HAM RADIO HORIZONS

October 1980 / $1.50

Meter Tricks for Homebrewers

The Novice Experience: Sam Morse's Revenge

Beyond QTH, RST, and Goodbye...

W9KNI Chases a R e On ...

- am Radio chniques
- X orizons
- Time
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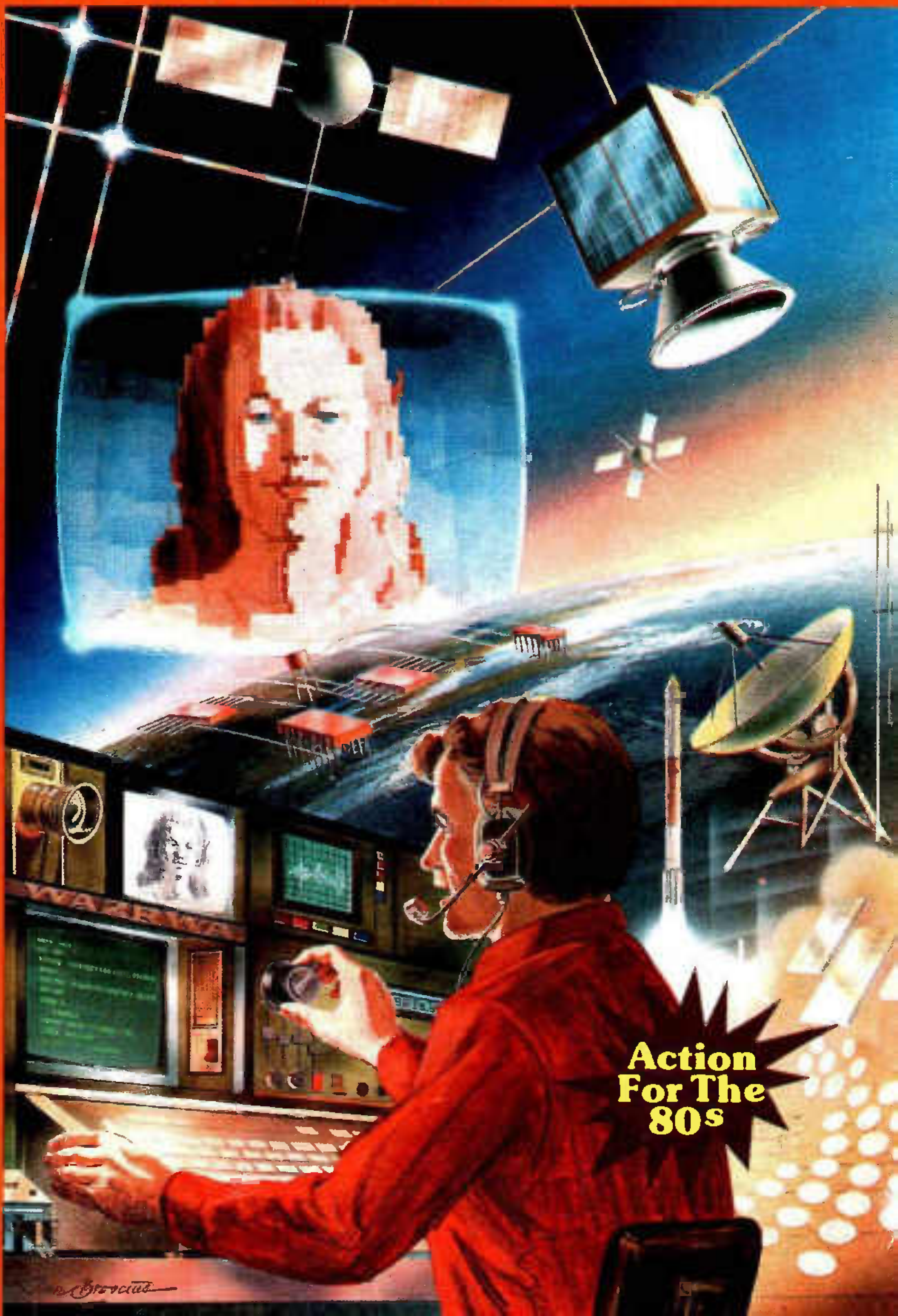

SUPER RIG

NEW TEN-TEC

OMNI-C 9 Band Transceiver + HERCULES Solid-State KW Linear

TEN-TEC SUPER RIG IS READY. For every band, every band condition. With the latest in solid-state hf technology, the latest in features. To make communications easier, more reliable — super.

OMNI-C

The new model in this famous series. With new coverage and new features to make it better than ever!

All 9 HF Bands. From 160 through 10 meters, including the new 10, 18 and 24.5 MHz bands. Coverage you can live with—for years and years.

3-Mode, 2-Range Offset Tuning. Offset the receiver section or the transmitter section or the entire transceiver! In 2 ranges: ±500 Hz or ±4 kHz. For complete flexibility in fine tuning, a DX work, or net operations.

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Super Specs. *Optimized sensitivity*—a balance between dynamic range and sensitivity (2 μV on 160 to 0.3 μV on 10 meters) *Greater dynamic range*: better than 90 dB. And a PIN diode switchable 18 dB attenuator. *200 watts input* on *all* bands! *100% duty cycle* on *all* bands for up to 20 minutes.

Super Convenient. *Built-In VOX* with 3 up-front controls. *Built-In PTT* control at front and rear jacks. *Built-In Zero Beat* switch puts you on exact frequency. *Built-In Adjustable Sidetone* with variable pitch and level. *Adjustable ALC* for full control from low power to full output. *2-Speed Break-In*, fast or slow speeds to fit operating conditions. *Built-In Speaker* eliminates desk clutter. *Automatic Sideband Selection*—reversible.

Super Design. *All Solid-State and Broadbanded*—from the pioneer, Ten-Tec. *Modular* plug-in circuit boards. *Functional Styling* with convenient controls, full shielding, easy-to-use size (5¾"h x 14¼"w x 14"d).

Super Hercules Companion. Styled to match, plus separate receiving antenna capability, plus transceiver front panel control of linear's bandswitching (one knob does it all).

Full Accessory Line including filters, remote VFO, power supplies, keyers, microphones, speech processors, antenna tuners—all in matching color.

Model 546 OMNI-Series C . . . . $1189.

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Amateur Radio's first full break-in solid-state kW linear amplifier. With the reliability you'd expect from the pioneer in high-power solid-state technology—TEN-TEC.

All Solid-State. No tubes. Instead, HERCULES uses two 500-watt push-pull solid-state amplifier modules with an output combiner. Super solid.

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Full Break-In. HERCULES puts the conversation back into high power CW operation—you can hear between every character you send.

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Full Gallon. 1000 watts input on *all* bands, 600 watts output, typical. Built-in forced-air cooling. Driving power: 50 watts, typical. Adjustable negative ALC voltage. 100% duty cycle for SSB voice modulation; 50% duty cycle for CW/RTTY (keydown time: 5 minutes max.) Continuous carrier operation at reduced output.

Full Protection. *Six LED status indicators* continuously monitor operating conditions and shut down the amplifier whenever any one exceeds set limits (the exciter automatically bypasses the amplifier under amplifier shut-down for barefoot operation). The six parameters monitored are: 1) overdrive; 2) improper control switch setting; 3) heat sink temp.; 4) SWR; 5) overvoltage/overcurrent; 6) rf output balance. *Two meters* monitor collector current, voltage, and forward/reverse power. And a highly efficient *automatic line voltage correction* circuit (patent applied for) eliminates the need for selecting transformer taps, prevents applying too high a voltage to final amplifier devices, becomes operative under low line conditions.

Super Power Supply. Provides approximately 45 VDC @ 24 amperes, operates on 105/125 VAC or 210/250 VAC. Tape wound transformer and choke reduce weight (50 lbs.) and size (7½"h x 15¾"w x 13½"d). Separate enclosure.

Super Styling. Designed to match OMNI, the HERCULES has the same height as OMNI, plus matching bail and matching colors. The front panel is simplicity in itself with two push button switches (power and mode) plus two knobs (meter and bandswitch), and a "black-out" monitor panel (when unit is off, meters are unobtrusive). Amplifier size is 5¾"h x 16"w x 15½"d.

Model 444, HERCULES amplifier & power supply . . . . $1575.

Experience SUPER RIG at your TEN-TEC dealer, or write for full details.

TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862
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Rack Attack from DenTron

Components are the latest in communication systems adapting to your stations' needs. The DTR-3KA and DTR-1200L are equipped with heavy-duty handles for easy rack mounting and rack brackets that can be easily removed. The DTR-1200L linear amplifier provides 1200 watts SSB and 1000 watts CW input continuous duty. It features large 3½" shadow box, back lit meters for easy reading, and tuned input for compatibility with solid state or tube transceivers. The DTR-3KA antenna tuner handles a full 3KW PEP. It features a built in 2KW dry dummy load with thermostatically controlled forced air cooling, a remote sensor box to insure meter accuracy and 50 OHM impedance. Component racks available at your DenTron Dealer.

DTR-1200L Linear Amplifier

Frequency Ranges:

80 Meter Band	3.45 - 4.6 MHz
40 Meter Band	6.00 - 9.0 MHz
20 Meter Band	10.00 - 16.00 MHz
15 Meter Band	20.95 - 23.50 MHz
10 Meter Band	Export Model

Modes:	USB, LSB, CW, RTTY, SSTV
Power Input:	1200W - SSB, 1000W - CW
Power Requirements:	234/117 VAC 50/60 Hz
RF Drive Power:	150 Watts maximum and 65 watts minimum for 1 KW DC input.
DC Plate voltage:	Idle + 2300V approximate
Duty Cycle:	100% SSB, CW, RTTY, SSTV
Input Impedance:	50 Ohms nominal
Input VSWR:	1.5 to 1 average
Output impedance:	50 Ohms nominal
Antenna load VSWR:	2 to 1 maximum
ALC:	negative going, adjustable from front panel
Spurious Emissions:	IMD - greater than 30 db down Harmonics - greater than 40 db down

Switchable 12VDC accessory output voltage

Multimeter:

Plate Voltage	0 - 3000VDC
Plate Current	0 - 500ma
Relative Output	Adjustable

Front Panel Plate Voltage Switching

FCC Type Accepted

Size:	5¼" H x 17" W x 13" D (19" W with rack brackets)
Weight:	46 pounds

DTR-3KA Antenna Tuner

Frequency Coverage: 1.8 - 30 MHz continuous
Built In 2 KW PEP Dummy Load - Forced Air Cooled
Input Impedance: 50 ohms (Resistive) to transmitter
Antenna Inputs
Coax 1, 2 & 3 - unbalanced—may range from a few ohms to a high impedance
Long wire - low to high impedance
Balanced line - 75-660 ohms
Power Capability: 3000 watts P.E.P.
Wattmeter: 200 watts forward
2000 watts forward
200 watts reflected
Accuracy: ± 5%
Remote sensor box
3½" backlit meters
Dummy Load: with manual or automatic forced air cooling.
Integral 3KW Balun

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Stow, Ohio 44224
(216) 688-4973

THIS MONTH'S HORIZONS

The Electronic '80s.

There's an old, old expression that goes, "You ain't seen nuthin yet," which, while not in preferred grammar, certainly says what needs to be said about our electronic progress in the past few years. The future will be even harder to keep up with, as manufacturers begin to reap the benefits of the research that is under way right now. There's a phenomenon called a learning curve in industry — the more you produce, the more you learn how to produce, which leads to more production, and so forth. Author Blakeslee is right in the thick of all the action in the electronics industry, and has shared some observations with us. The only problem is, things are happening faster than he can write about them. Better read his article on page 12 before it becomes out of date!

The Novice Experience

Last month, Jeff told about the Amateur Bug and how it finally bit him after years of resistance. This month, he spells out some of the consequences, such as an infection that leads to a ringing in the ears — a ringing called Morse code. Try page 28.

Ham Radio Techniques

Bill's suggestions for the month of October include some ideas about record-keeping, a multi-band dipole, a loop-dipole, a neat balun, and a bit of analysis of the ZL-special antenna from New Zealand. It's easy to take, and also good for you!

Time Warp QSL?

A QSL card with a postmark before the contact was made? You gotta be kiddin'! It has happened, and there *is* an explanation (there always is), which WA2ANU provides on page 38.

DXer's Diary

Some call it luck, but Bob's diary this month shows that it takes a bit more than that. Put on that spare set of headphones over there, and listen in as he runs through some tricks and mental gymnastics to catch one that he still needs a card from. Tune the bandspread dial to page 42.

Liven Up Those QSOs

Are you caught in the tide of QSOs that all sound the same . . . Name, weather, QTH, RST, goodbye? Still writing everything down? Don't give up. You're on the way to improvement, even if you can't see it just now. Here's a chat with a newcomer about this very common problem, and a few tips on how to make those QSOs memorable. You can eavesdrop on page 46.

Using That Surplus Meter

How many times have you been turned off from building that latest project when you saw the price of a new meter? Especially when the meter called for cost as much as all the other parts combined! Well, there's hope for all you new homebrewers. It's a simple trick — known and used by thousands of old-timers, but not often found in today's Amateur literature. Read how easy it is to put that beautiful surplus "bargain" to use, starting on page 49.

Ham Radio Provides Guidance

Hams are noted for their willingness to help other hams, and numerous beginners have praised their friendly mentors for the advice and time so freely given. It is no surprise, then, that a young would-be equestrian, with help from friends and parents, found a ham who was more than happy to provide communications for a very important event. It's a touching and beautiful story, and you can read it on page 52.

The Cover

Satellites, Microprocessors, Integrated Circuits, Digitized Television transmission — these are only samples of what is in store for Amateur Radio in the next few years, and our cover catches the excitement of being part of the Electronic 80s. Original painting by Tom Broscius, WA2RWA.

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More details? Ad Check page 78.

HAM RADIO HORIZONS

October, 1980
Volume 4, Number 10

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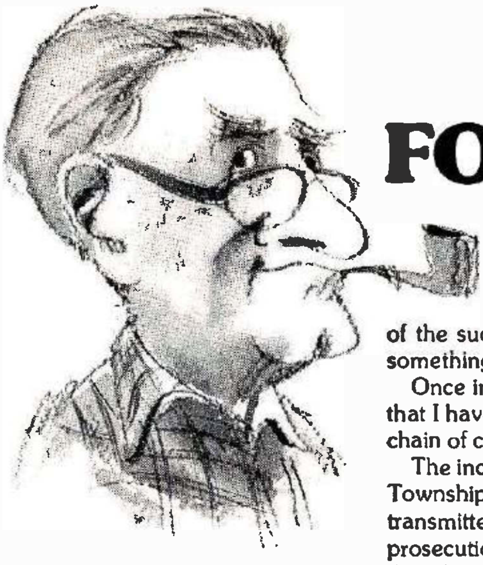

FOCUS & COMMENT

I usually like to keep this page a bit on the upbeat side, pointing out some of the fun things to do in Amateur Radio, or applauding some of the successes scored by our service. Most of the time it's not hard to find something on the brighter side to talk about.

Once in a while, though, something comes along that frosts me to the point that I have to say something about it. The latest incident is but another link in a chain of creeping bureaucracy that will adversely affect our way of life.

The incident that brought all this on is the decision by a court in a New Jersey Township. They have enacted an ordinance prohibiting "interference by radio transmitter." This effectively makes each and every Amateur in town liable for prosecution for causing "electrical, visual, or audible interference," or "annoys, disturbs or endangers the comfort, repose, health, peace, safety, or general well being of others within the Township." Further, the ordinance covers interference with "receiving sets, musical instruments, phonographs, or other machine . . ."

This is all the more disturbing because the FCC had inspected the Amateur's station and had given him a clean bill of health. They further pointed this out to the neighbor who was experiencing interference on his TV, Hi-Fi, electric organ, and intercom sets, (Where, oh where is that "Goldwater Bill"?)

What's more, a Superior Court Judge upheld the ordinance on the grounds that there was only *implied* Federal preemption of control of radio communications, not specific preemption.

If you think about that for a moment, you'll see that it opens a can of worms that is almost indescribable. If this disease spreads, where does one go to obtain a license to enjoy a worldwide hobby? Does this ordinance apply to *all* transmitters, or just to Amateurs? How about the broadcast station that is putting an image smack in the middle of my favorite "DX window" on 160 meters? The transmitter is interfering with my general well-being, so, can I shut it down? How about the police-department radio that tears up my TV picture every time he calls one of the units?

What about the recent sporadic-E propagation that had an Iowa TV station wiping out reception of a local station here in New England? Suppose my neighbor blamed me for it (because of all those highly visible ham antennas), and filed charges. How many thousands of dollars would it cost me to prove to a court of law that I didn't do it? Could I countersue the Iowa station for damages? Or is this ordinance singling out Amateur Radio as the whipping boy?

Now, most of us would back off a bit rather than contribute to hard feelings in the neighborhood; would rather try to work things out and try to eliminate the interference, whether it be the fault of a poorly designed TV, Hi-Fi, or other apparatus, or the fault of mixing, intermod, or even some non-Amateur type of noise. But, how far must we go?

It's about time we became a bit more intolerant of these encroachments on our rights to enjoy our hobby — to use these privileges that we all earned by passing exams.

Does the home-entertainment-equipment manufacturer's rights to make a profit by turning out shoddy material take precedence over your right to operate an Amateur Radio station? Apparently it does.

It's not the Hi-Fi owner's fault. He paid good money for the equipment and feels that he should be able to enjoy using it. It is not your fault that the equipment he bought cannot tell the difference between your signal and that from an FM station or an 8-track cassette. That leaves only one party to blame — the manufacturer who made the equipment.

What to do about it?

For one thing, keep track of these Congressional bills that would force manufacturers to clean up their act. They'll keep popping up from time to time, and will be reported in all Amateur publications, including Newsline in this magazine. When you hear about one, act! Write! Get involved!

For another, *remember*. The next time there's an election of any kind in your town, *remember* who did what to whom, and put your kind of people in office. The next time Amateur Radio is instrumental in helping in time of disaster, or even just helping local officials or organizations with a fund drive, a parade, a marathon, or any of dozens of public-service deeds hams do, *remember*, and don't hesitate to point out the difficulties they would have had if Amateurs could not transmit because of the possibility of causing interference to some $1.98 broadcast set along the way. *Remember* to tell them how much more tax money it would take to provide equivalent commercial communications equipment (which, too, causes interference) plus paid operators.

Above all, *remember* to stiffen your back. Fight back, legally, calmly, and thoroughly. Otherwise we'll all be reduced to collecting stamps (until someone finds a reason to pass an ordinance against that) and watching summer reruns on interference-free (?), low-cost TV sets.

Oh, yes, just in case you'd like to help the poor guy out, the New Jersey ham on the short end of the stick is Randy Bynum, WB2SZK, and donations to a fund can be sent to W3CL, 2087 Parkdale, Glenside, PA 19038. Be sure the notation "Randy Bynum Defense Fund" is on whatever you send.

Tom

Thomas McMullen, W1SL
Editor

EITHER WAY YOU GO...2 OR 6!

GO WITH QUALITY. GO WITH ICOM. GO WITH THE BEST.

The IC-251A is the newest addition to ICOM's all mode transceiver line. Like the matching IC-551, the IC-251A has dual digital VFO's, three memories, scanning (even SSB), and many other features you only get from ICOM.

Both units include the no backlash, no delay light chopper, similar to the IC-701, as a standard feature at no cost. Coupled to the microporcessor, this provides split frequency operation as well as completely variable offsets.

Check the specs, and you'll agree, either way you go, ICOM is simply the best.

SPECIFICATIONS

Listed below are some of the IC-551 specifications. IC-251A's specs are identical except where noted **(in bold)**.

Frequency Coverage: 50~54MHz **(143.8~148.19MHz)**

RF Output Power:
SSB 10W PEP
(1~10W adjustable) **(10W)**
CW 10W
(1~10W adjustable) **(10W)**
AM 4W
(0~4W adjustable) **(—)**
FM* 10
(1~10W adjustable) **(1~10W)**

Sensitivity: SSB/CW/AM
Less than 0.5μV for 10dB S+N/N
FM* More than 30dB
S+N+D/N+D at 1μV

Squelch Sensitivity: SSB/CW/AM
1μV
FM* 0.4μV **(0.4μV)**

Selectivity: SSB/CW/AM
More than ±1.1KHz at -6dB **(1.2)**
Less than ±2.2KHz at -6dB **(2.4)**
(When Pass Band Tuning Unit is installed: less than 1KHz at -6dB)
FM* More than ±7.5KHz at -6dB
Less than ±15KHz at -60dB

Dimensions: 111mm (H) × 241mm (W) × 311mm (D)

Weight: 6.1kg **(5kg)**

Spurious Response Rejection Ratio: More than 60dB

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Please send me: ☐ **IC-551 specifications sheet;** ☐ **IC-251A specifications sheet;** ☐ **List of Authorized ICOM Dealers.**

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All stated specifications are subject to change without notice. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

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by Frank Glass, K6RQ

"The successful repair of any device results in restoring its operation at least to the level it had just before it quit." With this basic concept in mind, author Frank Glass gives you step by step instructions on how to repair all kinds of electronic equipment. Fourteen chapters cover every aspect of repair procedure from component use and failure and how to read schematic diagrams to a most important subject, safety. This book is a must for the amateur new to servicing his own equipment. 85 pages. ©1979.

☐**RQ-OR** **Softbound $7.95**

1980 34th EDITION WORLD RADIO & TV HANDBOOK

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THE ARRL ANTENNA ANTHOLOGY

by the ARRL staff

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☐**AR-AA** **Softbound $4.00**

FM and REPEATERS for THE RADIO AMATEUR

by the ARRL staff

This completely new and updated edition gives you the latest in FM technology and design theory. Highlights include microprocessor control circuitry, and a Phase Lock Loop 2 meter transceiver. This mobile operator's favorite now has more to offer. If you're into FM and repeaters or just want to learn more, we have the book you're looking for. 176 pages. ©1978.

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SHORTWAVE PROPAGATION HANDBOOK

Edited by George Jacobs, W3ASK, and Theodore J. Cohen, N4XX

For many hams, both new and old, radio wave propagation is still a mystery. Realizing this, the authors went about the task of preparing a simplified text that could be understood by hams, swl's and engineers alike. Stress has been given to simplified explanations and charts. The authors also detail a simplified method of do-it-yourself propagation forecasting. To assist your forecasting efforts, the book contains a complete listing of the 12 month smoothed sunspot numbers since 1749. Join those who know how to predict when the bands will open to specific areas of the world. ©1979.

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Each book is full of sample questions that cover just about every aspect of the FCC Amateur exam series. These handy study guides are a must for the soon-to-be or ready-to-upgrade Amateur. Convenient pocket size lets you take your study guide with you everywhere. Softbound.

☐**AR-QA**	Novice ©1979	**$2.00**
☐**AR-TG**	Technician, General ©1979	**$2.50**
☐**AR-AE**	Advanced, Extra ©1979	**$3.00**

RADIO HANDBOOK — 21st Edition

by William I. Orr, W6SAI

This 21st edition includes 1080 easy to read pages on everything from oscillators to antennas. In addition you'll find new and enlarged sections on frequency synthesizers, IC design, HF and VHF linear amplifier construction and NBVM. Radio theory, construction projects, tests and measurements, and reference data — all here, under one cover. W6SAI and more than 20 other notable Amateurs have combined their talents to produce one of the finest and most complete Amateur Radio reference sources in print. 1080 pages. ©1978.

☐**24034** **Hardbound $21.50**

GENERAL CLASS AMATEUR LICENSE STUDY GUIDE

by Phil Anderson, WØXI

This book was written in simple laymen's language with uncomplicated explanations and examples used to present electronic radio concepts and ideas. Throughout each chapter, questions and answers are used to strengthen your understanding of the terms and concepts presented. This book also covers several methods that can be used to improve code reception skills. The final chapter is a sample FCC exam which the author feels he would ask if he were to give the FCC exam. 160 pages. ©1979.

☐**21617** **Softbound $6.50**

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RF-2900

And what you see on the outside is just a small part of what Panasonic gives you inside. There's a double superheterodyne system for sharp reception stability and selectivity as well as image rejection. An input-tuned RF amplifier with a 3-ganged variable tuning capacitor for excellent sensitivity and frequency linearity. Ladder-type ceramic filters to reduce frequency interference. And even an antenna trimmer that changes the front-end capacitance for reception of weak broadcast signals.

To help you control all that sophisticated circuitry, Panasonic's RF-4900 gives you all these sophisticated controls. Like an all-gear-drive tuning control to prevent "backlash." Separate wide/narrow bandwidth selectors for crisp reception even in crowded conditions. Adjustable calibration for easy tuning to exact frequencies. A BFO pitch control. RF-gain control for improved reception in strong signal areas. An ANL switch. Even separate bass and treble controls.

And if all that short wave isn't enough. There's more. Like SSB (single sideband) amateur radio. All 40 CB channels. Ship to shore. Even Morse communications. AC/DC operation. And with Panasonic's 4" full-range speaker, the big sound of AM and FM will really sound big. There's also the Panasonic RF-2900. It has most of the features of the RF-4900, but it costs a lot less.

The Command Series from Panasonic. If you had short wave receivers as good. You wouldn't still be reading. You'd be listening.

*Short wave reception will vary with antenna, weather conditions, operator's geographic location and other factors. An outside antenna may be required for maximum short wave reception.

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NEWSLINE

HURRICANE ALLEN BEGAN 1980's hurricane season with one of the century's most violent tropical storms, strewing death and destruction across the Caribbean. Hardest hit was St. Lucia, where 175 MPH winds flattened much of the island and left many dead and injured. Allen's northwesterly path then took it past the south coast of the Dominican Republic and Haiti and the north edge of Jamaica, all of which suffered extensive damage from the high winds and torrential rains. The Cayman Islands and southwestern Cuba were also hard hit by Allen.

Amateur Radio, Benefiting From extensive experience gained in August, 1979, during Hurricane David, again performed admirably with both emergency and health-and-welfare traffic. As with last year, the Hurricane Watch Net on 14325, very effectively MCed by YLs WA1KKP in Rhode Island and K4RHL in Florida, was a principal contributor to the Amateur Radio Communications effort. Weather reports to and from the National Weather Service's Hurricane Center occupied a great deal of attention, along with high-priority disaster traffic. Newly installed 2-meter equipment at the Hurricane Center provided the weather specialists with such an effective direct input of Amateur-relayed reports that some weather men were reported to be referring to the Amateur Service as their "Communications Department" in media interviews!

THREATS AND INDECENT LANGUAGE over the air have cost a Niagara Falls Amateur $2000 in fines. Conflicts with users of a Buffalo repeater over foul language first escalated into some incidents of window breaking and tire slashing, eventually culminating in over-the-air threats to several repeater operators and their families. At that point the FBI was called in, and on December 5 and 24, 1979, and January 16, 1980, they monitored WB2QHC making such threats over 2 meters. In addition, they heard him using obscene and indecent language on the air on December 19.

After Hearing The FBI's evidence, WB2QHC pleaded guilty on all four counts in Federal District Court. Federal Magistrate Edmund Maxwell then fined him $500, the maximum penalty, on each count.

TWO CALIFORNIA AMATEURS HAVE BEEN CITED by the FCC for jamming the Grizzly Peak Repeater, WB6AAE/R, in late May. One, an Extra class license holder, was caught sending unidentified CW on the repeater input. The other, a YL Novice, was cited for operating on the repeater using a false call.

TWO PHONE BAND EXPANSIONS, and 10 MHz for CW/RTTY only, will be sought from the FCC, ARRL directors voted at their Seattle meeting. Planned are petitions to give General, Advanced, and Extra class licensees 10.1-10.15 MHz for CW and RTTY, with a maximum input of 250 watts. They'll also seek 20-meter phone expansion, with Extras to have 14150 up, Advanced 14175 up, and Generals all above 14225. On 40, a new slot for Extra Class Phone, 7075-7100, will also be suggested.

A SERIES OF OSCAR COMMEMORATIVE postage stamps is being promoted by K6PGX. His plan calls for each OSCAR satellite to be commemorated on a different denomination stamp; OSCAR 1, launched in 1961, being the first "bird" honored. Norm is looking for support from the Amateur Radio community for this idea. He is encouraging anyone interested to write to the postal service, expressing an opinion as to why commemorative stamps picturing one or more of the OSCAR series would be appropriate and significant. Address comments to the Postmaster General, Citizens Stamp Advisory Committee, Washington, D.C. 20036.

NOW THERE'S ANOTHER OSCAR! But it's not an Amateur project and it doesn't carry Amateur Radio. Aviation Week (July 28 issue) reports that GT&E is using the name OSCAR to describe a new military satellite program — Optical Submarine Communications by Aerospace Relay — designed to communicate with submerged submarines from outer space. AMSAT's legal counsel is investigating the issue, but it appears that the name OSCAR is not protected by copyright.

PREEMPTION OF ANTENNA LIMITS by the Federal government, thus barring local communities from zoning or appearance ordinances against Amateur antennas, has been proposed by Personal Communications Foundation President N6AHU in Seattle. Speaking at a SEANARC 80 seminar, Joe suggested that such a preemption could be made part of the Communications Act rewrite and thus relax antenna limits for Amateurs to those of the FAA and FCC.

U.S. AMATEUR POPULATION SWELLED to 385,625 licensees at the end of June, an increase of 1,837 from the start of the month. FCC statistics go on to show that Amateur Radio has experienced twice as much growth (12,583 new licenses issued) in the first six months of this year as it did in all of 1979 (6,119 new licenses). June's increase, in fact, nearly equals the 2,401 licenses issued between April and December of last year!

ADDENDA FOR AMECO STUDY GUIDES, incorporating recent FCC changes in the Novice through Extra class Amateur exams, are being offered free of charge. For information, contact Ham Radio's Bookstore or write Ameco Publishing Corp., 275 Hillside Avenue, Williston Park, Long Island, New York 11596.

The winter is particularly severe. In the northeastern part of the country snow has been piled high since early December. John Ham is toasting his feet in front of his large fireplace while enjoying a succession of contacts. Propped up in his lap is a book-shaped terminal which provides a color TV display and remote control of his ham gear, which is in the attic room where it's been since the late 1970s.

John finishes his 160-meter QSO with ol' Bill, out on the tip of Cape Cod. He punches the keypad on the side of the display to set up the gear upstairs for a QSO with his friend Kam in Singapore. They talk every Saturday evening, using a uhf uplink from John's station to the North American satellite, a cross link to the Pacific satellite, and a similar downlink to Kam at the northern end of the Straits of Malacca. Kam's QTH is the equator, so his weather is always hot, and he can't resist a barb or two about the "snow birds" of New England. He also sends a picture of his newborn daughter, which flashes up on John's flat-screen display.

THE ELEC

80s 80s 80s

Some Thoughts About The Effect of Semiconductor Technology On Ham Radio During The Next Decade

By Douglas Blakeslee, N1RM

TRONIC

Is this 2190? No, just 1990 — ten years from now! Changes in electronics in general, and communications technology in particular, are coming at an ever increasing pace. The future is rushing at us more and more quickly.

SSTV and fm have become popular almost overnight. Transistorized rigs have replaced tube types. Satellite and terrestrial repeaters have opened new opportunities. And, probably most important of all, the microprocessor and other complex integrated circuits have been developed. Ham radio has begun its ascent (or descent, depending on your point of view) into the digital world.

One cannot review the changes of the 70s without wondering about the next decade. What's happening in electronics, and how will it affect our hobby? We'll review the basic changes in technology and attempt some predictions (which are solely the views of the author). No doubt others will have other ideas.

The semiconductor foundation

This century will surely be known as the age of communications. The vacuum tube came along just a few years into the twentieth century, courtesy of Lee DeForest. Two immediate uses were seen for a device that amplified minute electric signals: increasing the distance between two telephones, and improving the efficiency of radio receivers. Later, tubes were also used as radio transmitters.

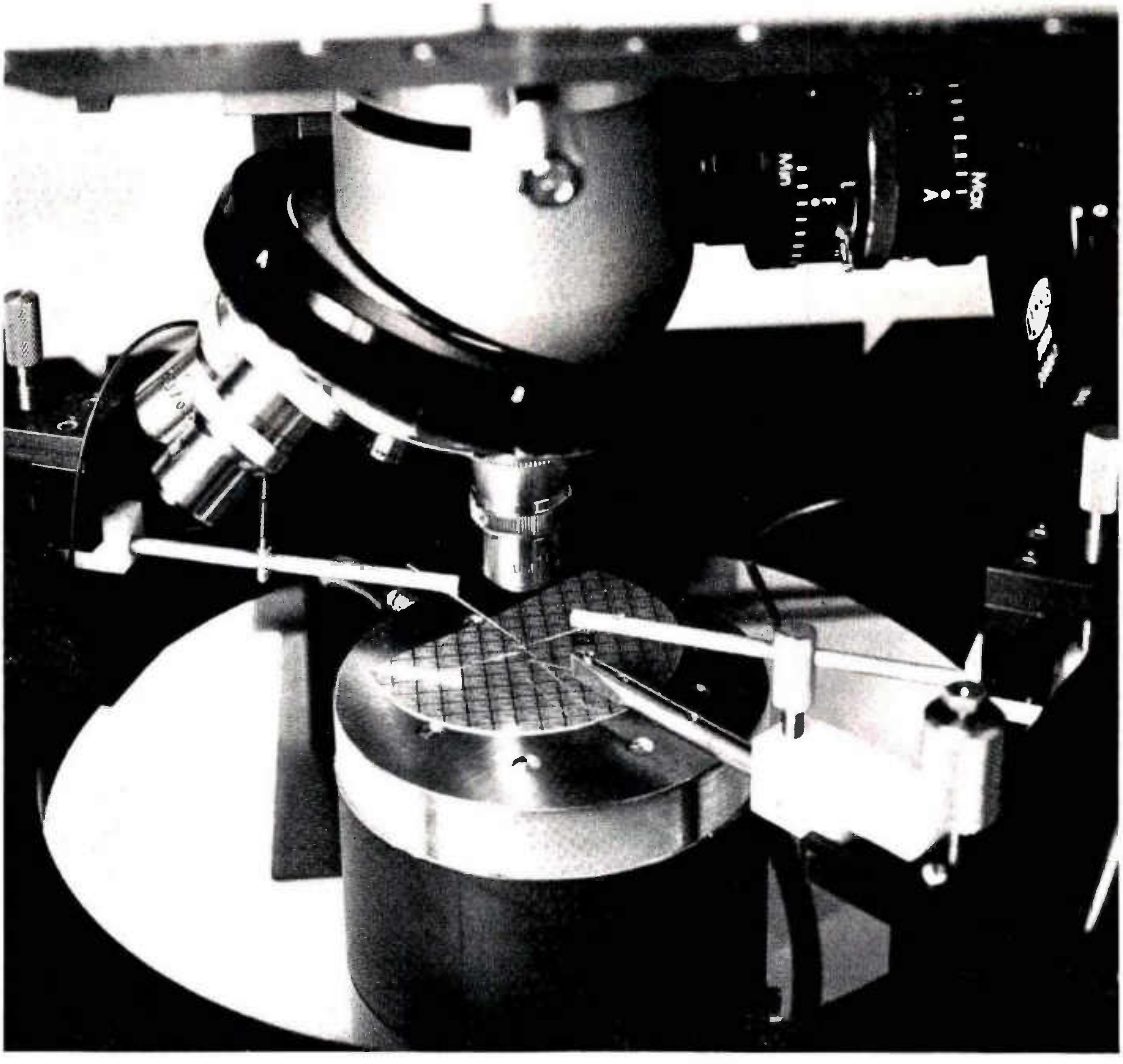
For the first half of the century, electronics development was centered on communications and entertainment devices — telephone, radio, record players, and, finally, television. In the 1940s, two developments occurred which were to revolutionize electronics. They were the invention of the transistor and the development of the computer. The first electronic computers were made with tubes, and they demonstrated all too well the limits of DeForest's invention. Tubes used (mostly wasted) large amounts of power, were physically large — making a device using thousands of tubes something huge — and proved to be rather unreliable (operating times between tube failures were measured in hours).

The transistor changed everything. It wasn't evolutionary — it was revolutionary. Made with a microscopic structure on a chunk of crystal that would fit through the eye of a needle, the transistor used little power and was inherently rugged and reliable. It has replaced the vacuum tube in every application except the generation of rf power above the 1000-watt level. It forms the semiconductor foundation for the electronic 80s.

When the vacuum tube was king, the leading five producers were RCA, Sylvania, General Electric, Raytheon, and Westinghouse. New technology breeds new leaders. Today the big five in semiconductors are Texas Instruments, Motorola, National Semiconductor, Intel, and Fairchild. The transistor changed whole industries. Just fifteen years ago the mechanical calculator was the standard, costing typically $800 with no memory capability. Today, an electronic calculator with memory costs less than $10. Friden, Marchant, Monroe, and Victor were the calculator suppliers. Now Texas Instruments, Hewlett-Packard, Casio, and Sharp are the leaders. Today, the automotive and telephone industries are caught up in similar electronic revolutions.

The first electronic calculators were built with individual transistors; they cost as much as their mechanical cousins. It was the integrated circuit (IC), multiple transistors on a single crystal chip, that produced the amazing reduction in cost while increasing performance. The degree of integration — the number of transistors on a single chip — has progressed from one, twenty years ago, to several hundred only ten years back, (called small- and medium-scale integration; SSI and MSI) to sixty-five-thousand today (large scale integration: LSI). In the 80s we'll see hundreds of thousands on a chip (VLSI — very large scale integration). By 1990, a million transistors will be fabricated in a single integrated circuit.

The first important benefit of integrated circuitry was cost reduction. A high-quality transistor has been reduced to one-hundred-thousandth its former cost over the past twenty years, from $20 for a single unit to 0.0002 cent as a part of an IC. The dramatic cost reduction is half of the calculator story. It tells us how the $10 selling price was achieved.



Semiconductor manufacturers are reducing costs by using larger wafers, allowing more transistors or integrated circuits to be produced in each lot. A few years ago, two-inch diameter wafers containing several hundred individual devices were standard. Today, four-inch wafers with thousands of devices are common. Shown here is a portion of a wafer being tested. Needle probes connect a transistor on the wafer to a test set.

The other part of the story consists of how all those transistors are interconnected. The circuits formed in a single integrated circuit can store numbers and can perform arithmetic operations. In fact, today an IC which has the computational power of the largest computers built using tubes is available for less than $5. These miniature computers have become the building blocks of the electronic future. Most, if not all, electronic systems will have a degree of "intelligence," meaning they will be operated by a computer using a stored program.

The twin factors of very low cost for complex electronic functions and the use of subminiature computers will form the basis for the electronic 80s.

For years, automobile designers avoided electronics, thinking that semiconductors were not reliable enough for the hostile environment in a car.

The revolution has begun

From the 1920s onward, there have been one or two major new consumer electronic products introduced each decade. The radio receiver and phonograph were popularized in the 1920s and 1930s, black and white television in the 40s, stereo receivers and color TV in the 50s, and solid-state radio receivers and transceivers in the 60s. The effect of integrated circuits began in the 1970s with such electronic goodies as calculators, digital watches, video cassette recorders, language translators, intelligent thermostats, and personal computers.

As interesting as the 70s have been, the 80s and beyond hold the promise of spectacular new products and services. Tens, perhaps hundreds, of new items and applications will be found. Some we can see — such as voice recognition and synthesis devices, electronically controlled automobiles, book-size flat-display color TV, electronic movies and mail, rooftop solar-power generators, pocket telephones, and "smart" appliances of all sorts. Some applications are beyond our vision and imagination today. Clearly the rate of product development is accelerating, and the availability of highly complex, low-cost integrated circuits will keep imaginative designers busy for decades to come.

By any measure — dollars, the impact on society, or whatever — the effect of the electronic 80s will be both enormous and profound. Although it is a bit off of our primary subject, a moment's digression to look at some specific applications will show the magnitude of the IC revolution:

Appliances: Every home and work appliance, from blenders to typewriters, from washing machines to copiers, will contain one or more microcomputers. The computer will be used for programmable features and for self-diagnosis. As electronic speech recognition and generation devices develop, our appliances will talk to us and will listen for our replies.

Automobiles: For years, automobile designers avoided electronics, thinking that semiconductors were not reliable enough for the hostile environment in a car. Only the dashboard radio was transistorized. But the twin goals of more miles per gallon and lower pollution can be met only with electronic controls. Once you start with electronics, there is no end to it: engine controls, anti-skid devices, trip computers, digital dashboards, electronic entertainment centers, anti-collision devices, and so on.

Communications: Although the next decade will not see the end of analog communications, the trend to digital is clear.

Because of the error-correcting codes and computer enhancement of digital signals, it will become the dominant mode. Satellite communications is nothing new, but their uses and applications will grow. The first applications of satellite-to-satellite relay — the switchboards of space — will be tried. Another major new field is cellular radio systems in the ultra-high-frequency radio bands. Such systems offer high-capacity mobile-radio communications and the portable, shirt-pocket, cordless telephone.

Electronic mail is on its way. As the cost of postal service increases while electronic facsimile terminals become cheaper and faster, a crossover point will be reached, at least for business users. Then, electronic mail will be a reality on a large scale.

Computers: With microprocessors costing less than $10, the use of the stored-program computer will become universal. Specialized units will run your radio, your household appliances, and your typewriter. Generalized home-computer systems will become more sophisticated, and electronic giants such as Texas Instruments, IBM, and Hewlett-Packard will join the home market.

Energy: The rooftops of America will be festooned with solar panels for hot water and electricity. Not only will the traditional photovoltaic (solar cell) techniques be employed, but new approaches such as that recently patented by Texas Instruments will be discovered as well. Under the roof, a specialized processor will replace the traditional thermostat to use the energy wisely.

This list is by no means inclusive. Equally impressive gains will be made in electronics for education, health care, entertainment, information distribution, and so on. For years, prognosticators have been saying electronics would become pervasive in our society and life styles. In the 80s these predictions will come true, in spades. Electronics will aid in defeating two of the major problems of the 70s: steady rates of productivity, and increasing inflation.

Highly automated manufacturing facilities are already in place. The service area is where major advances in productivity can be made through word processors for secretaries, and automatic test equipment for field repairmen. Electronics is very anti-inflationary. As in our example of the calculator presented earlier, the cost reductions effected can be 100 to 1000 per cent. Advanced electronic products open new export markets to improve the nation's balance-of-trade position. In this country, the displacement of older technologies by electronics has caused disruptions, but, on balance, many more jobs have been created than destroyed. Such is not the case in some European countries which have no semiconductor industries; the effects on their standard of living and, thus, their societies may not be positive.

Radio technology

Among those who search for evidence of intelligent life elsewhere in the universe by listening for evidence of radio activity, there is the theory of the 100 years of radio development. Based on our own experience, scientists theorize that it takes a civilization some 100 years to go from a no-radio technology to full development on the frequencies of interest. In the 80s we are well along the road to full radio development.

Except for minor differences in speech processing, one kilowatt transmitter is just as effective as another. Amateurs are prohibited by regulation from improving their signals by using power levels above two kilowatts PEP. Amateur transmitters above 300 watts typically use tubes. The technology is available to build solid-state amplifiers of one or two kilowatts, but such amplifiers are expensive. In high-power transmitters, techniques are available to improve efficiency beyond that of Class C. However, such "improvements" are most useful in reducing the heat dissipation of a final amplifier. The added power output adds only a fraction of a dB to the received signal at the far end.

Below 100 MHz, it is possible today to build a receiver with sufficient sensitivity so that noise from external sources, not the receiver itself, is the limiting factor. Great strides have been made in improving a receiver's ability to handle very strong signals while still hearing the weak ones. There is more work to do in communications-receiver design. Building a low-noise, low-spurious-frequency synthesizer remains a challenge, as do vhf and wide-dynamic range i-f filters. Still, the current crop of better quality receivers and transceivers often has excellent receivers, more than adequate for most Amateur purposes.

Equipment for the uhf-and-above spectrum is the subject of intense research and development. New transistors using gallium arsenide (GaAs) are available for solid-state transmitters and receivers. Gunn diodes and other modern products of the semiconductor lab are reducing the cost and complexity of millimeter-wavelength gear. For the technically inclined, many of the challenges of the 80s will be found above 1000 MHz.

At the end of the vacuum-tube era, a simple two-tube high-frequency receiver cost approximately $60 for parts. Today, a similar transistorized unit can be built from $15 in components, despite the fact that the value of the dollar has been eroded some fifty per cent by inflation. The low cost of semiconductors has engendered a new cult in Amateur Radio — those who turn off their expensive transceivers in favor of simple, homemade equipment. The ability to solder a few parts together and produce a simple transmitter or accessory has tempted many Amateurs to try their first construction project. It's a healthy trend. As the complexity of integrated circuits continues to increase while costs decline, the items that can be put together in a home workshop are limited more by the imagination of the builder than by the cost of components.

One component which hasn't received much attention in Amateur literature, but which has exciting potential, is the analog microprocessor. This integrated circuit consists of an analog-to-digital (A/D) converter, a digital microprocessor, digital memory, and digital-to-analog converter (D/A). It takes a very large silicon chip to hold all this circuitry. (The unit being developed by National Semiconductor has been nicknamed "Big Bertha.") The microprocessor section must be very fast, for it must execute its stored program in the time that the data converters (A/D and D/A) operate.

Ham radio is an analog world. A device that can take an analog signal, perform intelligent operations and output an analog signal has great potential. For openers, it's ideal as an audio-frequency-spectrum analyzer, signal processor for teletype and slow-scan TV, speech synthesizer, and speech-recognition device.

New frequencies

Surely, one exciting facet of the 80s will be new high-frequency bands. The World Radio Administrative Conference (WARC) of 1979 approved new frequencies at 10, 18, and 25 MHz. The most profound effect will be on DXers. It will be eight-band DXCC rather than five, a staggering requirement for 800 country contacts plus obtaining 800 QSL cards. That's a challenge that will test even the most hearty.

Of course, new equipment and new antennas will be needed. A stack of Yagis covering the 7- to 28-MHz bands will be a Christmas tree, indeed. Multiband antennas are difficult to design. A design for a four- or five-band trap-Yagi array, or even an eight-band dipole, would involve some massive compromises. Some of the equipment manufacturers will undoubtedly offer modification kits to upgrade existing transceivers for the new bands. Those rigs designed with broad-band, solid-state technology will be the easiest to modify. Given the marketing technique of the Japanese manufacturers, which calls for introduction of a new transceiver family every two or three years, we will be led to believe that our existing equipment is obsolete long before all of the new bands are available. For those with a technical bent, converter and transverter designs will abound for the new bands, just as they did for the 160-meter band, before it was included in most new transceiver designs.

The trend in the U.S. has been to regulate classes of subbands as incentive for Amateurs to upgrade their licenses in order to obtain special privileges.

The new bands are not wide, unfortunately. They will not eliminate, or even abate, the overcrowding in the high-frequency bands caused by a world Amateur population that has doubled and doubled again. Just how the new frequencies will be divided up for CW, phone, SSTV, radio teletype, and so on remains to be settled. One can argue that our country should — in at least one of the new bands — not set subbands but try instead the European approach of dividing up frequencies by gentlemen's agreement and convention. The trend in the U.S. has been to subdivide bands into

Digital integrated circuits require complex test equipment. Shown here is a Fairchild Sentry 7 in use at Raytheon Corp. The large desk contains digital driver/detectors for each pin of the IC package. A tester such as this costs $500,000.

subbands as incentive for Amateurs to upgrade their licenses in order to obtain special privileges. With a long-term trend to additional regulation of subbands, a try at deregulation seems appropriate, if only for purposes of comparison.

For those interested in propagation effects, the 10-MHz band will be the most interesting. The 40- and 20- meter bands have vastly different propagation conditions. Thus, a band halfway between the two will be unique.

WARC 79 also established a new uhf band at 900 MHz which could have excellent potential for the uhf/vhf enthusiast and for new repeater channels. It is unclear that this band will be assigned for Amateur use, however. There is sentiment within the Federal Communications Commission to establish a new personal (CB) service in this band. The substantial success of the Amateur Service in protecting existing bands and in obtaining new ones at WARC 79 demonstrates what a determined group with strong leadership can accomplish. A similar effort must be mounted in this country if 900 MHz is to be available for Amateurs.

The various projects attempting to modify the characteristics of the ionosphere temporarily provide Amateurs an opportunity to contribute, through their hobby, information for basic scientific research.

Communication modes

By Goodman (W1DX), the long-time *QST* writer and editor, has pointed out that for a new communications mode to become popular in ham radio, an Amateur must be able to listen to it and to hear with his own ears that it has potential. Goodman and others at *QST* attempted to popularize fm both before and after World War II. Fm could be copied on existing a-m receivers by tuning off the signal (a technique called slope detection). But none of the assets of fm are evident when using slope detection. Thus, fm languished until an FCC decision to reduce channel widths in the commercial mobile services made tons of high-quality fm equipment available at surplus prices. Once Amateurs tried fm on good fm equipment, it was here to stay.

SSB fared much better after World War II. It met the Goodman criteria, because, with some fiddling with the r-f and audio-gain controls plus the BFO, SSB could be copied on then existing communications receivers. At first, many a-mers limited themselves to snide remarks about the funny "duck-talk" stations. But many listened, and heard with their own ears that SSB sounded very good, especially on weak and fading signals. The long trek from a-m to SSB was on. Today, a-m has almost disappeared from the bands below 10 meters.

NBVM (narrow-band voice modulation) has been lauded by *QST* as a revolutionary advance which will potentially double the number of voice channels available in a given band. One must be skeptical about NBVM because it fails to meet the Goodman criterion. Developed for commerical mobile service, the new technique has met little acceptance in its intended application. There, it has been attacked on both technical and practical grounds. So its future is in doubt. There is often a big gap between what is technically feasible and what is practically applicable.

Especially in the years before World War II, schemes abounded for bandwidth reduction or increasing transmission speed. It seemed that every new engineering graduate had a scheme for packing ten pounds of information into a five-pound bag; the schemes didn't work in practice. After the war, Shannon, of Bell Labs, set forth what became known as Information Theory. Shannon's equations showed that really only five-pounds of information would fit in that five-pound transmission bag.

Voice, because of its high-peak, low-average, energy density and its dead spaces between syllables and words, is a candidate for processing and bandwidth reduction. Processing techniques at both audio and radio frequencies have been extensively reviewed in Amateur literature — somewhat out of proportion to the benefits which such techniques provide. A

The effect of all the electronic gadgetry on a voice or other analog signal is to add noise and distortion at each step in the transmission process.

Propagation

Radio conditions will begin on a high, and end rather low, in the 80s, as the current sun-spot cycle enters its declining years. Thus if you want Worked All States or Worked All Continents on 50 MHz, now is the time to get going. The wide frequency assignments of 10- and 15-meters have taken an increasing share of the load caused by the exploding ham population worldwide. As the decade progresses and the ionosphere no longer supports long-distance communications on these bands, active Amateurs will be forced to the overcrowded lower frequencies or to vhf/uhf. It is not a happy prospect. When the decade ends, we'll all be reminiscing about the good old days of 1980 and be looking forward to a new sun-spot high.

Despite the intensive investigations of the last twenty years, the wild, roving ionosphere hasn't yielded all of its secrets. We still don't know what causes long delayed echos in the high-frequency bands, nor can we explain some of the propagation modes found on 50 MHz. For those who choose to pursue it, radio propagation is still a fertile field for research by observation.

number of attempts at bandwidth reduction within the limits of Shannon's theory have been attempted. Kahn's Echoplex of fifteen years ago was demonstrated at the ARRL — it has perhaps been forgotten by the authors today who portray NBVM as revolutionary. It is rather evolutionary in the search for more efficient modes of communications. Unless equipment for this technique can be built at home by those with moderate technical skill, or unless the cost can be reduced to the point where manufacturers see it as a sales aid, NBVM will never satisfy Goodman's requirements.

Shannon's equations showed that really only 5-pounds of information would fit in that 5-pound transmission bag.

The use of machine-to-machine communications in Amateur radio is growing. For radioteletype (RTTY) and slow-scan television (and to an extent, Morse code), both sending and receiving by electronic equipment is employed. RTTY has been limited to the Baudot code by FCC regulation, at speeds below 100 words per minute. The use of ASCII, a code very popular with all types of computers and terminals, has now been authorized. ASCII will simplify Amateur RTTY equipment because most keyboards and display terminals use it. To convert information to Baudot for transmission and then back to ASCII for display increases cost and complexity.

Standards for ASCII transmission were issued recently by FCC. It's hoped that speeds much higher than 110 baud will be allowed after a trial of the new standards. Higher speed will require a penalty in bandwidth, for Shannon's theory shows that the faster you want to send information, the more bandwidth you require. SSTV is transmitted using a narrow-band fm technique. Much of the SSTV enhancement equipment is digital, so digital transmission is attractive.

Digital voice

Some years ago, the changeover began from analog to digital transmission for the world's telephone systems. Inter-city and inter-exchange links are now often implemented with digital transmission, as are some commercial satellite circuits. Eventually, the majority of the world's telecommunications will use digital transmission. Because the sophisticated techniques and low-cost integrated circuits being developed for digital telephone and satellite transmission are applicable for ham radio (assuming approval for the mode by the Federal Communications Commission), a review of what's happening in the telephone world is appropriate.

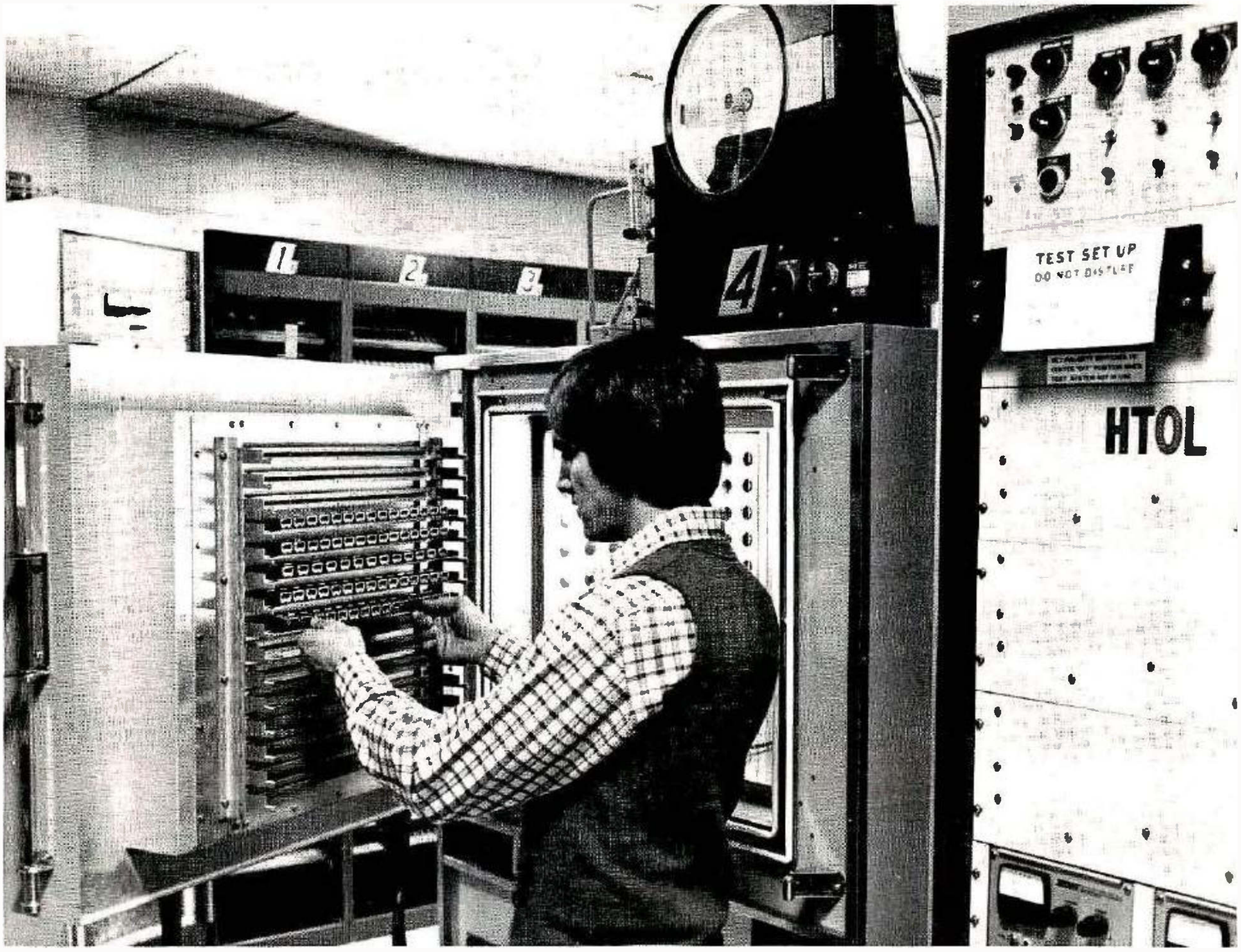
The BIT (a contraction of BInary digiT) is the basic unit of the digital world. It can have two states, on and off, zero and one, or whatever names one might wish to apply. Any number can be represented by a series of zeros and ones, which is called binary notation. A string of zeros and ones is called a word. To confuse matters, words can be of different sizes. Popular lengths are 8, 16 and 32 bits. And, words can be packed into groups for transmission called frames or packets.

By contrast, the world of voice transmission, called analog or linear, involves carrying the voice signal directly without conversion. A voice signal varies in both amplitude (loudness) and frequency (tone). For good intelligibility, frequencies up to 3200 hertz must be transmitted (hertz is the unit of frequency). This limitation does not provide high-fidelity reception at the receiving end. For hi-fi, at least 20,000 hertz would be required. However, increasing the band of frequencies by some seven times would only increase the intelligibility by a few per cent.

Voices are not the only analog signals being passed around the telephone network. Television is an analog signal. Computers employ devices called modems to convert their binary world of zeros and ones into tone signals suitable for transmission via the telephone network, as do facsimile and other image systems.

Transmission cost is directly related to transmission speed. Speed is directly related to bandwidth, the number of hertz per second which can be sent down a given transmission channel. For voice, 3200 hertz of bandwidth is needed. For a television signal, 6,000,000 hertz is required.

Information theory also tells us that there is no unique advantage to analog or digital transmission. That's the theory. In practice, analog transmission has two disadvantages. First, the amount of information in a voice signal is very low. To say it another way, much of the transmission time is wasted with breaks in the speech, pauses, and so on. A digital transmission system can make use of any time available, packing other frames or packets of digital information into any empty spaces. Any long-dis-



Complex integrated circuits such as microprocessors and memory devices must have high reliability. Most manufacturers "burn in" complex devices by operating them at high temperatures with power on for up to 180 hours. Those ICs that are likely to fail do so in the stress of temperature plus power. Integrated circuits that pass the burn-in period can be expected to have a long, trouble-free lifetime.

tance transmission must be amplified (by devices called audio repeaters) at many points in order to be audible at the receiving end. Also, special electronic circuitry is needed to negate the effects of transmission delays and to suppress echos. The effect of all the electronic gadgetry on a voice or other analog signal is to add noise and distortion at each step in the transmission process. Each repeater degrades the signal quality, and the effects are cumulative. A great advantage of digital is that the zeros and ones can be decoded and regenerated at each repeater, the output being a new signal which is a duplicate of the original. Thus, the bad effects of the transmission path are not cumulative for a digital signal.

Of course the human voice can be very distorted and still convey intelligence. Digital information must be received in essentially correct form to be usable. To this end, any number of error-detecting and error-correcting schemes have been devised. They are necessary, but they increase the amount of information that must be sent, which means either wider bandwidth or slower transmission rates. However, the use of computers in a digital "clean-up" process will further enhance the digital transmission mode. We've all seen the moon and planet photographs from NASA space probes. They're usually shown before and after computer enhancement. Those computers have software programs which do a digital "cleansing," rendering photos that are much sharper, with higher contrast. With the microelectronic revolution producing "computers" for under $10, it will soon be possible to have intelligent analysis and regeneration of digital signals.

Some 15 years ago engineers in the Bell system and in the European government-owned telephone

Another way that semiconductor manufacturers bring down costs is by using automatic test and handling equipment. Shown here is a test system built by Lorlin Industries of Danbury, Connecticut, for Texas Instruments, Singapore. The unit tests and sorts dual-gate MOSFETs at the rate of 10,000 per hour.

companies decided that digital was the way of the future on the basis of cost, the desirability of a common network, and the projection that the requirement for nonvoice information transmission would grow to far exceed that of speech. So, standards were established from among the myriad digital transmission techniques. As always, the Americans came up with one standard and the Europeans another.

Both systems, as theory dictates, sample the analog signal at a rate more than twice its bandwidth to get all of the information. The sampling rate is 8000 bits per second. These signal samples are converted into 8-bit digital words. Because 8 bits are used, 256 states can be represented. In the sampling process, a signal is determined to be between two points, not to be an exact value. This technique, called quantization, introduces some noise. The larger the number of bits, the lower the noise. The resulting signal is transmitted one bit at a time in what's called pulse code modulation (PCM).

The U.S. telephone standard is for 24 channels of digital information (24 different telephone conversations) to be transmitted together; the Europeans chose 32. This is done by providing 24 or 32 different time slots for signals from different sources. The U.S. standard results in a transmission rate of 1.544 million bits per second (abbreviated 1.544 Mb/s). Europeans use 2.058 Mb/s.

Starting in the 60s Bell used digital transmission to the 8-bit, 24-channel standard (called T-1 carrier, with multichannel installations named D3 channel banks) to interconnect telephone exchanges within cities. Later, the same technique was used to expand the number of calls on single rural telephone lines and to provide the transmission medium for the latest generation of electronic telephone exchanges (ESS4). Bell cannot afford to change the entire network to digital in a matter of years. In fact, we'll be into the next century before Ma's world is all digital.

The conversion of an analog signal to PCM digital and then back again is no small task. It takes the complexity of a small computer. Already, eight semiconductor manufacturers have built PCM CODECs (for COder/DECoder) in a single integrated circuit. What takes several large boards full of equipment in older channel units is now available in a single circuit the size of a thumbnail. It is advances such as these in semiconductor technology that will bring digital voice to Amateur Radio.

The technology exists today for linking repeaters and satellites. But, links carrying one conversation at a time are hardly exciting.

However, if each link could carry 24 or 32 channels, and if transmission could be digital so that all Amateur modes could be utilized, then some exciting possibilities are apparent.

Repeaters

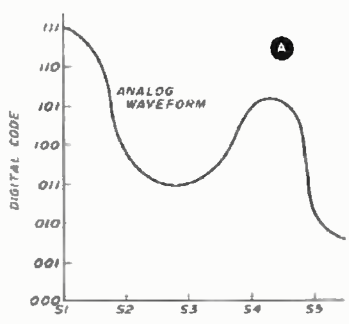
Terrestrial repeaters in the 144-, 220-, and 420-MHz bands provide coverage of much of the nation. Hams who don't have an fm rig in the car or a miniature portable in a back pocket will soon be in the minority. The rapid growth of fm and repeaters in the late 60s and the 70s has made the fm rig as common as the SSB transceiver. Semiconductor technology has produced integrated circuits with an entire fm i-f strip, detector and audio amplifier in a single chip. Another IC can generate thousands of transmit and receive frequencies from a single crystal, making synthesized transceivers available at popular prices. Actually, if you factor in the effects of inflation and the devalued dollar, today's synthesized units are actually less expensive in constant dollars than their six-channel predecessors.

The trend in repeater design has long been to put the best equipment on the highest point that can be found. The techniques employed are those developed for commercial services, although some advanced Amateurs have "jazzed" things up with microprocessors, teletype under voice, and TV. While the desire for a repeater with coverage that goes on forever is fine for the open spaces of our country, major metropolitan areas suffer. The situation in Los Angeles is probably the most chaotic, with as many as 800 users for each 2-meter channel. Clearly, the spectrum usage is not efficient if each repeater covers wide areas where the ham population is very dense. The commercial mobile-radio services, which use 30 to 50, 150 to 172 and 450 to 512 MHz have the same problems. The growth of mobile-radio use has been limited because of the few channels available and the demands of various services. Because much of Amateur repeater practice has stemmed from techniques developed for commercial services, it is instructive to review where they are headed.

Several years ago, a new band of frequencies around 900 MHz was designated for business use

Table 1. Transmission times and contents for various modes. The fastest transmission rate possible on a voice channel is 9600 bits/second. A typical high speed digital channel is 256,000 bits/second.

		Approximate Transmission Time (Seconds)	
	Number of Bits	**9600 b/s**	**256,000 b/s**
One page of text (uncompressed)	10,000-40,000	1-4	0.04-0.16
Facsimile image (compressed)	200,000-600,000	20-60	0.8-2.4
One page, 3 color image (compressed)	2,000,000-10,000,000	200-1000	8-40
Contents of a computer floppy disk	5,000,000	500	20
Contents of a computer tape	1,000,000,000	100,000 (29 hours)	4000
One second of digital speech (PCM) code	64,000	7	0.25
One second of digital speech (compressed)	2,400	0.25	0.01
One second of video image (Picturephone)	6,300,000	660	25



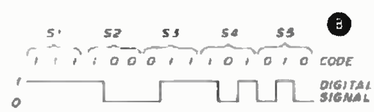


Fig. 1. Creating a digital signal from an analog waveform involves taking samples at preset intervals. These data are converted to a digital code (our example at A uses three bits) and the code is transmitted in serial form (B).

— with the potential for more channels than in the three existing bands combined. A large section of the new band is assigned for mobile-telephone service.

Traditionally, in vhf commercial mobile radio, one station talks to another by direct transmission. To cover long distances, robot repeater stations are used to retransmit signals. To expand commercial mobile-telephone service sufficiently so a wide section of the population could use portable or mobile telephones, a cellular system has been proposed. Sets of frequencies would be used in each cell, which would cover a geographically small area. The same sets of frequencies could be reused in every third or fourth cell. As a person moves from one cell to the next, his radiotelephone changes channels automatically with no interruption of the conversation. Of course, powerful computers are needed to manage a cellular radio system, which will be the most complex radio project ever undertaken.

Bell considers commercial cellular radio an extension of the phone system, and has proposed a nationwide network of systems. Equipment would be largely supplied by Western Electric. Motorola, which supplies equipment for some seventy per cent of the existing commercial radio market, reacted with cries of pain and anguish, not wanting to see the largest potential market for radio equipment become the exclusive property of A.T.&T. Motorola wants Bell to stick to phones and to stay out of the radio business. The debate has raged for years before the Federal Communications Commission. The stakes are so large that it may be additional years before some compromise is reached and cellular radio becomes a reality.

FCC has allowed Bell and Motorola to each build a demonstration cell system. The techniques and equipment for 900 MHz need more than a little work. The engineers of both companies are hard at work perfecting things. Motorola has been showing a shirt-pocket-sized cordless telephone that is actually a radio transceiver for a cellular radio system.

Amateurs will surely follow the commercial lead to cellular radio. When and how is an open question. The equipment and techniques could be applied quickly if Amateurs have a 900 MHz band. That's why the FCC sentiment to assign these frequencies to a Citizens-Band type of service rather than Amateurs portends a battle by hams for the frequencies. The 420- and 1296-MHz bands are potential candidates for cellular systems. Of course, the FCC is not the only obstacle to Amateur cellular repeaters. Today, repeater groups often regard each other with everything from quiet distrust to open hostility. Getting a majority of Amateurs together in Los Angeles to implement a cellular system would take leadership and organization that doesn't exist today. The problems are human, not technological.

Satellite repeaters also hold tremendous potential. The first Amateur satellite, OSCAR 1, was a product of the effort of a few dedicated individuals. It was a triumph more of rocketry and of what a ham can do in his home workshop than of technology. None who listened to the happy "HI" in Morse code from OSCAR 1 would dispute that something very important had happened.

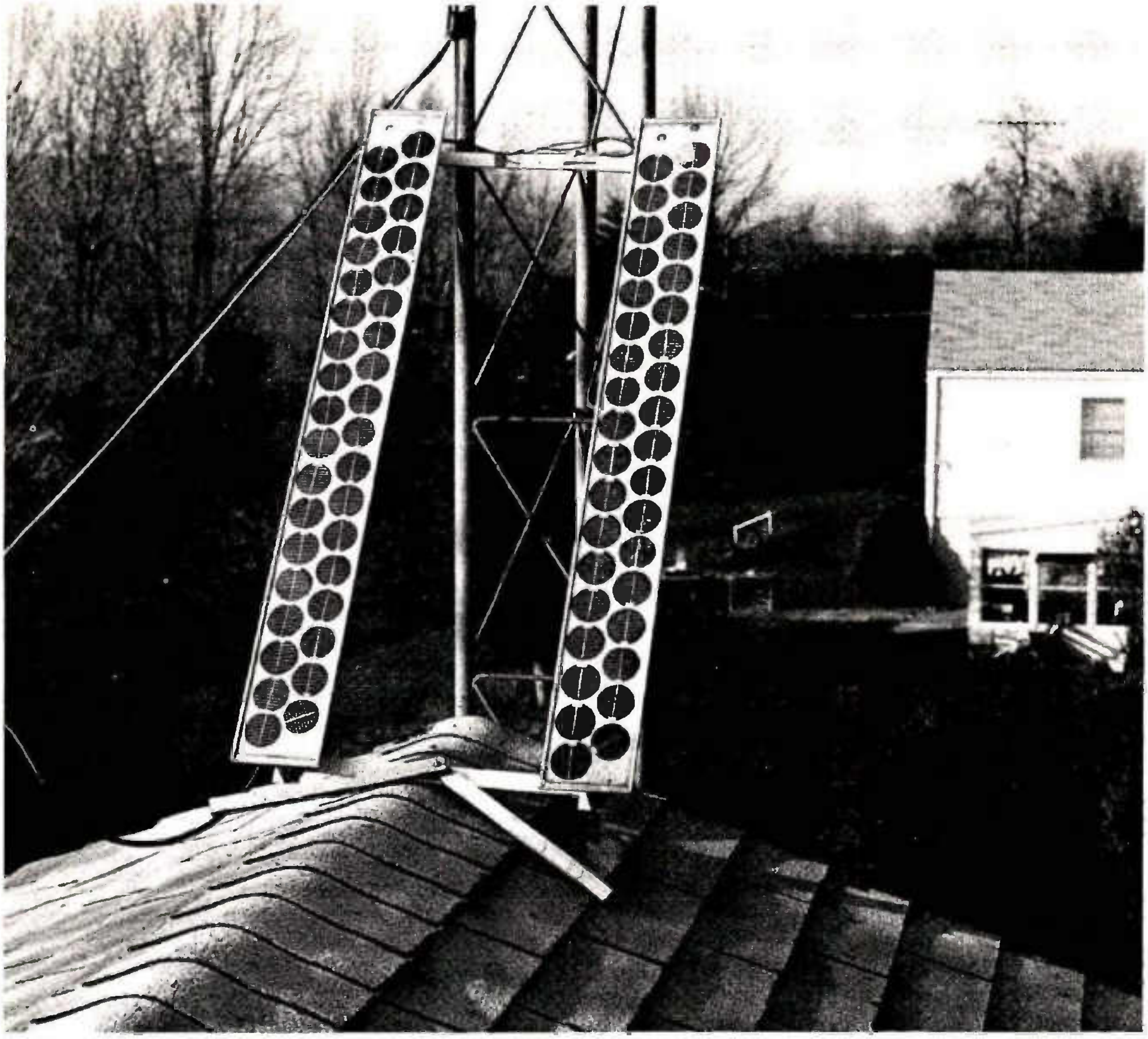
A major satellite program is beyond most of the nations of the world. Amateurs have banded together under the umbrella of AMSAT to build a series of ever increasingly complex broad-band repeaters in space. To date, the satellites have been in low orbits, sweeping continuously around the planet. Thus, most of the time is spent waiting for an OSCAR to come around.

The high-orbit AMSAT bird was to have been called Amateur-Oscar 9 (AO9) after launch. AO9 was destroyed when its launch vehicle failed, dropping the Amateur satellite and several other projects into the Atlantic Ocean.

In commercial service, communications satellites are stationed some 22,500 miles up, and on a point over the equator. In this "parking" orbit, the satellite moves at the same rotational speed as the Earth. Such positioning is called geosynchronous. From a "parking" orbit, one satellite can provide continuous coverage of approximately four-tenths of the planet. Hughes built the first geosynchronous commercial unit, Syncom 2. There are now 72 geosynchronous satellites in orbit, of which some 50 were launched by the U.S. for communications use.

Commercial communications satellites use the same frequencies as terrestrial microwave networks. Some 83 per cent of A.T.&T.'s long-haul circuits employ the "C"

Cheap intelligence in integrated circuits will be the basis of the electronics revolution in the 1980s.



These solar panels are used by the author to power his ham station.

microwave band, which uses frequencies from 4 to 6 gigahertz (GHz), for all of the geosynchronous satellites in use today, so there is already a shortage of frequencies developing.

The first commercial relay satellites worked with only one signal at a time. Today the standard satellite for international relay, Intelsat 4A, has 20 individual repeaters which can handle some 6000 telephone circuits. It also employs a beaming technique that uses the same frequencies in separate beams headed east and west. Although none have yet been built, multibeam satellites with as many as 400 beams have been proposed — a given channel could be used in up to 25 beams. Also proposed is a satellite using multiple beams with a number of beams concentrated on areas of high population while only a few beams cover rural areas. On-board switching networks would select the optimum up- and down-link beams for given channels. Another approach is to use moving (scanning) beams. One proposal is for a beam that could scan the entire United States in one-hundredth of a second.

On-board switching has tremendous potential for increasing the flexibility and use of satellites. With even modest switching capability, direct links between satellites are possible. With inter-satellite links, a message to a point outside a satellite's coverage area can be switched directly to a second satellite, saving one up-link and one down-link channel.

Another partial solution to the channel-shortage problem is to use higher frequency satellites. Frequencies in the 11 to 14 and 19 to 29 GHz bands are planned for commercial satellite usage within a year. They provide eight times the channel space available in C band. These higher frequency bands are shared partly, or not at all, with terrestrial communications. They have the advantage of smaller antennas but more complex transmitters and receivers are required. Moisture in the atmosphere plays havoc with these very short radio waves, but such problems can be overcome by a combination of high power transmitters, alternative links, frequency changes, and special signal coding techniques.

WARC 79 approved microwave frequency allocations for Amateur satellite use. AMSAT has proven that Amateurs from around the world can combine to produce advanced satellite systems. A project is now under way to replace AO9. If you want to be a part of the effort, write AMSAT, P.O. Box 27, Washington, DC 20044.

Recently, SRI International executed a huge computer program which modeled the world's economy for the decade of the 80s, and came up with a gloomy prediction: the best laid plans of companies and individuals might well end up way below expectations because of a shortage of energy and the persistent inflation caused by energy problems. One energy alternative which has special application in the radio field is solar power.

The solar cell (more properly called a photovoltaic cell) is a thin slice of pure silicon 1½ to 4 inches in diameter. After processing, the cell produces direct current when exposed to sunlight. Arrays of solar cells generate enough power to run things such as telephone exchanges, for example. If you want more juice you add more cells.

Solar power is a renewable resource that's nonpolluting and requires no maintenance. Its primary problem is initial cost. Solar cells today cost $10 per watt of energy produced. To be competitive with energy from fossil fuels, the cost must come down to 70 cents a watt. Congress has approved spending over one billion dollars to develop solar energy. The Energy Department forecasts a cost of 50 cents per watt by 1985. This is probably too optimistic; you cannot advance technology simply by spending money. (More than half of the people involved in solar power in this country are government employees supervising the spending of all that money.)

In addition to the cells themselves, to make a complete solar-power system you need a storage device (a battery) and a device to convert direct current to the alternating current used by most equipment (an inverter). Most ham equipment works on 12 volts so no inverter is needed to use solar power. Also, energy from the sun provides an ideal emergency capability for a radio set. No worries if commercial power fails. Some fm repeaters in remote sites are already solar powered. As the cost of sun-powered generators comes down, Amateurs will be among the first to embrace this new technology.

AMSAT has proven that Amateurs from around the world can combine to produce advanced satellite systems.

Solar cells are not the only way to generate electrical power from sunlight. Jack Kilby of Texas Instruments, one of the inventors of the integrated circuit, thinks he has a better idea. So does his employer, who is backing him with a multimillion dollar development program. Solar cells are expensive because pure silicon wafers are expensive. Silicon, the primary ingredient in sand, is one of the most abundant substances on earth. But making sand into pure silicon tubes is a slow, expensive process. Then slicing it up into wafers wastes half the material.

Kilby's approach uses small droplets of silicon rather than flat wafers — much less expensive to manufacture. The electricity produced by these small cells liberates hydrogen, so the resulting energy can be stored in a tank — which is much less expensive than batteries. A fuel cell can produce alternating current from the hydrogen. Fuel-cell generators were used to produce electricity aboard the spaceships that went to the moon. Once developed, a $10,000 Kilby system could produce 20,000 watts of power, more than enough to run a large home, ham shack included. In fact, left over power could be sold to the local electric utility. Unfortunately it will be the end of the decade before we'll be able to purchase a Kilby system at the hardware store.

In conclusion

Jerry Sanders, the irrepressible chairman of AMD (a West Coast manufacturer of ICs) has called integrated circuits the crude oil of electronics. His analogy has received a lot of attention in the industry press. Just as cheap energy was the driving force behind the industrial revolution, cheap intelligence in integrated circuits will be the basis of the electronics revolution in the 1980s. Many of those new ICs are going to be in ham applications. The next decade will surely be an exciting time to be an Amateur. Our own imaginations will be the limiting factor on what can be done with our hobby.

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HRH

Samuel Morse's Revenge on Humanity

The Novice Experience

BY

JEFFREY DICK

If the Deity had meant for us to understand Morse code, I recall thinking, we'd all have been born with a code oscillator in our navel.

It seems so easy, now that the dih-dahs have meaning, but for a while it was enough to drive one to the funny farm.

I've been fortunate in preparing for my Novice exam to have done so in a class of ten or twelve others, where I could gauge my progress by the agonies of others. There were originally eighteen or so in the class, but the numbers diminished as some met failure in dealing with the code. Our instructor, Herb, N4UE, said it was simply a matter of time — time spent listening to the code — before we'd get the hang of it.

Within the class we had the usual range — the guys who'd write down the dits and dashes as they heard them and never seemed to link them to letters; the guys who'd struggle along with a fogged and vacant stare; and a couple of guys who picked up the code as though it were their native tongue.

It struck me, picking through a variety of ham radio magazines, that there is in this country a whole sub-culture, an entire economy, which survives on the Morse initiation-rite of our fraternity. You can buy books, tapes, records, random-code-generating keyers, readers, faster tapes, faster records, flash cards (never have understood that one, Jack), and a host of other fool-proof systems to help you learn what old Sam Morse had in mind.

What finally worked for me were the ARRL tapes. Listening for twenty-minute periods squeezed in throughout the day — driving to work, at lunch, before going home, after dinner, first with 5-wpm tapes and then throwing in a 7½ job for the last five minutes, then repeating with 7½ and 10 and, finally, 13 wpm. The technique was to spend fifteen minutes listening to the fastest speed thus far mastered, and five minutes at the next increment upward. Goal setting helps, too. Seeing, for example, if you can sustain five minutes of continuous copy at your latest attained speed.

Undoubtedly, the most frustrating aspects were the lapses which would appear and disappear until it all jelled: combinations of dits and dahs I knew yesterday elude me today, are gone tomorrow, and reappear at the next step up in speed.

It doesn't help, either, when your six-year-old, who can't quite read yet, copies six letters in a row and tells you so, pointing out in the process an error on your own pad. Nevertheless, time proved to be the answer, along with a generous supply of batteries for the tape recorder.

In the beginning I recall wondering how, in using random-generation code tapes, I'd ever know for sure if I had gotten the code practice correct. It's amazing how you just know; there's no need for a corrected text. It simply makes sense at some point and you regard it as one of the sweet mysteries of life, filed away with remembered sunsets and knowing when to duck your head.

The Novice classes were interesting enough, and we found Herb to be extremely patient. It was pretty evident the class would rather talk about actually operating than about X_L, X_C, and the magical properties which make them do funny things with electrons. Despite it all, Herb would work his way through the syllabus each Monday night — it rained on ten of thirteen class nights, and made me think I was in Seattle rather than Raleigh. The standing joke became "It must be Monday because it's raining."

After passing the code test, it was time to mail the 610s off to Gettysburg and wait. The tests arrived in two weeks, and five of us sat down to pencil in the blanks beginning with question 81.

In a sense, I guess the test was anticlimactic. It wasn't as difficult as I'd imagined. My first thought was that I'd missed an awful lot of years on Amateur Radio because I'd let the prospect of taking an exam on electronics intimidate me.

What really surprised me, though, was how few questions on the Novice exam dealt with theory and how many dealt with regulations, even though Herb told us to expect precisely that situation.

I was even pleasantly surprised at how the government had managed to come up with an exam which made sense. My previous exposure to government communications having been an annual bout with Form 1040, and two years as a U.S. Treasury agent, where memos and reports were not allowed to go out until they were in proper government lingo and thus incomprehensible, the questions on the exam seemed extremely fair. There were only two "sneakies" on the whole exam, meant to snag the unwary who might answer impulsively. All in all, though, the exam was quite reasonable.

Now it's time to wait for the postman; it's time to wait and see what scrambled combination of the alphabet and numeric system will be mine and mine alone, granted me by the FCC and the magic of COBOL. Dumb thoughts, now, like: what's the probability of getting a call, the last three letters of which are identical or consecutive.

As the Hemingways of the world might put it, it is a time of waiting, now, and little else. Your fate, for whatever consolation it is worth, is in the hands of the federal government. The slowly grinding wheels of state must turn one revolution and crank out a call sign.

For those of you waiting for your call, I'll save you some speculation as to why it takes so long for your license or upgrade to arrive, but I'll warn you in advance that by reading what follows, you'll deprive yourself of a lot of great daydreams and wild images as to what could possibly take the FCC so long to send you your call.

I'll answer the big question first: according to the FCC, it takes anywhere from four to six weeks from the date the completed exam is received in Gettysburg for your license to be processed and mailed.

Having said that, I can tell you exactly how many steps it is to my curbside mailbox, how many rivets are in the base of the mailbox, will agree that the box probably needs repainting, and that even asking the postman to check the bottom of his mailbag in case the license somehow got trapped there does little to speed the process.

In the period you are waiting for your ticket to arrive, you can:

— play enough Scrabble to memorize the backs of the tiles and give you an easy 100-point advantage over any opponent other than another would-be Amateur waiting for his ticket.

— measure, re-measure, cut and erect dipoles to every tree on your lot.

— attend at least a half dozen hamfests and swapfests and pick up some great ideas for a few more antennas.

— listen to the CW stations on the Novice bands, and hear every single state in the Union coming in 599, knowing full well you may never again hear some of those states for the rest of your natural life once the ticket arrives.

— make up a clever phrase for every three letter alphabetic permutation and combination from AAA to ZZZ, that is, Youthful Green Zebra, Rapidly Approaching Quasar, etc.

— tune up into the Extra-class phone bands on 20 meters and hear them talking nasty to each other as they battle in a pileup (on second thought, you might want to save that one for something to do when you've shipped your rig off to the factory for repair, since pileups occur nightly, are constantly and infinitely variable and, thus, can go on for months).

In truth, your license will arrive when the postman brings it; no sooner, no later.

Sarah Rogers knows.

Her job (she's one of several) is to answer the telephone inquiries that come into the Amateur Section of the FCC's offices at Gettysburg, Pennsylvania. The most frequent inquiry, she confides, is, "Where's my ticket?" The next most frequent question is, "Did I pass my exam?" The latter is a poor second, Ms. Rogers says, because most candidates know pretty well whether they have passed the exam before they answer the last question.

Here's a neat tip for you: The FCC notifies unsuccessful examinees a couple of weeks earlier in the time cycle than those who have passed the exam, who usually find out when their license arrives. So, no news is good news. Tip number 2: enclose a stamped, self-addressed post card with your exam, and on the day your exam is graded the FCC will mail back a notification you have passed.

You might be interested in the volume of work which befalls the Amateur Section in a given month. It is substantial.

In the month of June, 1980, for example, they received and/or processed the following:

— requests for a Novice exam (Form 610)	1,605
— resubmits (improperly filled out 610s)	177
— new Races applications	4
— Races modifications	4
— other exam requests (which should have gone to a field office)	76
— all other resubmissions	957
— Novice exams graded	2,573
— field office exams — new applications	416
— field office upgrades	5,346
— renewals	4,052
— advanced modifications only (2 × 2 calls, etc.)	187
— new club, military recreational or secondary call requests (even though the FCC no longer issues such calls and hasn't since March, 1978)	6
— requests for duplicates, changes of address	110
— Canadian 410s (notification of US operation)	13
— 610-A — alien operation requests	175

Not bad for a month's work, gang.

Back to the immediate subject at hand, the Novice ticket and what it takes to get it to your door.

First, the folks at the FCC do take notice of your anxiety. New licensees are given priority over all other business. Your completed exams, for example, take priority over modifications, etc. When the exam arrives, it is placed with all others received that day, and assigned a receipt date. The processing then proceeds by date, and the priority is strictly observed. If, for example, your exam was not properly filled out and had to be sent back, they will still keep the initial receipt date if it is corrected and returned promptly. Upon receipt, your completed exam is matched with the 610 on file in the office. If all is in order, the exam is graded manually (an individual rather than a machine reviews the exam paper). Unsuccessful candidates are picked out for separate notification. Passed exams are then sorted by call area, and sent to the Call Sign desk. Here, they affix a label with your new call sign.

Then your new call is logged onto a data-entry sheet and, from the sheet, cranked into one of the government's computers. It takes about a week for your call to go from the Call Sign desk to the computer, and another week for the computer to spit it back out. Licenses are printed by computer, but only on Tuesdays and Fridays (no, contrary to popular belief, Monday, Wednesday, and Thursday are not federal holidays — the computer just has other things to do, too). Then the licenses go back to Gettysburg for a final check to make sure everything was entered right and printed out right (garbage in, garbage out, remember) and then trusted to the divine protection of the U.S. Postal Service.

The whole thing is supposed to take about thirty days. Currently, it's running about five to six weeks.

The FCC suggests you not call them before eight weeks if you haven't received your license.

If you have waited eight weeks and do decide to call, you may be lucky enough to talk to Sarah Rogers. She is very helpful and, after working for the Amateur Section for a while, has decided to take classes this fall and apply for a ham license of her own.

More next time: Getting Operational — Some Interesting Maxims.

HRH

Ham Radio Techniques

BY BILL ORR, W6SAI

Indian summer is almost upon us but there are still a few good days left to do antenna work before the colder months swoop in on a blast of chilly air from the arctic. And, plenty of interest in antennas exists! In fact, antenna work is just about the only field left to the experimenter who is reluctant about tearing into his factory-built, solid-state transceiver, or doesn't have the time, money, or test equipment to build some of the newer, exotic circuits.

Most antenna experiments can be conducted with the aid of an inexpensive SWR meter and a notebook to keep track of the various tests and experiments. Most hams have the SWR meter, but relatively few keep track of their experiments in a permanent record.

Do as I do; buy yourself a large, bound notebook, and record all antenna data and experiments in it. Even if you have purchased an antenna with pre-set dimensions, it is wise to save the assembly instructions and to keep a permanent record of all important antenna dimensions and electrical measurements. By keeping this simple record, it is always possible to check back to the original data after an antenna modification, or if you suspect that something is wrong with antenna performance.

My notebook contains SWR curves, dimensions, and observations of all antennas erected in the past few years. In some cases, a Polaroid photograph of the antenna is taped to a notebook page. In addition, interesting antenna articles from magazines are photocopied and pasted into the notebook.

An historical record book such as this provides an expanding reference and history of performance of your various antenna systems. Believe me, it is mighty comforting to run an SWR curve of an antenna after a heavy storm and compare it with a curve run weeks before! The experimenter's notebook is the cheapest item of "test equipment" you can own, and one of the most valuable!

A Coaxial multiband dipole

Shown in *Radio Communication*, the interesting publication of the Radio Society of Great Britain[1] is a design for a multiband dipole capable of operation on 40, 20, and 15 meters (**Fig. 1**). The antenna was designed by Vincent Lear, G3TKN (England) and patterned after the original multiband dipole design of W4JRW, patented about 1950. W4JRW's design used "decoupling stubs" formed from tubular 300-ohm TV-line, with the stub forming part of the dipole element on the lower frequency band. The original antenna functioned on the 10 and 15 meter bands.

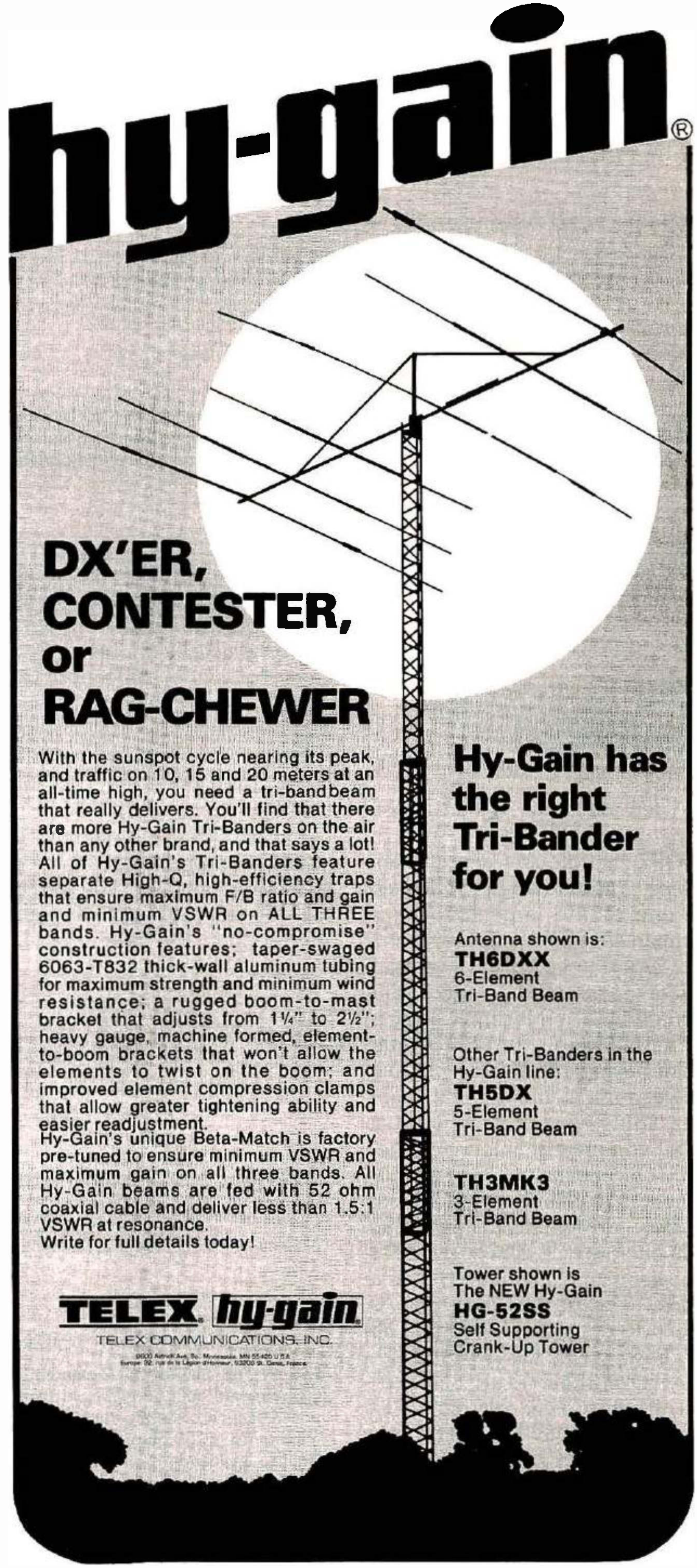
The G3TKN version of the antenna is suitable for three-band operation, and uses coaxial cable to form the stubs, as shown in the illustration. Vincent used uhf-type TV coaxial cable, but possibly any type of cable (such as RG-58/U) could be used. It is important that the ends of the stub sections be suitably sealed to prevent moisture from entering the cable; "bathtub caulk" will do the job.

G3TKN suggests that if the velocity factor of the cable is not accurately known, it should be measured with a dip oscillator or noise bridge. The dimensions shown are for RG-58/U, which has a velocity factor of 0.66.

The coaxial section acts in the same manner as the conventional antenna trap. The center section of the antenna functions as a half-wave dipole on 20 meters. On 40 meters, the coaxial stubs present an inductive reactance that — together with the tip sections — resonate the system on that band. The whole antenna functions on its third harmonic for 15-meter operation. SWR values of 1.4-to-1, or less, are obtainable on all three bands.

Because of the additional weight of the coaxial sections, G3TKN suggests that the antenna be mounted as an inverted V with center support, and with the ends tied off taut to reduce sagging.

The tip sections may be adjusted to provide antenna resonance at any point in the 40-



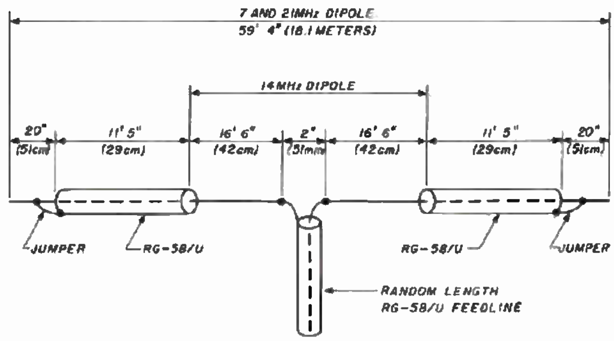


Fig. 1. The G3TKN dipole for 40, 20, and 15 meters as adapted for RG-58/U coaxial cable. Ends of cable should be suitably sealed to prevent moisture from entering cable. White, "bathtub" caulking will suffice. A 2-inch insulator is used at the center of the antenna.

meter band: adjust for the lowest SWR at your favorite operating frequency.

The ZL-special Revisited

A few days ago, I had a visit from my old friend Bill Hillard, K6OPZ. He brought along a laboratory report recently released by one of the large aerospace companies in Southern California. The report covered an investigation of the so-called ZL-special antenna (**Fig. 2**). This simple array is a two-element, unidirectional beam having 135-degree phasing between the elements. The beam was adjusted and tested on a large, commercial antenna range, and some definitive data was obtained that dispels some of the mystery surrounding the antenna.

In brief, the ZL-special provides a power gain of about 4 dB over a dipole. The front-to-back ratio is about 36 dB, with a deep null off the back of the beam. Front-to-side ratio is about 50 dB.

Thus, the power gain of the ZL-special seems to be a little less than a two-element Yagi of equivalent size, but it has superior rejection of unwanted signals from the side and back. The deep null directly off the back, shown in theory, is usually unobtainable because of signal reflection from nearby metallic objects or buildings.

The proper phasing is achieved by a cross-connected, 300-ohm twin-lead transmission line connected between the antenna elements, in conjuction with proper element spacing and the fact that the forward element is slightly shorter than the rear one. Unwanted reactance at the feedpoint is greatly reduced by decreasing the length of the element, and the correct 135-degree phase relationship is achieved at an element spacing of only 0.1 wavelength.

Feedpoint impedance is 100 ohms, balanced to ground. This suggests the use of a balun transformer to match the antenna to a 50-ohm unbalanced transmission line.

The dimensions and data given at 14 MHz apply to elements having an outside diameter of 1/2-inch. A practical antenna would require a support structure to keep the small-diameter elements from sagging.

An impedance-matching balun

A linear 2-to-1 balun transformer suitable for use with the ZL-special (or any other array having a 100-ohm feedpoint) is shown in **Fig. 3**. Dimensions given are for 20 meters, but may be proportioned for other bands. The driven

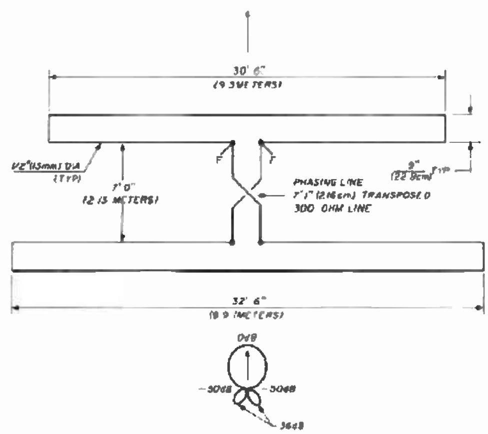


Fig. 2. Top view of the 2-element ZL-special beam antenna for 14 MHz. Antenna elements are built of 1/2-inch diameter tubing, and the phasing section is a transposed section of heavy-duty "TV-type" 300 ohm line. Antenna is fed at **F-F**. Feed impedance is 100 ohms. The polar plot of antenna is shown below, illustrating good front-to-back and front-to-side ratios. Antenna gain is about 4 dB over a dipole.

element of the antenna is tapped on the balun tubes as shown, and the termination covers the range of 8 ohms (near the input end) to 800 ohms (at the output end). The impedance transformation is logarithmic from the 50-ohm point to the open end. Overall length of the balun is about 30 inches.

The balun (balance-to-unbalance) transformer may be used to match a 50-ohm coaxial line to any balanced antenna having a feedpoint termination between 8 ohms and 800 ohms. The balun is constructed of 3/8-inch diameter brass or copper tubing. The 50-ohm coaxial line is introduced into one balun tube and is cross-connected to the opposite tube at the 50-ohm point. Balun resonance is established by means of a capacitor which may be moved up and down the balun. The balun tubes are shorted together at the low-impedance end by a metal strap soldered to the tubes, and are held in position at the high-impedance end by a ceramic insulator. A coaxial receptacle is soldered to one tube and a length of RG-8A/U (with outer jacket and shield removed) is passed through the tube, brought out through a hole in the tube, and cross-connected to the opposite tube.

The balun may be adjusted by the following simple procedure:

Place the balun on a surface free from nearby metallic objects that might detune it. No connections are made to the device at this time. Couple a dip meter to the input (shorting bar end) of the balun and tune the meter for resonance (in this case, about 14.2 MHz). Adjust the position of the variable capacitor up or down the balun until dip meter indicates resonance. Now, connect a 50-

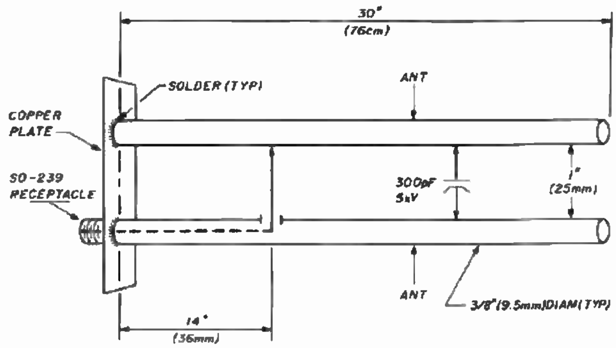


Fig. 3. A 20 meter linear balun. This device matches a 50 ohm unbalanced line to a balanced antenna having a feedpoint impedance between 8 and 800 ohms. The connection between the coaxial receptacle pin and the opposite tube is made of a length of RG-8/U coaxial line with outer jacket and braid removed. A hole is drilled in the tube 14 inches from the receptacle and the line is attached to opposite balun rod. A copper plate is soldered to the balun tubes. Antenna connection points are moved along line to establish impedance transformation and capacitor is adjusted back and forth to remove residual reactance.

ohm, non-inductive resistor to the coaxial input receptacle. A hand-selected, 47-ohm, 1-watt composition resistor will do.

Next, connect an impedance bridge (or noise bridge) to the balanced output terminals. Use short leads. Set the bridge to 100 ohms. Couple the dip meter to the balun to provide measurable output on your impedance bridge, and adjust the position of the output terminals along the balun until an indication of 100 ohms at null is achieved on the impedance bridge. Note that the adjustment technique remains the same regardless of the type of bridge used.

Another adjustment technique is to place a 100 ohm, non-inductive resistor across the balanced output terminals and apply a small amount of rf power at 14 MHz to the balun. Adjust the balun to provide a 1-to-1 SWR on the transmission line between the balun and the signal source.

As I mentioned earlier, this balun will provide a balance-to-unbalance action along with a transformation between 50 ohms (unbalanced) and a balanced load ranging between 8 ohms and 800 ohms. This makes it a very handy device to use in many antenna designs. True, the device is bulky, but its power-handling capability is high and the balance provided is very exact. Bandwidth of the device is sufficient to cover any one Amateur band. (Thanks to K6OPZ for information on this interesting device.)

A compact loop antenna

Squeezed for antenna space? Here's a simple antenna that is inexpensive to build, efficient, and takes up a minimum of space (**Fig. 4**). It is merely a dipole bent into a square. This provides a loop antenna that is about 1/8-wavelength on a side. It may be mounted in either a horizontal or vertical position. When horizontal, the radiation pattern is substantially omnidirectional, with a slight increase in radiation from the open end through the feedpoint, as shown by the arrow. When mounted vertically, maximum radiation is at right angles to the plane of the loop.

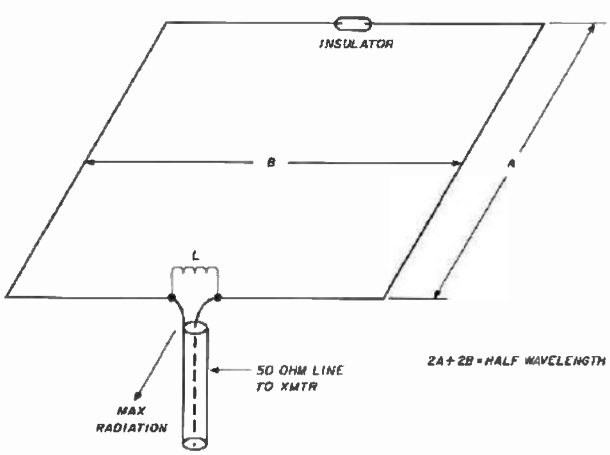


Fig. 4. Oblique view of compact loop antenna. In this drawing, the loop is parallel to the ground. Circumference of loop is a half-wavelength, i.e., 33 feet for 20 meters, 22 feet for 15 meters, and 16'4" for 10 meters. The loop sides, therefore, are about 8'3" for 20 meters, 5'6" for 15 meters, and only 4'1" for 10 meters. Coil L is 12 turns of No. 12 tinned wire, 3/4-inch inside diameter, 1-1/2 inches long. Number of turns is adjusted for lowest SWR on transmission line — approximately 8 turns for 20 meters, 6 turns for 15 meters, and 4 turns for 10 meters.

Loop input impedance is quite low (of the order of 20 ohms) so a simple impedance matching coil is placed across the loop terminals. All you have to do is adjust the number of turns in the coil to achieve a low value of SWR on the transmission line at your favorite operating frequency.

There's quite high voltage across the antenna insulator at the ends of the antenna opposite the feedpoint, so make sure it is a good one. A three-inch-long, ribbed ceramic insulator will do the job.

I'll leave the mechanical design to you. A simple X-frame of PVC pipe, bamboo, or wood slats should do. You really don't have to rotate the antenna if it is placed in a horizontal position. Get it as high in the air as you can and you'll be surprised at the results from this simple antenna design!

It should be possible to make this into a two-band antenna by placing a dipole for the next higher band inside the larger dipole. If you try this, let me know how it works out for you!

Additional reading

From time to time, I point out interesting publications that are a great help to active, on-the-air hams. Here's a good one for you: "The Long Island DX Bulletin," published bi-weekly by the Long Island DX Club (LIDXC). The address is Box 173, Huntington, New York 11743, and the domestic mailing rate for one year is $10. All DX hunters should have this fine newsletter at hand to catch the rare ones!

Reference

1. "Radio Communication" is the Journal of the Radio Society of Great Britain, 35 Doughty St., London WC1N 2AE, England.

HRH

Adding some real "Zip" to your mail service

Time Warp QSL Delivery

DAVID GEISER
WA2ANU

Some participants of a recent ARRL Open CD Party have received QSLs *postmarked before the contest began!* There's no fraud involved here, but there is something unusual about the envelopes containing the cards. Every one of them was postmarked April 11, 1980, and have some value to a stamp collector.

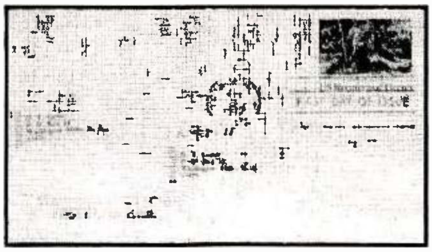
The value of the envelopes is that these were new stamp "First Day of Issue" cancellations and are collected by many stamp enthusiasts. A peculiarity of the mail system allowed me to make the contacts, fill out the QSLs, place them in envelopes and mail them, and the postmark (in this case) was before the contact date. No magic or science fiction was involved.

Beginners and award hunters value QSLs, but most other Amateurs and DX stations see little value in "just another" U.S. (particularly W2) QSL. The first-day-of-issue cover does give the recipient something of value (perhaps only to a neighbor or child) and costs the sender little extra but planning and thought.

First-Day covers

Several new stamps are issued each year by the Postal Service, and each of these is accompanied by some ceremony. Part of that ceremony includes accommodating philatelists (stamp collectors) who want the new stamp "the first day." As the stamps are sold at only one post office the first day (and the next day at all other post offices that ordered them), only residents of one particular town seem to be favored. Actually, the "first day" post office will make "First Day of Issue" cancellations for about two weeks beyond the official date. The collector is thus encouraged to buy the new stamps in his own home town, affix them to envelopes, and mail the envelopes with a postcard "filler" (or QSL!) inside to the First Day post office for cancellation. As another accommodation, the collector may send filled, addressed, but not stamped envelopes to the First Day post office with his check or money order (for not more than 50 stamps), and the post office will affix the stamps.

Often, some local organization or professional stamp collectors will prepare quite elaborate envelopes commemorating the event with pictures, biography, or historical notes, and sell these for a dollar or so above the cost of stamps. These organizations sometimes have advertisements or notices in stamp collecting journals, but there may be problems in having QSL cards inserted and mailed to the proper addresses.



First Day Cover — Typical first-day-of-issue cancellation. When the proper address is not known in time, use a removable label to address the cover to yourself, and make later delivery to the addressee.

Some stamps, such as U.S. first class (now 15¢ but predicted 20¢ for 1981), and overseas airmail stamps are particularly suited to this form of QSL forwarding. Other stamps, like the penny, 3.2¢, 8.4¢, and dollar denominations are awkward or uneconomical to use. Ordinarily, QSLs must be accumulated until an appropriate stamp is issued.

Issue information

Notice of each new stamp (and collector accommodations) is given in the *Postal Bulletin*, received by each post office, and usually available for reading from your friendly postal clerk (don't pick a busy time!). Many post offices place notices of new stamps and their distribution on bulletin boards, or have them available in a loose-leaf notebook. These give exact details of how to make up the envelopes and where to send them. The Postal Service calls these "New Issue Announcements." A personal subscription is available for $3.00 from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Ham special-event radio stations

Often, new stamp issuance coincides with some local celebration, such as our local celebration of the Battle of Oriskany. Amateur radio tied in the battlefield with Fort Stanwix (Rome, New York) and the Saratoga Battlefield to "announce the victory" and pass congratulations. Casual (as well as scheduled) contacts were commemorated with special QSLs with first-day-of-issue cancellations. The postal two-week grace period made filling out and posting the QSL cards practical. (The Utica Amateur Radio Club paid expenses, so no "donations" were asked.)

No time warp?

Only the accident of the Open CD Party being between the "first day" and cutoff date for the new Frances Perkins stamp permitted sending the "time-warp" QSLs. Ordinarily, hams include thanks for the first-day cancellation, but this time there was a sensation with those who noticed the difference in dates. Now you know how it was done.

Successful?

More than 95 per cent of the U.S. hams, and 80 per cent of the foreign hams, respond with QSLs. Some even apologize for not having any! (That's okay, a letter can confirm.) It takes some effort, but for both parties there is a true trade of favors beyond the radio contact.

HRH

HI-Q BALUN

- For dipoles, yagis, inverted vees & doublets
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- Helps eliminate TVI
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Small, rugged, lightweight, weatherproof
Replaces center insulator
Handles full legal power and more
With SO-239 connector

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HI-Q ANTENNA END INSULATORS

Rugged, lightweight, injection molded of top quality material, with high dielectric qualities, and excellent weatherability. End insulators are constructed in a spiral unending fashion to permit winding of loading coils or partial winding for tuned traps.

May be used for
- Guy wire strain insulators
- End or center insulators for antennas
- Construction of antenna loading coils or multiband traps

$4.95

Patent No. 4,091,350

DIPOLES

MODEL	BANDS	LENGTH	PRICE WITH HI-Q BALUN	WITH HI-Q CENTER INSULATOR
Dipoles				
D-80	80/75	130′	$28.95	$24.95
D-40	40/15	66′	25.95	21.95
D-20	20	33′	24.95	20.95
D-15	15	22′	23.95	19.95
D-10	10	16′	22.95	18.95
Shortened dipoles				
SD-80	80/75	90′	31.95	27.95
SD-40	40	45′	28.95	24.95
Parallel dipoles				
PD-8010	80,40,20,10/15	130′	39.95	35.95
PD-4010	40,20,10/15	66′	33.95	29.95
PD-8040	80,40/15	130′	35.95	31.95
PD-4020	40,20/15	66′	29.95	25.95
Dipole shorteners - only, same as indicated in SD models				
S-80	80/75		$11.95/pr.	
S-40	40		$10.95/pr.	

All antennas are complete with HI-Q Balun or HI-Q Antenna Center Insulator, No. 14 antenna wire, ceramic insulators, 100′ nylon antenna support rope (SD models only 50′), rated for full legal power. Antennas may be used as an inverted V, and may also be used by MARS or SWLs.

Antenna accessories — available with antenna orders

Nylon guy rope, 450# test, 100 feet	$3.49
Ceramic (Dogbone Type) antenna insulators	.70/pr.
SO-239 coax connectors	.55

All prices are postpaid USA 48
Available at your favorite dealer or order direct from:

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BOX 21305, S. EUCLID, OHIO 44121

Dealer Inquiries Invited

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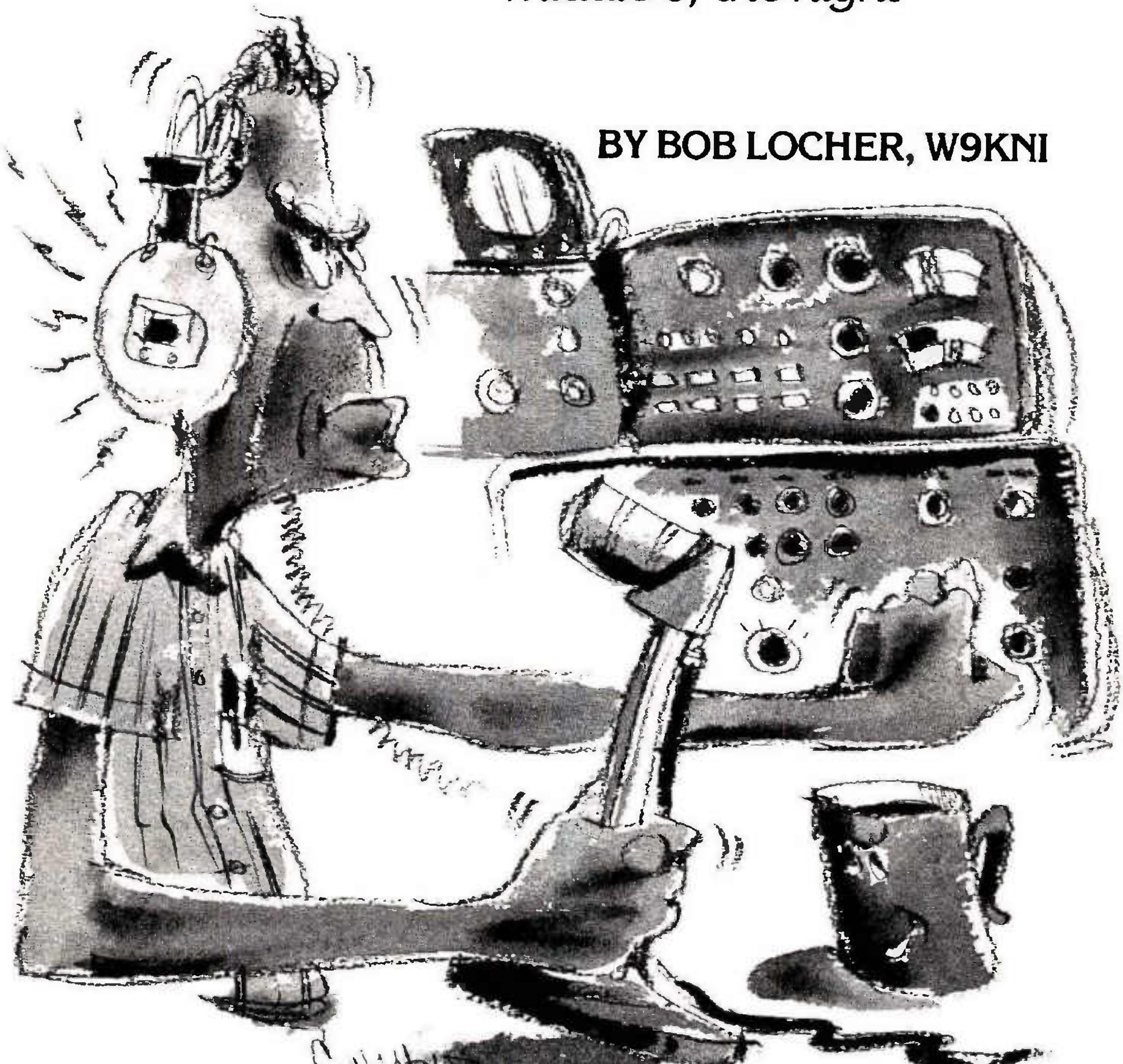
More details? Ad Check page 78.

DXer's Diary, Chapter 3

Some tense moments in the middle of the night



BY BOB LOCHER, W9KNI

Dinner was early tonight, and I'm at peace with the world. My son has gone to a scout meeting, my daughter is doing homework, and my wife is engrossed in a new book from the library; it's a fine evening for DXing.

I park a cup of coffee out of harm's way near the rarely used speaker, and settle the phones over my head. I turn the antenna selector switch from ground position to the 20-meter antenna position, and suddenly the receiver is full of signals.

Let's see now . . . swing the antenna out of the west, and let's haul it around to the northeast. We should have a fine path to Europe, but they'll all be in bed, and only a few signals from there will be heard. It's too early for the Middle-East boys to be saluting the sunrise. That goes for the West Indian Ocean too, but, in a couple of hours . . . well, we'll just have to wait and see.

Ah, there's a clear frequency. I pull the VFO on it, and key down for a moment. Yup, 120 watts output. Yeah, 5 watts reflected. All's well with the rig and the antenna. I glance over at the linear — it's all tuned up for 20 CW. I leave it off — I can summon its full output in seconds, so I save running time on the filaments.

The linear is a homebrew job, with a single 3-500Z, built to one of Bill Orr's fine designs, using mostly surplus parts. Only the tube, socket, and chimney were new when I built it. I muse on . . . when I built it, things were a bit tight. We had a baby on the way, and a shiny new linear was out of the question. But, a little overtime generated the coins for the tube and its associated socket and chimney, and some careful flea-market work coupled with some judicious swapping delivered the rest of the components in the linear.

Now things are better, and I could buy a new linear, but my old homebrew job runs just fine, and a kW is a kW. Besides, I've burned out all the weak links in the linear long ago, and cured the TVI. The old box has too much blood, sweat, and tears built in to part with it now.

I move the receiver dial down to the bottom edge of the band, and begin tuning up the band. I decide not to make this pass a really intensive one, where every weak signal is dug out of the mud and held up for examination — that's a slow and time-consuming process, though a terrific way to snag some really good DX. First, instead, I'll listen to the louder signals, and only stay if they are about to sign a call. That way I'll have a pretty good feel for the band within five minutes, and if there's a surprise DXpedition or a huge pileup somewhere, I'm almost sure to find it.

If I'm to be successful in this pileup it's going to have to be by guile, not muscle.

Let's see. There's a strong CQ, but with the tell-tale tags of a DX signal. Hmm. Yes, it's DL1BU. He's a good S-9 plus. Guess we have a good path to Europe tonight, as I expected. It's two in the morning over there. He must be suffering from insomnia. He signs; several stations begin their calls. I tune on.

What's that one? Bit of a chirp, bit of fuzz on him — must be a transpolar signal going through the auroral zones — not too bad though. Oh. Okay, it's a UA9, a western Siberian. Pretty common, but a clue for propagation. Should I swing the antenna up to directly North, over the Pole? I decide not to — there could still be an interesting African on the bands, and I'd be more likely to miss him if I go straight North. I might give it a try a little later, though, after I've made one or two passes across the band.

There's EI3CP having a rag chew — his 40 plus WPM is music to listen to. There's a YU — it seems like they come through no matter how bad conditions are, and no matter what the time of day is. Maybe they don't sleep?

Hey. There's a bit of a pileup. Perhaps a dozen Americans calling someone. Let's see who it is . . . Yes, there he is. Not a very strong signal, but a nice, firm, measured fist . . .

"K8MFO K8MFO DE TA2FM TA2FM R . . ." Turkey! I worked a TA over a year ago, but no QSL. The fellow probably was a pirate. Better fire up quick!

I hit the power switch on the linear, and listen to the loud ZAPPP! as the automatic surge-suppression circuit cycles. The high-voltage meter pops up to 2600 volts, and it's ready to go. I check the frequency just above the TA. It seems clear, so I ease the VFO up, back down the exciter drive and put power to the linear. Oops! Better turn the output wattmeter to the high range. Hmm. A little redip of the final; little more drive; a little more loading. Okay, redip the plate; little more drive. That's it. Let's go!

I jump the receiver back down a couple kilohertz to the TA's frequency. Where is he? There's a loud backscatter W. Probably K8MFO. I've heard him before; he's one of the aces on old 20.

"QSL OK TABRIK. TNX QSO 73 ES DX TA2FM DE K8MFO SK." As MFO signs, I hear three or four tailends drop in. Okay. let's see what's happening here. I listen carefully. Yes, there he is again. Not real strong, but good copy. I switch in my narrow filter, and get him centered.

"R 73 ES TKS DON SK DE TA2FM QRZ?"

I listen a moment — a whole flock of stations calling him, mostly on his frequency. He's never going to be able to copy anyone in the middle of that heap. I'll try up a kilohertz.

Quickly, I move my VFO up a bit and start my call . . .

"TA2FM DE W9KNI W9KNI W9KNI AR."

I listen. His frequency is entirely covered by callers, and if he's coming back to anyone there's no way of knowing. Since my transmitting frequency is at least one kHz above his I can safely call him again without QRMing him if he's already back to someone else — as all those fellows calling him on his own frequency are. I call again, "DE W9KNI W9KNI AR." I listen.

It's better now. A couple of stations are still calling, but I can hear the TA in there, back to someone, even though I can't copy him due to the QRM from those still calling. Guess they figure that more is better. That's true in bowling, but not in golf. Or here.

Ah! Finally, peace. "QTH HR ISTANBUL ISTANBUL NAME IS TABRIK TABRIK HW AR W8ZCQ DE TA2FM KN."

Hmm. Looks like the Eights own the franchise tonight. Ought to leave a chance for the enterprising Nines.

Let's find that 8ZCQ frequency. He's not on the TA's frequency. I take a look higher. Nope, nothing there. I've heard 8ZCQ before. He has a good signal, and I know I'll hear his backscatter. Let's look lower.

Yes, there he is. "NAME HR DAN DAN PSE QSL CPY? TA2FM DE W8ZCQ KN."

Okay. He's a little lower than 8MFO was. With that pileup there's sure to be several who are going to be camped on 8ZCQ's frequency, so that's not where a poor W9 can hope to prosper.

I have a choice. I can move lower than 8ZCQ, in hopes that when ZCQ has finished, the TA will find a pileup on ZCQ's frequency and will tune lower, looking for a station in the clear. Or, I can figure that he won't tune down any further, and instead he'll tune back up. If that logic holds, my best bet is probably 8MFO's frequency — below the TA's frequency, but above ZCQ's.

But I think I'll try farther down from 8ZCQ. The TA has moved down twice now, about a kilohertz each time. If he's using a transceiver with some kind of receiver incremental tuning, he's still got two or three kilohertz range left to tune down with.

I move the VFO, and plant myself exactly one kHz below 8ZCQ. Ah, there. "73 TU SK QRZ DE TA2FM K."

QRM on him again. Wish those turkeys would move . . .

I listen half a second — a pretty good sized pileup begins to call furiously. Well, here goes nothing.

I drop in my call twice and listen, but I can't tell a thing. Way too many people calling him dead on his frequency. That's pretty stupid, and impolite, too. One should never, never call a DX station on his exact frequency if there's a pileup on him. That way no one can hear him come back. Even if he's working people on his own frequency, call at least 200 hertz above or below, and that close only as a last resort.

Of course, some DXers use transceivers and can't accurately zero beat on CW, even with external VFO's. But they are the ones who get left for dead in the pileups.

I call the TA further as I muse, then listen again. Ah, there he is, in QSO with someone . . . me? Can't tell. His response and the call of the station he is working was obliterated by the clowns calling him on his own frequency, even though he's listening well off it.

". . . ISTANBUL NAME TABRIK TABRIK HW COPY N9MM DE TA2FM KN."

Hmm. That's Norm down in Indiana, with that terrific antenna system. Okay, where is he? I tune down, near my calling frequency. Aha, there he is! I guessed right — the TA did tune farther down again. Ohhh-kay; I touch my spotting switch — yup, I'm not quite zero beat with 9MM — but it's close. He's a little above me, about three hundred hertz. That means that the TA moved about 700 hertz down after his last QSO. So, I'll set up my VFO 700 hertz below 9MM. Good. He's signing clear already with the Turkish station. Here goes!

I call — then wait for the dust to clear. Yup, he's in there. Hey! Maybe — ahh, shucks. He's working K2TQC. All right, let's see where TQC is.

TQC comes back. Yes, there he is. I touch my VFO spotting button. Well I guessed right, anyhow. I'm almost exactly zero-beat with TQC. But he's got the QSO and I don't. Now what to do? Let's see here . . . we're getting pretty far below the TA's transmitting frequency. If he's using a transceiver, his incremental tuning has to be just about out of string for tuning down. And, on the other hand, some of the people in the pileup are getting wise to his tactics, with more and more stations setting up below the last contact. Again, the boys to the east appear to have the edge in propagation to this fellow, so my chances of win-

ning out in the pileup on the basis of signal strength alone are remote at best.

My best bet has to be to figure that he's going to start tuning back up the band.

Let's see now. If he just starts tuning back up from the edge of his RIT, it won't do much good at all. There are people calling him all across six kilohertz; from K2TQC's frequency all the way back to his own frequency. But, he doesn't seem interested in a lot of QRM, either — the way he keeps moving shows that he's trying to find callers on relatively clear frequencies.

I think I should try calling him above his frequency now. When he starts moving back up, he's not going to find a clean frequency until he's at least a kilohertz above his own transmitting frequency. That's the theory, anyhow. I have to admit to myself that it's something of a long shot — maybe he's not using a transceiver and is going to continue tuning down, stringing anxious DXers all the way down to the bottom edge of the band. If he does, I'm afraid my chances of snagging him are slim, because propagation seems to be not particularly in my favor.

What the heck, it's worth a try, and I'm getting nowhere here. I move my VFO up, and park myself two kilohertz above his frequency. The TA signs clear with the TA and I call.

QRM on him again. Wish those turkeys would move. There, it's easing now. Yes, he's back to someone. Once again, I have to listen through his entire transmission to see who got him. OK, it's W1HZ. Where's he. Yup, there he is — about a kilohertz below where K2TQC was. So I guessed wrong. Now what should I do?

I decide that my plan is still a good one, considering the circumstances. The TA could keep moving down the band, but even knowing that I'm unlikely to be able to outmuscle the east coast boys with propagation as it is. If I'm to be successful in this pileup it's going to have to be by guile, not muscle. I decide to stay exactly where I am.

That TA has been on a while. I just hope that he doesn't decide to pull the plug.

There. He signs clear. I call. And, of course, he's covered by QRM. I give another brief call, then wait. Yes, he's back to someone. I listen.

"INSTANBUL NAME TABRIK TABRIK HW CPY W9KNI DE TA2FM KN."

Hey! Hey! Hey! I got him! I got him!

"R R TA2BK DE W9KNI R FB DR TABRIK ES TNX VY MUCH QSO RST 569 569 ES QRM HR NR CHICAGO CHICAGO NAME BOB BOB PSE UR QSL HW CPY? TA2FM DE W9KNI KN."

"R R W9KNI DE TA2FM R TNX BOB QSL OK VIA BUREAU 73 ES DX SK W9KNI DE TA2FM SK QRZ?"

Wow! It really feels good to enter that QSO in the log. What a nice catch.

I turn on the 2-meter radio to call it in on the DX net, in case anybody else wants a shot at it. But I don't need to. I hear . . .

"Hey — that KNI got him."

"Yeh, I heard it too. Boy, is that fellow ever lucky!"

I turn off the 2-meter radio, and go upstairs for a fresh cup of coffee to replace the cold and forgotten one parked near the receiver. Lucky?

HRH

Put Some Snap Into Your QSOs

JAMES FISK, W1HL*

Finding your way out of dullsville

"Hi Chuck. Be with you in a minute," said Dave. Chuck watched with envy as the older ham's fingers worked the paddles of his bug with practiced ease, sending code at a speed the novice couldn't begin to handle.

Then Dave signed and the other station came back. Chuck noticed how his friend leaned back comfortably, copying the incoming dits and dahs in his head. Finally, the QSO ended; Dave turned and said, "Thanks for waiting. Buddy of mine up in Toronto was telling me about his car troubles. Pour yourself a cup and let's hear how things are going with our latest Novice."

"Not bad," said Chuck, "but I sure like the way you old-timers handle CW."

"Well, don't forget, I've been at it awhile. Besides, I was totally confused at the start too. It'll come. Just give it time."

"I suppose so," answered the newcomer, "but, you know, what you said about your buddy's car troubles brings up something that's been bugging me. I've had, I don't know how many QSOs now, and they all seem to be a rehash of the others. Everyone says the same thing . . . 'thanks for your call, your RST is such and such, my QTH is, name, then back to you.' It's gotten to the point where I know what the other guy's gonna send before he sends it. How do I get someone to talk cars with me?"

Dave smiled. "Don't be too quick to condemn those canned QSOs. They're doing something very valuable for you."

Everyone says the same thing . . . it's gotten to the point where I know what the other guy's gonna send before he sends it . . .

What's that?" asked Chuck, a slightly puzzled look crossing his face.

"They're teaching you to copy code in your head, and that, my friend," said Dave, stressing the point with a finger stabbing the air, "is the key to your becoming a crackerjack CW operator some day."

"Don't see how hearing the same things over and over is making me a better operator."

"Let me show you how. You write down everything the other guy sends you now, right?"

"Yes."

"What about your call and the 'de' signal, write them down?"

"No, I don't."

"Why not?"

"Cause I know what they are soon as I hear them."

"That's my point, Chuck. You know their sounds as groups of letters forming 'de' or your call. You've copied them by ear so many times that there's no need to write the individual letters down anymore."

"That makes sense."

"Sure, and the longer you keep at it the more groups of letters you'll recognize as words, and stop putting them down on paper."

Come to think of it, I'm not writing RST anymore, just putting the report right in my log."

"Exactly, and some day things like, 'my QTH is' will be so obvious, you won't bother copying them either. You'll just wait till the town name comes along and enter that in the book. When that happens, you're on your way to ultimate CW, copying in your head."

"How 'bout that," Chuck exclaimed, a grin replacing the puzzled frown.

"And here's what you can do to speed up the learning process," continued Dave. "As you're copying along, you'll know when the

*James Fisk, W1HL, is no apparent relation to the late Jim Fisk, W1HR, although they knew each other, and had discussed this article before the death of W1HR. Editor sending station is about to say certain things. Stop the pencil and just listen to these. Learn to recognize the words as sounds. Pretty soon you'll phase out the pencil altogether, except for a few notes now and then."

"I get the idea. Like at the end of a QSO when the other guy sends 73 and 'thanks for the contact' — none of that needs to be written down, does it?"

"That's right. So, these canned QSOs, by their predictability and repetition are really doing something pretty useful for you. Later on," continued Dave, "You'll find experienced operators don't bother with saying 'ur RST' and 'my QTH.' They'll condense the whole thing into, 'ur 589 hr in East Overshoe.' "

"That sure speeds things up."

"That's the name of the game in CW, Chuck. To say what you want to say with the least time and effort. Keeps the conversation from dragging. That's why abbreviations are used so much."

"Yeah, I've learned a bunch of those like 'abt' for about, and the letter, C, for yes."

"Two good ones. There are loads of ham books around with lists of abbreviations. Get one and learn them. But be careful to stick with the commonly used ones. Don't go making up your own."

"What about punctuation?" was the next question of the novice.

"Don't use it," Dave answered flatly, "except for the question mark. The experienced CW op almost never sends a comma or period . . . no need for them. That's one thing I hear on the novice bands all too often. Punctuation just slows down a QSO and I don't know of a thing that identifies a beginner quicker than using it."

"Speaking of speeding up your contacts, Chuck, are you into break-in operation yet?"

The canned QSOs, by their predictability and repetition, are really doing something pretty useful for you.

"No. How's that done?"

"Ever heard the other station ask you a question, then send the letters, BK, and stop sending?"

"Yeah, just the other night on 15, a KA4 I was working sent BK, and then nothing. I kept waiting for him to go on but he didn't. Finally, he sends my call, then his, and the go-ahead K. Is that what you're talking about?"

"That's it. You see, Chuck, we're only required to send our calls every ten minutes for ID. So why take all the time necessary to send them more often? The idea behind break-in is send the letters, BK, for break, and the other station starts right in, continuing the ragchew without sending calls. When he's done, he sends BK, stops transmitting and you pick it up. Again, no calls. Makes for much snappier contacts."

"I can see how it would," answered Chuck. "Just have to be sure I stick in a call for ID regularly."

"Another thing I hear beginners do that slows down a QSO," said Dave, pouring more coffee, "is sending things three or four times. It's not necessary. If the other guy needs a repeat of your name after you've sent it once or twice, he'll ask for it."

"That's just a bad habit someone's picked up along the way?"

"True. Another bad one is sending the long-winded CQ. This really labels the poor operator and warns of a potentially dull QSO. More than likely, the receiving operator will simply lose interest while waiting, and tune elsewhere."

"Can't say I'd blame him. The few I've heard have really turned me off. Timed one character the other day sending CQ for three minutes, would you believe?"

"I believe it," replied Dave. "It seems to me the ideal CQ is one where we send three, maybe four, CQs, then our call just once, then repeat the whole thing a couple of times, perhaps signing our call twice on the tail end before sending K. If you fail to get an answer, do it all over."

Punctuation slows down a QSO, and I don't know of a thing that identifies a beginner quicker than using it.

"Okay. That sounds like a good approach. So now I've heard the guy sending a nice short CQ and decided I want to work him. What then? What's your advice on calling him?"

"Well, I've heard some hams send the other guy's call four and five times, then sign theirs once. Trouble with this is that the fellow on the other end knows his call; he doesn't need that. He wants *your* call, so send it at least as often as you do his."

"What I've been doing is sending his call two, maybe three, times, depending on band conditions, and following with my call about the same number."

"That's good. You're getting the idea. Keep it short and snappy. He can always send QRZ? if necessary. The old pros will go that one better. Sometimes they'll answer a CQ sending the other call and his just once. That's it. When you get an op like this on the other end you know you've landed a real hot shot. This approach only works when signals are really booming in. Can't use it when they're weak or being clobbered with QRN or QRM."

"Okay, Dave. I've got to get going, but let me run through this again and make sure I've got it:

> To learn copying in my head, listen to the general stuff and save my writing for specifics like town, city, and operator's name.
>
> Learn and use abbreviations.
>
> Avoid punctuation like the plague.
>
> Learn how to use break-in operation.
>
> Don't repeat things too often.
>
> Keep CQs short and snappy.
>
> Watch out for bad habits which clutter a transmission and make it drag.

"Did I get 'em all?"

"Sounds great to me ol' buddy. Just keep in mind one important idea: it's not just how fast he sends that makes a good CW op, it's what he sends, too; how effective is he in communicating his thoughts in the least time and with the least confusion to the receiving operator. Keep practicing all the points we've talked about, and pretty soon you'll be talking car troubles and a lot more on CW. Next time, we'll talk about the right way to use procedural signs."

HRH

RODERICK BLOCKSOME,
KØDAS

Adapting Surplus Meters to your Circuit

Don't guess — measure

A problem which many homebrewers face is how to change the range of an existing meter to a more desirable one. Many hams have found that meters in the junk box will seldom have the range required for a particular project. The alternatives to this problem are: buy new meters with the desired ranges (expensive); swap meters with another homebrewer (possible); or design a meter shunt and/or multiplier for your junkbox meters.

There are a couple of advantages to the latter course of action. If more than one meter is required in a project, identical matching meters can be used, and yet measure different currents or voltages. Also, a switching arrangement can be used so that one meter can read many ranges in different circuits.

How can you approach the problem of changing the basic range of a meter? There are several methods, each suited to a particular application. Each method requires that the internal resistance and the full-scale current of the meter be known.

Determine I_{fs} and R_i

Most surplus meters have scale markings which do not indicate the true full-scale meter reading. For example, a meter may have a 1 mA basic movement but the scale marking may read 0 to 100 mA. The equipment for which the meter was designed contained the necessary shunt or multiplier resistors. If your meter falls in this category, look at the fine print near the bottom of the face plate. Often, the basic movement data is printed there — such as "FS = 50 μA" for a 50-microampere, full-scale movement as an example. If there is nothing indicated on the meter face, you will have to set up the test circuit shown in **Fig. 1**.

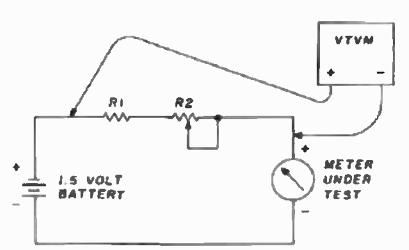


Fig. 1. Measuring full-scale current.

If you suspect the meter to have a 1 mA, or lower, movement, use R1 = 1k and R2 = 25k. Set R2 for maximum resistance in the circuit before connecting the battery. If the unknown meter reads full scale, increase R1 or R2 until R2 can be adjusted for an exact full-scale reading on the meter. Read the dc voltage across R1 and R2 with a VTVM. If the reading is close to the battery voltage, you know that the meter has a relatively low internal resistance. Disconnect the circuit and measure R1 and R2 as accurately as possible. Then calculate the full scale

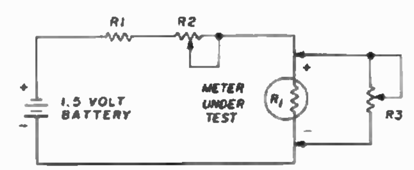


Fig. 2. Determining the internal resistance of a meter.

current (I_{fs}) of the tested meter, using the formula (Ohm's law):

$$I_{fs} = \frac{E}{R1 + R2}$$

where E is VTVM reading in volts.

Using the same test circuit, you are now ready to determine the internal resistance of the meter in question. Do not attempt to measure this internal resistance directly with your ohmmeter as in most cases you will damage the meter being tested. Reconnect the circuit used previously (**Fig. 1**), and readjust R2 for an exact full-scale reading on the meter. Next, connect a variable resistor, R3, across the meter terminals as shown in **Fig. 2**. Adjust this resistor for a reading of exactly one-half scale on the unknown meter. R2 must remain undisturbed.

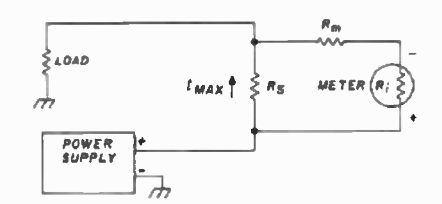


Fig. 3. The "voltmeter" method of measuring current.

Disconnect R3 and measure its value as precisely as possible. This value is equal to the internal resistance of the test meter. If the resolution of R2 or R3 is a problem, low-value, multi-turn potentiometers with series resistors can be made up and substituted for R3 and R2.

You now know the full-scale current (I_{fs}) and internal resistance (R_i) of the meter, and are ready to adapt it to the needs of your circuit. First, consider the case where you need to read a current higher than the I_{fs} of the meter. There are two methods to accomplish this; the "voltmeter" and the "shunt" method.

Voltmeter

The "voltmeter" method offers the more versatile, if not the most accurate, means for the ham to implement. Suppose you have a high-impedance circuit in which you wish to measure up to 300 mA of current flowing in it. Insert a small resistance in series with this circuit, and measure the voltage drop across this resistance by calibrating the meter to read current. This type of circuit is shown in **Fig. 3**. The formula for calculating the values is:

$$R_s = \frac{I_{fs}(R_m + R_i)}{I_{max}}$$

Since R_s determines the value of R_m, and vice versa, what criteria do we use in selecting one or the other? Generally R_s should be at least twenty times smaller than R_m. Additionally, R_s should be a value, which if inserted in series with the external circuit, will not significantly affect the operation of the circuit. Inserting R_s will cause a voltage drop in the circuit equal to I_{max} times R_s. For example, if I_{max} varies from 0 to 300 mA and we let R_s = 5 ohms, then the voltage drop introduced into the circuit would vary from 0 to 1.5 volts. This would be negligible for a tube plate supply, but would be unacceptable for a transistor collector supply.

When selecting R_s, use as precise a value as possible since this will have a large effect on the accuracy of the meter circuit. The wattage rating of R_s should be three to five times the calculated maximum dissipation. This will prevent inaccuracies due to temperature drift of R_s.

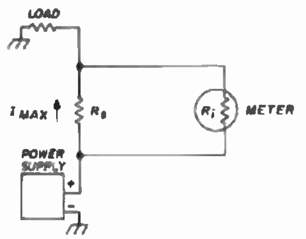


Fig. 4. The "shunt" method of measuring current.

Shunt

The "shunt" method may be used in instances where the circuit impedance is low and the voltmeter method undesirable. This type of circuit is shown in **Fig. 4**. Calculate R_s with the following formula:

$$R_s = \frac{I_{fs} R_i}{I_{max}}$$

R_s is determined solely by I_{max} and the meter used. Normally, R_s is quite small and must be very precise. Wattage and current ratings for R_s are important in this method also. If R_i is small, the resistance of the meter leads may be an appreciable portion of the total resistance, and must be considered in the calculations for the sake of accuracy.

Since R_s is usually very small and must be very precise, it is best to construct it from lengths of resistance wire. The wire tables in various handbooks give resistance-per-unit of length, as well as current ratings, of various wire sizes.

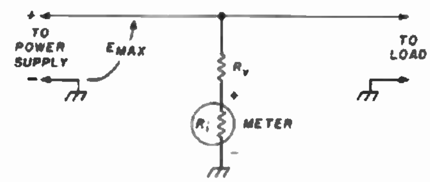


Fig. 5. Circuit for measuring voltages.

Last, consider the case of voltage measurement in a circuit. This is most simply and accurately accomplished by the meter circuit in **Fig. 5**. R_v is determined by:

$$R_v = \frac{E_{max}}{I_{fs}} - R_i$$

This circuit and formula enables the meter to read E_{max} at full scale, and proportionally lower at voltages less than E_{max}. If voltages over 500 are to be measured, use several resistors in series to make up R_v. Always calculate the power dissipation and select resistors of sufficient rating.

Many high quality meters may be found at flea markets and surplus stores at a fraction of new prices. Many seemingly useless meters of otherwise high quality may be put to use by designing the proper circuit for them.

HRH


"WHICH CHEWER DID YOU WANT TO SEE – RAG, BONE OR FURNITURE?"

A Lesson In Courage

KEN HONEYWELL

Stacy Todd, an eleven-year-old from Brownsburg, Indiana, has never seen a horse. She has never seen the reins in her hands, the riding suit she wears, or anything else, for that matter; and yet, she won two second- place ribbons this past summer in the Hendricks County (Indiana) 4-H Fair. Stacy was born without sight, and her story is one not only of tremendous human courage but also of her interaction with Amateur Radio in a new and unusual application.

It all began in the summer of 1978, when Brownsburg mail carrier Tom Clossey, who also operates a riding stable with the help of his wife, Judy, spotted Stacy riding a bicycle behind her father, James Todd.

"He was teaching Stacy to follow the sound of his voice. That's the only way she could ride. Judy and I figured that if she could ride a bike, we could teach her to ride a horse.

"Balance is a very important part of riding, and she had good practice learning to balance on the bike," Tom said.

The Closseys thought about the project for almost a year before talking to the Todds.

"We knew there would be some risk involved, but Stacy and her parents were enthusiastic. We brought her out to the stable close to the end of her school year to meet the horse," Judy said.

The pony the Closseys had selected for Stacy's training was a fourteen-year-old named Sir Jack. They chose him because he was gentle and very experienced; in fact, he had been grand champion of the 4-H Fair three years running. The Closseys decided their work with Stacy justified bringing Jack out of retirement.

Up until this time, Stacy had had little experience with animals of any kind.

"I rode a horse once, when I was seven, at a summer camp. Mom and Dad told me about 4-H, and I said I wanted to try it. Now, the only animal I really want is a horse. I won't touch dogs or cats, because they jump all over you," Stacy said.

"Jack is really gentle, even though he stepped on my foot when he was coming out of the stall the first time I met him."

Judy and Tom Clossey, with Duke, guiding Stacy by means of a 2-meter hand-held rig.

Stacy began her lessons and made remarkable progress. "She responded a lot better than a lot of the children we teach. She would go out and get the pony, brush him, and walk him. We also taught her anatomy. She knows the parts of the horse better than any of our other students," Judy said.

Tom said Stacy was treated "like any other normal 4-H'er. I cut her no slack. In fact, I was pretty tough at times."

"Her first thought was that she couldn't do it. She'd come home from the stable and hit the bed. But, after she'd rested, she'd always want to go back," Stacy's mother said.

At the stable, the Closseys would lead Stacy by shouting directions at her, but they wanted to put her in the 4-H Fair. "We wanted to do it in a quiet way. We wanted her to walk into the ring just like any other contestant," Tom said.

The Closseys hit upon the idea of guiding Stacy by radio, but they weren't quite sure about how to go about it. "Training Stacy was the easy part. Our biggest problems came in trying to get the radio.

"I had an ex-police officer on my mail route, and I asked him about the possibility of getting a small radio, like the FBI uses. He put me in touch with the Indiana State Police, but they told me I couldn't use such a thing. They said such small devices were only used for listening, and not trans-

The word "can't" doesn't exist — at least not for an 11-year old equestrian

mitting, which I hadn't thought of," Tom said.

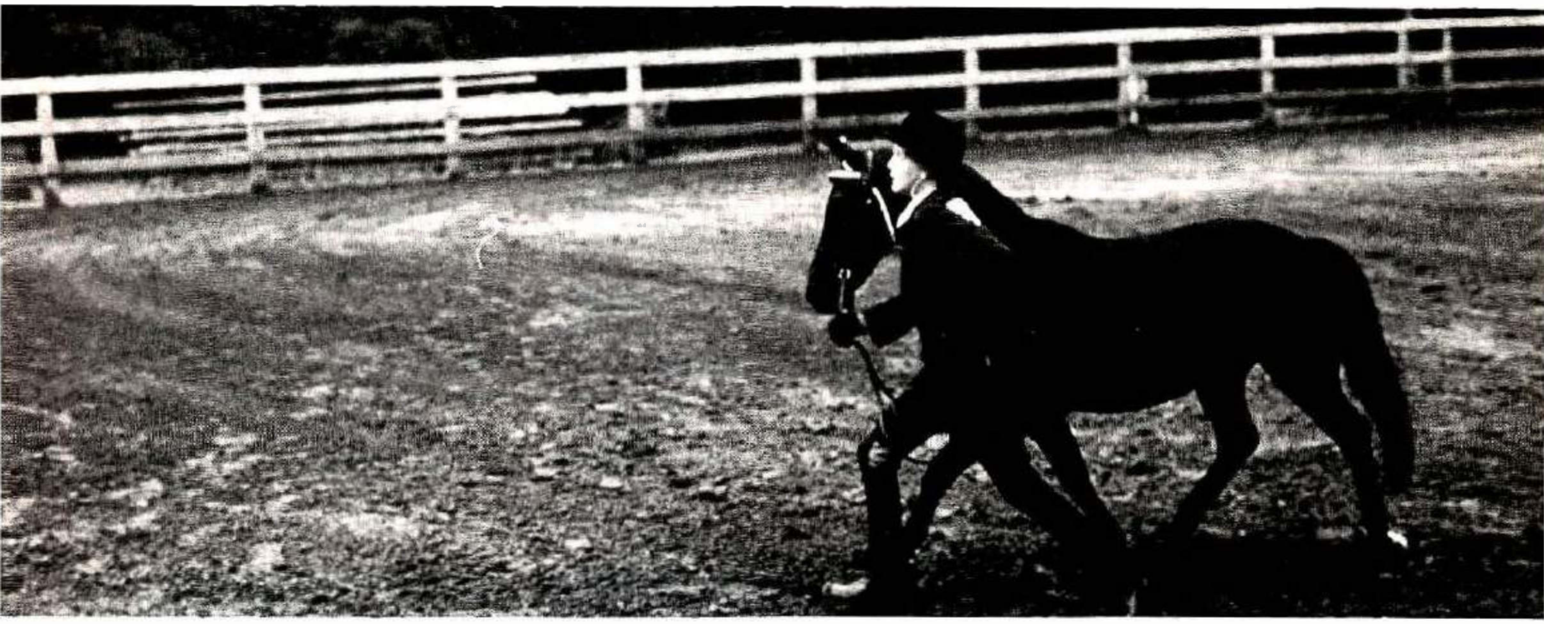
The Closseys next called the Indiana Telephone Pioneers, "a group that does things for the blind, but they didn't have what we needed. They told us of a company that made a small radio, but we found out there was an FCC ban on it," Tom said.

Down but not yet discouraged, they approached Brownsburg Police Chief Harold "Hoot" Gibson. "He connected us with Damon Duree, W9PEV, president of the Indianapolis Repeater Association, Inc., and our troubles were just about over."

Duree contacted Gene Duke, WB9VRU, who lived fairly close to the Closseys and Stacy. "I don't know why I was picked out of all the operators in the area, but I'm glad I was. I'd been an Amateur for about three years, I had good equipment, and I love to work with people, especially children. I guess I was right for the job," Duke said.

Duke first met Judy Clossey on a three-way conference call with Duree in the first week of July. Since the show was scheduled for the end of the month, they didn't have too much time to work with Stacy. "We discussed what we could use and how we could use it. We wanted the equipment to be small, so we could hide the receiver under Stacy's coat," Duke said.

Duke next decided to use Amateur Radio equipment. To transmit, he settled upon a 2-meter Wilson Mark IV hand-held unit. The receiver to be concealed in Stacy's coat was an SBE Police Scanner, which Duke adjusted with a new crystal to monitor at a frequency of 146.34 MHz. "We were really happy with the way this set-up was working. The fm frequency was a lot cleaner and nicer to work with than the CB," Tom said.



Stacy and Sir Jack go through their paces.

The first time Duke went to the Clossey's stable, he took along some Citizen's Band equipment. He had made an earpiece for Stacy, and they fastened a receiver to the back of her belt and ran a wire up her back to her ear. In testing, though, they soon found the CB to be too noisy. "There was just too much static. We needed a good communications system. It was important that she hear every word," Duke said.

With only two weeks to go before the 4-H Fair, Stacy, Duke, and the Closseys worked tirelessly. They enlisted a group of 4-H members to play horse show with Stacy, to help give her the feel of the real competition. "The other kids were more than willing to help. Most of them just stuck around, without being asked," Judy said.

The problems Duke and the Closseys encountered in guiding

Stacy were small but troublesome. Judy came up with the idea to use the clock as a guide. She would tell Stacy "one o'clock, two o'clock," and so forth, and that worked pretty well. Gene suggested we use left and right directions also, so we could keep her on a straighter course.

"Another problem was that the pony naturally shoves to the left. We had to adjust Stacy's direction constantly because of this.

"Also, all the directions were reversed in the ring. We had to do a certain amount of adjusting, too. It was an education for people who can see," Duke said.

Friday, July 27, finally came. The Closseys and Stacy's parents were visibly nervous about her upcoming performance. Stacy herself was a bit shaky: "My fingers were all thumbs. We were all nervous."

A potentially major factor in Stacy's performance was the muddy track she would have to lead Sir Jack around. "We never practiced with her in the rain, and we were a little concerned about Stacy running with the horse in the mud," Judy said. Beside this, and the pressure such competition usually brings, was the added tension because this was the first time anything of this sort had ever been attempted, anywhere.

The judge did not know before the contest that one of the participants would be blind. Neither did the other contestants, nor most of the spectators.

Stacy and Jack were led up to the gate, where they could make their entrance. Duke and the Closseys, with Tom at the microphone, took their places at the side of the arena.

Stacy was the last in her group to enter the ring. Tom got on the microphone after Duke had cleared the air of interfering calls, and she was on her way.

Whereas all the previous contestants had passed along the fence surrounding the arena on the right side of the judge, Stacy had a bit of trouble staying on course, even with Clossey's help. She passed along the left side of the judge, who was obviously amazed by this determined young girl's valiant attempt to do what the others take for granted.

Next, Stacy had to run alongside her pony, and executed perfectly what most would think to be a difficult, if not impossible, feat for a blind person.

With Clossey's help, Stacy walked to the center of the arena and turned Jack around to wait for the judge's inspection. She stood quite a distance away from the others in the arena, but she had made it, nonetheless. Now, it was just a matter of time before the judge made his final decision.

Clossey kept in constant contact with Stacy, both guiding her through her paces and encouraging her along the way. Once he got her turned around and in position, Clossey kept Stacy smiling and confident and told her when the judge was coming around.

The judge made his decision and walked to the side of the arena, where he was heard to remark, "That girl is astounding."

A loudspeaker clicked on. The first place winner was announced. As she stepped forward to receive her award, the announcer said, "Second place goes to Stacy Todd."

The look on Stacy's face at that moment was not one soon to be forgotten. Her arm soared into the air, her lips broke into a wide smile as she sucked in her breath in

Gene Duke and his 2-meter gear that helped guide Stacy and Sir Jack through the show.

Stacy and her parents, Mr. and Mrs. James Todd.

amazement and ecstasy, and if her sightless eyes could have sparkled, they would have shone as none ever had before. "I couldn't believe it," she said. "I bet I jumped four feet in the air." Tom and Judy Clossey stood at the fence with Gene Duke, and all three were equally overjoyed. Behind them, Stacy's parents, oblivious to the photographers, television cameras, and spectators surrounding them, embraced in a tear-filled moment of exuberance.

But, as much of an accomplishment as it was for the Closseys, Duke, and the Todds, the moment belonged to Stacy. The girl who had never seen a horse — and never would — was a champion, in every sense of the word.

Today, Stacy still attends the School for the Blind in Indianapolis, about a thirty-minute drive from her home. "Her teachers think the summer really helped her," Mrs. Todd said. "She had a bad year the year before, but now she makes all As and Bs."

With Stacy's success under their belts, Duke and the Closseys are preparing for a possible expansion of their techniques. "We'd like to take a group of blind children and teach them what we taught Stacy. Gene wants to work up a small radio unit that we could use for such a group," Tom said.

Stacy also vows to continue working with, and learning about, horses. "I don't care how hard it is. I'm going to keep doing it."

HRH

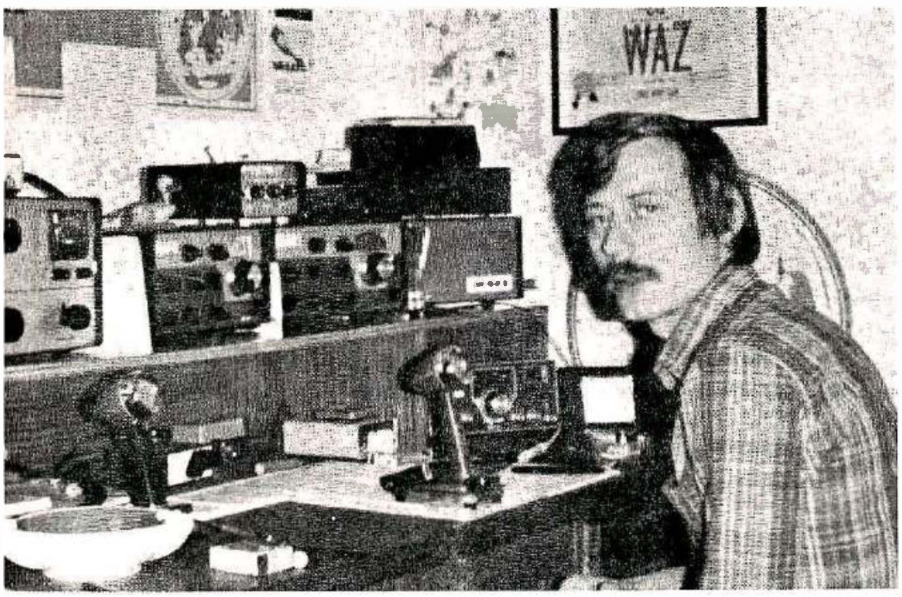
More details? Ad Check page 78.

DX Horizons

By Bill Kennamer, K5FUV

October marks a month of real DX with the coming of the *CQ* World-Wide DX Contest. Sponsored by *CQ* magazine, the SSB portion of the contest falls on the last full weekend of October each year (this year, October 24 and 25). At no time during the year will as much DX activity be concentrated into one weekend. In fact, the "antenna testing" going on during the week before the contest is usually enough to enable you to find a few choice catches.

The structure of the contest is designed to encourage DXpeditions to countries that may not otherwise be very active. This is especially true of some of the Caribbean Islands that are easily accessible, where licenses are easy to obtain, and yet the operators are usually not active enough to satisfy the demand. For this reason alone, the DXer would do well to sit at home on that weekend, as country count can usually be increased during this contest.



Hans, DK9KX, at his well equipped shack. Hans was one of the operators on the FRØACC/G Glorioso expedition last spring. Look for more big things from Hans in the future.

Why the contest?

Contests serve many purposes for the Radio Amateur. For the DXer with a high country count, it provides some excitement while waiting for another "new one." On this weekend, he must start at zero and build his country count again. For the dyed-in-the-wool contest operator, it's another story. He is very competitive, and operates this contest, or any other, strictly as a test of his competitive skills. In fact, most operators of this variety are very lax about QSL cards, not being overly concerned over whether they receive a card or not.

The antenna experimenter is usually also involved in contesting, as there is no better test of theories about height, size, design, etc., than seeing how long it takes to crack a pile-up.

Finally, the person who really can benefit most from a contest is the casual or beginning DXer. In checking my own list of over 200 countries, I find only 97 that were not confirmed as a result of my contest activities. With some diligence, it should not be hard to increase your country count.

Operating the contest

Operating the contest is not difficult. In fact, it's even easier than every day DXing. While there is more competition in the pile-ups, there are more pile-ups to spread the pack out, so you probably will get through faster than you would on an ordinary non-contest weekend.

Procure a checklist for operating. Cushcraft Antennas provides a fine list, with five-band listings of both countries and zones. It should be available at your local Cushcraft dealer. Using the checklist, try to put a callsign in as many blocks as possible. In this way, you will be forced to look for new countries — even those you've worked before — and will be constantly searching. Also, if possible, obtain contest log forms and complete them.

Finding a band on which to start is no problem; just look around for the DX activity about fifteen minutes before the contest. Also, don't try to crack the biggest pile-up on the band during the first hour. It's far better to work a few of the more common countries and get the feel of what's happening. Then you will be more relaxed, and the contacts will come easier.

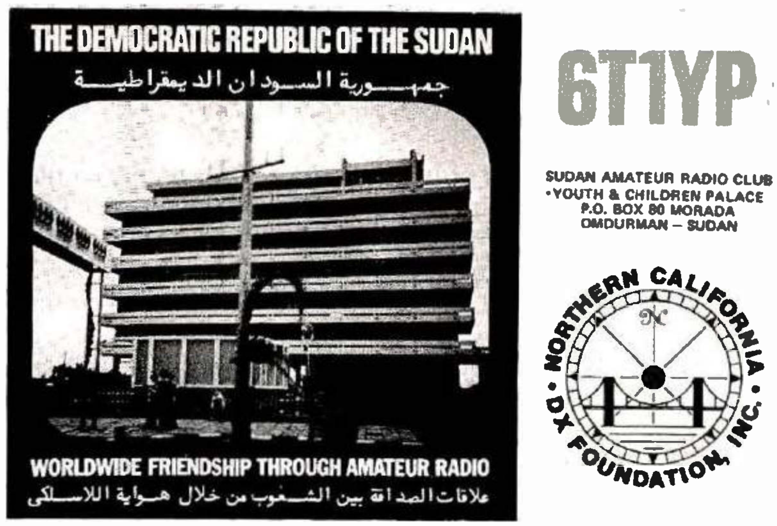
As you listen during the pile-ups, pay attention to the contest exchanges. Notice that they are very short. Only the reports are exchanged, and the most efficient operation occurs when nothing is repeated. Say your report only one time; if a repeat is necessary, you will be asked. If it's not necessary, you will have saved enough time for another QSO somewhere else later. When working the pile-ups, it's important to know what your chances are of getting through. If they're good you can stay; if not, tune around the band and come back later. To determine whether to stick or go, several points should be kept in mind. First, is the station available? Is he a sharp operator with a high hourly rate, who will obviously be around for the whole contest (come back later), or someone who sounds like he doesn't really know what the contest is about, and may QRT at any time (stay). Next, is propagation favoring your call area? If he isn't working mostly stations in your district, go somewhere else, rather than adding to the confusion with little chance of success. Of course, if he's working only stations near you, be sure to stay.

When calling into a pile-up, be sure to use only standard phonetics. Using "cute" phonetics can confuse a DX operator whose command of the English language may not let him understand the phonetics you are using. While "Heaven Help Me" may not mean anything on the other end, "Hotel Hotel Mike" will. Also, call only once in a pile-up. I've heard many contest QSO's take place while another operator was repeating his call a second time. Calling twice only creates confusion, besides, you can't hear if your transmitter is operating. Remember, your chances of success in a pile-up are halved if a 200-per-hour rate is slowed to 100-per-hour by the confusion on frequency.

Finally, if at all possible, operate with your noise blanker off. Turning it on brings on overload problems in your receiver, something that can't be tolerated during a contest weekend. In fact, if at all possible during the peak period of the opening, operate with an attenuator in the circuit, as this will also help reduce overloading in your receiver.

These tips are not meant as an all-around guide to contest operating. The experienced contest

The ever popular Dave Guthrie 5NØDOG/K5QX, with his new Hal RTTY terminal and Drake TR7. Dave is a friend of DX and contestor alike because of his willingness to be very active. Look for him all bands, all modes. QSL to W4FRU.



Successful in working 6T1YP, the Children's Youth Palace in the Sudan? Then look forward to receiving one of these QSL cards in the mail.

operator will do many things differently. The suggestions have been given merely to get you to dive in and participate. Above all, don't be afraid of the pile-ups, and don't get frustrated. Put in about twenty hours of operating during the contest and see if you don't get hooked. You'll be surprised at the results.

Africa

Dr. Ed Richmond, W4MGN, recently made a trip to Western Africa. His purpose was pedagogical research in functional literacy and language, thus he was not able to make it a full-fledged DXpedition. He operated from stations made available by local Amateurs. Countries he visited included 6W8, Senegal; C5, Gambia; TU, Ivory Coast; TY, Benin; 5V7, Togo; XT, Upper Volta; and TZ, Mali. All operations were without lists or schedules. CW was used when allowed, although it should be pointed out that some African countries do not allow CW operation.

Does DX come to the Fresno bash? You bet. Pictured from left are DJ9ZB of Abu Ail fame, and HB9MX, QSL manager for Clipperton expedition. Make plans to attend next year.

Willis Island

Graham Mears, ex-VKØGM, will be on Willis Island as VK9ZG until sometime in December of this year. He plans operation on at least five bands, with possibilities for 6 and 160 meters also.

Graham will be using a Yaesu FR-101/FL-101 combination, with a tri-band beam. He will be operating both phone and CW.

QSLs for VK9ZG go to VK3OT. *Don't* send Green Stamps.* IRCs or mint Australian postage stamps are acceptable. *DXer's slang for dollars.

Sudan

Sudan is located in Africa, extending from the Red Sea to Libya, and southward to Uganda and Zaire. Omdurman, located just to the north of Khartoum, the Capitol, is the home of the Children's Youth Palace. During the month of June, 1980, Martti Laine, OH2BH, and Dr. Ville Hiilesmaa, OH2MM, went to the Youth Palace for lecturing and training in Amateur Radio for Club Station, 6T1YP. While there, they made the final adjustments to the station and operated for several days. The station, equipped with a TH3 tribander and dipoles, will be active after their departure. Mr. Fabul Kabbar, ST2FF, is in charge of the Youth Palace and the Club Station. The station is supported by the Northern California DX Foundation.

Martii and Ville also traveled to Juba, in Southern Sudan. Juba is in the Province of Equatoria, which has been given limited autonomy since 1972, thus qualifying for separate-country status with the prefix of STØ.They operated from Juba using the call ST2FF/STØ. Equipment used included TS-180S transceivers, MLA 2500 amplifiers, and they were able to operate simultaneously on two bands.

IRC or green stamp?

Many times, one will hear a conversation over the air that goes like this, "Yeah, I just shipped him a card with a Green Stamp." One wonders if the well-meaning soul knows what he is doing. In some countries, possession of a foreign currency is a punishable offense. Also, mail is sometimes opened, resulting in much questioning and possible prosecution for an otherwise innocent operator, and a setback for Amateur Radio in general in that country. Among countries where the Green Stamp can cause legal problems (and this is not a complete list) are: YB, VU, A51, AP, and most of Africa and Asia.

Even when possession of the Green Stamp is not prohibited, it can still cause problems. For example, in Australia, small amounts of dollar bills are traded like we trade IRCs. But consider the plight of the VK QSL manager. What does he do with Green Stamps in large volumes? First, they must be redeemed at a bank, where serial numbers are recorded, and they must be declared as a gift, thus becoming taxable, leaving 82 cents. Airmail postage is 55 cents, cards are 10 cents each, and airmail envelopes are 8 cents each. This leaves 12 cents to defray expedition ex-

QSL Information

Station	QSL via
AI5P/SV1	W3HNK
AP2VGH	K6SVL
A35JL	K9AUB
A4XCA	G4BWP
CN8CW	WA3HUP
CR9A	WB2KXA
CT2CE	AG1K
C5ABV	N4BPP
C6ACY	K4ZGB
C31JE	DL2SE
DA1WA/HBØ	DJØLC
EC2DA	EA2VW
EE1PG	Box 98, Vigo
FGØFOO/FS	N6RA
FK8DO	N4TN
FM7WO	WB4SXX
FPØMD	WB4SXX
FYØESE	DJ5KQ
FWØDD	VE3ODX
GJ4JPZ	DJØZF
G5ABB	W5UFZ
HK4CGH	NØAJZ
HL9WO	W5UFZ
HS1ALV	HS1BG
HS1AMU	WB2JRG
HS4 AMI	VE3DPB
H81AC	HP1AC
JTØFU	Oleg, Box 639, Ulan Bator, Mongolia
J6LKU	VS6CT
J6LKY	N6NK
KC4AAA	W6MAB
KG4HC	Harry Chamberlain, Box 12, FPO NY 09593
KG4WC	K4EXA
KH6EDY/KH7	KH6BZF
KP4EHP	KP4EHB
KV4AA	K6PBT
K5LBU/STØ	KC4CD
OA4SS	KB6J
OD5HQ	DJ9ZB
OH2OT/OHØ	OH3KM
PJ2CC	5 Aug-13 Aug, 1979 *Only* WB3JRU
PJ2CC	28 Mar-30 Mar, 1980 *Only* WB3JRU
PZ1DR	WD4NBX
P29AX	Michael Axmen, SIL Box 332 Ukarumpa, Papua New Guinea
R2B	UP2BAS
SR3KEY	SP3HYM
SVØAO	HarryTomair, Box 3061, APO NY 09223
TL8CR	YO9WL
UZØA	UK9AAN
VE8MTD	VE4TZ
VK9CCT	VK5QX
VK9XW	VK6RU
VQ9DM	K1BZ
VQ9JC	PSC 4, Box 17255, APO SF 96274
VP2VEZ	W5HF
VP2VFL	W7KHN
VP5AA	W4ZR
VP8ZR	G3KTJ
VS5GM	N2OO
WAØTAD/OA8	N4CQ
WD9DEE/C6A	WD9DEE
W5JMM/SU	SFM, Box 21, FPO NY 09527
XT2AU	WA1ZEZ
XT2AX	DK4AS
XT3AA	AI1D
ZB2GJ	KH6IMX
ZD8HR	N6HR
ZF2BY	K4VYN
3B6CD	3B8CF
3D2CC	VE6AKV
4A4MDX	XE1OX
4B4MDX	XE1OX
4S7DE	WB9OQV
5H3KS	Box 250, Dar es Salaam
5U7AF	Box 877, Niamey
5W1BT	WA6AHF
5Z4WD	DF7GX
7P8BL	K5PMF
7X4AN	DJ2BW
7X5QQ	F6FMQ
9G1AP	IØLCJ
9G1TN	Box 615, Tema Ghana
9K2DR	Bob Roberts, Box 21944, Kuwait, Arabia
9K2EW	WA3SWH
9M2MW	K4BF

penses. That's not much, and a whole lot more trouble for the manager.

Consider the problem one has with IRCs. In small quantities, they're okay, although you must depend on the operator to go to his post office to redeem them. This could take days, weeks, or possibly even months.

Also, some post offices won't redeem IRCs at all, and others limit the number per day that they will accept. In fact, one well-known DX operator brought his IRCs back to the U.S. to sell them before sending out QSLs.

Although both IRCs and Green Stamps have advantages and disadvantages, there is a better way. Mint foreign postage attached to a proper size return envelope will provide excellent return results. In fact, one of the locals here reports a 97 per cent return using this method. It's very easy on the DX operator; all he has to do is fill out a card and slip it in the envelope. With any luck, your card should go out the next day. As a good source for mint stamps, send an SASE to George Robertson's DX Stamp Service, 7661 Roder Parkway, Ontario, New York 14519. He'll send a list of stamps and prices.

Club news

New Officers for the Long Island DX Association are: President, Carl Lindenman, W2TDQ; Vice President, Allen Singer, N2KW; Treasurer, Charles Wagner, WA2YUH; Secretary, Arthur Bernstein, N2KA; and Corresponding Secretary, Robert Jacobsen, K2YGM. All correspondence should be sent c/o Arthur Bernstein, N2KA, 387 Avenue S, Apt. 6D, Brooklyn, New York 11223.

HRH

Questions & Answers

Entries for this column must be by letter or post card, only. No telephone requests will be accepted. All entries will be acknowledged when received and those judged to be most informative to the most Amateurs will be answered by return mail. Questions must relate to Amateur Radio.

Readers are invited to send a card naming the question they feel is most useful in each issue. Each month's winner will receive a prize, and there will be a prize for the most popular question of the year. In case of two or more questions on the same subject, the one arriving here the earliest will be used.

And the winner is...

It's good to note that you readers are voting for some of the questions sent in. You had us worried for a while there. Our June winner is L. J. Kane, AJ7H, for his question about grounds and grounding. Congratulations! Your autographed copy of Bill Orr's *Radio Handbook* is on its way.

Wire Length

I see various tables as to the length to cut wire antennas, but I have never been able to determine if you use just that length, or add on an amount for attaching to insulators. What is the proper procedure for cutting the antenna the correct length? — Gerald Word, WB4ZMT.

The rf energy in your antenna is interested in only the length of wire that is resonant, and the portion that bends back and is wrapped around itself doesn't even exist as far as your transmitter is concerned. The proper procedure will depend upon how you make up the end of the wire and the insulator, and everyone does it differently.

Most people have a "feel" for how much wire they use up to make the connection, and allow a "certain amount" extra for this purpose. If you want to be more precise, make a sample wrap

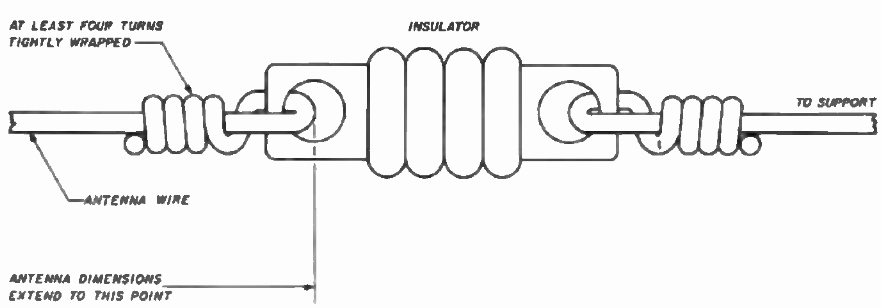


Fig. 1. Wire-length dimensions extend to the end of the wire after it has been looped through the insulator and wrapped back upon itself. It usually takes four to six inches of wire to make a good, tight wrap.

through an insulator and then undo it, and measure how much extra is needed. Remember that you have two insulators to contend with — the one at the center requires some extra wire too. The correct length of the finished antenna is from one tip of the wire (in the eye of the insulator) to the other tip.

If you need to "prune" the antenna, doing much hauling up and down, it's best to make the wrap on the ends rather loose, so you can unwrap it and cut off an inch or two, then rewrap it and check for SWR again. (You did cut it a bit long in the first place, so you could prune it to the correct length, didn't you?) After the final adjustment, make a neat and tight wrap (**Fig. 1**) that will not come apart in the middle of a windstorm.

Alignment

How about something on alignment? The instructions for the receiver I am working on say to make sure that the oscillator frequency is on the high side of the signal frequency. How do I hear the oscillator over the signal, or how do I tell when it is on the high side? How about an article on alignment? — Joe Dreyer, WA2RUY.

You can tell where the oscillator is by where the image frequency appears. For instance, assume that your i-f is 455 kHz, and you tune in a signal at 14.2 MHz (14,200 kHz). If your oscillator is on the high side, it must be 14.655 (14,200 plus 455 equals 14,655). Move your signal generator frequency slowly up the band. You should hear its signal again at 15,110 (14,665 plus 455 equals 15,110). On the other hand, if the oscillator is on the *low* side of the signal its frequency will be 13,745, and you will find an image at 13,290. The reason you move the signal generator frequency instead of tuning the receiver is that an Amateur-band-only receiver will not tune that far, whereas signal generators cover a wide range of frequencies.

As to articles on alignment — it's a good idea, but there are so many different types and makes of receivers out there that it would be very hard to cover all of them. As you have seen from your experience, what works for one does not work for another. Best bet is to get an instruction book and follow it faithfully. (What, you didn't get a book with that used Kluge MK-IV at the flea market? That'll teach you to be more selective next time! I've always felt that the lack of a book cuts the value of used gear in half.)

Tune-up problem

My question concerns a discrepancy between the tune-up of my linear into a dummy load and into a Yagi antenna.

I find that when I tune the linear into the dummy load, the amplifier settings do not correspond with those I obtain when tuning into the antenna (SWR on the Cantenna is 1:1, on the TA-33 is 1.5:1). Can you tell me the reason for this difference?

To put it in basic terms: your antenna is not presenting a *resistive* 50-ohm load to your coax cable. You should tune the antenna so that it *does* match 50 ohms. When this is done, the settings should be identical for either the antenna or the load, *at one particular frequency*! The settings will change slightly as you move from one end of the band to the other, but not all that much.

Why the sensitivity to what seems to be a low SWR? Blame the watt/SWR meter. I'm not saying it is no good, but rather that no simple meter of the type that most hams use can tell the whole story. A mismatched antenna presents an *inductive* or *capacitive* reactance at the end of your coax, and your SWR meter cannot tell you which (that's where the "noise bridge" shines for antenna adjustment). Your final's output circuit is sensitive to the reactance, and you must adjust the tuning and loading controls to make up the difference. (Just to put your mind at ease, place the dummy load at the end of your coax and see how the settings correspond. If they are the same as when the load was in the shack, you've eliminated one suspect, right?)

Recommended reading

"Use a noise Bridge," by Jack Althouse, K6NY, November, 1978. *Ham Radio Horizons*, page 38. Back issue or photocopy of article, $2.

Credit where it's due

I understand that many colleges give credit for knowledge and experience gained outside of the regular classroom. Do you know of any that give college credit for learning demonstrated by virtue of an Amateur Radio license. — Robert B. Nichols, K2VTT.

We don't have a list of schools that give credit for Amateur Radio activity, but there was a very good article telling how to go about getting credit for just such experience back in the July, 1979, issue of *Horizons*. Best thing to do is approach your own school's administration (or advisors) in the same manner the author of that article (W8DUV) did.

HRH

airTime

Rob Schneider, N6MR

Southern California DX Club Certificate

Anyone who has been on the air for more than a week must have noticed that California Amateurs, especially southern California Amateurs, are ridiculously easy to work. That there are more than 50,000 of us floating around the bands may have something to do with it, but whatever the reason, after a while the prospect of working sixes loses its magic for most hams.

The Southern California DX Club now issues a possible cure: a Certificate of Recognition, with endorsements, for working various numbers of club members. To qualify for the basic award, you must work and confirm contacts with 35 club members on any frequency from 1.8 to 30 MHz. A bronze seal is issued for 75 contacts, silver for 100 contacts, and gold for 125 member QSOs.

QSL cards are not required; verification by the Awards Chairmen of ARRL or IARU clubs is acceptable. Contacts must have been made on or after January 1, 1980, for award credit.

To qualify, submit a list of contacts with verifications and $2 or 10 IRCs to Norm Friedman, W6ORD, Co-Chairman of Awards Committee, SCDXC, 5400 Lindley Avenue #312, Encino, California 91316. A current club membership list is available from the same address for an SASE.

Worked All Forgottonia

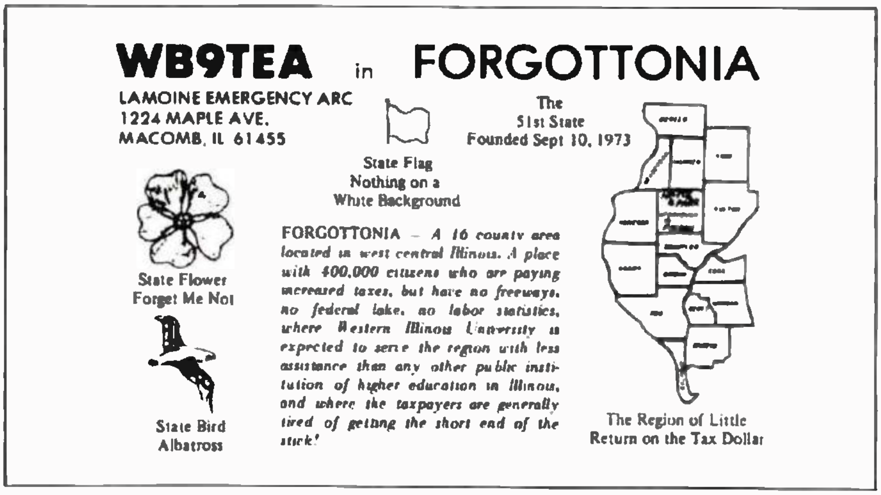
Forgottonia, in case you forgot, is our 51st state. Founded in 1973, Forgottonia is made up of 16 counties in west-central Illinois. It is populated by a half-million residents who claimed their forgotten status as a result of "driving nearly impassable roads, sending their children to under-funded schools, and being ignored by all Illinois officials except the Department of Revenue."

This "independent" region now offers two awards to Amateurs, both sponsored by the Lamoine Emergency Amateur Radio Club of Macomb, Illinois. The *Worked Forgottonia* award will be conferred on Amateurs confirming contacts with three Forgottonia stations. *Worked All Forgottonia* will be awarded to operators confirming contacts with at least one Amateur in each of the 16 counties of Forgottonia.

For the record, Forgottonia is composed of Adams, Brown, Calhoun, Cass, Fulton, Greene, Hancock, Henderson, Knox, McDonough, Mercer, Morgan, Pike, Schuyler, Scott, and Warren counties.

To apply for either award, send QSL cards along with a 9 × 12 SASE to AG9Y, c/o LEARC, 1224 Maple Avenue, Macomb, Illinois 61455.

HRH



POST BOX

Dear Horizons:

In the "Post Box" of the July, 1980, issue a reader asked a question about listing of nets. He beat me to part of my question — nets. However my question goes further.

As a new ham, just having gotten my General, I am at a loss as to what frequencies are used for what purposes. For example, per "Gentlemen's agreements" what parts of various bands are used for calling DX, RTTY, SSTV, etc.? I don't want to step on anyone's toes by calling "CQ" in a segment of the band where you don't do that, but I have never seen anything published covering the proper frequencies covered by these "Gentlemen's agreements."

Could you list a chart covering the various frequencies for the various modes on the Amateur bands, nets not included?

Arnold "Ben" Irvine, KA3ENV
Coopersburg, Pennsylvania

We've never seen such a chart or list either, Ben. The only official separations are those listed by the FCC in their rules and regulations. Other than that, no one owns any frequency, and, while they may have an agreement on how to use certain segments, they are by no means closed to everyone else. Common courtesy, however, says that you should respect the use of special modes or activities wherever possible. Best way to avoid stepping on toes is to listen, listen, listen. You'll soon get a feel for what is happening in different areas, and can join or avoid them, as you like. Also, a quick "QRL?" or "Is this frequency busy?" before jumping into a quiet spot will avoid some problems.

Funny thing, though, there seems to be a lot more gentlemen's agreements than there are gentlemen. **Editor.**

Dear Horizons:

I am not yet a ham operator, but by the time you publish this I will probably have already taken my code test.

I have only one of your issues (June, 1980) and have not subscribed. Your special on antennas has helped me select the right one. I'm 13 years old, and am already experienced in making printed circuit boards. I wonder if you'll have an article on some of the new ways to make your own PC boards at home?

Thanks a lot; keep it up.

Rick Miller
Naperville, Illinois

PC-board authors, take heed. **Editor.**

Dear Horizons:

I would like to thank you very much for an interesting publication. The articles are always a pleasure to read, especially to a beginner like myself.

My interest in Amateur Radio goes back twenty-five years. Due to various reasons, I never got on the air until the other night when I worked another Novice up the street. What a thrill! A dream coming true after twenty-five years.

Also, I've met some great people involved with Amateur Radio. They are always willing to give a hand with suggestions or procedures.

Ben Alabastro, WA2PXR
Frankfort, New York

Dear Horizons:

Thank you for the antenna issue, June, 1980. The Inverted Vee is often the most used city lot wire antenna and Ed Noll did a great job in explaining theory and construction.

One shortcoming of the issue was not including trap theory and construction. An extensive article, in plain language, on the construction and theory would be perfect for the wire antenna operator. This will be especially helpful to the ham who has a particular problem (other than budget) when trying to operate multimode.

Always happy to learn more about my number one hobby.

Rick Fultz, KA5DHQ
El Paso, Texas

We have a trap article in the works, Rick. Will put it in print soon. **Editor.**

Dear Horizons:

I noticed your remarks in the Q&A column of July, 1980. KA4LZG asked why "— ·" was used in lieu of "9" on a RST 5NN reply.

I'm going back quite a way, on commercial frequencies using CW on 400-510 kHz. When sending ship traffic that contained many numbers, it was customary to confirm those numbers in the text with "short numbers," that is:

1 · —
2 · · —
3 · · · —
4 · · · · —
5 · · · · · (or ·)
6 — · · · ·
7 — · · ·
8 — · ·
9 — · (note)
0 —

If you listen to these frequencies, you'll find that these short numbers are still used.

I find there are so many items that old-timers use but fail to pass on to our younger and newer operators. Maybe this will help KA4LZG.

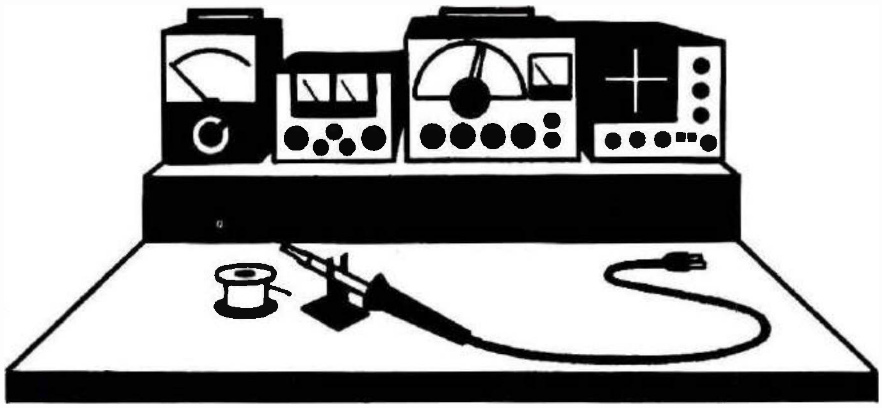
Otto Freytag, K4QFM
Riviera Beach, Florida

Dear Horizons:

Whatever happened to the Station-of-the-Month? I believe that the idea was a good one, as it gave Amateurs, particularly Novices, a chance to see how to set up a station and operate it with maximum convenience and good appearance. I hope it wasn't apathy!

Cy Stanway, VE3IFS

As the saying goes, our audience was underwhelmed! **Editor.**



BENCHMARKS

A Kenwood Crash Helmet

I have finally done something about my greatest fear, which is smacking the face of my TS-520-S against the doorframe of the shack, or some other equally immovable object, while carrying it to the car or elsewhere.

I once had the opportunity to use a Yaesu FT-101B that had been frontally assaulted by forces unknown during a transfer its owner, Charlie, had undergone. The movers apparently hadn't padded the front of it adequately, and it suffered a blow of some kind. It was not a very enjoyable rig to use because of that; the VFO knob bound in one spot, and wobbled up and down severely. Charlie became quite an expert in answering the first-time-user's inevitable question, "What in the world happened to this thing?" I vowed not to let the same thing happen to my own new radio when I got it.

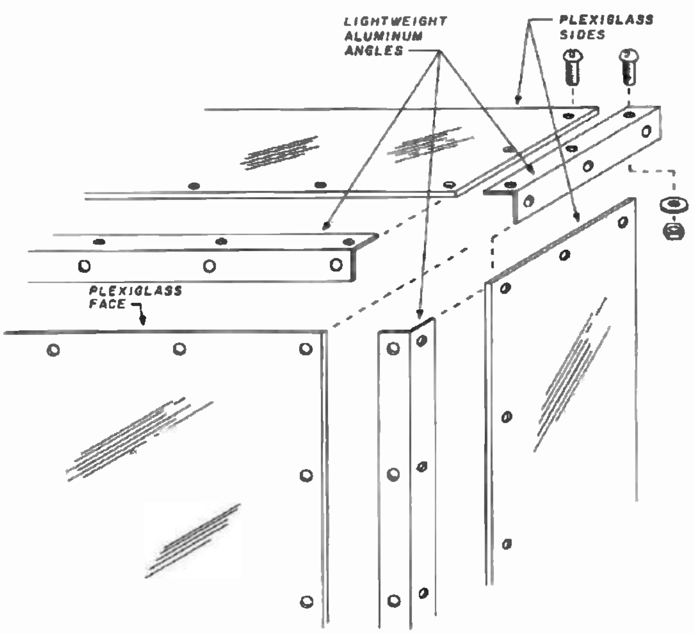


Figure 1

Kenwood installs handles on their "portables," but nothing that serves as protection, even as an optional item. Forty pounds of rig can build up an incredible amount of force at the end of your arm if swung, even slightly. My dreams of forever-new TS520-S were always dimmed by fear of the "crunch" that might come someday. Certainly a cover of some kind needed inventing.

Many ideas came and went before the final product was made. Styrofoam, sheet-metal, and *Fiberglas*, to name a few, were mulled over before being dismissed as being too crude, expensive, or not protective enough. I'm not blessed with enough patience to make a professionally sculpted job, so its being rugged, cheap, and easy to make took precedence.

Kenwood themselves have done the most important part of this project for you; they have provided a lip around the face of their rigs on which the cover will rest. Depending on your workmanship, a very tight fit can be made to this rim. I made my cover from 1/8" *Plexiglas* which I scrounged from a sheet-metal shop. You can make yours from this same material or anything else that you find handy of the same approximate thickness and stiffness. Exact measurements are not required, as the cornerpieces that hold it all together will hide a multitude of mistakes.

Start by cutting the end pieces and join them together in the box shape of the radio front. Make sure the edge that contacts the rig is *flat*, otherwise it will rock on the high point and drive you crazy trying to fit it. Also, ream out the bolt holes a bit larger than the bolts so there will be some slack to play with while fitting. Once the frame is together to your satisfaction, cut and mount the face piece with the same corner molding stuff you used for the box (**Fig. 1**). I used some aluminum angles left over from when siding was put on our building; it cuts easily with scissors, and is very strong when used like this. Use whatever you have to hold this face on; I used sheet-metal screws for assembly convenience. Place some hooks on the sides for rubber-band mounting (**Fig. 2**), and you're ready to go.

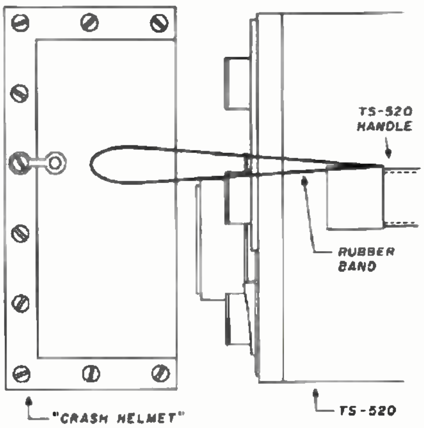


Figure 2

Some of you may comment on how easily the plastic could break, and you're right, it will! If it does shatter while doing the job it was designed for, I won't feel that it owes me anything. Besides, a cover of this sort is not a license to handle the rig recklessly, it's just an insurance policy.

Larry Herbert, WB3HEX

Product showcase

New Low-Cost AC Power Controller

Marway Products, Inc. has introduced a new low-cost, compact ac power controller with eight outlets, EMI filter, built-in circuit breaker, and other high-performance UL/CSA-approved components. The MPD 117 controls, filters and distributes ac power from a single outlet to up to eight devices for optimum performance of microcomputer systems, stereo and audio-visual components, and other office- and home-electronics devices, reported Wayne Whitney, president of Marway.

"Marway designed the MPD 117 to fill an existing void in high-quality ac power-controller devices. The MPD 117 is the logical extension of our growing line of power controllers. For example, the standard small-business computer system has a video-display terminal, floppy-disk drives, a processor, and a printer," Whitney explained. "One wall outlet doesn't provide enough receptacles or adequately controlled power to efficiently operate all those devices. The MPD 117 transforms the common wall outlet into a highly capable power source that distributes power cleanly and conveniently for up to eight devices." According to Whitney, power surges, "glitches," noise interference, and line transients are eliminated with the MPD 117.

Marway's MPD 117 has eight outlets — two direct and six controlled by an illuminated "off/on" switch — and features a high-performance EMI filter, built-in circuit breaker, and noise suppressor. All components are protected by the rugged, all-metal, fine-finish black chassis, with convenient mounting flanges. A 6½ foot power cord is standard. Single-unit price is listed at $89.00. OEM discounts are available. Standard color is black. Designer colors are available as an option. For further information, contact Marway Products, Inc., 2421 S. Birch St., Santa Ana, California 92707.

RTTY Reader

A new radioteletype code reader has been introduced by Microcraft Corporation for SWLs, Novices, and veteran radio operators. It is completely self-contained, featuring an eight-character moving LED display, separate, active, mark and space filters, and tuning LEDs. All text characters — letters, numbers, and punctuation, are shown sequentially on the display. It features an extremely versatile decoding system capable of handling 170, 425, and 850 Hz FSK with RTTY speeds of 60, 67, 75, and 100 WPM Baudot and 100 WPM ASCII. All that is required for operation is to connect it to the loudspeaker of a communications receiver — no CRT is needed. It is compact, measuring 7.375 × 5.75 × 3.375 inches (18.73 × 14.6 × 8.57 cm), and weighs 4 pounds (1.8 kg). The kit version, RRK, recommended for only intermediate to advanced builders, costs $189.95. The wired and tested version, RRF, is $269.95. An optional 220 Vac, 50/60 Hz transformer is available for an additional $6.00. Shipping and handling in the Continental United States is an additional $5.00. Shipments are made worldwide and requests for quotes are invited. Microcraft Corporation, P.O. Box 513, Thiensville, Wisconsin 53092.

More details? Ad Check page 78.

Hy-Gain Adds Three New Towers

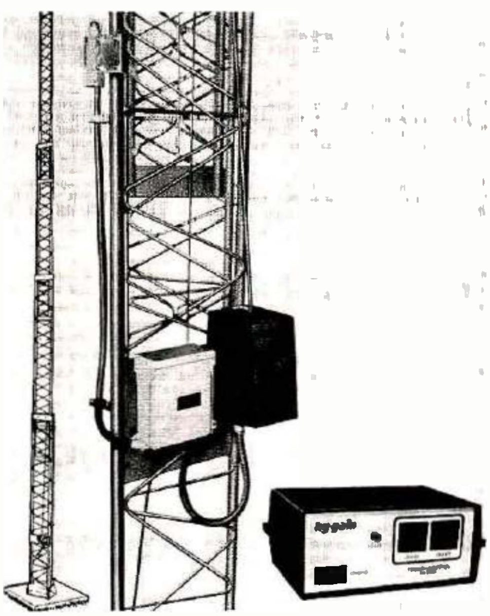
Hy-Gain, a division of Telex Communications, Inc., has announced the addition of three new products to its fast-growing line of towers. The HG-70HD, a new 70-foot (21.3 m), self-supporting crank-up tower, is the tallest of seven towers now offered by Telex/Hy-Gain. The tower is all steel, has four sections, and features an improved guide system providing rigid, close-tolerance structural support while leaving the tube ends open for complete surface galvanizing and unrestricted moisture drainage. This heavy-duty tower was designed for antenna loads of up to 16 square feet (1.5 square meters) in winds of up to 60 mph (96.6 kmph). The top section is predrilled for thrust-bearing bolts, and a rotor mounting plate is included.

Hy-Gain has also developed a new electric winch system, Model No. HG-EW, that fits the new HG-70HD as well as the existing 54-foot (16.5 meter) HG-54HD and the 52 foot (15.8 meter) HG-52SS. The winch control box can be locked, which allows the tower to be secure in either the extended or retracted position. It has a limit switch which prevents a possible overload at the upper stop position. A manual crank is also supplied in the event of an electrical power failure. The HG-EW is equipped with an automatic brake which is always in positive engagement when the winch is not operating.

This winch system can be converted at any time to remote-control operation by adding the new Hy-Gain tower control (HG-EWRC) which has been specifically designed as a modular addition to the HG-EW winch. This remote-control unit allows the operator to conveniently raise and lower the tower from a remote location such as a ham shack. The control displays upper and lower limit positions, up or down operating direction, and also provides a fail-safe sensor and indicator which automatically shuts off the winch should extreme side loads affect tower telescoping. Both the winch and the remote control are available for 110 and 200 volt operation.

For further information regarding these new products, contact Clyde Blyleven at Hy-Gain, Division of Telex Communications, Inc., (402) 467-5321, 8601 Northeast Highway Six, Lincoln, Nebraska 68505.

Telex/Hy-Gain is a manufacturer of antennas, towers, rotators, microphones, and headsets for Amateur, CB, marine, professional two-way radio, industrial, and military applications. The company markets its products nationwide and internationally in over 80 countries.



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SALE: Heathkit HR-1680 receiver, mint. Hallicrafters HT-37 transmitter, mint. Vertical 80-10 meters. Great deal, $250.00. Phil Nigash, KA5EVR, 325 Kelil, Farmington, AR 72730.

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FOR SALE: SAMS CB RADIO REPAIR BOOKS. Books 1-220. Perfect condition. Most never opened. $968.00 value; $550.00 including shipping. Les Cameron, 12222 Centralia Rd., Lakewood, CA 90715.

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LINEAR AMPLIFIER PLANBOOK II: 92 pages, $11.95. Code training course, 3 record set with book, 30 lessons from 2 to 22 wpm, $8.00. From CB to Ham beginner, 144 pages, $4.75. Modification kits, crystals, and more in our catalog — $1.00 — refundable, sent free with purchase. A. P. Systems, P.O. Box 488, Milford, PA 18337.

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WANT TO TRADE for good CW ham gear ($150 value), fifty piece service for eight, Rogers Oneida silverplate silverware, rose design, in good condition, purchased in 1951. Jim Howell, KA4EBW, Route 9, Box 251, Salisbury, NC 28144. 704-633-9183.

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COMING EVENTS

YL ANNIVERSARY PARTY: CW: Starts October 15 at 1800 UTC and ends on October 16 at 1800 UTC. Phone: Starts on November 5 at 1800 UTC and ends on November 6 at 1800 UTC. More info or logs: Ione O'Donnell, WA2DMK, Newcomb, NY 12852.

MASSACHUSETTS: 19-79 Repeater Association of Malden, Massachusetts first annual flea market on October 19 at the Beachmont VFW Post, 150 Bennington St., Revere, Massachusetts. Admission: $1.00. Talk-in on 19-79 and .52. More info: P.O. Box 221, Malden, MA 02148.

More details? Ad Check page 78.

THE CEDAR VALLEY AMATEUR RADIO CLUB'S annual hamfest is Sunday, October 5, in Cedar Rapids, Hawkeye Downs Exhibition Hall. Technical talks, Large Flea Market, Manufacturers and Dealers welcome. Talk-in on 146.16-.76, .52, 223.34-.94 MHz. Advance tickets $2, $3 at the door. Write CVARC Hamfest, Box 994, Cedar Rapids, Iowa 52406.

TEXAS: Houston Com-Vention 80 on October 3-5 at the Marriott Brookhollow Hotel, Houston. ARRL sanctioned with at least 40 commercial exhibitors, tech sessions, DX and contests. Hosted by the Texas DX Society. Banquet speaker: Roy Neal, K6DUE, science editor for NBC news. Special hotel rate set up. For more info: HHC, P.O. Box 79252, Houston, TX 77024.

INDIANA: Marshall County A.R.C.'s Plymouth Indiana Swap and Shop on October 12 at the National Guard Armory in the west part of Plymouth. Tickets: $2.00 advanced and $2.50 at door. More info: P.O. Box 151, Plymouth, IN 46563.

NEW JERSEY: Greater Delaware Valley Hamfest on October 19, 8:00 AM - 5 PM at the Nashville East Cotillion Ballroom, Rt. 73, Pennsauken, NJ. Outdoor flea market, indoor exhibits, door prizes hourly, seminars, food, YL-XYL activities, table spaces. Advanced tickets $2.00 S.A.S.E. At gate: $2.50 YL/XYL free. Talk-in on 146.19-.79 and 146.58 simplex. Tickets, info., or table reservations: Greater Delaware Valley Hamfest, 15 E. Camden Ave., Moorestown, NJ 08057. (609) 234-3926.

LOUISIANA: The New Orleans Hamfest-Computerfest (AMACOM '80) on October 11-12 at the Airport Hilton Inn in Kenner Louisiana. Sponsored by the Jefferson A.R.C. Forums, demonstrations, large flea market, commercial exhibits and more. More info: AMACOM '80, P.O. Box 73665, Metairie, Louisiana 70033.

NEW YORK: Radio Amateurs of Greater Syracuse Hamfest on October 4 at the New York State Fairgrounds, Syracuse. Commercial exhibits, door prizes, and more. For more info: R.A.G.S., P.O. Box 88, Liverpool, NY 13088.

VIRGINIA: ARRL Virginia State Convention and Hamfest on October 4 and 5 at the Virginia Beach, Virginia Arts and Conference Center. ARRL, traffic, DX, technical forums, XYL free bingo and lounge. Admission $3.50. Advance ticket drawing. Tickets and info: T.R.C., P.O. Box 7101, Portsmouth, VA 23707. S.A.S.E.

PENNSYLVANIA: Pack Rats fourth annual Mid-Atlantic States VHF Conference on October 4 at the Warrington, Pennsylvania. Advanced registration: $3.00, $4.00 at the door. Includes admission to Hamarama 80 flea market at Bucks County Drive-in, Rt. 611, Warrington. Flea Market alone is $2.00. Tailgating: $2.00 per space. Talk-in W3CCX on 52. Info for both events: Ron Whitsel, WA3AXV, P.O. Box 353, Southampton, Pennsylvania 18966. (215) 355-5730.

TEXAS: El Paso Hamfest on October 11 and 12 at the Missle Inn, 9487 Dyer St., (U.S. 54) Talk-in on 146.28-.88. Seminars, swap tables, door prizes, and more. Write El Paso Hamfest, P.O. Box 4573, El Paso, TX 79914 or call Mary Ann or Roy Gould, (915) 751-7638.

NEW ZEALAND: New Zealand Association of Radio Transmitters Inc. VK/ZL Oceania DX contest 1980 from 1000 GMT Saturday, October 4 to 1000 GMT Sunday, October 5 Phone. 1000 GMT Saturay, October 11 to 1000 GMT Sunday, October 12 CW.

JAMBOREE-ON-THE-AIR: Starts: 001 UTC October 18 Ends: 2400 UTC October 19. Sponsored by the World Scout Bureau. Not a contest, just an opportunity for all kids to talk about scouting. No logs required. Certificates available from W2GND, H.A. Harchar, 216 Maxwell Ave., Hightstown, NJ 08520. Freqs. Phone: 3940, 7290, 14.290, 21.360, 28.990, 50.500; CW: 3590, 7030, 14.070, 21.040, 28.190, 50.050; Novice: 3750, 7125, 21.140. All SSTV, RTTY frequencies.

NEW YORK: ARRL Hudson Division convention on November 7-9 at Pines Resort Hotel in South Fallsburg, New York. Exhibits, door prizes and much more. More info: Randy Gutentag, WA2RMZ, 86 Balch Ave., Piscataway, NJ 08854.

More details? Ad Check page 78.

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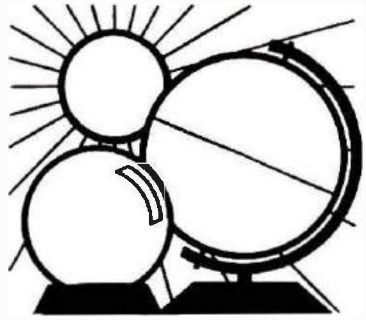

DX FORECASTER

Last-minute forecast

October is likely to be a rather placid month, except for perhaps the 4th, 5th, and 6th, when solar eruptions may create an unsettled-to-active geomagnetic field and an ionospheric disturbance that could be accompanied by unusual atmospheric effects — along with freak radio propagation conditions. A disturbance of somewhat lesser magnitude may occur between the 24th and 28th, when radio propagation is likely to be upset for a day or two. Full moon and perigee occur on the 23rd.

Band-by-band conditions

Six and *ten meters* are likely to provide some excellent openings on several days during the month, when MUFs climb above 50 MHz. Look for strong signals during the afternoon and evening hours, particularly to South and Central America, and even into South Africa from the East Coast. West Coasters should stay alert for openings into the South Pacific at such times. *Ten* should provide some excellent long-haul DX, as well as many short-skip opportunities.

Fifteen and *twenty meters* will be jumping with signals most of the day and early evening as MUFs rise above 21 MHz shortly after sunrise until long after sunset between the U.S. and most areas of the world. Expect strong openings on most days for north-south propagation, and moderate to strong signals on east-west propagation. In particular, *twenty* will open sooner and stay open longer, with early-morning and late-afternoon signal peaks. *Fifteen* will not provide the 24-hour possibilities of *twenty*, but will excel at signal-to-noise ratio. Both bands will exhibit strong short-skip signals during daylight and early evening hours.

Forty and *eighty meters* once again become prime DX bands as summer static fades into oblivion. You will hear signals on *forty* around the clock, but the DX propagation begins at about sunset and lasts throughout the night. Look eastward after sunset, and westward before sunrise. Very strong north-south propagation between the U.S. and Africa, Central and South America, and even Pacific locations can occur on many days of the month. On *eighty*, the band opens somewhat later, with signals peaking after midnight on the trans-equatorial paths. Short-skip communications will prevail on both bands during the afternoon and early evening hours.

One-sixty meters — Welcome the top band back once more, as hours of darkness and sunrise provide some fine openings. You may expect slight problems from QRN, but many days of the month are likely to provide superb opportunities to work DX and short-skip stations.

As always, keep tuned to WWV at 18 after the hour for last-minute propagation information. Watch *trends* in the *A* values and solar flux index to see whether the bands are improving or deteriorating. Remember: high solar flux and low *K* and *A* numbers mean good DX propagation is likely.

HRH

GMT	PDT	WESTERN USA N ↑ ASIA FAR EAST	NE ↗ EUROPE	E → S. AFRICA	SE ↘ S. AMERICA	S ↓ ANTARCTICA	SW ↙ NEW ZEALAND	W ← OCEANIA AUSTRALIA	NW ↖ JAPAN	MDT	MID USA N ↑ ASIA FAR EAST	NE ↗ EUROPE	E → S. AFRICA	SE ↘ S. AMERICA	S ↓ ANTARCTICA	SW ↙ NEW ZEALAND	W ← OCEANIA AUSTRALIA	NW ↖ JAPAN	CDT	EDT	EASTERN USA N ↑ ASIA FAR EAST	NE ↗ EUROPE	E → S. AFRICA	SE ↘ CARIBBEAN S. AMERICA	S ↓ ANTARCTICA	SW ↙ NEW ZEALAND	W ← OCEANIA AUSTRALIA	NW ↖ JAPAN
0000	5:00	10	20	20	10	10	10	10	10	6:00	—	20	15	15	10	10	10	10	7:00	8:00	—	15	20	15	10	10	10	20
0100	6:00	10	20	20	10	15	10	10	10	7:00	—	20	20	15	10	10	10	10	8:00	9:00	15	20	20	15	15	10	10	20
0200	7:00	10	20	—	15	15	10	10	10	8:00	—	40	20	10	15	10	10	10	9:00	10:00	—	20	20	20	15	15	15	20
0300	8:00	10	—	—	15	15	10	10	15	9:00	—	40	20	10	15	10	15	15	10:00	11:00	—	20	20	20	20	15	15	20
0400	9:00	—	—	—	15	15	10	15	15	10:00	—	40	20	10	15	15	15	15	11:00	12:00	—	20	20	20	20	20*	15	20
0500	10:00	—	—	20	15	15	—	15	20	11:00	20	40	20	10	15	15	15	20	12:00	1:00	—	20	20	20	20	20	—	20
0600	11:00	—	—	20	20	15	—	15	20	12:00	—	40*	20	10	20	20	20	20	1:00	2:00	—	40	20	20	20	20	—	20
0700	12:00	20	—	20	20	20	40	15	20	1:00	—	—	20	10	20	20	20	20	2:00	3:00	20	40	20	40	20	20	20	—
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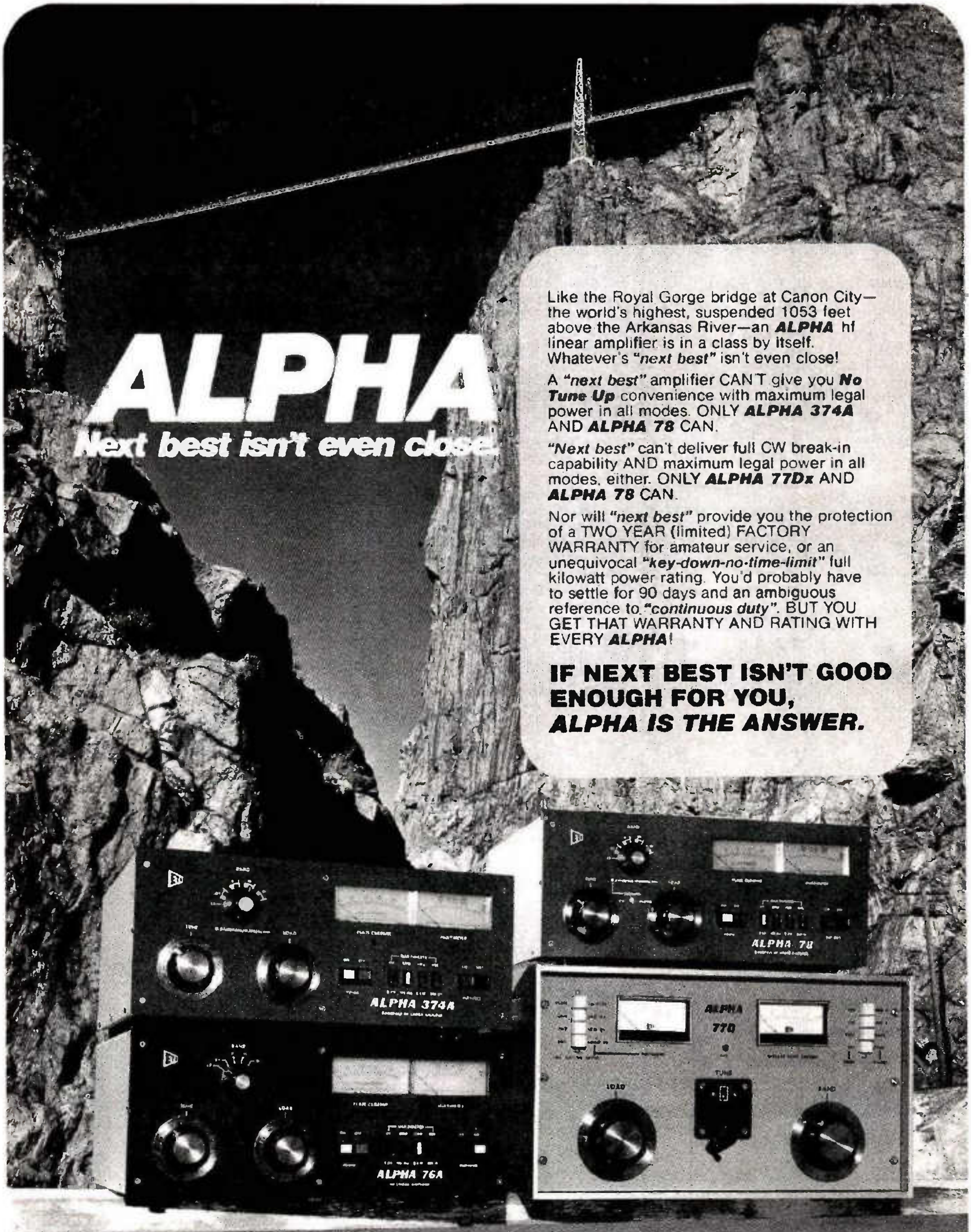
1300	6:00	20	—	—	40	40	40	20	20	7:00	20	20	—	10	20	20	20	20	8:00	9:00	—	20	—	10	—	20	20	20
1400	7:00	20	20	—	20	—	20	20	20	8:00	20	20	—	10	—	20	20	20	9:00	10:00	20	20	10	10	—	—	20	—
1500	8:00	20	20	—	10	—	20*	20	—	9:00	15	15	—	10	—	—	20	20	10:00	11:00	20	15	10	10	—	—	20	—
1600	9:00	15	15	—	10	—	15	20	—	10:00	15	15	10	10	—	—	20	10	11:00	12:00	15	15	10	10	—	—	—	—
1700	10:00	15	15	10	10	—	15*	20	—	11:00	15*	15*	10	10	—	—	20	—	12:00	1:00	10	10	10	10	—	—	—	—
1800	11:00	15	15	10	10	—	10	—	—	12:00	15	15*	10	10	—	10	20	—	1:00	2:00	10	10	10	10	—	—	—	—
1900	12:00	15	15	10	10	—	10	—	—	1:00	15	15*	10	10	—	10	10	—	2:00	3:00	10	10	10	10	—	—	—	—
2000	1:00	15*	15	15	10	—	10	—	—	2:00	15	15	10	10	—	10	10	—	3:00	4:00	—	10	15*	10	—	—	—	—
2100	2:00	10	15	15	10	10	10	10	—	3:00	—	15	10	10	10	10	10	—	4:00	5:00	—	10	15	10	10	10	—	15
2200	3:00	10	20	20	10	10	10	10	10	4:00	—	20	15	10	10	10	10	—	5:00	6:00	—	15	20*	10	10	10	10	10
2300	4:00	10	20	20	10	10	10	10	10	5:00	—	20	15	10	10	10	10	10	6:00	7:00	—	15	20	15	10	10	10	10

OCTOBER

HAM CALENDAR October

Saturday	Monday	Tuesday	Wednesday	Thursday	Friday	Sunday
			1	2	Houston Com-Vention 80 — Marriott Brookhollow Hotel — Houston, Texas — 3-5 3	Radio Amateurs of Greater Syracuse Hamfest — New York State Fairgrounds — Syracuse, New York — 4 Fifth Annual Tidewater Hamfest — Virginia Beach, Virginia, Arts and Conference Center — Tickets and information — TRC, P.O. Box 7101, Portsmouth, Virginia 23707 SASE — 4-5 New Zealand Association of Radio Transmitters Inc. — VK/ZL/Oceania DX Contest 1980 — 24 hours from 1000Z Saturday 4 October to 1000Z Sunday 5 October — 4-5 4
Blossomland Amateur Radio Association — The 1980 Blossomland Blast — Lake Michigan College Convention Center near Benton Harbor, Michigan — N8BPI — 5 Cedar Valley Amateur Radio Club's Annual Hamfest — Cedar Rapids, Iowa — Hawkeye Downs Exhibition Hall — CVARC Hamfest, Box 994, Cedar Rapids, Iowa — 5 5	Florida Ham News — Swap Net By the Broward ARC 146:31-91 at 7:30 PM Glenhurst Radio Society Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB West Coast Bulletin Edited & Transmitted by W6ZF 8:00 PM PST 3540 kHz, A-1, 22 WPM 6	AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) 7	8	9	10	New Zealand Association of Radio Transmitters Inc. — VK/ZL/Oceania DX Contest 1980 — 24 hours from 1000Z Saturday 11 October to 1000Z Sunday 12 October — 11-12 The New Orleans Hamfest — Computerfest AMACOM — Airport Hilton Inn, Kenner, New Orleans, Louisiana — WA5MJM/NNN0ZXW — 11-12 11
Plymouth, Indiana, Swap and Shop — National Guard Armory — MCARC, P.O. Box 151, Plymouth, Indiana 46563 — 12 12	Florida Ham News — Swap Net By the Broward ARC 146:31-91 at 7:30 PM Glenhurst Radio Society Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 13	AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) 14	15	The TU-Boro A.R.C. — Odd Fellows Hall, 149-14 14th Avenue, Whitestone, NY — WB2PFO — 18 16	17	All Scouts Jamboree-On-the-Air 1980 — Starts 0001Z 18 October, ends 2400Z 19 October — 18-19 18
19-79 Repeater Association of Walden, Massachusetts — Beachmont VFW Post, 150 Bennington Street, Revere, Massachusetts — Talk-in on 19-79&52 — 19 19	Florida Ham News — Swap Net By the Broward ARC 146:31-91 at 7:30 PM Glenhurst Radio Society Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB West Coast Bulletin Edited & Transmitted by W6ZF 8:00 PM PST 3540 kHz, A-1, 22 WPM 20	AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) 21	22	23	24	25
26	Florida Ham News — Swap Net By the Broward ARC 146:31-91 at 7:30 PM Glenhurst Radio Society Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 27	AMSAT Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) 29	28	30		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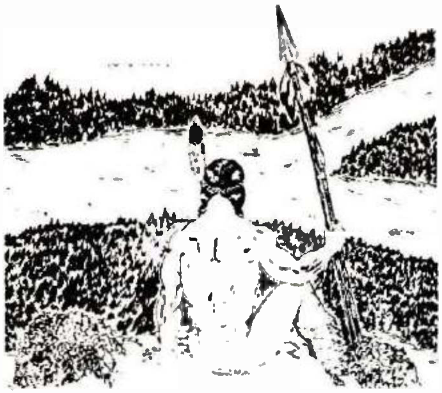

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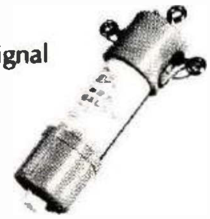

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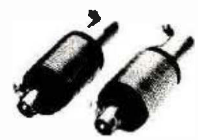

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  Receives shortwave, medium-wave, and long-wave bands.
- **30 bands, each 1 MHz wide**
  Easy-to-use band switch with large knob.
- **Five-digit frequency display and analog dial**
  Accurate digital display with 1-kHz resolution and illuminated analog dial with precise gear dial mechanism.
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  Precise 12-hour clock with AM and PM indicators. Timer turns on radio for scheduled listening, and even controls a recorder through remote terminal.
- **Up-conversion PLL, wideband RF circuits**
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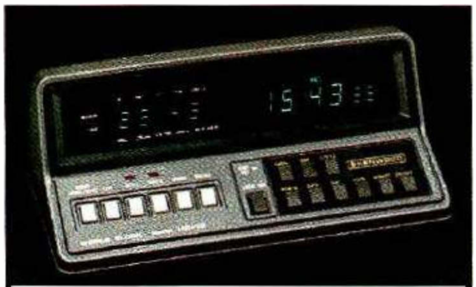

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