerably. Check with the owners.
Total cost for this one event was $6500 in donated services.

Now, if 10 counties in one state were each to participate in one event that month, $65,000 in donated services are provided! During April and May, when there are many runs and walks, one local club participated in five events in four weekends. That's $32,500/club of donated services in one month!

You may want to consider spreading the cost of the HTs and repeater over the course of a year. The dollar figures may be more realistic.

Other Topics...APRS

The Dayton forums started off with an introduction to APRS (Automatic Position Reporting System). Bob Bruninga, WB4APR (Hamvention's 1998 Technical Excellence Award winner), described APRS availability for all levels of computers, ranging from 286s to the modern Pentium IIs. Bruninga said that it's important to support all levels of computers. Most hams are not going to take their top of the line laptop PC into a disaster area, but they may be more willing to take an older model "hamfest special" that they picked up for a few bucks into the field. The software authors have worked very closely together to make sure that their systems are compatible with each other.

"Now, if 10 counties in one state were each to participate in one event that month, $65,000 in donated services are provided! During April and May...one local club participated in five events in four weekends. That's $32,500/club of donated services in one month!"—Dayton forum

Features of WinAPRS allow specific information to be tracked for National Weather Service and Red Cross needs. Examples were also given of APRS being used for direction finding and tracking applications at the street level. Those attending the Hamvention saw a close working relationship between the APRS designers and electronic weather station equipment manufacturers.

Several speakers discussed linking APRS with the Internet. Comments were made that amateur radio fills an important need when the infrastructure fails. However, once you're out of the disaster area, there's a solid communications network available. The question was raised as to why not use amateur radio where needed and then combine it with one of the most important communication tools of the decade through the use of Internet gateways.

Young and the Young at Heart

At the Youth Forum, we heard stories of young hams having fun making contacts, but they also recognize the importance of serving the public. Stories of providing communications for a local run or walk-a-thon were told. Watch future issues for more details on youth serving in the public interest. Also, hams who operate bicycle mobile described how cycling event coordinators have come to rely on amateur communication (*see the April issue for more details—ed.*).

Ham of the Year

Finally, we want to acknowledge the Dayton Amateur of the Year, Andrew J. "Andy" Feldman, WB2FXN. According to Hamvention officials, Feldman has been active in public service since he was licensed in 1962. He's served as Suffolk County, New York, ARES District Emergency Coordinator and as the Suffolk County's American Red Cross chapter disaster communications chairman. Recently, Andy became Director of Communications for the New York Wing, Civil Air Patrol. He is also an active Skywarn member.

Feldman was in the forefront of ham radio support activity following the TWA 800 disaster in July, 1996, and during an outbreak of fires on Long Island in the summer of 1995. Feldman, who works at the Brookhaven National Lab as a technical contract specialist, says he enjoys OSCAR and packet operation in his spare time.

Ray Kendall, N2FRA, monitors field monitoring teams on APRS (Automatic Position Reporting System). Use of APRS in response vehicles allows officials at the EOC (Emergency Operating Center) to keep constant tabs on the location of each vehicle.

tion communications to the EOC. All tasks were done under the watchful eyes of the observer.

Although it was a drill, great care was taken to prevent possible ingestion of any radioactive particles. The ventilation systems of the vehicles in use were turned off, which meant there was no heat or air conditioning. Smoking, eating, and drinking were not allowed. Vehicles arriving at the evacuation reception centers were checked for radiological contamination. If one was found to be contaminated, it was sent for a spot washing. The vehicle occupants entering the reception center were also checked for contamination. If necessary, they were sent to the shower rooms, after which their skin was rechecked.

This process continued until the EOC sent the announcement that all conditions at the nuclear plant had returned to normal, marking the end of the drill.

Westchester County RACES Does Its Part

Westchester County RACES provided the communications at the County Operations Center, the JNC, the American Red

Charlotte, N2GPP, and Wayne, N2FDD, Rappaport staff telephones at the EOC. Ham radio is useful for reporting information from the field to the EOC, but the hams' training makes them valuable in other communications roles as well.

Cross Chapter, and in several Health Department field monitoring vehicles.

In order to train more Health Department staff, two large 15-passenger vans and a third small van were used for field monitoring. RACES officials took advantage of the larger van and sent two hams along. One was an experienced field monitoring communicator and the other was a new RACES member. The group also exercised a shift change of operators at the EOC to make sure no one lost track of who was at what location in the field. (The vans also had APRS—or Automatic Position Reporting System—equipment on board, which was useful for the EOC to keep track of the vans.) RACES members were pressed into primary service when one of the public works radios failed in the field.

Ham radio "techiness" came into play twice in the field monitoring vans. First, a piece of radiological test equipment failed and a ham suggested opening it to see what was wrong. It turned out that a component had shorted. This was quickly repaired by health officials. Also, the cigarette lighters in the vans didn't work. According to Alan Crosswell, N2YGK, this was most likely a means of enforcing the county's no-smoking policy. It turned out the fuses had been removed. Not a problem if you are accustomed to blowing fuses and know where to look!

When It Counts...

Fortunately, all this activity surrounding the Indian Point Nuclear Power Plant was only a practice run. And fortunately for the communities in the surrounding area, they know they can count on the dedicated people of the Putnam Emergency and Amateur Radio League and the Westchester County RACES when the need arises.

Once again, ham radio equipment, training, and ingenuity helped keep the information flowing. And ham preparedness could prove crucial in the event of the "real thing."

Doing Your Part

No matter where you live, you and your neighbors are exposed to potential dangers, whether natural or manmade. Ham radio provides a unique way to provide protection and assistance. To find out how you can help your community through ham radio, ask at your local radio club about getting involved with ARES or RACES, or whatever other name the emergency/public service groups in your area may go by.

And if you already are involved in emergency/public service communications, we'd like to hear what you're up to and share your stories with your fellow *CQ VHF* readers. Please send activity reports via e-mail to <bjosuweit@aol.com> or <cqvhf@aol.com> or by mail to "In the Public Interest," *CQ VHF*, 25 Newbridge Rd., Hicksville, NY 11801.

Thanks to N2MUG, N2YGK, Hudson Division Loop, and KD4ITI for their assistance with this month's column. ■

North Carolina Declares Amateur Radio Month

Governor James Hart has declared June Amateur Radio Month in North Carolina. The Governor cited the Tarheels' 17,000 hams as being "committed to providing the highest level of emergency communications with trained operators."

He also cited the hams' work during Hurricanes Hugo and Fran and the assistance given to the National Weather Service. He noted that hams donate their time and equipment for no charge.

Some Really Cheap Antennas

So you think you can't afford a beam antenna for your VHF station? Think again. You can build a bunch of Kent's "Cheap Yagis" for less than the cost of your feedline!

Back in 1993, Arnie Coro, CO2KK (who also writes for *CQ VHF*), spoke to the Central States VHF Society Conference in Oklahoma City on the incredible difficulty of building advanced-design antennas in the Third World (...just run out to the local store, pick up your 6061-T6 aluminum rod, Delrin® Insulators, Teflon® dielectric coax baluns...)—even if they were affordable, these items simply are not available.

Arnie's talk got me thinking; how can someone without access to fancy parts or big money use all the advanced technology and modeling software we have today to make antennas easier to build? And how can even "rich Americans" build up a VHF Rover station without putting hundreds of dollars into the antennas? Enter...the "Cheap Yagi."

"So how can someone without access to fancy parts or big money use all the advanced technology and modeling software we have today to make antennas easier to build?"

The booms are made from wood, and the reflector and director elements are cut from solid aluminum ground wire available by the roll at RadioShack and elsewhere (other materials will also work if they're more readily available; see "Cheap Yagis—the Nitty Gritty" for details). The driven element (only) is made from bare #10 copper wire. With the wood booms and ground wire reflector and director elements, you can build up a handful of these antennas for about $10.

Over the last five years, hundreds of the antennas have been successfully constructed and over 30 variations designed. I'm currently using them on bands from 50 to 1296 MHz (see Photo A for all but the 6-meter version). This month, I'll give you the details for building a variety of these antennas for the 70-centimeter band (we'll talk about the 144- and 222-MHz versions of these antennas in the next column).

Impedance Magic...um, Matching

Let's take a quick look at some of the theory behind these antennnas. In Figure 1a, we have a *simple dipole*. The impedance of a simple dipole is about 72 ohms. As we put other elements around the dipole, the impedance loads down. So if you carefully control the spacing between elements, you can control the impedance of the dipole (which, in a beam antenna, serves as the driven element). In Figure 1b, we have a simple dipole with a wide spaced reflector and director added—a basic three-element Yagi. The loading effect of these elements brings the impedance of the driven element down to 50 ohms. Now 50-ohm coax can be directly connected to the antenna—no matching bars, no baluns, no gamma matches.

Figure 2a is a *folded dipole* element, which has about 300 ohms impedance by itself. By bringing the additional elements in real close (Figure 2b), 300 ohms can be loaded down to 50 ohms; again, resulting in a simple 50-ohm match. All impedance matching is done in the structure of the antenna itself!

I ended up using a 150-ohm "J" for the driven element on my Cheap Yagis. As you can see in Figure 3 and Photo B, the "J" is kind of a cross between a dipole and a folded dipole, and it has several advantages over either of the other options. First, the folded dipole design required the first director to be mounted very close to the driven element, and this spacing was extremely critical (read that as difficult to build). And the straight dipole required very loose coupling and I couldn't get good gain numbers. Also, the straight dipole couldn't be used to make 72-ohm versions for those with better access to 72-ohm feedline than to 52-ohm (more on that in a later column).

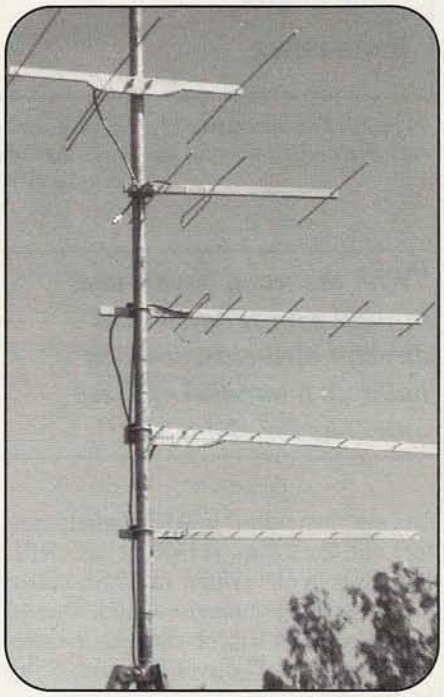


Photo A. I have a stack of "Cheap Yagis" on 144, 222, 432, 902, and 1296 MHz. These antennas are all veterans of numerous rover expeditions and VHF contests.

For a while, I wondered if I had invented a new driven element. But it turns out

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

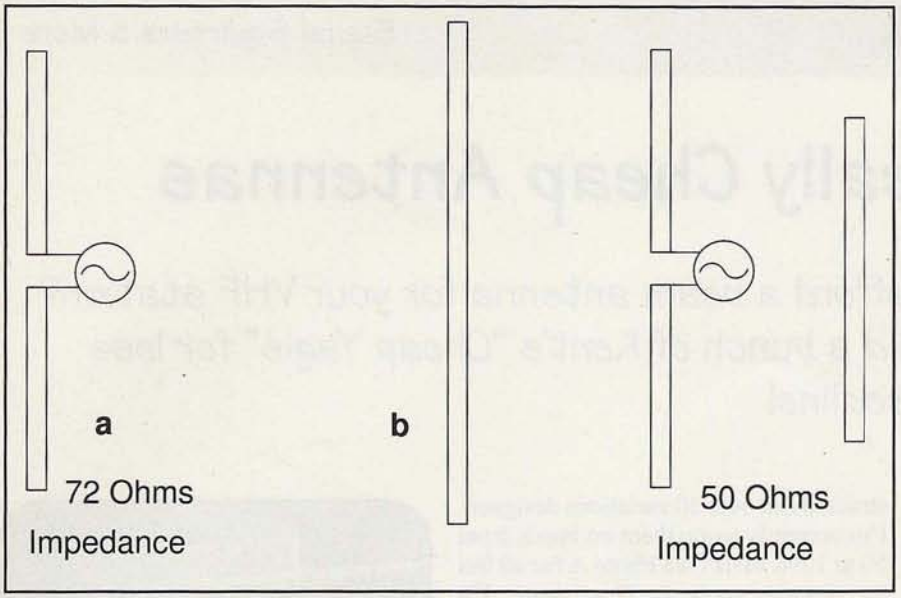


Figure 1. The impedance of a simple dipole antenna (a) is approximately 72 ohms. Adding a reflector and director (b) can lower the impedance to 50 ohms as well as turning the dipole into a three-element Yagi.

"With the wood booms and ground wire reflector and director elements, you can build up a handful of these antennas for about $10."

that my "invention" is at least a half-century old. Zack Lau, W1VT, at the ARRL dug up a book written in 1950, called *Understanding Amateur Radio*. One of its projects was a three-element, 2-meter beam using a "J" driven element. Story of my life!

Designing and Building the Cheap Yagis

The family of "Cheap Yagis" was designed with the *Yagimax* program, tweaked in *NEC* (another antenna design program), and the specific dimensions of the driven elements were experimentally determined on the antenna range. Actually, Yagimax will give you a good "ballpark" indication of the driven element impedance. Since I want to load 150 ohms down to 50 ohms, I designed the antennas for a 17-ohm (that's about 1/3 of 50) driven-element impedance. This wasn't exact, but it was close enough to let me move on to the next step: building models of the antennas and tweaking them on the antenna range. It doesn't take long to get the SWR down to 1.1:1 or lower and confirm the gain numbers. (*For more on antenna ranges, see "Inside an Antenna Range" in the August, 1997, issue of* CQ VHF.*—ed.*) All of the antennas you see in the photos have been prototyped, tested, and are in the air (well, maybe we lost a few of them this spring).

NEC software predicts 11.2 dBi (*decibels over* isotropic, *a theoretical perfect radiator—ed.*) for the six-element version of this antenna at 70 centimeters, 12.6 dBi for the eight-element design, and 13.8 dBi for the 11-element model

"NEC software predicts 11.2 dBi...for the six-element version of this antenna at 70 centimeters, 12.6 dBi for the eight-element design, and 13.8 dBi for the 11-element model....These gain numbers have held up well in several antenna contests."

(Photo C shows the six- and eight-element versions). These gain numbers have held up well in several antenna contests.

Theoretically, there is another .5 dB (that's point-five) of gain available...*IF* we went to a more complicated driven element, changed the dimensions to hundredths of an inch (see my pet peeve below), and tweaked for gain instead of a clean pattern. But these guys are cheap, easy to build, and idiot resistant (I know better than to say idiot-*proof*) as is, with perfectly respectable gain figures.

It should be noted, however, that the gain figures are based on using a wood boom. A wood boom not only saves money, it makes several design problems disappear. As a Yagi element passes through a metal boom, the effects of the boom change the element's electrical length. The amount of change depends on the diameter of the boom, mounting method, dielectric constant of the spacers, and a bunch of other stuff. With

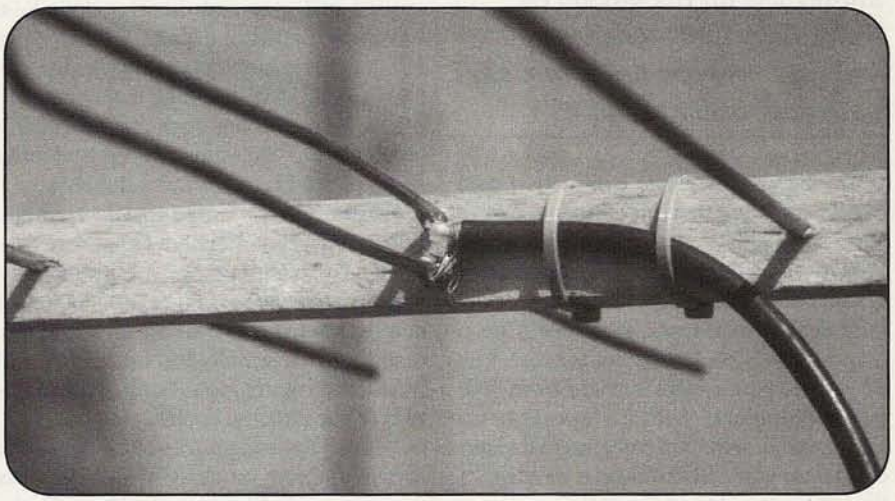


Photo B. A close-up view of the driven element, which is bare #10 copper wire. The shield of the coax is soldered to the center of the element; the center conductor of the coax is soldered to the bottom of the J. The center of the driven element is a null point, so we can solder the coax directly to it without affecting it.

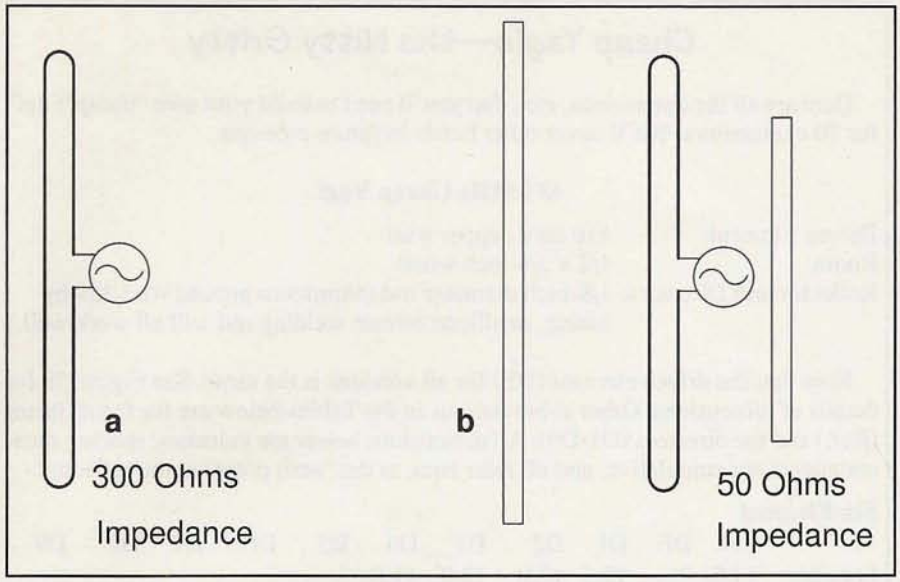


Figure 2. A folded dipole has a characteristic impedance of approximately 300 ohms (a), which can also be lowered to 50 ohms (b) by using the same technique as seen in Figure 1. However, element spacing is critical and the director must be very close to the driven element, making construction difficult.

wood, none of this is a problem. If you want to substitute a metal boom, you're on your own.

Look, Ma—No Balun!

The "Cheap Yagi'" design doesn't use a balun...and doesn't really need one (*a balun is a transformer to match a balanced antenna to an unbalanced feedline—ed.*). I have tried quarter-wave chokes and ferrite beads on the coax, but I just haven't been able to measure any RF running around on the outside of the coax. If you really believe that your antenna *has* to have a balun, you can

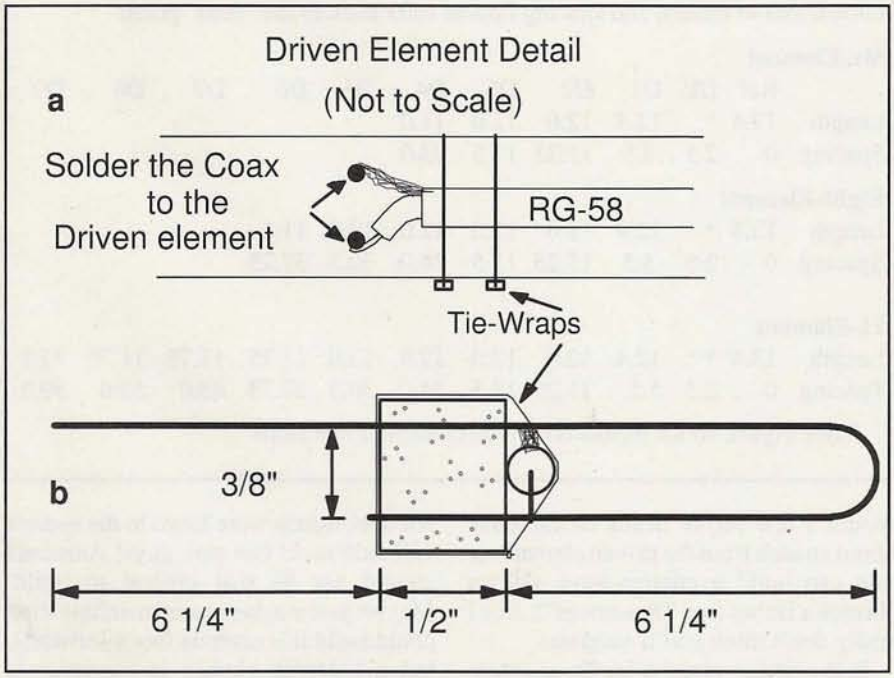


Figure 3. The "J" driven element has a characteristic impedance of 150 ohms and a variety of advantages over dipoles and folded dipoles, as discussed in the text. One advantage is that the feedline may be soldered directly to the antenna element (a). Use the dimensions in (b) to make the driven element for all versions of the "Cheap Yagi" described in this article.

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*:

- "A Repeater-Internet Interface," by John Hansen, W2FS
- "High-Speed CW Meteor Scatter—Portable," by Jim McMasters, KM5PO
- "A Wind-Powered Repeater," by Cesar Amaro, NP3H

Plus these equipment reviews...

- ...Cherokee AH-50 6-Meter Handheld, by Heather Hampton, KE6HEY
- ...G3WDG 13-Centimeter Transverter Kit, by Simon Lewis, GM4PLM

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

Cheap Yagis—the Nitty Gritty

Here are all the dimensions, etc., that you'll need to build your own "cheap Yagi" for 70 centimeters. We'll cover other bands in future columns.

432-MHz Cheap Yagi

Driven Element: #10 bare copper wire
Boom: 1/2 x 3/4-inch wood
Reflector and Directors: 1/8-inch diameter rod (aluminum ground wire, hobby tubing, or silicon bronze welding rod will all work well.)

Note that the driven element (DE) for all versions is the same. See Figure 3b for details of dimensions. Other abbreviations in the Tables below are for the reflector (Ref.) and the directors (D1-D9). All dimensions below are in inches; spacing measurements are cumulative, and all refer back to the "zero point" at the reflector.

Six-Element

	Ref.	DE	D1	D2	D3	D4	D5	D6	D7	D8	D9
Length	13.5	*	12.5	12.0	12.0	11.0					
Spacing	0	2.5	5.5	11.25	17.5	24.0					

Eight-Element

Length	13.5	*	12.5	12.0	12.0	12.0	12.0	11.25			
Spacing	0	2.5	5.5	11.25	17.5	24.0	30.75	38.0			

11-Element

Length	13.5	*	12.5	12.0	12.0	12.0	12.0	12.0	11.75	11.75	11.75
Spacing	0	2.5	5.5	11.25	17.5	24.0	30.75	38.0	45.5	53.0	59.5

* See Figure 3b for details on driven element dimensions

435-MHz Satellite Version

Same driven element and same materials as the 432-MHz version. Again, all dimensions in inches, and spacing figures refer back to the "zero" point.

Six-Element

	Ref	DE	D1	D2	D3	D4	D5	D6	D7	D8	D9
Length	13.4	*	12.4	12.0	12.0	11.0					
Spacing	0	2.5	5.5	11.25	17.5	24.0					

Eight-Element

Length	13.4	*	12.4	12.0	12.0	12.0	12.0	11.1			
Spacing	0	2.5	5.5	11.25	17.5	24.0	30.3	37.75			

11-Element

Length	13.4	*	12.4	12.0	12.0	12.0	12.0	11.75	11.75	11.75	11.1
Spacing	0	2.5	5.5	11.25	17.5	24.0	30.3	37.73	45.0	52.0	59.5

* See Figure 3b for details on driven element dimensions

mount a few ferrite beads on the coax about an inch from the driven element, or you can build a quarter-wave sleeve/Bazooka Balun (see "Resources"). But I really don't think you'll need one.

In the design process for these antennas, I kept all dimensions to tenths of an inch or even quarters of an inch. This is one of my pet peeves. Recently I saw a construction article for a 20-meter beam. All dimensions were listed to the nearest *1/10,000 inch*! Get real, guys! Antennas should not be that critical to build. Maybe, just maybe, a good machine shop could build this antenna (for a fortune!), but a 1-degree change in temperature would throw off everything as the metal expands/shrinks! This is just someone getting carried away with numbers. As Tom Clark, W3IWI, likes to say, "Why

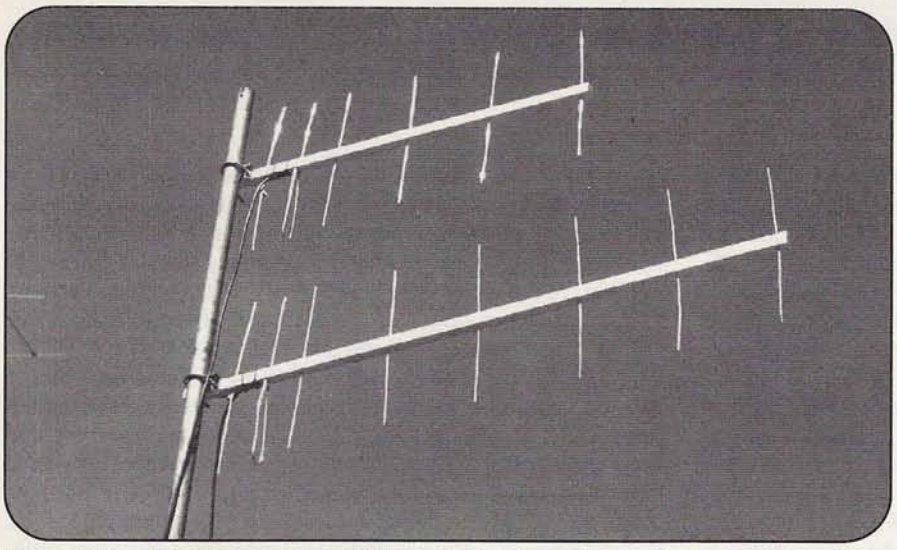


Photo C. Two 440-MHz versions of "Cheap Yagis." With the wood booms and ground wire reflector and director elements, you can build up a handful of these antennas for about $10.

be approximately correct when you can be precisely wrong?"

Speaking of dimensions, you'll find all the numbers you'll need for six-, eight- and 11-element versions of the "Cheap Yagi," cut either for 432-MHz SSB/CW work or 435-MHz satellite work, in "Cheap Yagis—the Nitty Gritty."

Using Your "Cheap Yagi"

In general, I don't recommend "Cheap Yagis" for long-term tower use. I had a 902-MHz version of this antenna on my tower for about four years. The weather did get to it after a while, but I put Spar Varnish (available from boating supply stores) on the later versions and they've held up pretty well. Even so, these antennas are not ideal for long-term outdoor service. On the other hand, I have four of them mounted inside my attic for ATV and 1290-MHz repeater service, and they should last until the termites get them. I keep my Rover antennas in the garage when not in use and they've held up well for the last five years. But even if you do leave 'em outside, remember—they'll be as cheap to replace as they were to build the first time!

That's about all for this month. Next time, we'll look at the numbers for expanding your "Cheap Yagi" collection to include 2 meters and 222 MHz.

We Get Letters...

I was really expecting the article on quads (April '98 issue) to generate a lot more feedback. The main point in the letters I *did* receive was that since quads have wire going in both polarizations, then the quad should be all polarizations.

An interesting concept, but you really need to measure the current in a quad loop. The currents on each side are traveling in opposite directions and the fields cancel out. So if you feed the loop at the bottom, the horizontal currents add, vertical currents cancel out. A bottom-fed loop radiates horizontal polarization only. And a side-fed loop radiates vertical polarization only. ■

"Why be approximately correct when you can be precisely wrong?"—Tom Clark, W3IWI

Resources

A more extensive discussion of "Cheap Yagis" has been published in the *Proceedings* of the 1994 Central States VHF Society Conference, p. 58. Copies are available from the ARRL, 225 Main St., Newington, CT 06111; Phone (orders only): (888) 277-5289 or (860) 594-0355; Fax: (860) 594-0303; Internet: <http://www.arrl.org>.

More information on building a sleeve/Bazooka balun can be found in the "Transmission Lines" chapter of the *ARRL Handbook*. In the 1997 edition, it's on Page 19.15. See above for ordering information.

Q & A

Questions and Answers About Ham Radio Above 50 MHz

Q: I am trying to find information to help me convert a Motorola Mo-Trac transceiver to 6 meters. I have several of these units, tech manuals, and crystals for 52.525 MHz (the national FM simplex calling channel). But I haven't been able to find anyone who can tell me what modifications I will have to make to the radio itself. Can you tell me who might be able to answer some of my questions? I appreciate any help you can give me.

Thanks & 73,

Jim Seipel, KBØPTC
Anthony, Kansas
<kb0ptc@wichita.infi.net>

A: We don't have that information at our fingertips here, Jim, but I'm sure one or more of our readers will be able to help you (there may even be an article in it, hint, hint). We've included your e-mail address so people can contact you directly. Folks, if you answer Jim via e-mail, please cc: us at <cqvhf@aol.com> so we can share your info with readers (or work with you on preparing an article).

Q: I would like to build a six-element Yagi antenna for 2 meters. I would like to see formulas for determining the length and spacing of the various elements, but, most of all, I would like to see an example of how to construct and incorporate into the design what is known as a "Gamma Match." I was told by several hams that a gamma match would be necessary to present the coax and transceiver with a 50-ohm load. All I currently know about the gamma match is that it is a part of the Yagi's driven element. How exactly is it constructed, and how exactly is it attached to the driven element? I intend to use bronze welding rod as the element material and a wooden boom. Any information would be deeply appreciated. Thanks, and 73.

Tony Impellitteri, KB9NCZ
Milwaukee, Wisconsin

A: Tony, the answers to your questions could fill a book...or two. Fortunately, those books have already been written and are readily available. Both The ARRL Antenna Book *and the* Practical Antenna Handbook, *by Joe Carr, K4IPV, contain the information you're looking for. Joe's book happens to have specific dimensions for a six-element 2-meter Yagi, along with information on Gamma matches.* The ARRL Antenna Book *provides the formulas from which you can calculate the dimensions you need, plus a BASIC program for determining Gamma match dimensions.*

In addition, this month's "Antennas, etc." column is all about "cheap Yagis" built much as you describe—and without the need for a Gamma match. Dimensions for 70-centimeter antennas are included this month; October's column will cover 2 meters and 222 MHz.

The ARRL Antenna Book *is available from the ARRL, 225 Main St., Newington, CT 06111; Phone (orders only): (888) 277-5289 or (860) 594-0355; Fax: (860) 594-0303; Internet: <http://www.arrl.org>.*

Joe Carr's Practical Antenna Handbook (2nd Edition) *is available through your local bookstore or from Tab Books, Division of McGraw-Hill, Inc., Blue Ridge Summit, PA 17294-0850; Phone: (717) 794-2191; Fax: (717) 794-2103.*

Q: Being a new ham, I'm trying to use a dual-band HT for portable, mobile, and base use. Everything seems to be working fine except for the mobile application. I have a cigarette lighter plug for my radio when I use it in my truck (a 1994 Ford F150 in case this proves to be relevant). When I attach this plug to my radio, I get a tremendous amount of what I can only call "motor noise" (it varies in pitch with motor RPM).

A friend of mine suggested putting an in-line noise filter in the +12-volt power line that goes to the add-on cigarette lighter plug box (a three-plug box wired straight to the battery) that I use to power my HT and a rechargeable flashlight. I installed this filter and it cut the motor noise about in half (I can now hear some of what is being said instead of just hearing static). But the noise is still there and it still presents a reception problem. Also, when I transmit, this motor noise that I hear on the receive side is the only thing that the station I'm talking to can hear from me (*big time* problem).

This is only a problem when the truck is running. When I turn it off, it goes away. I've also tried unplugging the flashlight charger and it didn't help at all. I have the same problem whether I'm using a rubber duck antenna or the 5/8-wave, 2-meter antenna I have mounted on the bed of the truck. The SWRs for both antennas are very good (less then 1.3:1 for the entire 2-meter band). I've run out of ideas for solutions. Any suggestions you have will be *greatly* appreciated since this makes it next to impossible for me to use my HT as a mobile rig.

Ian K. Harrell, KF4WMY
Mount Airy, North Carolina

A: We forwarded your letter to our own in-house automotive expert (and packet columnist), Don Rotolo, N2IRZ, who offered this reply:

Ian—Tracking down automotive noise is partly a science, and partly black magic. It's even more difficult when you can't actually see and hear it for yourself.

It seems as though you're hearing "alternator whine," residual AC voltage produced by the alternator. This is usually heard as a high-pitched musical tone that increases in frequency with engine speed. Make sure the problem isn't spark plug (ignition) noise, which is a popping noise that changes frequency with engine speed and would require a completely different approach to remedy.

It's good that you've wired your cigar lighter box directly to the battery—it's fused on both leads, right?—but the noise sounds severe. An important clue is that an in-line noise suppressor helped; you probably just need a few more. I don't think the problem is related to the antenna, especially since the problem is still there with only a rubber duckie connected.

First, assuming we have alternator whine, go right to the source: the alternator. Put a suppressor between the terminal with the heavy wire leading to the battery and the frame of the alternator. Don't use an in-line suppressor here, unless it's rated for the maximum amperage capacity of the alternator, usually over 100 amps. Next, place one right at the outlet box. This one *should* be the in-line type. It would also be helpful to place a big electrolytic capacitor across the cigar lighter terminals, something like 100 µF at 35 volts or so.

Make sure the vehicle's battery is in good condition, since it's the biggest noise suppressor you'll ever find. Clean the terminals for good contact. The wires leading to the outlet box can't be too heavy, so perhaps replacing them with 12 or 10 gauge wires would be a good idea. The reduced impedance of the heavier wires will help. Finally, make sure the alternator doesn't have any problems which might be making the problem worse. You might want to contact Ford, perhaps they know something useful.

In this case, if a little bit helps, a lot will help more. If all of these suggestions don't cure the problem, please write back. 73,

—N2IRZ

Q: I have been a "plug-and-play" ham for five years. I'm a network analyst by day, and give out countless ad-hoc computer lessons over the air during off hours. I also want to become my club's "microwave elmer," but I can never make the imaginary quantum leap from seeing "no-tune transverters" for microwave between 902 MHz and 5760 MHz to the huge masses of wiring harnesses and parts we see in your magazine for similar setups.

Perhaps you could find a construction article for a transverter from the *ARRL UHF/Microwave Project Manuals*. They are either cleaner or easier than what we usually see featured, or they're leaving a lot out of a finished project!

Also, please stress that CB radios will work fine as IF radios for transverters to 6, 2, and 440. We don't need to buy 10-meter radios if we already have SSB CBs. Some may even be nervous about leaking RF onto 10 meters, where they may not be legal. A simple crystal change will move the IF down to 27 MHz. Could a crystal change bring the IF down by 1.005 MHz for the 2-meter model to hit 144.200 MHz directly? It seems to me that, even if we are channel-locked, the VHF SSB world would welcome many more visits by us FMers.

Along that line, please tally your readers for models of SSB CB radios they would like to transvert, and assemble quick, step-by-step instructions for preparing the three most popular radios. Last year, you showed us how to safely insert RX (receive) on a RadioShack HTX-100 10-meter radio. Adding an "RX-only" SO-239 and a PTT keyer jack to the rear of our CBs will certainly get us on the way to VHF and up. Start the list with my RadioShack TRC-465!

And, finally, please show us how to get 1 milliwatt out from our HTs. There may be bigger issues here, but I see the 2-meter world as having millions of handheld microwave IF rigs. FM may not be the most efficient mode, but if it can put us on the bands, let's do it!

Steve Jackson, N3VZL
Fairless Hills, Pennsylvania

A: We asked CQ VHF *microwave columnist Kent Britain, WA5VJB, to reply to this question:*

Steve—I've worked on many a CB radio over the years, but there just isn't any one common unit that I would recommend going to all that effort to modify. It's very difficult to tune the band with Step/RIT-Step/RIT-Step/RIT.

The RadioShack 10-meter rigs are going for $75 at the flea-markets. I paid $35 for mine. And I won't even touch the legalities of publishing mods for CB rigs to operate out-of-band.

But I just don't think you'll ever be able to listen for weak signals with a CB rig. Just too much leakage. (But if you get one to work, we would be happy to publish your findings!!)

A few problems with *CQ VHF* republishing ARRL material, but I plan to have some simple rigs published in my column in the coming months.

Hang in there...73,

—Kent WA5VJB

In a follow-up e-mail, Steve asked:

I understand the usability and performance questions (I should have known that the performance issues were that severe), but I don't understand the out-of-band issue. I had mentioned lowering the IF to 27 MHz so that the CB would stay in band while allowing us to transvert up to the SSB portion of at least 6 and 2.

Steve—W2VU here for this part of the answer. FCC rules specifically allow—and encourage—hams to modify their radios. But we are the only service for which this is allowed. CB rigs must be type-accepted by the FCC, and may be legally modified only by someone with the appropriate FCC commercial license. So any modification of a CB rig is illegal unless performed by a licensed two-way tech. In addition, any "leakage" on the IF frequency would put our ham signals "out-of-band" onto CB frequencies. And you still run into the practical issues of so many different CB radio designs, with different IFs and different frequency-generating schemes. So it only makes sense, when you have a known reliable 10-meter rig available at bargain prices, to look in that direction for your microwave IFs.

An Introduction to FM Toning

Modern VHF FM rigs come with a dizzying variety of tone options, from CTCSS and DTMF to DSQ and TSQ. What do they all mean? How do they work? And why should you want to know? As usual, K4TWJ has all the answers!

Have you ever tried to call someone on a known-active repeater strong enough for you to work from your backyard only to realize your signal wasn't even getting into the machine?

"How can this be?" you must have thought. "My transmit offset is right and others are using the repeater with no problem. What's happening?"

Or perhaps you've occasionally noticed short transmissions of one-, two-, or three-digit "Touch-Tone" tones on direct or repeater frequencies when no one was talking—and no one replied. Radio intrigue? Covert or underworld operations? Doubtful. You're probably experiencing the popular trend of *FM toning*.

What is FM toning and how can you use it? That's the subject of this month's column, along with some special ideas for including tone control in your own applications, such as setting up a personal or group paging system, or limiting access to a rig you occasionally use in its cross-band repeat mode. Let's get started with some basic facts.

Photo A. Close investigation of an FM rig's keypad usually reveals its toning capabilities. The secondary function of this Alinco DJ-580's "6 button," for example, operates its CTCSS decoder *and the secondary function of its "B" button operates the rig's DTMF/DSQ paging system. (Photo courtesy Alinco)*

Name That Tone!

Generally speaking, two types of toning systems are popular in the United States: *CTCSS* (also known as "PL," a Motorola-trademark for "Private Line") and *DTMF* (which AT&T has trademarked as TouchTone®).

CTCSS is an abbreviation for *Continuous Tone Coded Squelch System*. It uses tones in the range of 67 to 250 Hz, frequencies that are usually below the audio range passed by rigs and repeaters. Even though they're often called "subaudible tones," and you won't hear them if they're outside the audio response range of a radio or repeater, human hearing range is generally considered to begin at 15 Hz, so if your radio does pass these tones and you have very good low-frequency hearing, you might be able to hear these "subaudible" tones.

DTMF stands for *Dual Tone Multi Function*. It's a transceiver-related, generic designation for telephone touch-tones like those used for autopatching. You transmit and/or hear these dual tones when pressing various buttons on your rig's keypad while transmitting.

Although not directly related to this particular discussion, there are some additional tones you may hear on the air. For example, there are 1750-Hz tone burs signals, often used in Europe to "wake up" a repeater (although many European repeaters are shifting to CTCSS access). Operators with rigs lacking a 1750-Hz tone can usually "whistle up" a repeater. In addition, there are data signals such as packet and slow-scan TV (SSTV). If you've every listened between 145.01 and 145.09 MHz, chances are you've heard the somewhat raspy-sounding tones of packet radio. We won't get into packet right now, though.

And, thanks to Kenwood's recent introduction of the new VC-H1 handheld color SSTV system, the 1200- to 2300-Hz sounds of pictures being exchanged on various VHF, UHF, and HF bands will surely become more noticeable in the near future. Compared to packet, SSTV has a more musical sound, peppered by "ticks" corresponding to sync pulses for each line of a picture. Tune around 14.230 MHz with an HF receive and you can hear SSTV views being exchanged worldwide. This is a fascinating mode with unlimited capabilities that I plan to discuss further in future columns. Meanwhile, let's continue with the CTCSS and DTMF story.

Why and When to Use CTCSS

During the early days of 2-meter FM's rise in popularity, the band was not very congested and interference among re-

By Dave Ingram, K4TWJ

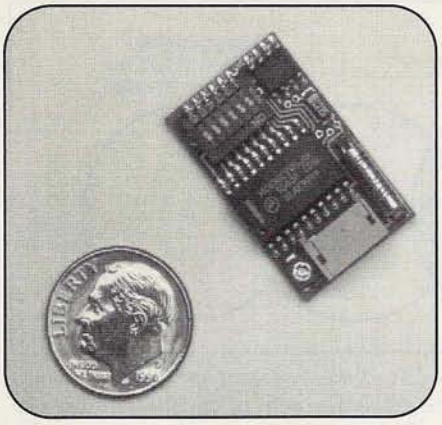


Photo B. This microminiature SS-64 CTCSS encoder from Communications Specialists, Inc., measures only 1 x .66 x .21 inches. It fits in almost any handheld or mobile FM transceiver, and is programmable to generate any CTCSS tone from 33.0 to 254.1 Hz. (Photo courtesy Communications Specialists, Inc.)

peaters or between repeaters and other users was not a significant problem. A simple carrier-operated arrangement was thus adequate for most repeaters. That is, any signal appearing on a repeater's input frequency activated its transmitter (still today's most common practice). But as repeaters (in both amateur and commercial services) became more abundant, interference increased accordingly.

The problem here was (and still is) twofold. First, *intermod* (intermodulation distortion) caused false repeater "key-ups," noise and irritating "grunge" that made quiet/rig-squelched monitoring difficult. Second, stations operating within overlapping coverage areas of same-frequency repeaters, as illustrated in Figure 1, often brought up both machines simultaneously (now that's

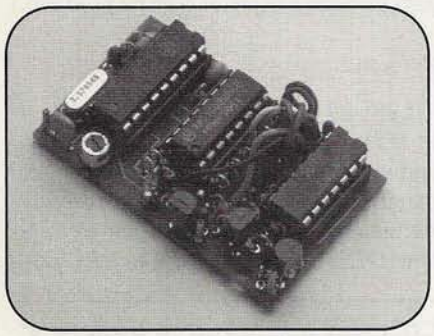


Photo C. This little DTD-1 four-digit DTMF decoder from Communications Specialists measures only 2 x 1.25 x .4 inches. It can be used at a repeater site, for example, to turn on or off an external circuit, such as a link transmitter. (Photo courtesy Communications Specialists, Inc.)

really "talking on two!"). Weather fronts supporting extended-range VHF communications produced a similar situation between same-frequency repeaters in geographically separated areas (listening to locals talk over a one-sided conversation can be confusing!). Now working DX on VHF is a gas, but it's not logical when one or both repeaters are in emergency-use status due to abnormal supercell or tornado-type weather—which, unfortunately, is often associated with a weather front. So, what's a simple and easy-to-implement solution to this modern-day dilemma? You guessed it: CTCSS control.

Refer back to Figure 1 as you follow this explanation. Repeaters "A" and "B" are both set to the same input frequency, but both how have CTCSS decoders installed. The decoder on repeater "A" is set to 88.5 Hz while the decoder on "B" is listening for a 250.3-Hz tone. Now, each repeater sits quiet until accessed by a carrier with a matching CTCSS tone on its signal. Likewise, a distant same-frequency repeater prone to skip during weather fronts would use a different CTCSS tone for access.

If you want to use the repeater, you have to know the tone. There are several ways to find out what it is: 1) check with local amateurs on simplex or non-CTCSS repeaters; 2) check the repeater's listing in the *ARRL Repeater Directory* many CTCSS-controlled open repeaters list their tone frequencies; 3) listen for an announcement of the tone from the repeater controller; or 4) use a rig with a tone detection circuit that will read out the frequency of any CTCSS tone it receives (this is the least reliable option, since many repeaters don't pass the tone through to their transmitters so you'd have to listen on the input frequency for a signal from a nearby station, in which case you can refer back to method #1).

Once you've got the tone, you then set your transceiver's CTCSS encoder to that frequency, and you're "in like Flint." When you're in an overlapping coverage area, live in the coverage area of two same-frequency repeaters (see Figure 2) or wish to work DX on a distant same-frequency repeater, you just reset your encoder to the related CTCSS frequency. If your transceiver has ample memories, you might even program several of them for same repeater frequencies but different CTCSS tones for quick one-knob selection to switch between them.

It's still important to understand that

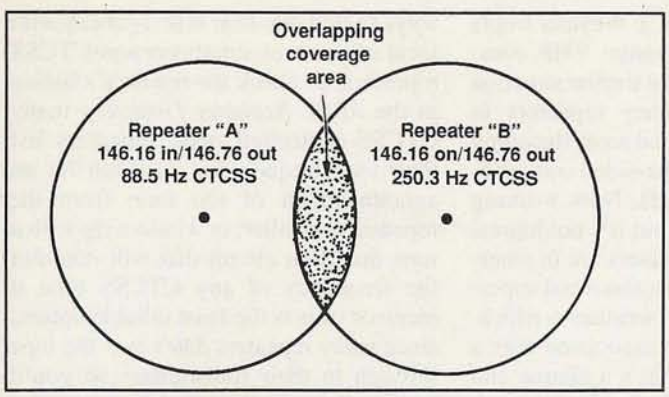


Figure 1. Example of how CTCSS allows two repeaters with overlapping coverage areas to share the same input frequency. See discussion in text.

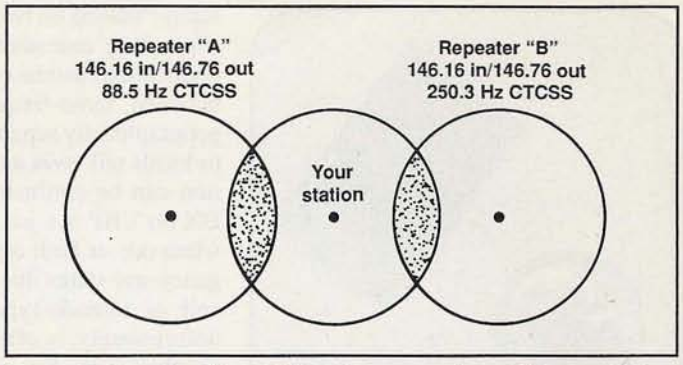


Figure 2. Example of how CTCSS allows a station within range of two repeaters using the same frequency pair to operate through one repeater without accidentally keying up the other. You choose which repeater you want to use by selecting the correct CTCSS tone.

CTCSS does not eliminate all on-frequency interference (it can't reject one of two signals appearing simultaneously on a repeater's input frequency, for example; so if there's a local QSO going on while you're trying to work a distant repeater, you will cause interference), but it sure makes life in today's busy VHF/UHF lane more enjoyable. Also, understand that modern CTCSS setups may be more sophisticated than what we've covered in this simple explanation. Typically, the most advanced setups are found in the most populated areas.

How about DTMF?

While the most common use of DTMF tones is to make phone calls via a repeater *autopatch* system, these tones are also occasionally used for access and control purposes. Some repeaters on "night access" may require a user to enter a DTMF tone sequence (either instead of or along with CTCSS) in order to bring up the repeater. And many repeaters use DTMF tones for on-air access to certain functions of the repeater controller. These may be control-operator functions performed via a control link on another frequency or user functions, such as calling up a specific message or feature from the controller.

Encoders and Decoders

Now, in order to make use of features controlled by either CTCSS or DTMF tones, you must use a rig that's equipped with the correct tone *encoder*, and, for some advanced functions (which we'll discuss soon), you'll want to have a tone *decoder* as well (see Photo A for an example). A tone encoder is a circuit or small device that produces tones for your transceiver to transmit. CTCSS and/or DTMF encoders are included as standard equipment in most of today's full-featured FM transceivers. A few years back, they were field-installed options or add-on items, such as the Communications Specialists SS-64 shown in Photo B. Incidentally, these units are still available today and are easily added to older models or bare bones rigs for accessing toned repeaters.

In several respects, a tone *decoder* might be visualized as a reverse equivalent or "far end mate" for an encoder. That is, it responds to or detects a specified tone (or tones) and produces a resultant action, like closing an external circuit. That external circuit, in turn, can activate a repeater's transmitter, reset a timer, or perform some other special function. Decoders, such as the one in Photo C, are usually installed at repeaters and respond to CTCSS or DTMF tones from your rig.

Recently, however, several manufacturers have begun including both encoders *and* decoders for CTCSS and DTMF in full-featured FM handhelds and mobile transceivers. These "fancy" features have caused some mild confusion among proud new owners—why would you want a decoder in your transceiver? The answer is that, even though CTCSS is *usually* employed for accessing repeaters, and DTMF is *usually* used for dialing autopatches, applications of both systems are continuously expanding. A decoder in your radio can offer you tremendous flexibility.

A Decoder in Your Rig

When used on a direct frequency (maybe for coordinating group activities or public events), a decoder can serve as a quite effective paging system. When used with a dual-band mobile FM transceiver crossband repeating signals from your handheld rig, it can limit access from unauthorized stations by requiring a secret tone for access. Check your transceiver's manual for exact setup details.

Do I sense some readers now asking if they can use their new rig's decoder to silently monitor a continuously active repeater, tell their friends the secret tone code, and receive only designated calls? Or perhaps use a special code to call up all members of your local emergency group? If the concept is agreeable with repeater owners and users, and you use DTMF rather than CTCSS encoding and decoding, yes indeed—and it is a clever idea. (Why not CTCSS? Remember, these low-frequency tones probably will not pass through, or will be filtered out by, the repeater. DTMF tones are in the normal voice range, however, and should pass through a repeater with no problem.)

DTMF Paging Systems

Let's take a closer look at using built-in DTMF decoders for personal paging and/or group calling. Depending on the manufacturer, it may be referred to as *digital squelch (DSQ), dualtone squelch system (DTSS), page*, or *tone squelch (TSQ)*.

"It's still important to understand that CTCSS does not eliminate all on-frequency interference...but it sure makes life in today's busy VHF/UHF lane more enjoyable."

"You can leave your handheld or mobile transceiver tuned to the busiest chatterbox repeater in town and silently monitor for hours (days!), and 'receive' only calls addressed specifically to you from designated friends."

DSQ and DTSS usually relate to three-digit DTMF systems (the fancy ones that can work through repeaters). Page or TSQ usually relates to CTCSS systems for basic operation on direct frequencies.

Did you check your rig's manual to see if either or both features were included in your unit? If so, did you become confused over its setup and operation? Don't despair. Every printed description I have seen of this "software project" is a brain twister. First-time setup is the hard part, but beyond that point, it's a treat to use. You can leave your handheld or mobile transceiver tuned to the busiest chatterbox repeater in town and silently monitor for hours (days!), and "receive" only calls addressed specifically to you from designated friends. Most transceivers even display or readout the calling/paging station's three-digit code and store it in memory for alerting you to missed pages. If the capability of displaying a caller's ID isn't necessary, stations paging or calling you don't even need a DSQ/DTSS-equipped rig. They simply punch up your three-digit code on their rig's DTMF keypad. Your rig then beeps and opens its squelch so you can hear the calling station. Neat, eh?

What about MY Rig?

I'd like to explain exact setup details/keystrokes and show each of you how paging works with your particular rig, but there are too many variations of transceivers, plus our space and time are limited. So here are some generic guidelines to get you started:

First, read your rig's instruction manual several times to visualize keystrokes and results. If you become confused, try telephoning the manufacturer's service department for a "talk-through." Then try it with two rigs in your shack so you can page one from across the room and see/hear it work (a real confidence booster). Finally, remember this tip: If and when your rig seems to have shut down and died, get a magnifying glass and check for a small TSQ, DSQ or "page" icon in its display. It indicates the unit is still in tone squelch mode for silent monitoring. Switch off the decoder, the icon will disappear, and normal operation will be restored. Be patient learning about paging. Once you're familiar with it, you'll love it!

Want to Know More?

Enough already! Once again, we've overfilled available space and must dive for the door. If our discourse was too brief and you want to learn more about a particular aspect of toning, drop me an SASE (self-addressed stamped envelope), along with your request for specific information. Meanwhile, stay tuned during the coming months for some really exciting information and ideas on mobile antennas and unique OSCAR satellite activities.

73, Dave, K4TWJ

Resources

Add-on CTCSS encoders and decoders are available from Communications Specialists, Inc., 426 West Taft Avenue, Orange, CA 92865; Phone: (800) 854-0547 or (714) 998-3021; Fax: (800) 850-0547 or (714) 974-3420; Web: <http://www.com-spec.com>.

Digital Conference Call for Papers

The 1998 ARRL and TAPR Digital Communications Conference will be held September 25-27, 1998, in Chicago, Illinois, at the Holiday Inn Rolling Meadows. This year's conference again provides multiple session tracks for beginning, intermediate, and advanced presentations on topics including APRS, satellite communications, TCP/IP, digital radio, Spread Spectrum, and many others.

Anyone interested in digital communications is invited to submit a paper for publication in the conference *Proceedings*. Presentation at the conference is not required for publication. Papers written in an informal style are welcome, as well as those written to academic standards. Papers are due by August 15, 1998, and should be submitted to Maty Weinberg, ARRL, 225 Main Street, Newington, CT 06111, or via e-mail to <lweinberg@arrl.org>.

The paper submission guidelines are available on-line at <http://www.tapr.org/dcc>. The 1998 ARRL and TAPR Digital Communications Conference will be co-hosted by Chicago Amateur Packet Radio Association (CAPRA), one of the oldest packet radio groups in the U.S.

Two Meters—A Band that Really "Rocks"

Two meters is the most popular ham band, for a lot of good reasons. But you might be surprised to learn that the most reliable means of making long-distance contacts on two is...well, read the article!

The 144-MHz band—2 meters—is the "bread and butter" of VHF weak-signal work. More folks are active here than on any other band above 50 MHz. Many of us cut our teeth on 2-meter SSB/CW, learning just how versatile, reliable, and wondrous the band can be. No other band does it all...tropo, *E*s, FAI, forward scatter, MS, EME, ducting, etc. The only limit to what's possible is in your mind.

Recently, Dave Blaschke, W5UN, made history again on 144 MHz when he worked a ham in Europe via single Yagi-to-single Yagi EME (moonbounce). Granted, they used maximum power output and very long Yagis, but he nudged the envelope of what's possible on 2 meters out ever further. Our hearty congratulations!

Of course, your typical 100-watt SSB or CW station on 2 meters is going to be hard pressed to contact anyone via EME (except maybe W5UN!), but working good DX on two is easier than you might think. And the most reliable method of doing it just might surprise you!

The Perseids meteor shower is due to peak this year on August 12. By following the procedures Tim explains this month, even a modest multimode station can make contacts of 500 to 1,400 miles on 2 meters via meteor scatter.

Meteor Scatter

Meteor scatter (MS) is the most reliable way to work stations over the long haul (500 to 1,400 miles) on 2 meters. That's right. I can see the look of disbelief across all your faces, but it's true. And you don't have to wait for a band opening. Meteors are entering our atmosphere every hour of every day. That said, the odds of successful MS contacts are dramatically improved when activity is scheduled around the various meteor showers that occur throughout the year. A modest station—one running 100 watts into a 15-foot or longer Yagi with a low-noise preamp and minimal feedline loss—can (with proper technique) work contact after contact via MS and rapidly fill in that grid map. This month happens to be home to the king of meteor showers, the Perseids. Most *ping jockeys* (myself included) began their MS careers with this shower.

Ping? Pong? King Kong?

How does MS work and what the heck is a "ping"? Simply put, the Earth is bombarded every day by thousands of tons of space debris. Most of these meteors are

"Meteor scatter (MS) is the most reliable method for working stations over the long haul (500 to 1,400 miles) on 2 meters. That's right. I can see the look of disbelief across all your faces, but it's true."

By Tim Marek, K7XC (K7XC@VHF.RENO.NV.US)

"A modest station—one running 100 watts into a 15-foot or longer Yagi with a low-noise preamp and minimal feedline loss—can (with proper technique) work contact after contact via MS and rapidly fill in that grid map."

bits of comets left over from when their tails were formed by passing close to our sun. The typical meteor, by the way, is no larger than a grain of sand. But, as it burns up in our atmosphere, it leaves behind it a trail of ionized air as much as 10 miles long, and it's this trail which can reflect radio signals.

The best time to use "the rocks" is just before dawn to an hour or two after. Rocks that meet the Earth head on, rather than overtaking it from the rear, produce much higher levels of ionization due to the meteor's apparent speed in relation to the Earth. A good analogy is to visualize a car accident. A head-on crash produces more energy than a car traveling at 30 mph being run into from behind by one moving 35 mph. Another variable is the size of the rock. The larger ones last longer, create much denser burns and generally start working higher above ground. All of this combines to produce burns that sometimes last well over a minute (typical is two to five seconds).

Taking advantage of this phenomenon requires rethinking your operating habits. MS is fast and furious compared to *Es* or tropo, where folks tend to ramble for what seems like hours on end. Here, you generally have two to five seconds to get your information across and establish a QSO. If you're only listening in, you'll hear a seemingly quiet band and then, without warning, a few syllables will come blasting out of the speaker and then disappear just as rapidly as they appeared. That's a "ping." Put enough pings together along with the correct information and you have a *complete contact.*

Proper Operating Technique

What is the "*proper technique*" and what determines a "*complete contact*"? MS ops have developed a way of sequencing their transmissions to make sure that only one station is transmitting at a given time. Based on the second hand of a clock, each minute is broken into four equal 15-second parts. (MS operators must regularly calibrate their clocks to WWV or CHU to be sure they're "in synch" with each other.) Then they take turns transmitting and listening, starting with the station farthest to the west. He would have the first and third quarter-minutes to transmit, while the eastern op would transmit during the second and fourth quarter minutes. This holds true for schedules and random contacts alike.

What Do You Send?

What you send is based on what you've heard. At the beginning of a 30-minute sked (schedule), you start by sending nothing but both calls for the full 15 seconds. My contact would go something like this: "WB7VVD K7XC WB7VVD K7XC WB7VVD K7XC Break". *Send nothing but calls until you have copied both calls.*

Once calls are copied, I'd continue to send calls along with a signal report. The standard report for MS is "S2" which means I can hear his signals OK on meteor burns between two and five seconds in length, about the same as the typical "59" heard on the HF bands. So now, after hearing both calls, I would send: "WB7VVD K7XC S2 S2 WB7VVD K7XC S2 S2 Break."

Once the other station hears both calls and the report, all he sends is "Roger S2 Roger S2 Roger S2 Roger S2 Break". When I hear this, I know he heard everything, and all I now send is "Roger 73 Roger 73 Roger 73 Roger 73 Break". The minute he hears a single "Roger" from me, it's a complete contact. But most ops will confirm by sending a few exchanges of "Roger 73" themselves, and that's how it's done. (*Procedures are slightly different for High-Speed CW meteor scatter, a mode long popular in Europe that's catching on like wildfire here in North America. Watch for an article on HSCW MS here in* CQ VHF *in the next month or two.—ed.*)

Just Scratching the Surface...

I don't have the room here to go into all the details on what times/directions are best for each shower, advanced techniques to help land the difficult contacts, backscatter, off-pointing, elevating the antenna, etc., but I'll try to cover those topics in a future issue.

For further reading right now, I'd suggest the book *Beyond Line of Sight*, by Emil Pocock, W3EP. It's a wonderful historical and practical look at the various modes of VHF and above communication. (See "Resources" at the end of this column for ordering information).

There are also some Web sites worthy of your time, including:

<http://www-space.arc.nasa.gov/~Leonid/> and
<http://fs1.ilk.de/sites/gap/leolinks.htm>
(for info on the 1998 Leonids Meteor Shower, Nov. 17–18, supposed to be one of the best ever this year);

<http://medicine.wustl.edu/~kronkg/meteor_shower.html>
(for info on the various meteor showers);

<http://fs1.ilk.de/sites/gap/ms.htm>
(for info on meteor scatter links).

Activity Reports

Late May and early June have exploded with some outrageous conditions on the VHF and UHF bands. For some, it reminds them of the wild and exciting 1996 season. Here are a few of the many activity reports...

From Steve, N4JQQ, EM55:

5/14/98—Six has been open all evening. It started with a strong opening into the NE and moved to the west. Along the way, it included the Midwest and just a few minutes ago, I was working Wyoming and got a call from a station in EL88 on the back of my beam! To give one an idea, here are the new grids I picked up: DN52, DN72, DN60, EN85, EN90, EN89, EL39 and EL88! Now that is a great evening!

From Dave, W6OAL, DM79:

05/18/98—That was a lot of fun Monday evening. I worked mostly to the east and southeast. I have never seen the band so loaded, yes there were folks actually QSYing to other parts of the band rather than hold their QSO on the calling frequency. Maybe things are sinking in. I had some really nice QSOs with folks, other than just the normal—"You're 5 X 9 in _ _ _ _, repeat your Name Call and Grid, QSL via the Bureau." I tried to work everyone who called but the QSB and QRM made it just impossible. I kept taking people off the calling frequency and up band but landing on others (sorry 'bout that to those I landed on) and QSYed again. Prior to one

QSO, a YL and I had to QSY five times before we found a clear spot. We'll have to do this again sometime!

From NØJK EM17:

5/22/98—I worked the following from 0200 to 0400 Z on 144-MHz tropo: WB2QLP EL96, W4FF EL96, W4AMJ EL88, WD4SVB EM61, K9KNW EL95, K5MQ EM31, N4RFN EL87, KT4AL EL88 (heard on 432, no QSO) and WØVHF EL87. First FL ever on 2-meter tropo. Running 150 watts into a 12-element Yagi.

From Robert, N7STU, DM07aa:

5/22/98—6 meters opened double hop around 02 Z–0330 Z to MI, IN, OH, with a first hop in CO, KS, NE. Very few single hop stations heard. Double hop conditions were weak with quick fading making copy difficult (strongest stations were WZ8D 579 on 50.099 and W8MM at 55, most others were 51 or less). Stations to the north and west of me had much better conditions. At 0245 Z I heard both XE2HWB/b and VE6EMU/b (in addition to the U.S. stuff above). U.S. opening seemed to die out around 0330 Z and XE2HWB/b beacon stayed strong till around 0415 Z. No VE or XE stations heard even though the beacons were strong for extended periods.

From John Godwin, K5IUA EL29cd:

5/23/98—The last three weeks have been great in regards to ducting on the VHF+ bands from here. Since 1994, I have been trying to keep fairly accurate records on propagation on 144 MHz of over 500 miles. The majority of the contacts were made via tropospheric ducting with *E*-skip, FAI, and meteor scatter totaling the rest (no aurora for me yet!). When I determine the number of days of propagation of over 500 miles, only terrestrial forms of propagation are considered. No EME or meteor sked contacts are used for the number of days. When giving the number of grids and states, only terrestrial propagation is used for the number worked, again no EME.

"Taking advantage of this phenomenon requires rethinking your operating habits. MS is fast and furious compared to Es or tropo, where folks tend to ramble for what seems like hours on end."

Year	Days	Grids	States
1994	53	164	39
1995	40	160	31
1996	52	128	22
1997	23	102	22
1998	26	93 as of 23 May.	

Does "El Niño" have an effect on all of this? Maybe, but I do not know for sure. The only thing I know for sure is that it has been fun. It also makes me wonder whether 1998 will be another great year?

From Michael, VE9AA:

I believe the first bona fide 6-meter transatlantic report of the season has just been given by MMØAMW. He heard the VE8BY/B beacon in FN53rs around 2037 Z (as per WEBcluster and VHF prop pages). Looks like if Larry, VE8HL, had been near the radio, we'd have had ourselves a "winner" for the first "across" of the season. As many of you now know, the reports of W1JJM hearing EA, CU, CT, and whatever on 6 meters a week or so ago was *not* true, but an honest mistake on a second-hand report given by a well-meaning ham. It actually referred to a 10-meter QSO/QSOs and what to listen for (or something to that effect). Who will be the first across this year?

From Austin M. Kyser, KB9PCW:

5/26/98—I was able to get on for 45 minutes and worked four new grids tonight by working the following: KB9KOH EM70 0136 Z K4HS EM73 0138 Z, K4JPS EM73 0144 Z, K4GSX EM73 0145 Z, K4HBI EM73 0146 Z, WD4RCO EM60 0155 Z, and W6OAL DM79 0215 Z. What a great evening. Holy Cow. I'm still in shock. Signals from Florida were coming in stronger off the side of my beam than the signals from Colorado head on. The band was coming in and out during the QSO with W6OAL. And I couldn't even hear the KB9KEM station 20 miles away running a kW on six. (I heard W6OAL work them just before me.) Station here was an Alinco DX-70TH running 100 watts into an MFJ three-element beam up about 20–25 feet in the air. This is going to be one FUN summer! Thanks for the contacts guys! I look forward to exchanging those cards soon!

Six-Meter AM Nets

Here, courtesy of Dave Booth, KC6WFS, is an up-to-date list of all 6-meter AM nets listed on his "50am" Web page, <http://www.geocities.com/Hollywood/5860/nets.html>.

State	Name/Location	Day	Time	Freq.
AZ	Arizona AM Net	Saturday	20:00 MT	50.400
CA	SCV AM net	Friday	19:00 PDT	50.400
CA	So. Cal 6m Club	Sunday	10:00 PT	50.400
DC	Washington, DC	Sunday	09:00 ET	50.400
FL	Orlando	Wednesday	20:00 ET	50.400
IL	Moline	Tuesday	20:00 CT	50.400
IN	Fort Wayne	Every Evening!	19:00 EST	50.580
MA	Mass/Cape Cod	Saturday	08:00 ET	50.400
NW	Northwest AM Net	Sunday/Wednesday	18:00 PT	50.400
OH	Toledo	Sunday	18:00 EST	50.360
OH	Wadsworth	Sunday	10:00 ET	50.550
PA	Media	Sunday	21:00 EST	50.550

In addition, here are a few informal 6-meter AM "chat" type NETS:

State	Name/Location	Day	Time	Freq.
NY	Albany	Nightly	?:?? ET	50.400
PA	Northern PA	Saturday	8:00 EST	50.400

General information on 6-meter AM operation is available on Dave's main 6-meter AM Web page, <http://www.geocities.com/Hollywood/5860/50am.html>.

Rock-Climbing for the Rocks

I should be out atop one hill or another for Perseids (this year's shower is due to peak on Wednesday, August 12). Sounds like fun. I'm also putting the truck back together for the rover run again this September. Plans are to activate 24 grids and, with any luck, we should pull it off.

73 from DM09bp de Tim Marek, K7XC/R, 360 Prestige Ct., Reno NV 89506; Phone: (702) 972-4722; Fax: (702) 972-5011; e-mail: K7XC@VHF.RENO.NV.US. ■

Resources

Emil Pocock's *Beyond Line of Sight* is available from ARRL, 225 Main St., Newington, CT 06111; Phone (orders only): (888) 277-5289 or (860) 594-0355; Fax: (860) 594-0303; Internet: <http://www.arrl.org>.

Give Your Grid!

With today's profusion of callsigns whose numbers don't match up with call areas, it's more important than ever to give your grid square when you're looking for VHF DX.

You're listening on the 2-meter single-sideband calling frequency (144.200 MHz) and—way in the background—you make out a weak CQ call but miss the callsign. So you swing your beam for some likely tropo or sporadic-*E* DX, and again hear the signal, slightly louder. Now you make out the callsign; it's from the next call area, and that makes you more than 600 miles away!

On comes the amplifier and you make repeated calls to this potential DX station. After five minutes of beam swinging, QSYing, and headphone grabbing, you finally get the complete call. You exchange RST reports, and now the big question...*Where Are You?*

***"After five minutes of beam swinging, QSYing, and headphone grabbing, you finally get the complete call. You exchange RST reports, and now the big question...*Where Are You?"**

The response just about drops you out of the chair. The station you're calling is just 12 miles away, working on an inside mobile antenna, and just received a new vanity callsign with a number different than the call area you're both in. All that effort for a local QSO.

And on the Other Hand...

Just the other evening, 6 meters was open from Southern California to the Pacific Northwest. Not really rare DX, but the opening lasted for almost two hours. Just as the band was closing down, one more CQ came over the calling frequency from a 7 station, and the signal was so weak we all just sort of felt it was going down with all the other Pacific Northwest 7s, and only one operator finally managed to make contact.

The rest of us must have been asleep at the switch. This 7 was located in Fairbanks, Alaska—double-hop *E*-skip! But no grid was given, so there was not much reason to believe some good heart-pounding skip was just coming in at the end of the opening.

***"...if you have a number in your callsign that's different from the call area you're in,* absolutely always say your location and grid square!"**

Always Give Your Grid

When calling CQ on any VHF calling frequency (*and yes, boys and girls, it IS OK to call CQ on VHF, anywhere except on a repeater—ed.*), SAY YOUR GRID! If you're mobile, and you have no idea what grid you're in, say your approximate location. And if you have a number in your callsign that's different from the call area you're in, *absolutely always say your location and grid square*! This way, you're not going to disappoint a lot of other hams who may think that you're rare DX when you're really just down the street with one of those new out-of-district vanity callsigns. And if you are indeed rare DX, announcing your grid square will alert—and excite—the folks at the other end of the band opening. Always give your grid!

Editor's Note: If your response to reading this is "Great idea...but what's a grid square?" don't worry, just take a look at this month's "Basics" section for an explanation of what grid squares are all about and a teeny-tiny copy of the ARRL's grid map of the United States (if you want a readable version, you'll have to buy a full-sized one from the ARRL (225 Main St., Newington, CT 06111; Phone orders: (888) 277-5289; Fax: (860) 594-0303; Internet: <http://www.arrl.org>), but they're cheap). Grids can be helpful on FM, too, if more people would use them.

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The opinions expressed in this column are those of the author and do not necessarily reflect the views of CQ VHF *or its publisher, CQ Communications, Inc.*

If you have an opinion on this issue or another matter of importance to the VHF ham community, we'd like to hear from you. Well-reasoned, well-written commentaries will be considered for our Op-Ed page. If we publish your Op-Ed article, we'll give you a complimentary one-year subscription (or extension of your current subscription) to CQ VHF. *Submissions not accepted for the Op-Ed page may also be considered for Letters to the Editor.* CQ VHF *reserves the right to edit all submissions for length and style.*

By Gordon West, WB6NOA*

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

Double-Hop Sporadic-E... from the Car!

Coast-to-Coast contacts via double-hop sporadic-E are what many "Magic Band" operators live for. But with 10 watts? From the Long Island Expressway?

Double-hop sporadic-*E* contacts, while not overly common, are reasonably possible to make during the summertime sporadic-*E* season. Likewise, it's not uncommon for Magic Band operators to make sporadic-*E* contacts while mobile. How about the combination of the two? This is the story of once such exciting contact that I snagged on July 9, 1996.

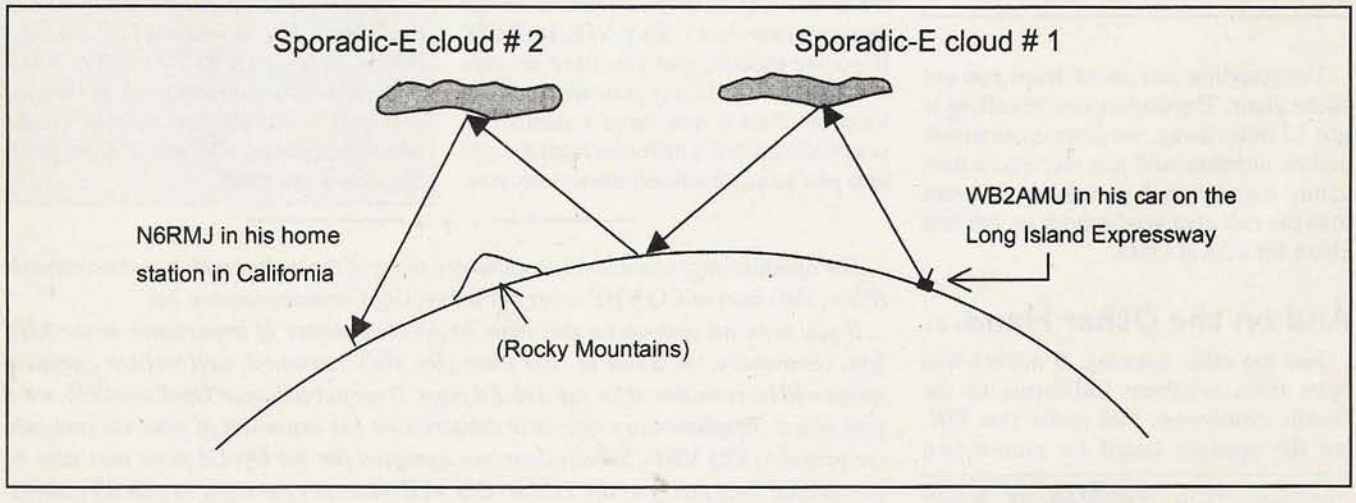
"I heard a little bit of a rumble of activity near the calling frequency and, when I tuned to it, it turned out to be a small pileup on N6RMJ out of DM14 in southern California!"

It was a Tuesday afternoon and I was leaving work at my usual time of 3:45 p.m. As part of my routine, I turned on my 10-watt, 6-meter mobile rig and tuned it to 50.125 MHz just before entering the Long Island Expressway in grid square FN30. This was an everyday ritual for me, particularly during the heart of the summer sporadic-*E* season, and it provided relief after a tough day at work. I heard a little bit of a rumble of activity near the calling frequency and, when I tuned to it, it turned out to be a small pileup on N6RMJ out of DM14 in southern California! I remembered his call from a contact during one of the last big F_2 openings in 1992 and now I was hearing him on a double-hop sporadic-*E* opening! He now was QSYing up to 50.175 MHz to move the pileup away from the calling frequency (*an excellent operating practice—ed.*).

A Double-Digit Dilemma

I was caught in a dilemma as I was already on the Long Island Expressway: should I join the pileup and try to work him with only 10 watts or pull over to a parking lot at the next exit and hook up the linear amplifier? While I've had some success with using 10 watts mobile, most of those contacts were of the single-hop variety. All the double-hop sporadic-*E* contacts that I'd made so far using 10 watts were from my home station with an antenna up 25 feet. Nonetheless, I decided to go for it using the 10 watts.

I tried to call N6RMJ at the end of each contact and missed twice as he went to someone else. But the third time was a charm. When he said "QRZ," I shouted



When conditions are right, even a low-power mobile station can work coast to coast on the Magic Band.

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

"When he came back, he was very surprised to hear that I was QRP and mobile! I thought, what good ears he has!"

at the top of my lungs with my mighty 10 watts over the road noise of the Long Island Expressway in the heart of rush hour traffic.

The Oscar-Mike Station...

He came back and said, "the Oscar Mike station come back again." I figured it had to me he was coming back to and I gave my call again twice (I was starting to lose my voice). He came back with my callsign as WB2QMU and gave me a signal report of 5 by 2. I came back with his signal report of 5 by 7, corrected my call for him and told him that I was running just 10 watts mobile from the Long Island Expressway in the heart of FN30. When he came back, he was very surprised to hear that I was QRP and mobile! I thought, what good ears he has! We finished the contact and I heard him for another five minutes. I did not hear any other West Coast stations and considered myself lucky to have been able to work him.

Never Give Up

One important lesson from all of this is that you can never give up on 6 meters, despite the fact there may be a pileup and signals may not be too strong. Many veteran 6-meter operators have—in addition to preamps—excellent *listening skills* that enable them to be able to pull out parts of callsigns. If they can pick up a part of a callsign, the pileup will subside temporarily (assuming the other ops are also reasonably good operators) and a QRP station will actually have a chance to make the contact. I have found this to be the case time and time again on 6 meters, and I'm glad N6RMJ was skillful enough to pull me out. ■

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

Announcing

1998 Colorado 14er Radio Event

Here's a fun event—with an emphasis on FM (simplex only)—for hams in and around the state of Colorado. It's not a contest...but how many active mountain peaks above 14,000 feet can you work?

By Bob Witte, KBØCY

The 1998 Colorado 14er Radio Event will be held Sunday, August 30th. During the event, a group of amateur radio operators will operate portable from the summits of various Colorado 14,000-foot mountains. The operating times will be from 9:00 a.m. to 12:00 noon local time.

Radio amateurs are encouraged to work as many of the mountaintop stations as possible. However, this is *not a contest*, no points are awarded, no scores recorded. A special event QSL card can be obtained by QSLing to the mountaintop station's home address (please include a Self-Addressed Stamped Envelope). Most mountaintop stations will be running low-power handheld radios. Stations running higher power need to keep in mind that they can interfere with stations they cannot hear.

Radio operators with 14er hiking experience who wish to participate should contact Bob, KBØCY at <RobtWitte@aol.com> (e-mail is preferred) or phone at 719-488-0859. Updated information on the event is posted at <http://members.aol.com/RobtWitte/colo14.html>.

To avoid having multiple stations on the same peak, radio amateurs who want to participate must coordinate with KBØCY.

Frequencies Used During the Event

146.43 MHz	Longs Peak
146.46	San Juan Range (Handies, Redcloud, ...) Sangre de Cristo Range (Crestone, Humboldt, ...)
146.49	Bierstadt, Grays and Torreys
146.55	Coordinating Frequency (Net Control, Pikes Peak)
146.58	Mt. Evans
147.42	Elk Range and North Sawatch Range
147.45	Mosquito Range (Quandary, Lincoln, ...)
147.48	South Sawatch Range (Huron and peaks south)
147.51	Pikes Peak (QSOs)
147.54	Reserved for Mountaintop Stations Only
223.50	Primary 222 MHz frequency
446.000	Primary 70 cm frequency
446.025	Alternate 70 cm frequency
446.050	Alternate 70 cm frequency
52.525	Primary 6M FM frequency

Other bands/modes: standard calling frequencies

Introducing Keplerian Elements

Keplerian elements provide a description of a satellite's orbit that lets your computer accurately predict its flight progress and also give you a picture of the orbit. Let's look at how they work.

How do you (or your computer) figure out when a satellite is going to be within range of your station, and where to point your antennas when it is? For hams, the most common answer is *Keplerian elements*, also known as "*keps*." Keplerian elements are not the only method of describing a satellite's orbit, but they're probably the most helpful to amateurs since they give useful information to both the human operator and the computer.

We'll begin our introduction with a pictorial description of satellite orbits as described by Keplerian elements. The description will include what the elements tell *you* about the way the satellite orbits the Earth. Once you're familiar with Keplerian elements, I'll show you the two basic formats in which they're generally available, and I'll discuss how you use this data in satellite tracking computer programs. We'll conclude by identifying places where you can get up-to-date Keplerian element sets.

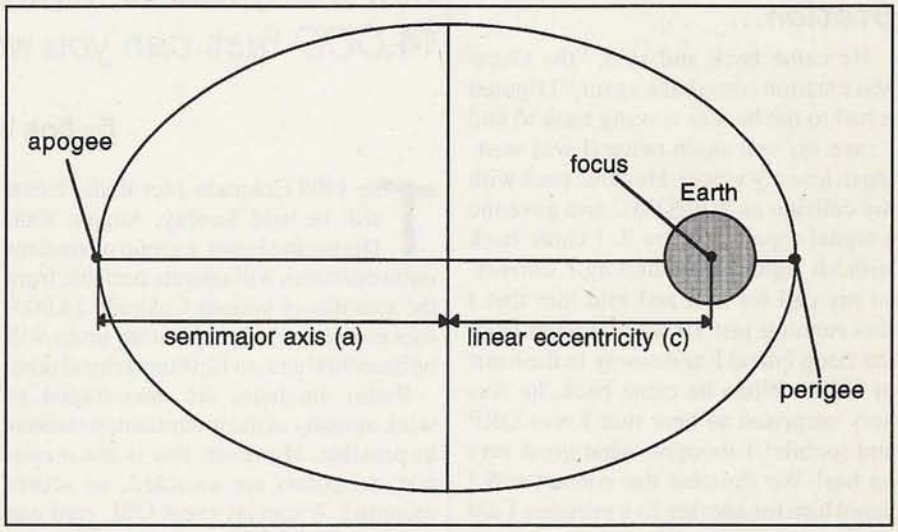


Figure 1. Kepler's First Law says satellites orbit in elliptical paths, with the Earth at one focus, or special off-center point, of the ellipse.

Let's Look at an Orbit

An astronomer and mathematician, Johannes Kepler first described the characteristics of orbital motion back in 1609 with his first two laws of orbital motion.

Kepler's First Law says that *satellites orbit in elliptical paths with the Earth at a special off-center point along the ellipse's longest dimension* (known as a *focus*). Figure 1 illustrates this relationship. The ellipse's longest dimension is known as its *major axis*. Hence, half of this distance is called the *semi-major axis* —our first Keplerian element (but see the reference to *mean motion* below). Also of interest is the distance that the Earth is offset from the ellipse's center: the *linear eccentricity*. Dividing the value of the linear eccentricity by the semi-major axis figure produces something known simply as the *eccentricity*—our second Keplerian element. The eccentricity, which has a value between zero and one, describes how much the orbital ellipse is elongated. A zero eccentricity means the Earth is at the center and we have a circular orbit, a very simple ellipse.

The semi-major axis and eccentricity figures show us the orbit's size and shape. This is enough information to compute the satellite's *altitude* at any place in the orbit. We can use the satellite's altitude to compute how much of the Earth's surface the satellite covers (its *footprint*). The higher the altitude, the more of the Earth's surface (up to 1/2) the satellite is able to "see."

We summarize *Kepler's Second Law* by noting that *satellites move faster at the lower altitudes of their orbits than they do at their higher altitudes*. In fact, the satellite moves most rapidly at its lowest altitude (known as *perigee*) and moves most slowly at its highest altitude (known as *apogee*). Because the satellite moves slowest at apogee, it spends most of its time in the high altitude portion of its orbit. Elliptical orbits are therefore desirable since the satellite spends most of its time in the part of the orbit where it has the greatest Earth surface coverage.

Kepler's Third Law was published in 1619. It says that if you know the size of the semi-major axis, you can calculate the orbital *period*, which is the time it takes for the satellite to make one complete orbit. Plus, if you know the period, you can also compute the orbital *frequency*, which is the number of orbits (or revolutions) the satellite makes in one day. The orbital frequency is called the *mean*

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

Table. Comparison of TLE and AMSAT Keplerian Element Formats

Two-Line Element (TLE) Format

```
STS-90
1 25297U 98022A  98114.50117130  .00006595  18101-9  10218-4 0  292
2 25297  39.0053 314.0189 0021469  60.3157   1.2388 16.02602767 1096
```

AMSAT Keplerian Element Format

Satellite:	STS-90	
Catalog number:	25297	
Epoch time:	98114.50117130	
Element set:	29	
Inclination:	39.0053	deg
RA of node:	314.0189	deg
Eccentricity:	0.0021469	
Arg of perigee:	60.3157	deg
Mean anomaly:	1.2388	deg
Mean motion:	16.02602767	rev/day
Decay rate:	6.59453e-05	rev/day^2
Epoch rev:	109	
Checksum:	286	

motion and it is usually used instead of semi-major axis in a Keplerian element set. (*If all of this is new to you, you might want to review the material we've just covered, referring as needed to Figure 1, before moving on.—ed.*)

Getting Oriented

Now that we know about elliptical motion, let's orient the orbit relative to the Earth. Figure 2 shows the four basic angles that orient the orbit; these are our remaining Keplerian elements. These angles are derived from astronomical terms so they have some unusual sounding names.

Two of the angles orient the ellipse's plane. The *inclination* is the angle between the ellipse's plane and the Earth's equator. Consequently, the inclination also tells you the highest northern (and southern) latitudes over which the satellite will fly directly. The other planar orientation angle is called *right ascension of the ascending node*, or *RAAN*. This is the angle measured eastward from a fixed direction in space called the *Vernal Equinox** to the satellite's South-to-North equator crossing (called the ascending node).

The other two angles are orientations within the plane of the orbital ellipse. The *argument of perigee* is the angle from the ascending node to perigee. If the argument of perigee is between 0 and 180 degrees, perigee is in the northern hemisphere and the southern hemisphere gets the best access to apogee (i.e., the high altitude portion of the orbit). Thus the best apogee access for the northern hemisphere occurs when the argument of perigee is between 180 and 360 degrees.

The *true anomaly* is the angle from perigee to the satellite's position at some defined *epoch time*, which means a specific real-world date and time. Keplerian elements actually use a variant of true anomaly called *mean anomaly*. The exact reason for this is somewhat complicated and beyond the scope of this article. However, mean anomaly makes it easier to compute the satellite's position for any desired time.

Keplerian Element Formats

Keplerian elements are distributed publicly in two basic formats: Two-Line

* The Vernal Equinox is the direction between the Earth and the sun at the beginning of spring in the northern hemisphere. A fixed direction is used because orbital planes maintain a fairly fixed orientation in space. Since the Earth rotates, there usually isn't a fixed place on the Earth for an orbit's ascending node.

Update

New 47-GHz Record QSO

Last month, we reported briefly on WA1ZMS's and K2AD's record-setting 47-GHz QSO on April 5, 1998, spanning 66.47 miles (106 kilometers). Well, they beat their own record in early May and, at the same time, qualified for VUCC Award #1 for the band (VUCC is the ARRL's VHF/UHF Century Club award, given for confirmed QSOs with a minimum number of grid squares on a specific band. On 47 GHz, the VUCC minimum is five grid squares). Here, courtesy of Brian Justin, WA1ZMS/4, and the W2SZ Mt. Greylock Expeditionary Force Web page, are details on Brian and Doug's latest record-breaking contact:

In early May of 1998, an attempt was made to try to work the required five grid squares from one fixed location (*a VUCC requirement—ed.*). The callsign of W2SZ/4 was used for the fixed station while WA1ZMS/4 was used by the rover station. Since our club, W2SZ (the Rensselaer Polytechnic Institute Amateur Radio Club), holds other VUCC firsts on 3, 5, and 24 GHz, we felt it would be fitting to have the callsign be given VUCC #1 on 47 GHz as well. Many folks within the club have helped out by locating parts and test equipment. It was decided that the summit of Apple Orchard Mountain in Virginia, due to its height, would be the best location for the fixed station. I stayed on the hilltop while Doug drove the rover station to five grid squares for QSOs with the fixed station.

Once Doug's location in each grid was radioed to me, I calculated the pointing angles for both stations and he then verified that his location was not blocked by foreground clutter. At this point, the stations were set up and we found that in less than a few minutes, signals were heard on both ends and the QSO was made. This was repeated from each of the other grid squares. The fixed station was located in grid FM07fm, while QSOs were made with the following grids: EM97, FM07, FM06, EM96, and FM08. The path distances for each QSO were: 68 km, 59 km, 60 km, 114 km and 60 km respectively. The QSO to EM96 broke our own record and set a new North American distance record.

For more information and photos, see <http://www.mgef.org/47ghz.htm>.

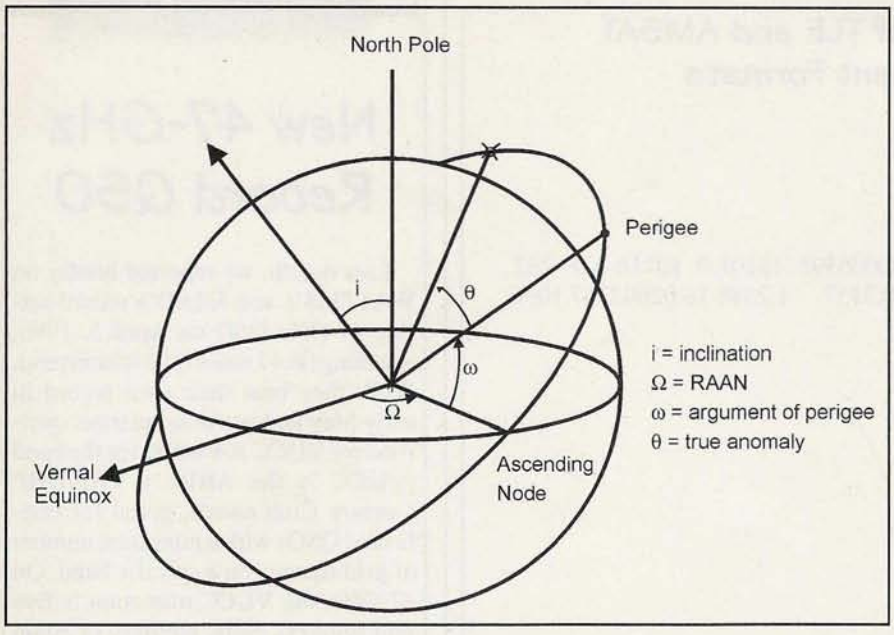


Figure 2. The remaining four Keplerian elements are angles that orient the orbital ellipse relative to the Earth.

Elements (TLEs) and the verbose AMSAT format. Most of the TLE data is computed by the United States Space Command, a military/government agency responsible for detecting, tracking, identifying, and maintaining surveillance on all man-made Earth-orbiting objects. Space Command then sends the TLE data to the NASA Goddard Space Flight Center (GSFC) for public release. The AMSAT format "keps" are derived from the TLE data. The Table shows you the same set of Keplerian elements for the Space Shuttle Columbia on the STS-90 mission, expressed in each format.

TLE Format—The TLE format was developed by the North American Aerospace Defense Command (NORAD) during the Cold War for quick transfer of Keplerian data over the slow teletype circuits of the day. The NORAD radars used this data to identify and track the satellites, thus preventing them from being accidentally mistaken for hostile intercontinental ballistic missiles.

You may notice that the so-called "two-line" elements actually have three lines per satellite. In fact, Space Command only releases the last two "Keplerian data" lines and this is Space Command's "official" two-line format. NASA GSFC adds the satellite's name (on "line zero") for easy identification.

AMSAT Format—The AMSAT format is easier to read by design. This format was originally developed so radio amateurs could read the Keplerian elements to each other over the air. Each number is labeled and units are given when appropriate. You should be able to identify the Keplerian elements we discussed earlier in the AMSAT-formatted set in the Table. If you do a number-by-number comparison, you should also be able to find the corresponding elements' locations in the TLE.

Observations about These Formats

Now that we've compared the two Keplerian element formats, you may have some questions about them. Here are answers to two of the most common:

• The orbit's *epoch time* is common to both formats. The first two digits of this number are the year (in this case 1998). The next three digits are the date described as a count (*1-366*) of the day-of-year (January 1 is day *001* and so on). The 114th day of the year (used in this case) is the 24th of April. The time of day is after the decimal point, given as a fraction of the day.

• The TLE format doesn't include the decimal point for the eccentricity. Since the eccentricity is always less than one, the decimal point is implied in the TLE.

While there are other differences between the two formats, detailing these would be also beyond the scope of this article. You can get more details about these formats from my Web page (see "Resources" at the end of this article).

Using Keplerian Elements In Satellite Tracking Software

If you're like most satellite-active hams, you'll use Keplerian elements for your favorite satellites in your tracking software. You can then let the tracking program do all the complex orbital calculations, figuring out where the satellite is, which way it's heading, and when it will be available for you to communicate with it. Most tracking programs can *automatically* read the TLE format, the AMSAT format, or both. Check which format(s) your software uses before trying to read them in from a data file.

One thing you should know is that Keplerian elements cannot accurately predict a satellite's position forever. The main reason is that there are forces that cause the satellite's motion to deviate slightly from the motion described by Kepler's laws. These *perturbing* forces include a non-uniform gravity field (since the Earth isn't perfectly spherical), aerodynamic drag from the upper atmosphere, and gravitational attractions from the Sun, Moon, and other planets. The orbital calculations in most tracking software correct for the larger of these perturbing forces, but the error eventually accumulates and becomes a problem. You can avoid these problems by updating your Keplerian elements as often as is practical.

How often should you update your Keps? In most cases, if you're using fixed antennas and just want to predict when the satellite will be available, updating once or twice per month should be good enough. If you're tracking beam antennas on an AZ/EL rotor and having the computer automatically correct for Doppler frequency shift, you should update at least once per week. (The Space Shuttle should be updated daily since it fires its thrusters frequently to trim or change its orbit.)

You should also note that not all tracking software uses the same orbital computations to predict satellite motion. However, the commonly available Keplerian elements come from Space Command and they are intended for use with their *Simplified General Perturbations Version 4* (SGP4) orbit prediction model. While SGP4 is not the most accu-

"If you're like most satellite-active hams, you'll use Keplerian elements for your favorite satellites in your tracking software. You can then let the tracking program do all the complex orbital calculations...."

rate model available, it is an excellent one. Unfortunately, using a different (even more accurate) prediction model than SGP4 will usually give you *worse* results. The reason is that Space Command "dithers" the Keps to make it easier for SGP4 to make quick and accurate calculations. The bottom line: if your tracking program offers a choice of orbital prediction models, *choose SGP4*.

Where Do I Get Keplerian Elements?

You can get Keplerian elements from several different places. The most current information is usually available from the Internet. You can get up-to-date Keplerian elements from a variety of Web sites (again, see "Resources") or you can get a set weekly by e-mail from AMSAT. To subscribe to the AMSAT Keplerian elements by e-mail, send a message to *listserv@amsat.org* with the text *subscribe keps* in the body. The AMSAT Keplerian elements are usually updated every Friday.

If you don't have access to the Internet, you can get Keplerian elements by packet radio. You can find Keplerian element messages on an AMSAT-subscribing packet bulletin board by using the *l> keps* command. Another place you can get Keplerian elements is *The AMSAT Journal*, which publishes updates in each (bi-monthly) issue.

Just to Summarize

Keplerian elements describe satellite orbits in a way that lets you "picture" the orbit and get some preliminary information about the satellite's Earth surface coverage. Your computer can use the Keplerian elements in satellite tracking software to make precise determinations of the satellite's position, motion, and surface coverage. The most commonly available Keplerian element data originates from Space Command and is publicly distributed by NASA. This data is also available from several sources, including e-mail, Web pages, and packet radio. Your computer will make more accurate orbital predictions using newer orbital data, so update your Keplerian elements as often as is practical. ■

Resources

For more detailed information on Keplerian elements, we recommend:

The Radio Amateur's Satellite Handbook, by Martin Davidoff, K2UBC, ARRL, 1998. Ordering info: ARRL, 225 Main St., Newington, CT 06111; Phone (orders only): (888) 277-5289 or (860) 594-0355; Fax: (860) 594-0303; Internet: <http://www.arrl.org>.

The following Web pages will provide you with additional information and up-to-date Keplerian element sets.

AMSAT:
<http://www.amsat.org/>
NASA GSFC BBS:
<http://oigsysop.atsc.allied.com/scripts/foxweb.dll/app01?>
Orbitessera:
<http://www.mindspring.com/~n2wwd>

Packet Networking Wrap-up: TCP/IP

This month, Don wraps up his five-part series covering the major packet networks with a look at TCP/IP—plus some thoughts on putting it all together.

For the past four months, we've taken a detailed look at packet networking software. We started in April with *TheNET X1J*, which is arguably the most popular of all the network types. We then had a look in May at *ROSE*, which is interesting for its differences from TheNET. Most recently, the topic was something new to North America (but old hat in Europe): *FlexNet*. Because it's so relatively unknown on this continent, we looked at it in greater detail, spanning June and July.

This month, we'll take a quick look at *TCP/IP*, then summarize what we've learned. (Since TCP/IP was covered in detail in a two-part column early last year, I don't plan on going into it *too* deeply this time around.)

What Is TCP/IP?

TCP/IP, which stands for *Transmission Control Protocol/Internet Protocol*, is thought of in professional circles mostly as the worldwide standard for data transmission on the Internet. In amateur circles, TCP/IP is the generic name given to a large and growing number of slightly different, but mostly compatible, suites of software used for much more than just packet networking. The meanings were once identical but took on slightly different nuances some time ago, starting with Phil Karn, KA9Q's NOS (Network Operating System) software for hams.

Today, when an amateur mentions TCP/IP, he generally refers to one of the various flavors of KA9Q's NOS, a suite of applications, servers, and a network. Each of several refinements improves upon the original NOS in some way or another, while remaining mostly compatible with all the others. For example, there are JNOS, TNOS, MFNOS, and more, and you'd be hard-pressed to tell the differences at a quick glance. Not to belittle all the development effort that went into each of these suites of software, but they are all basically the same.

One thing that sets apart ham radio's version of TCP/IP from other packet networking software is that it's more than just networking software. Ham TCP/IP is really a suite of different, but related, pieces of software offering a more-or-less complete solution. First, we have a basic *network* with routing capabilities. That means we can route a message or connect request using the software. Next, we have various *applications* for users included with the basic package, such as an e-mail program. Lastly, we have *servers* which run within the network, such as e-mail servers (a smart BBS) and HTTP (Web page) servers. Applications make the user's life easier, and servers enhance the network with things for users to do.

This means that the amateur use of the term TCP/IP really encompasses much more than a network, which is TCP/IP's major difference from TheNET, ROSE, and FlexNet. TCP/IP isn't a piece of software you run in a TNC to create a network—it's more like an application that uses an existing network to pass its traffic, despite having networking capabilities of its own.

TCP/IP via TheNET

Most Amateur TCP/IP work uses TNCs running TheNET for the majority of the network links. At important nodes, you'll find a so-called TCP/IP "Stack" (a name for a pile of programs which, together, implement TCP/IP) running on a computer. These larger nodes use the TNC-based network for interlinks, mostly for the inherent cost savings of TNCs versus computers. Since TNCs alone can perform the routing functions, users can enter the network most anywhere and make their way to one of the computer-based nodes. There, they can find all the servers which dispense information to the users.

TCP/IP networks, as implemented by amateurs, require more computing power than "conventional" networks, but offer a complete package of things to do with the network. Think of what we call TCP/IP as being a complete solution, much like the World Wide Web—everything from soup to nuts. The systems we've examined in the past few months are more like data pipes, moving data from place to place, and not really doing much else. (Moving data, by the way, is what a network *should* really be doing, in my opinion.)

Of course, one huge advantage to these amateur-based TCP/IP networks is that they're completely compatible with the Internet and most commercial networks. This allows data to pass with equal ease across radio and wire links. TCP/IP is a bit of a bear to implement as a network, and it's really optimized for wires, not RF, but the fact that everyone in the real world uses it carries a lot of weight (not to mention convenience).

Again, I'm not going to look at TCP/IP in any great depth since we did that early last year when we looked at the (nearly) self-configuring JNOS from KA1NNN. I only mention TCP/IP because it's an important part of packet networking, even though it's much more than just a network. If you're interested in learning more about TCP/IP and ham radio, I urge you to dig out those issues (February and March, 1997), read what's there and

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

Table. TheNET, ROSE, and FlexNet Feature Comparison

	TheNET	ROSE	FlexNet
Hardware	TNC2, AEA PK96, PC* 19k2 typical high end	TNC2, PC*, Linux? 19k2 typical high end	RMNC, PC 115k typical high end, 2MB possible.
Software	Monolithic, Source code available	Monolithic, modular applications. No source code.	Modular, Developer's kits for applications & drivers (with source) available, no source for kernel.
Configuration	Can be complex, defaults not optimal.	Simpler, but routing tables are complex. NETMGR software helps	Simple, set only port speeds and TXDelay.
Provision for user interface	None, user's TNC determines	None, user's TNC determines	User can run at home, without network module, for advanced features
Stability & bugs	Stable, current version in use for years	Not completely bug-free	Well-tested, stable
New developments	Nothing new for years	Some recent activity, but mostly stagnant	Actively being developed further
Support	NEDA, TAPR's NETSIG; good support, mature user base.	RATS, Author; fair support, few users.	FlexNet group in Germany; good support, wide user base, language issues.
Routing style	Multi-hop, interact with node	Single-step	Choice of single step, multi step, more
Overall rating	Two stars. OK for beginners, but inefficient as a data pipe.	One star. Best routing, good data pipe, hard to gain user support.	Three stars. Good routing, most efficient data pipe, flexible.

* Similar and compatible software for PC.

A feature comparison between TheNET, ROSE, and FlexNet. Surprisingly, they are all quite similar, and all are a good choice. FlexNet, with its more modern features, open system, and greater capabilities, is—in my opinion—the clear leader for the future.

make use of some of the resources listed. (*Back issues are available from our office for $4 each, postage included, to U.S. addresses.—ed.*)

Putting It All Together

What have we learned these past five months? We've taken a detailed look at each of what I'll call the "Big Three" packet networking software packages, including how to get the software and get a node on the air. Each system uses essentially the same steps, TheNET and ROSE use the same hardware, and they all move data from one place to the next.

Other systems are out there, but are either not really a network, are much more powerful than necessary (making for configuration difficulties), are simply not well-enough known, or aren't unique in their operation (often, more than one of these apply). I also have to admit, there's no way I'll ever be able to find out about all the different networks out there. It isn't just a matter of having the time, but also the language skills. I'll bet I never heard of what they use in Japan, but I'll also bet it works well, and isn't documented in English

TheNET and ROSE are primarily TNC-2 based, although they can also be run on certain other TNC-like platforms. This offers the advantage of cheap and standard hardware, but limits us in our network to the performance of the humble Z80 microprocessor (the chip on which the TNC-2 is based). Both have been either ported or adapted for DOS PC usage, specifically the G8BPQ and FPAC offerings. The downside of this arrangement is that channel drivers, the interface from the PC to the radio, are hard-coded and not diverse enough to satisfy most sysops.

FlexNet runs on special hardware (the RMNC card) not easily available outside central Europe, but has also been ported to the DOS PC. Here, the channel drivers are diverse, and the source code is available to guide programmers in creating new ones. These drivers support hardware much faster than the TNC-2, allowing network speeds in the range of hundreds of kilobits-per-second.

TheNET and ROSE software is readily available on most on-line services, as well as on the Internet. Source code is also available for TheNET, but not for ROSE. FlexNet software is available only at the FlexNet Web site, and the networking module is only available upon request. Source code for most drivers and applications is available, as are developer's kits, but not for the kernel and networking module. FlexNet uses relatively modern architecture, which we call *modular*, while TheNET and ROSE use the older, monolithic architecture. If there's a bug

or compatibility problem, FlexNet only has to upgrade the offending module, while TheNET and ROSE require a completely new release.

Node Building

All three systems need about the same amount of work to assemble a node. This is primarily driven by the RF hardware and power supply requirements. The actual node computers (Z80, 6809, or Intel 80x86) all require just about the same work to set up, configure, and get running.

All three systems can be implemented on a PC running DOS. There's a Linux version of ROSE available from England, but I haven't much information on how stable it is. There is a project under way to port FlexNet over to Linux, but no completion date has been set. On a related note, a TCP/IP stack is available for nearly every operating system there is, including DOS, Linux, Mac, OS/2, even Windows. Not all are intended for amateur radio use, but they can be adapted.

TheNET requires the most configuration, with hundreds of parameters that can be modified. While some may argue that this offers considerable flexibility, I say it's just more ways to wreck the network. One badly set parameter can make things work poorly, and nobody can figure out why. Maintaining a TheNET network requires minimal work, except if you're using the TCP/IP router feature, which can require constant updating.

ROSE has fewer parameters to be set, and therefore less chance of damaging things. However, because of the sysop-defined routing parameters, much more routine maintenance is required in a changing network. If the routing tables aren't set properly, it can crash the network in a few hours.

FlexNet is the easiest to configure: all you have to set is the baud rate and TX delay. Everything else is handled on the fly, based on network conditions, by the software. The algorithms are well-researched and conservative, meaning they work well in maintaining throughput on the network.

Support

ROSE and TheNET each have essentially one guy who wrote the software, and answers to questions not found in the documentation have to come from them, when they have time. Neither Tom Moulton, W2VY (ROSE), nor Dave Roberts, G8KBB (TheNET), have written anything new in years, and development of their respective networks has essentially stagnated (thankfully, at bug-free versions). FlexNet also has a single author, Gunter Jost, DK7WJ/K7WJ, but he's supported by a young and enthusiastic team, based at the technical university in Darmstadt, Germany. Progress is continuous, and answers to questions are usually fast (except during exams!).

"My ideal system would be a network layer of FlexNet, with TCP/IP applications running through it....With a FlexNet data pipe, all data is carried transparently. With TCP/IP applications, Web-like graphics, multimedia—whatever—are easy to implement...."

The Nitty-Gritty

So, what can a rational person gather from all this? I've used all of the networking systems we've been discussing these past five months, and have come to find that, well, they're all not that bad. No matter which you choose, it will perform reliably and move your data from place to place.

TheNet is good for beginners, because you can put it up and it will work. And, with a few optimizations, it isn't too shabby, either.

ROSE is geared towards networking purists because it does things like a real, professional network. It's faster than TheNet, but the network tends to be transparent to users; so it's hard to gain support from them.

TCP/IP is good because it's highly compatible with the real world, but the price is difficult configuration. Also, we're not taking full advantage of all TCP/IP has to offer, like graphical user interfaces, perhaps because we're asking too much of a single software package.

FlexNet, in my opinion, is the next great network, because it's the most modern, the fastest, and is still easy to configure. The disadvantage is that it isn't well known in North America, but that will change shortly.

FlexNet in New England

By the time you read this, the North East Digital Association (NEDA) will have begun implementing a FlexNet network in New England. Much like NEDA's work with TheNET, the idea is to put up a real, working network, tune it to perform optimally, all while publishing a technical magazine telling everyone what they've learned. Their goal is to provide all the information anyone could need to implement an excellent network on their own. Stay tuned for details.

The Ideal Network

In the past five months, we've come to realize that a data transportation system is kind of senseless without applications, like a roadway would be without something at the other end. We build roads to provide access to specific locations. Now we should be thinking about what kind of things we want to do with data, and then build the network to accomplish it.

My vision of the ideal packet radio system is much more than just a network. The network is important, of course—it actually carries the data. But data alone is boring; you also need applications. My ideal system would be a network layer of FlexNet, with TCP/IP applications running through it. The existing AX.25 applications (BBS, Chat Nodes, etc.) are fairly boring and old-fashioned. With a FlexNet data pipe, all data is carried transparently. With TCP/IP applications, Web-like graphics, multimedia—whatever—are easy to implement, in most cases with free commercial software. Anything your network can do, FlexNet does better. And, TCP/IP is simply the most popular and compatible protocol suite there is.

Looking Ahead

After such a lengthy series of articles on a specific subject, I have to wonder if it was worth it—for you. I know that I've learned a lot researching and writing it all. The written word is a mostly one-way communications system, and having become used to radio and its two-way capabilities, I miss the feedback. I want to thank all those who have taken their valuable time in the past to write, and I encourage all of you thinking "I wish he'd write about..." to fill in the blank and send it in to me, c/o *CQ VHF* or via e-mail to <N2IRZ@compuserve.com>

Next month, we'll have a look at APRS again, this time with Internet capabilities. Even the commercial world can't do *this* trick yet. Until then, thank you for reading and 73.

—N2IRZ

Grid Squares

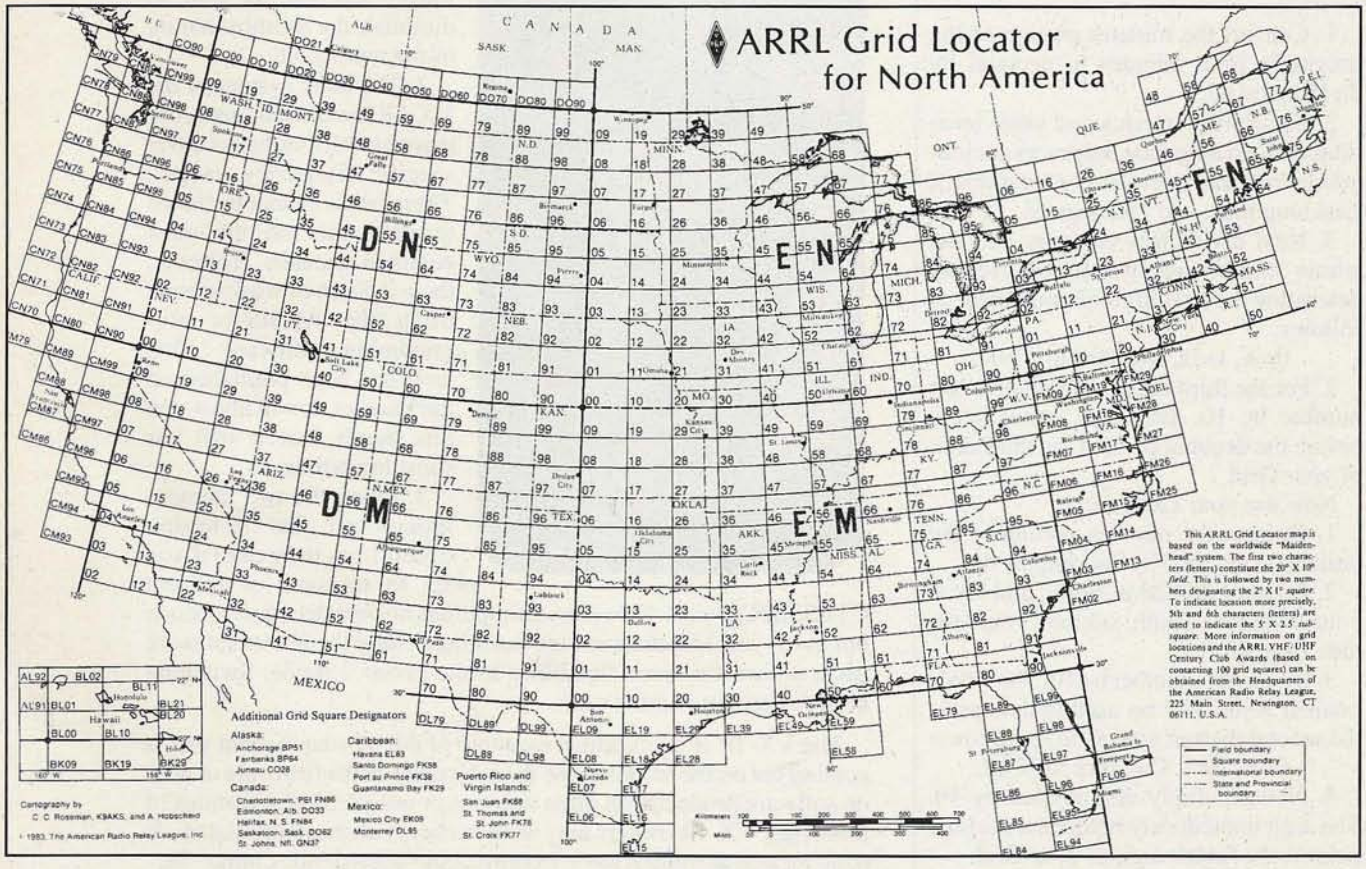
Basics

In almost any article you read about VHF/UHF weak-signal work, VHF contesting, or awards programs, you're bound to run into the phrase "grid square." This is a specialized system that hams active on VHF use to locate each other and to describe their own locations.

A grid square is actually a rectangle, and a rather large one at that. Each rectangle measures 1° of latitude by 2° of longitude and has a unique two-letter, two-number identifier. The CQ offices in Hicksville, New York, for example, are in grid square FN30, and ARRL headquarters in Newington, Connecticut, is in FN31. (To save you the trouble of doing the math, there are 32,400 grid squares covering the planet.)

The system got its start in Europe in 1980 as an update of a system that had been used by European hams for decades. American hams began using it a few years later, in large part to help equalize VHF contest competition between different parts of the country. The problem was that most contests had you determine your score by multiplying the number of contacts you made by the number of states you contacted. But a station in New Jersey, for example, could easily work 10 or more states with a basic 2-meter SSB setup, while an identically equipped ham in Kansas would be lucky to work *two* states. Grid squares, which are all the same size and shape (generally speaking), were supposed to help "level the playing field." They did to some extent, but still can't compensate for differences in population density. So while the ham in Kansas may be able to get his signal into a dozen different grid squares, there's no guarantee that he'll be able to find other hams to contact in each of those grids. On the other hand, our ham in New Jersey should have no trouble at all finding at least one active ham in each of the dozen grid squares that *his* signal can reach. Even so, grid squares today have become the basis for most major VHF contests and awards and provide operators with a quick reference on which direction to point their beams for specific contacts.

How do you determine your grid square? Start by looking at a Grid Locator map. These are available at nominal cost from the ARRL and are also pub-



The ARRL VUCC Grid Locator Map. (©1995 ARRL, reprinted with permission)

lished in a variety of references, including CQ's *The VHF "How-To" Book*, the *ARRL Operating Manual*, and the ARRL's *Your VHF Companion.*

If you're clearly within one particular grid square, then look no further. If you're not sure, you can calculate your location with a variety of computer programs or with a mathematical formula (see "Figuring Out Your Grid Square" below). The key to all of them, though, is knowing your latitude and longitude as precisely as possible. If you have a topographic map of your area available, use that. Otherwise, try your public library's reference department or ask local hams who are already active on VHF/UHF weak-signal. Then you can start to have fun "chasing grids."

Figuring Out Your Grid Square

To determine your Grid Square without a map, you'll need your longitude and latitude rounded to the nearest minute. Save the number obtained from each step, as it will be used in the next.

First use your longitude:

1. Convert the minutes portion of the longitude from minutes to decimal by dividing by 60.

2. For North America and other locations of West longitude, subtract your longitude from 180 degrees. For locations of East longitude, add 180 degrees.

3. Next divide this value by 20. The whole number result will be used to determine the first digit of your Grid, as follows:

0=A, 1=B, 2=C thru to 17=R.

4. For the third digit, multiply this last number by 10. The digit immediately before the decimal point is the third digit of your Grid.

Now use your Latitude:

1. Convert the minutes portion of the latitude to decimal by dividing by 60.

2. If your Latitude is North, add 90. If your latitude is South, subtract your latitude from 90.

3. Divide this number by 10. The whole number result will be used to determine the second digit of your Grid, as follows:

0=A, B=1, C=2 thru to 17=R.

4. Now, multiply this number by 10. The digit immediately before the decimal point is the fourth digit of your Grid.

This completes your four-digit Grid Locator. ■

Reader FEEDBACK!

Feedback on VX-1R Feedback

Dear *CQ VHF*:

I noticed that in your March issue ("Reader Feedback," pg. 41) you published some information about the Yaesu VX-1R that was not entirely correct. These comments (on scanning limitations and AM receive sensitivity) were apparently based on an older version of the VX-1R.

The VX-1R has been through several firmware revisions since its introduction. Revision 1.06 is the current version that is shipping. In revision 1.06, the AM receive problem was corrected. The VX-1R will now do a pretty decent job of receiving local AM stations with the supplied rubber duck antenna.

The VX-1R can also be made to be a pretty capable scanner using the following tips:

1. The supplied rubber ducky is tuned more specifically for the amateur radio bands. Reception falls off pretty rapidly at the band edges. Switching to a higher performance SMA antenna really wakes up the receive capabilities of this radio. However, the tradeoff is that you may lose AM receive with the longer antenna, as well as diminish the stealthy nature of the radio a bit.

2. The bank system of the VX-1R has caused some controversy. All nine banks cover specific frequency ranges. These banks cannot be linked together like on the most common scanners. However, there is a sort of work-around using the ADMS-1c programming software. This mod has been published on the Internet. It will allow you link bands, but it still has some limitations.

3. Using the two memory groups can also be useful. Group 1 has to be used if you need to transmit or receive CTCSS/DCS tones. However, Group 2 has no tone decode or encode but gives you 152 channels for scanning. Using the above software trick, allows for some flexibility in the group 2 mode. Switching between groups is quite easy.

The VX-1R is an excellent example of the new equipment that is coming out on the market these days. Updates to the firmware or add-on software products can often improve or unlock hidden features of these rigs. VX-1R owners may want to check out the unofficial mods page located at <http://www.icongrp.com/~sllewd/index.htm>. 73,

Mike Ellerson, KS4JU
Athens, Georgia

CQ VHF Ham Link

CQ VHF Hamlink offers *free listings* of clubs, licensing classes, and exam sessions! For $1/month or $10/year, we also offer listings of **ham-related** *personal* Web sites (*commercial* **ham-related** Web listings are $5/month or $50/year).

Web site listings must be accompanied by payment in full in check or money order in U.S. dollars and mailed to *CQ VHF Weblink*, Attn: Bernadette Schimmel, 25 Newbridge Rd., Hicksville, NY 11801. Credit card orders are accepted by mail, phone (516) 681-2922, or fax (516) 681-2926. Club, class, and exam listings may be submitted to *CQ VHF Clublink*, or by e-mail to CQVHF@aol.com. Please be sure to say what it is in the subject line (e.g., Club Listing).

Club Listings

CA, Santa Barbara, Amateur Radio Club: Meets 3rd Friday of Sept-May at 7:30 p.m., County Schools Auditorium, 4400 Cathedral Oaks Rd., Santa Barbara. For more info about SBARC, see the club Web site: <http://www.sbarc.org>; or call (805) 569-5700.

CO, Bicycle Mobile Hams of America: A national non-profit club of bicyclists who use VHF ham radios for emergencies, lost riders, route information, chatting, etc. 450 members in 46 states, 6 countries. Annual Forum at HamVention. Net: 14.253, 1st & 3rd Sundays, 2000 UTC. E-mail: <hartleyal@aol.com> For info, sample newsletter, send SASE to BMHA, Box 4009-CV, Boulder, CO 80306-4009.

FL, Highlands County Amateur Radio Club: Meetings held 3rd Monday of each month, 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Visitors welcome. Repeaters at 147.045 +.6, 442.350 +5.0, with packet on 144.970. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio@strato.net>.

FL, Metro Dade REACT 4881: One of the few **all-ham** REACT teams in the U.S., providing public service through communications. Mtgs ev. Thurs. 8 p.m., details on 147.315 MHz (+600) repeater. For info, contact Metro Dade REACT, 3735 SW 89 Ave., Miami, FL 33165; e-mail: <react4881@juno.com>; WWW: <http://www.geocities.com/Heartland/Ranch/4881>; or Robert Cruz, KE4MCL, President, at <react4881@juno.com>.

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

IL, Logan Area Amateur Radio Club, Logan County: Meetings held 3rd Saturday of each month, 7 p.m., American Red Cross Bldg., 125 South Kickapoo St., Lincoln, IL. Primary repeater: 147.345+. Secondary repeater: 145.390-. Contact President, Bob Rucker, KB9JSE, at (217) 735-2506; <KB9JSE@ccaonline.com>.

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

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

MB, Canada, Winnipeg Amateur Radio Emergency Service (WARES): Callsigns VE4YWG (Public Service Communications) VE4EOC (City Emergency Operations Centre). Meetings 3rd Tuesday of the month, 1930h Sir Wm Stephenson Library 765 Keewatin St. Membership open to all licensed amateurs at least 18 years of age living in or near Winnipeg interested in emergency amateur communications. E-mail Jeff Dovyak, VE4MBQ, Emergency Coordinator at <ve4mbq@ve4umr.ampr.org>; Web: <http://www.geocities.com/CapeCanaveral/Hanger/1632/wares.html>.

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

OH, Cleveland area, Cuyahoga Amateur Radio Society: Meets 3rd Wednesday of every month except Dec at 8 p.m. at Busch Funeral Home community room, 7501 Ridge Rd., Parma, Ohio. June, July, and Aug, "Picnic Meetings" are held at Cuyahoga County Metropolitan Park. Repeaters are on 146.82(-), 443.825 & 444.75 (+), 53.83 & 53.01 (+), plus digipeater at 145.07, and club simplex frequency of 146.475 MHz. For more info, contact club president, Tom Wayne, WB8N, at (440) 232-4193 or at <wb8n@en.com>.

OH, Firelands Amateur Repeater Association (FARA): Assn. of amateur radio operators and their families in North Central Ohio, dedicated to operation and maintenance of a repeater system south of Berlin Heights. Meets monthly on 4th Tuesday at Erie County Services Cntr., 2900 Columbus Ave., Sandusky at 7 p.m. in basement cafeteria. For info, write FARA, P.O. Box 442, Huron, OH 44839. E-mail: Tim Stookey, N8AHK, President: <n8ahk@amsat.org>; Web: <http://www.fara.berlin-heights.oh.us/index.htm>.

OK, Tulsa Amateur Radio Club: P.O. Box 7283, Tulsa, OK 74159-4283. Repeaters 145.11, 147.045, 442.00, 443.00, 443.45, 443.75, 444.625. Autopatches on 145.11, 443.00. Net every Thursday on 145.11 @ 8 p.m. (linked to 442.00, 443.75, 444.625). Meetings 3rd Tuesday of each month at 7 p.m., West Regional Library, 2224 West 51st St., Tulsa, OK. Breakfast meeting, 1st Saturday of month at 8 a.m., Ollie's Restaurant, 4070 Southwest Blvd., Tulsa. For more information, call (918) 446-6451, Vince Moore, N5RFW, Public Service Liaison Officer.

ONT, Canada, Muskoka Amateur Radio Club: Meets at Huntsville Hospital Board Room at 2 p.m. on 2nd Sunday of each month. Visitors welcome. Net at 7 p.m. Monday on 146.775. Muskoka ARC, VE3MZY, 437 Aspdin Rd., Huntsville, ONT, P1H 1Y4, Canada.

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

TN, Cleveland Amateur Radio Club: Meetings every 2nd and 4th Tuesday of the month (except Dec) at CARC Clubhouse, 560 Johnson Blvd., Cleveland, TN, at 7 p.m. EST, and 7:30 p.m. EDT. CARC operates a 2-meter repeater on 146.925 MHz (-600) and a UHF repeater at 444.275 MHz (+5 MHz). Contact W4GZX, P.O. Box 2683, Cleveland, TN 37320-2683; E-mail: <carc@rocketmail.com>; Web: <http://www.geocities.com/SiliconValley/Lab/1660>.

UT, Rocky Mountain Radio Association (RMRA): Offers Utah, Wasatch Front, unique UHF to 6, UHF to 2, and UHF to HF remote gateways. Net Thursday at 9 p.m. on 447.900 PL 114.8 UHF/6-meter gateway open 24 hours/day on 448.700 PL 114.8. RMRA Web site: <www.inconnect.com/~rmra>; or e-mail: <rmra@inconnect.com> for more information.

WV, Oak Hill, Plateau Amateur Radio Association (PARA): Meetings held 1st Tuesday of each month at 7:30 p.m. in basement of New River Pawn Shop, 328 Main Street, Oak Hill. Mailing address is PARA, P.O. Box 96, Fayetteville, WV 25840. Repeaters are 146.790-; 147.075- and 443.300+. For more information, contact Juddie Burgess, KC8CON, Secretary, at <kc8con@usa.net>.

Exam Sessions

CA, Los Angeles: United Radio Amateur Club, K6AA, Los Angeles Maritime Museum (6th St. on Main Channel of Harbor). Contact Elvin, N6DYZ (310) 325-2965. VEC: W5YI. Cost: $6.35 (or current amount

allowed); Dates: 2nd Saturday each month except Dec; time: 1:30 p.m.; Preregistration recommended, but not required.

FL, Highlands County: Examinations held 4th Monday of each month, 7 p.m. Agri-Civic Center Conference Room 1, South US 27, Sebring, FL. Walk-ins are welcome. Web site: <http://www.strato.net/~hamradio>; E-mail: <hamradio@strato.net>.

IL, Chicago: Ham testing session 1st Thursday each month, from 7–10 p.m.; test all levels (Novice thru Extra). Reservations NOT required. For info, contact Dennis L. Sladek, N9OZ, 4344 W. 51 St., Chicago, IL 60632; Phone: (773) 838-8088; E-mail: <n9oz@juno.com>.

IL, Chicago: VE testing, just 4 blocks from Midway Airport, 1st Thursday of every month, 7–10 p.m. Midway VE Team-W5YI affiliated, 4344 W. 51 St. (Archer & Kostner Streets), Chicago, IL 60632. Phone: (773) 838-8088; Fax: (773) 735-8469. Web site: <www.megsinet.com/dsladek>; E-mail: <dsladek@megsinet.net>.

IL, Lincoln (LAARC): Offers ARRL VEC exam sessions for Novice, Tech, and Tech Plus licenses on 2nd Saturday of every other month at Lincoln Public Library Annex Bldg., 725 Pekin St., Lincoln, IL. Pre-registration recommended but not necessary. For info, contact: Mike Roos, N9WGT, at (217) 732-6323. Exam fee: $6.39.

NC, Wilmington: Azalea Coast Amateur Radio Club will hold a VE testing session on Aug 8, 1998 10 a.m. at Morton Hall. University of North Carolina Wilmington Campus. Contact Jack, WD4OIN, at (910) 791-1566.

OH, Cleveland area: Cuyahoga Amateur Radio Club holds exam sessions on 2nd Sunday of each odd-numbered month (except May), at Olde Independence Town Hall, 6652 Brecksville Rd. (Rte 21), Independence, OH. Sessions start at 9 a.m., fee is $6.95, and a valid ID and copy of your FCC license is required (if you are already licensed). For more info, contact Gary Dewey, NI8Z (216) 642-1399 or at <gdewey@en.com>.

SC, Columbia: ARRL/VEC testing session for all license classes will be held June 20, 1998, and on 3rd Saturday of each even month (Aug, Oct, Dec) at 9 a.m., Heathwood Hall Episcopal School, 3000 South Beltline Blvd., Columbia. For more info, visit the Web site at: <www.qsl.net/ku4qn>, e-mail: <KU4QN@juno.com>, or call (803) 779-5234. Exam fee is $6.35. Elements 2 (Novice written exam), and 1A (5 wpm code) are free of charge.

Personal Web Site Listings

Jim Bridge, KQ6BS, URL: <http://www.qsl.net/kq6bs>. Specialty: weak signal.
Robert Cruz, KE4MCL, Web: <www.geocities.com/Heartland/Estates/5281>. KE4MCL Swap Shop is a place for hams to advertise their old gear and place want ads. No dealer ads accepted.

Commercial Web Site Listings

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

MS-Windows Software: RAC Callbook CD-ROM, Ultimeter Weather Stations and more, info <n2ckh@cybercomm.net>; Web: <www.QTH.com/n2ckh.bytewise.org>

Teletec: Manufactures 6, 2, 1 1/4-meter and 70-cm linear amplifiers as well as receive pre-amplifiers; Web: <http://www.Teletec-usa.com>.

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

Letters *(from page 9)*

nothing of what I've just written here is true. I know that. Please don't write to tell me about it. Maybe I've been exposed to too much RF...]

Long May It Wave

Dear *CQ VHF:*

Gordon West's design for a portable mast (*CQ VHF*, June 1998, p.20) is quite similar to one designed by Bob Buus, W2OD, and myself. It was described in an article we co-authored in the May 1992 issue of *QST* magazine.

While Gordon's mast is a good deal more elegant than ours, we provided the advantage of minimal cost. The 19-inch rack panel as well as most of the rest of the parts needed for the support came from Bob's junk box. And the five-foot sections of antenna mast are strong, inexpensive, and readily available from your local electronics supply house or RadioShack. I have used this mast/support numerous times in providing communications for public service events. It usually is used to elevate a Ringo Ranger or a four-element beam for 2 meters, depending on the requirements of the situation. 73,

Cary Fishman, WB2BSJ
Tucson, Arizona

Cary—Gordon did not design nor claim to design the mast he wrote about in the June issue. This is a commercial product, marketed primarily as a collapsible flagpole for RV use. He decided to write it up as an article because of the attention it was drawing from hams wherever he put it up. Thank you for pointing our readers toward your QST *article, which should provide a great do-it-yourself option for those who don't want to spend $350 for the commercial product.*

Advertisers' Index

"VHF, UHF, AM, FM, Air Band, Police, Fire—TV" too? Wow"

"The VX-1R is smaller than most pagers!"

"Over 19 hours of use from the rechargable lithium ion battery!"*

"Looks like Yaesu did it again!"

VX-1R

Ultra-Compact Dual-Band Handheld

Features

Frequency Coverage
Wide Multi-Band Receive
RX: 76~999 MHz**
TX:144~148, 430~450 MHz

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AM Aircraft/Public Safety Receive

CTCSS Encode/Decode

DCS Encode/Decode

CTCSS/DCS Tone Search

Dual Watch

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***Cellular blocked*
**Battery Life: 5-5-90 duty cycle.*

The world's smallest HT with all the high-tech features Dick Tracy could ever want!

The ultra-compact size of the VX-1R Dual-Band is the first thing you notice as you cradle it in your palm. But the high-tech features make this radio one you must have now! Simple combinations, using seven buttons and one knob, control this marvel of engineering. One soft key touch, and wide receive VHF/ UHF—76~999 MHz RX (except cellular); 144~148, 430~450 MHz TX, or AM/FM Broadcast, Aircraft, Police, Fire—even TV, spring to life! Touch again for Yaesu-exclusives, SmartSearch™ and ARTS™, or Priority Channel Alarm. Built-in CTCSS and DCS Encode/Decode for 2m/440 amateur bands, CTCSS/DCS Tone Search, and Dual Watch, are included along with 291 Memory Channels in 9 banks with 500 mW power output. Backlit LCD Display shows 6-character alphanumeric capability; backlit keypad makes operation easy in dim light. And, although the VX-1R is the world's smallest† dual-band HT, you get over 19 hours* of use with just a 1 hour recharge from its long-lasting lithium ion battery! Big features, small size—the most satisfying combination in the world! See it at your Yaesu dealer today!

FT-50RD
MIL-SPEC,Heavy Duty, Dual-Band Handheld

FT-51R
Dual-Band with Dual Receive and Help Menu Function

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For the latest Yaesu news; hottest products, visit us on the Internet! http://www.yaesu.com

†Smallest HT as of Jan. 1998

Seeing is Transceiving

Portable SSTV is here! Kenwood's new VC-H1 Visual Communicator combines an image-scan converter, CCD camera and LCD monitor in a compact battery-operated unit. Simply hook it up to your Kenwood transceiver to start sending and receiving color images over the air.

VC-H1 Visual Communicator

◗ Ideal for outdoor SSTV

Until now, for anyone interested in SSTV (slow-scan television), portability has not been an option. But thanks to component miniaturization the VC-H1 is not only small enough for handheld use but it runs off 4 AA batteries so you can take it anywhere. This makes it ideal for field days, special events, disaster communications and even fishing trips.

◗ Full compatibility

The VC-H1 can be connected to any transceiver with just a cable, and it offers full compatibility with all of the standard SSTV formats. Uploads/downloads are quick and easy; the images are also sharp and clear.

◗ All-in-one design

In addition to the detachable 1/4-inch CCD camera, the VC-H1 features a 1.8-inch color TFT (thin film transistor)-type display. As well as viewing incoming pictures, you can review your own prior to transmission. The built-in microphone & speaker can be used in place of a separate speaker-microphone for your transceiver.

◗ Image memory

Up to 10 pictures can be stored in memory. This allows you to compare and pick the best shot to send. You can also store incoming pictures and protect them from unintentional deletion.

◗ Computer connectivity

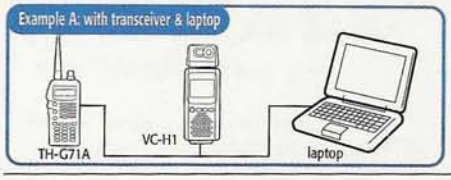
One of the great features of the VC-H1 is the ability to work with a personal computer. Hook it up to the RS-232C port on your laptop using the optional connection kit (includes Microsoft® Windows® 95 software) and you can save pictures (in JPEG format) that you send and receive. You can then cut and paste using standard graphics software, or even superimpose your own text. What's more, you can actually control the VC-H1 from your computer.

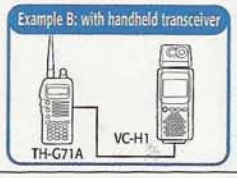
◗ Call sign superimpose
◗ AF mute
◗ Auto power-off

SPECIFICATIONS

• Terminals : Data I/O (for transceiver), Video in, Video out, COM (for computer),DC IN (4.8 – 7.0V) • Dimensions, projections not included (WxHxD): 2-5/8 x 1-3/8 x 6-3/4 in (62 x 30 x 160 mm)

Specifications are subject to change without notice.
Screen-shot photographs are simulated.
Microsoft and Windows are registered trademarks of Microsoft Corporation





TH-G71A
144/440MHz
FM Dual Bander

- 6W (VHF), 5.5W (UHF)
- PC programmable
- 200 memory ch. with alphanumeric display
- MIL-STD 810E (rain & shock)
- CTCSS tone scan
- DTMF memory (10 ch. up to 16 digits)
- Wide-range coverage

ISO 9001
JQA-1205

Communications Equipment Division
Kenwood Corporation
ISO9001 certification

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