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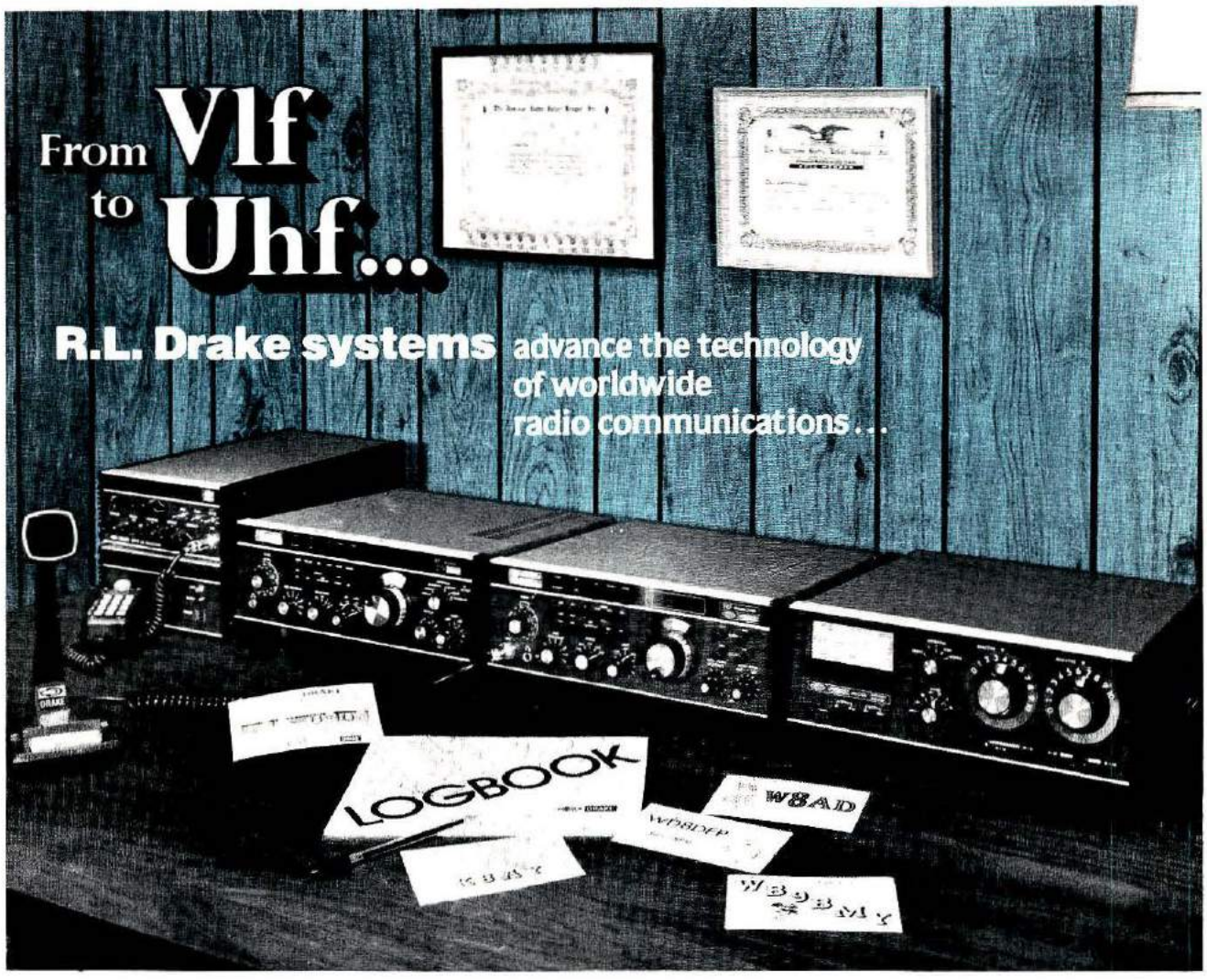

with innovative system engineering that offers you a number of "first in the world" features.

The Drake 7-line system:

Drake TR-7: The first amateur transceiver in the world to offer full general coverage (0-30 MHz) reception capability, 1.8 to 30 MHz transmission capability, and synthesized "up-conversion" design techniques. It's ready now for future band expansions, MARS, and other services.

Drake R-7: The first amateur receiver in the world to combine full general coverage (0-30 MHz) reception and synthesized "up-conversion" design techniques, with transceive capability, full passband tuning, notch filter and dual receive antenna circuitry.

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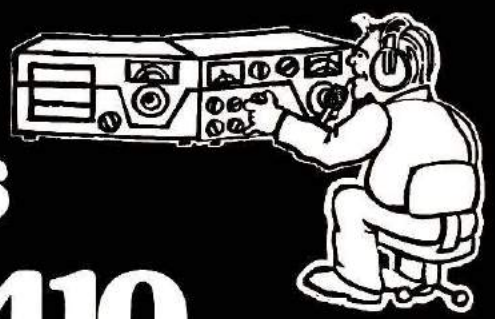

DenTron

DENTRON Clipperton L linear amplifier

HI/LO power switching, covers 160 thru 15 meters, 2000W PEP SSB, 1000W DC on CW, RTTY, SSTV, continuous duty power supply 2500 idle SSB, 1800V idle CW, covers most MARS freqs. just outside ham bands, easily changed 117V or 234V AC 50/60 Hz. Final Tubes: 4-572B.

599.50 Call for quote.

DENTRON GLA-1000 linear amplifier

Freq. 80 to 15 meters, covers most MARS frequencies. RF drive: max 125, power consumption: 117 VAC 50/60 Hz 12.5 Amps, factory fused at 15 Amps, 234 VAC 50/60 Hz 7 Amps, DC input: 1 KW CW and 1200W PEP SSB, Final Tubes: 4 D-50A tubes (6LQ6).

379.50 Call for quote.

DENTRON MT-3000A antenna tuner

Dentron's ultimate tuner! For coax, random wire, and balanced feed systems, built-in antenna selector switch for 5 different antennas, power handling 3 KW PEP, built-in 50 ohm 250W dummy load, dual watt meters, 3 core heavy duty balun, continuous tuning: 160 to 10 meters.

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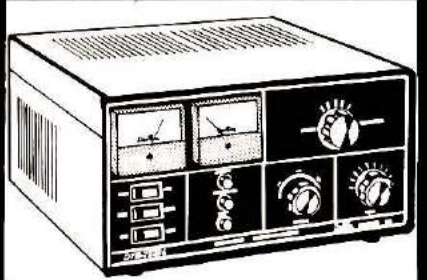

DENTRON DTR-2000L 2000W precision linear amplifier

Features a Broadcast proven 8877 tube, freq. coverage 160 thru 15 meters, covers most MARS frequencies, modes: USB, LSB, CW, 234/117 VAC 50/60 Hz, RF drive power 125W max and 65W RMS min. for 1 KW DC input, 1.8-21 MHz 2000W PEP.

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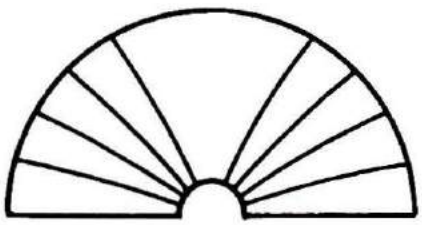
THIS MONTHS



HORIZONS

A Converter For 20/15/10 Meters

When W8YFB built the beginner's receiver for our February and March issues, he kept it as simple as possible, while maintaining a goal of better-than-average performance. Accordingly, it was limited to coverage of 80 and 40 meters. Realizing that most amateurs would not be content to listen to just that part of the spectrum, especially now that the sunspot cycle is creating a wonderland out of our higher bands, Bill had a matching converter ready to go as soon as we asked for it. It's equally simple — a couple of transistors, two PC boards, a switch, some crystals, and a handful of small parts. It'll do wonders for a general-coverage receiver, too, so build one even if you didn't tackle the receiver project.

An Amateur Convention In The Far East

Conventions are always fun. They provide the opportunity to see old friends, to meet new ones, to learn about new equipment and techniques, and to enjoy the friendship of ham radio. But what about a convention where the call signs of the attendees read like the latest DX bulletin — HS1, 9M2, YB0, DU, VK, 9N1, S76, A6, 9V1, and so on? There is only one such affair, the annual conference of the South East Asia NETwork, SEANET. Let's share the adventures of N1RM as he takes us on a guided tour during the 1977 SEANET convention in far-off Thailand.

Robot Circuits Simplified

What's a robot? Webster defines it as "an automatic apparatus or device that performs functions ordinarily ascribed to human beings or operates with what appears to be almost human intelligence." W6HDM explores the concept of robots in the ham shack — simple circuits that can be used to perform a variety of electronic tasks.

Amateur Radio For You And Me

Amateur Radio is easier to get into than you think, and it's never too late to take part in the fun offered by this worldwide hobby. Whet your appetite on this sample of what hams are up to — read about who they are, then join the group.

What's The Band Like?

You've heard those propagation forecasts from WWV. What does the information mean to you as an amateur? Author W2XQ presents an easy-to-understand interpretation of propagation information, together with some handy operating aids to enhance your DX activities.

Golden Years — The Doerle Shortwave Receiver

Here's the story of an early pioneer in shortwave receiver design, Walter Doerle, who made it possible for fellows in the early thirties to get in on the new world of shortwave radio. He came up with a simple and easy-to-build set that was inexpensive even during the depression years. Old timer Bill Orr gives the details.

The Cover

W8YFB designed the receiver described in the previous two issues of *Horizons*, and he planned ahead with a converter to make it work on 20, 15, and 10 meters. It's easy to build, and requires only a few parts. Tom Broscius, WA2RWA, caught the spirit of the project in his original painting. The story starts on page 12.

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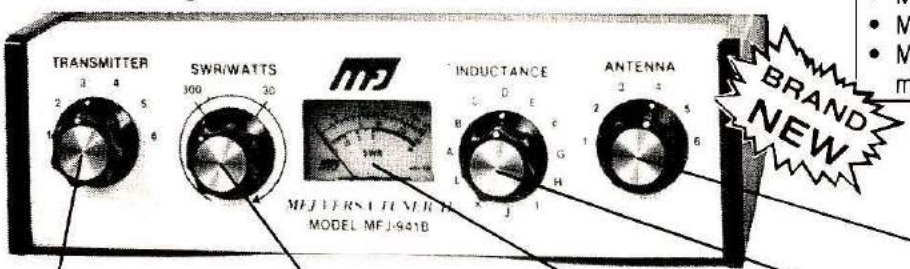
This NEW MFJ Versa Tuner II . . .

has SWR and dual range wattmeter, antenna switch, efficient airwound inductor, built in balun. Up to 300 watts RF output. Matches everything from 1.8 thru 30 MHz: dipoles, inverted vees, random wires, verticals, mobile whips, beams, balanced lines, coax lines.

MFJ LOWER PRICES!

NEW, IMPROVED MFJ-941B HAS . . .
- More inductance for wider matching range
- More flexible antenna switch
- More sensitive meter for SWR measurements down to 5 watts output



NEW LOWER PRICE

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Transmitter matching capacitor. 208 pf. 1000 volt spacing.

Sets power range, 300 and 30 watts. Pull for SWR.

Meter reads SWR and RF watts in 2 ranges.

Efficient airwound inductor gives more watts out and less losses.

Antenna matching capacitor. 208 pf. 1000 volt spacing.

Only MFJ gives you this MFJ-941B Versa Tuner II with all these features at this price:

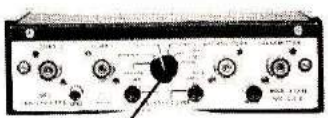
A SWR and dual range wattmeter (300 and 30 watts full scale) lets you measure RF power output for simplified tuning.

An antenna switch lets you select 2 coax lines direct or thru tuner, random wire/balanced line, and tuner bypass for dummy load.

A new efficient airwound inductor (12 positions) gives you less losses than a tapped toroid for more watts out.

A 1:4 balun for balanced lines. 1000 volt capacitor spacing. Mounting brackets for mobile installations (not shown).

With the NEW MFJ Versa Tuner II you can run your full transceiver power output — up to 300 watts RF power output — and match your transmitter to **any** feedline from 160 thru 10 Meters whether you have coax cable, balanced line, or random wire.



ANTENNA SWITCH lets you select 2 coax lines direct or thru tuner, wire/balanced line, dummy load.

You can tune out the SWR on your dipole, inverted vee, random wire, vertical, mobile whip, beam, quad, or whatever you have.

You can even operate all bands with just one existing antenna. No need to put up separate antennas for each band.

Increase the usable bandwidth of your mobile whip by tuning out the SWR **from inside your car.** Works great with all solid state rigs (like the Atlas) and with all tube type rigs.

It travels well, too. Its ultra compact size 8x2x6 inches fits easily in a small corner of your suitcase.

This beautiful little tuner is housed in a deluxe eggshell white Ten-Tec enclosure with walnut grain sides.

SO-239 coax connectors are provided for transmitter input and coax fed antennas. Quality five way binding posts are used for the balanced line inputs (2), random wire input (1), and ground (1).

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NEW MFJ-945 HAS SWR AND DUAL RANGE WATTMETER. NEW LOWER PRICE

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Same as MFJ-941B but less 6 position antenna switch.

NEW MFJ-944 HAS 6 POSITION ANTENNA SWITCH ON FRONT PANEL. NEW LOWER PRICE

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NEW MFJ-943 MATCHES ALMOST ANYTHING FROM 1.8 THRU 30 MHz. NEW LOWER PRICE

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Same as MFJ-941B, less SWR/Wattmeter, antenna switch, mounting bracket. 7x2x6 in.

ULTRA COMPACT 200 WATT VERSA TUNERS FOR ALL YOUR NEEDS.

MFJ-901 VERSA TUNER MATCHES ANYTHING, 1.8 THRU 30 MHz. NEW LOWER PRICE

$49.95

Efficient 12 position air inductor for more watts out. Matches dipoles, vees, random wires, verticals, mobile whips, beams, balanced lines, coax. 200 watts RF, 1:4 balun, 5x2x6 in.

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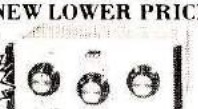

Same as MFJ-901 but less balun for balanced lines. Tunes coax lines and random lines.

MFJ-16010 RANDOM WIRE TUNER FOR LONG WIRES. NEW LOWER PRICE

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1.8 thru 30 MHz. Up to 200 watts RF output. Matches high and low impedances. 12 position inductor. SO-239 connectors. 2x3x4 inches. Matches 25 to 200 ohms at 1.8 MHz. Does not tune coax lines.

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April, 1979
Volume 3, Number 4

HAM RADIO HORIZONS

CONTENTS

Ham Radio Horizons is published monthly by Communications Technology, Inc Greenville, New Hampshire 03048 Telephone 603-878-1441
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This is the time of year when many high-school seniors are scurrying around, planning their future education, sending applications off to the college of their choice, and taking entrance exams. Seniors who are also Radio Amateurs are probably considering a career in electronics. If they're lucky, they will have a knowledgeable guidance counselor who can steer them in the right direction; if not, they'll probably pick a school with a good reputation and work from there. Sometimes this works out, and sometimes it doesn't — it depends entirely on what the student is looking for.

Electrical and electronics engineers who graduated more than ten years ago would probably not recognize the engineeering curriculum now offered by their old alma mater because, in the past few years, there have been significant changes in engineering education. During the 1960s the classical engineering educational programs tended to become more and more theoretical oriented, with less emphasis on applied engineering. The backgrounds of some electrical engineering staffs changed from being primarily applied electronics to applied mathematics, and attempts to develop practical engineering programs were not all that successful. In recent years, however, some engineering colleges have restructured their curriculums for a better balance between the theoretical and the practical. On the other hand, some colleges have continued to stress the theoretical aspects of engineering science, so the prospective student is faced with a very important, but difficult, choice.

Not too long ago, the prestige of an engineering school was almost always gauged by the theoretical emphasis of its courses; each school tried to outdo the others in the theoretical sophistication of its curriculum. Unfortunately, the majority of jobs within the sphere of electronics engineering does not require such an advanced mathematical sophistication as they do a "gut" understanding of electronics. If you talk to students at a *theoretical* school, you'll find that many of them don't know how to solve a simple steady-state ac problem, although they can invert a matrix and use state-variable techniques.

The difficulty with this type of engineering education is that graduates are not adequately prepared to solve the day-to-day engineering problems they will be presented with in industry. Employers are faced with the prospect of several months of on-the-job training before the newly hired engineer becomes a fully contributing member of the staff. Obviously, a new engineer who can solve problems quickly and practically in the real world is a valuable asset.

In the 1970s several colleges introduced four-year electronic technology programs in an attempt to get back to the old practical engineering concept; the courses at these colleges emphasize electronic hardware and laboratory techniques as well as electrical theory. Although graduates of these Bachelor of Science Technology programs have been pictured as fitting into the occupational spectrum somewhere between the technician and the engineer, many professors see technology graduates as having much wider employment opportunities. In fact, technology graduates now have opportunities in many areas of electronic applications and design traditionally occupied by engineering graduates, jobs vacated because of the change in emphasis in engineering education programs.

Students who are interested in this type of engineering program should be aware that there is a wide difference in B.S. programs parading under the "Technology" banner. Some curriculums are managerially oriented, others are slanted toward applications and design, while still others are little more than two-year electronic technician training programs with added courses in the arts and humanities to fill out four years. Students who wish to enter this area should obviously choose a school carefully to be sure they get exactly what they want.

Jim Fisk, W1HR
editor-in-chief

Imagine All The Places You Can Tuck ICOM's Remotable IC-280. (Think small.)

The **IC-280** 2 meter mobile comes as one radio to be mounted in the normal manner: but, as an option, the diminutive front one third of the radio detaches and mounts by its optional bracket, while the main body tucks neatly away out of sight. Now you can mount your 2 meter radio in pint-sized places that seemed far too cramped before.

Measuring only 2¼"h x 7"w x 3⅜"d, the bantam-sized microprocessor control head fits easily into the dash, console or glove box of even the most compact vehicle. Or if those places are already taken by the rest of your "mobile shack," the **IC-280** head squeezes into leftover nitches under the dash, overhead, under the seat or even on the steering column.

But don't be misled by the petite size of this subdivided radio: the **IC-280** is jam packed with the latest state of the art engineering and convenience features. No scaled down technology here!

With the microprocessor in the detachable control head, your **IC-280** can store three frequencies of your choice plus the dial, which allows you to select from four frequencies with the front panel switch without taking your eyes off the road. These frequencies are retained in the **IC-280's** memory for as long as power is applied to the radio, even when power is turned off at the front panel switch. And if power is completely removed from the radio the ±600 KHz splits are still maintained!

The **IC-280** works frequencies in excess of the 2 meter band with ICOM's outstanding single-knob tuning, so you can listen around the entire band without fooling with three tuning knobs. With steps of 15 KC or 5 KC, the **IC-280** puts rapid and easy frequency change at your single fingertip and instantly displays bright, easy to read LED's.

Available Options:
- Touch Tone pad/microphone combination, which fits the mic plug on the radio face with absolutely no modification
  (Fits all ICOM 4-pin mic radios.)
- 15' unassembled cable kit for long distance remote mounting of the detachable control head

IC-280
2 meter FM, 4+ MHz
Mobile Transceiver

If you are a newly licensed novice, send for ICOM's catalog and discount purchase coupon. Mail your name, call sign and date of license to your ICOM distributor (see the bottom of this ad).

All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

Specifications subject to change without notice.

IC-280 Specifications: ☐Frequency Coverage: 143.90—148.11 MHz ☐Operating Conditions: Temperature: −10°C to 60°C (14°F to 140°F), Duty Factor: continuous ☐Frequency Stability: ±1.5 KHz ☐Modulation Type: FM (F3) ☐Antenna Impedance: 50 ohms unbalanced ☐Power Requirement: DC 13.8V ±15% (negative ground) ☐Current Drain: Transmitting: 2.5A Hi (10W), 1.2A Lo (1W), Receiving: 0.630A at max audio output, 0.450 at SQL ON with no signal ☐Size: 58mm(h) x 156mm(w) x 228mm(d) ☐Weight: approx. 2.2 Kg ☐Power Output: 10W Hi, 1W Lo ☐Modulation System: Phase ☐Max. Frequency Deviation: ±5 KHz ☐Spurious Output: more than 60 dB below carrier ☐Microphone Impedance: 600 ohms dynamic or electret condenser type, such as the SM-2 ☐Receiving System: Double superheterdyne ☐Intermediate Frequency: 1st: 10.695 MHz, 2nd: 455 KHz ☐Sensitivity: 1 uv at S+N/N at 30 dB or better, Noise suppression sensitivity 20 dB, 0.6 uv or less ☐Selectivity: less than ±7.5 KHz at −6 dB, less than ±15 KHz at −60 dB ☐Audio Output: More than 1.5W ☐Audio Output Impedance: 8 ohms

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FOCUS & COMMENT

Who says the free-enterprise system doesn't work? Or that the Radio Amateur has but a tiny voice crying in the wilderness of the business world?

Let's take a look at some recent developments in equipment for the beginning Amateur, for example. Just a few years ago there were no *simple*, effective, low-priced transceivers on the market. One company, Heath, tested the temperature of the pool by producing the HW-7 in kit form. It was as much aimed at the low-power enthusiast as at the beginner. Hams far and wide suggested improvements and modifications, many of which showed up in the successor model, the HW-8.

There was a short lull in the proceedings, as though other manufacturers were watching, waiting, and thinking. Many beginners, faced with the prospect of assembling a kit (a new experience — frightening to some of them), and further bewildered by the use of transistors (another new experience), went the flea-market route and bought older equipment. Some of it worked, some didn't. New equipment was generally tailored to the Big Operator, the Rag Chewer, the DXer, and the guy who didn't worry about the cost as long as it was the very latest and best.

Things started getting better just a year or so ago. Some new names appeared on the marketplace, producing some very simple equipment at reasonable prices. Kantronics comes to mind, with their simple, two-band receiver and a crystal-controlled transmitter — the pair could be obtained for just a shade under $100. They also produced a VFO in a separate package to add flexibility to the transmitter.

Another basic rig that became available was the Ten-Tec Century 21, a 5-band CW transceiver with simplified controls and 70-watt capability. It's price was a bit more than the Kantronics combination, but still under $300 — not bad for a decent 5-band rig.

More recently, another well-known manufacturer has added his equipment to the beginner's lineup. Atlas has introduced a 5-band receiver that is just about as simple to operate as any you'll see, the RX-110. It has only three controls; audio gain, tuning, and a band-selector switch. This receiver fits nicely into a Novice budget at slightly over $200. An interesting feature of this deal is that they have designed a companion transmitter module to go with it when you're ready for it — at a price that's not out of line, considering inflation and the complexities of making a CW/ssb transmitter.

There's another encouraging note to all of this — these are all American companies. Being closer to the consumer, they can keep in touch with the needs of the market, and respond more easily to the requirements of beginning hams.

Now, before you take all of this as an endorsement of some sort, let me state that I have not operated and evaluated any of these rigs — I'm just observing a trend. It's a good trend, and I hope you'll do your part to encourage it by providing feedback to the designers of these (and other) rigs. If you like them, say so. If you have a gripe, tell them about it. They will respond — the free-enterprise marketplace demands it.

And, as a consequence, all newcomers to Amateur Radio will have a wider choice of better, low-cost rigs available when they want to get on the air.

Thomas McMullen, W1SL
Managing Editor

FROM THE COMPANY WITH A LONG LINE OF RTTY FIRSTS

1971 — RVD-1002
1st RTTY
Video Generator

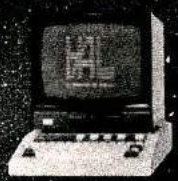
1972

DKB2010
1st RTTY & MORSE
Keyboard

1973 — RVD-1005
Improved RTTY
Video Generator

1974

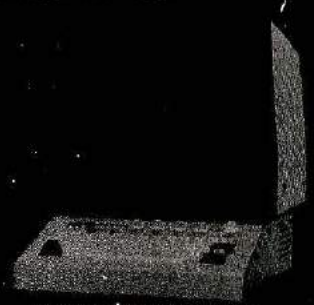
1975 — ST6000
High-performance
RTTY Demodulator



DS3000 KSR Version 2
1st Microprocessor
Controlled Amateur Equipment
with Editing for Baudot & ASCII

1976

1977



1978 — DS3000 KSR Version 3
1st 3-mode Amateur Send-Receive Terminal
for Baudot, ASCII, and MORSE

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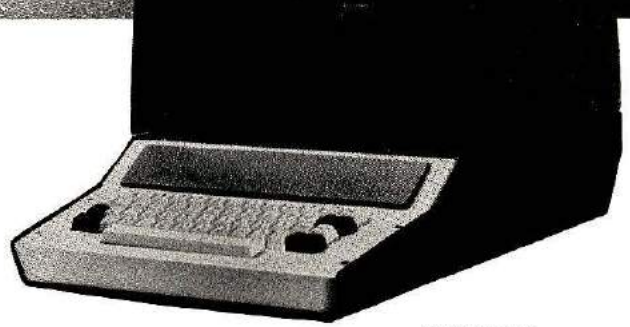
ST5000
Low-cost, Big-performance
RTTY Demodulator

AND NOW...

DS3100 ASR



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THE Wilson GIVE-A-WAY

Wilson Electronics announces a factory authorized rebate program. Here's how it works:

Purchase a TT-45 and a System Three at the same time and Wilson will give you a factory 5% rebate from the price you paid for the package. You can use this to pay for the concrete to install it, or buy the XYL a little something to keep her happy! Or . . . we will give you, at no charge, a M-27, the best 7 element, 2M beam available today! The choice is yours to make!

Just send Wilson the receipt of your purchase from your dealer, showing your cost, and let us know what you want — 5% cash, or a M-27. But hurry! This offer starts April 1, expires midnight, April 30, 1979, and receipt must be mailed before June 1, 1979.

Don't wait! See your nearest dealer to take advantage of this great Give-A-Way!

SPECIFICATIONS

TT-45 TOWER

- Maximum height, 45'
- 800 lbs. winch with padlock feature
- 2800 lb. raising cable
- Totally freestanding with proper base
- Total weight, 189 lbs.

Recommended accessories:
RBRF-10, SBRF-10, CBRF-10.

The TT-45 is a freestanding tower. Ideal for installations where guys cannot be used. If the tower is not being supported against the house, the proper base fixture accessory must be selected.

SY-3 TRI-BAND ANTENNA

Band MHz	14-21-28	Turning radius	15' 9"
Maximum power input	Legal limit	Maximum mast diameter	2" O.D.
Gain (dBd)	8 dB	Surface area	5.7 sq. ft.
VSWR at resonance	1.3:1	Wind loading @ 80 mph	114 lbs.
Impedance	50 ohms	Assembled weight (approx)	37 lbs.
F/B Ratio	20 dB	Shipping weight (approx)	42 lbs.
Boom (O.D. x length)	2" x 14' 4"	Direct 52 ohm feed or balun	
No. of elements	3	Maximum wind survival	100 mph
Longest element	27' 4"		

M-27 - 7 ELEMENT 2M BEAM

Band MHz	144-148 MHz	Beam width @ 3 dB pt.	27 degrees
Gain	11 dB	Turning radius	32.13"
VSWR	1.2:1	Mast diameter (O.D.)	1" - 1½"
Impedance	50 ohms	Surface area	44 sq. ft.
Boom (O.D. x length)	1" x 64"	Wind loading @ 80 mph	5.5 lbs.
Number of elements	7	Shipping weight (approx)	6.5 lbs.
Longest element	40"	Assembled weight (approx)	3.5 lbs.

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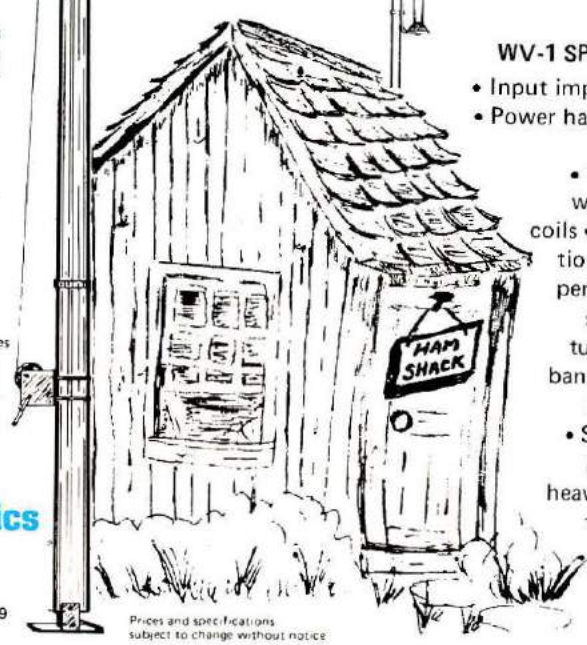

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- Input impedance: 50 ohms
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NEWSLINE

FCC'S PERSONAL RADIO DIVISION is being abolished as part of a sweeping reorganization of the Safety and Special Services Bureau approved by the Commissioners! In the reorganization, Safety and Special Services is to be arranged functionally rather than by service, into four divisions: Policy Development, Rules, Licensing, and Compliance.

Safety And Special Services presently has three "service" divisions: Personal Radio, Aviation and Marine, and Industrial Safety and Public Service, all of which are going out of existence in the reorganization. In addition, there is also an Industrial and Public Safety Rules Division, plus a Legal, Advisory and Enforcement Division. With the reorganization, people working on rules, policy, legal or enforcement within the present service divisions will, for the most part, probably end up in the appropriate new division. However, at this point little is known as to who, how or when the shuffle will be accomplished.

Net Result Of The Change is expected to be an improvement in Safety and Special Services overall efficiency, with much more flexibility in shifting workloads. What it will mean for the FCC licensees such as Amateurs is less clear cut. Improvement in such routine matters as license processing seems certain, but where to go to get a question answered or discuss a problem could become difficult and confusing compared to the present setup.

LICENSE FEE REFUNDS came a step closer to reality with Commission adoption of a first Report and Order on its fee refund inquiry, General Docket 78-316. Only fees above $20 are to be refunded in this first phase, which will begin after the necessary fee refund applications and instruction packets can be printed and distributed.

Commission Staff Work has already begun on Phase II of the refund program, which will cover fees of $20 or less.

FCC'S INVESTIGATION of licensing irregularities in the Indianapolis area, which began in mid-1976, is still in progress. A number of central Indiana Amateurs received letters from the Commission in mid-February asking them to explain questionable aspects of their licenses or calls.

POSSIBLE "POINT-OF-SALE" control of Amateur transmitters has been nixed again by FCC's legal staff. Legally, however, it does appear retailers and manufacturers can impose such restrictions.

THE SAN ANTONIO REPEATER Organization received the National Weather Association's 1978 Award, for Outstanding Contributions to Meteorology by a Volunteer Organization, at a ceremony in San Antonio last Friday. Presenting the award was Mr. E.A. Diloreto, Meteorologist in Charge for the San Antonio National Weather Service Office.

The Organization was cited for "invaluable and sacrificial service by the volunteer operators in obtaining and transmitting meteorological and hydrological reports during the devastating August 1978 Texas Hill Country floods," its "3½ years of service to Bexar County, Texas, as severe-storm spotters and stream-gauge watchers with the National Weather Service's Skywarn Program," and the "considerable personal expenditures made by the Amateur operators in keeping a modern, effective communications system working and ready for the benefit of all in times of crises." Congratulations to SARO's members.

PROPOSAL TO SHARE 220 MHZ with the Maritime Services as contained in the FCC's final Report and Order on WARC 79, was formally challenged in a Petition for Reconsideration filed January 22 by the 220 MHz Spectrum Management Association of Southern California. In its well-done document, the 220 SMA pointed out that Amateurs were not given a chance to comment on the proposed sharing or on the change in Amateur status from primary to secondary. It further discusses the heavy 220 MHz use by Amateurs in coastal areas, and cites the role of Amateurs and Amateur repeaters in emergency situations. Several alternative locations for short range maritime communications were also cited.

"W6JAM," SCOTT LOOKHOLDER (WB6LHB), was sentenced February 6 to one year probation and a $1000 fine by Judge Lawrence Lydig in Los Angeles Federal District Court. Lookholder had pled guilty on January 10 to three counts of using abusive language over the air. A provision of his probation was that he was not to use Amateur Radio for a year, and the judge also recommended that he receive psychiatric help.

Despite Widespread Interest in the case, which involved much of the Los Angeles area repeater jamming over the past year, only four Amateurs were in the courtroom for the sentencing. Only eight area Amateurs had submitted written statements to the prosecution about the jamming's effects, a disappointment to those who felt the case warranted more effort. FCC action against Lookholder's license is also considered likely.

ARIANE'S LAUNCH HAS BEEN PUSHED back an estimated five months, and with it the launch of the Phase III Amateur satellite. The delay will be used to advantage in further polishing and refining the performance of the Phase III bird.

CONVERTER PROJECT FOR 20/15/10 METERS

BY BILL WILDENHEIN, W8YFB

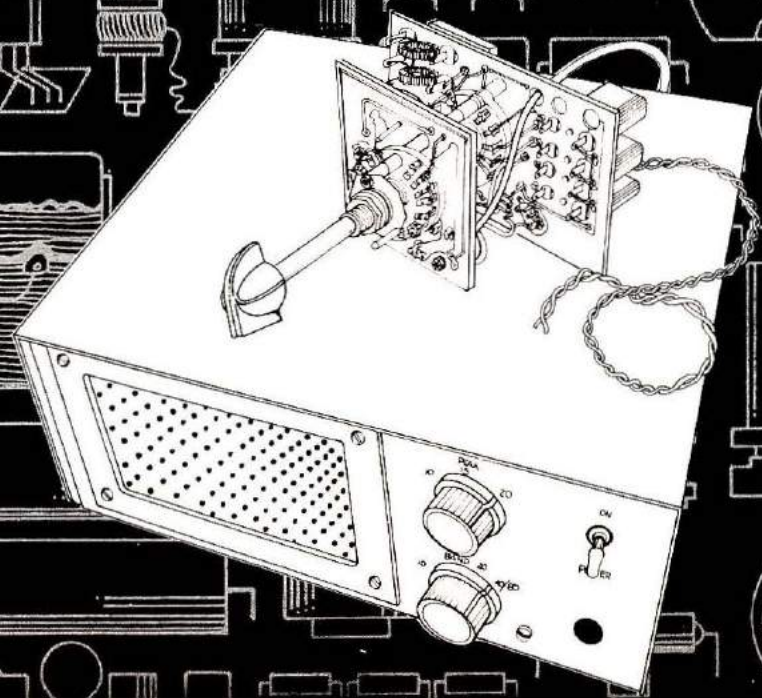
This little converter was designed to be used with the 80/40 meter beginner's receiver, but will work with any receiver covering 3.5 to 4.0 MHz. If you have one of the less expensive general-coverage receivers, and it is not too peppy on the high bands, this converter can be used to give you better sensitivity, and, what is often very significant, it will have a drift characteristic the same as on 80 meters. When used with the beginner's receiver it results in sensitivity of much better than 1 microvolt — typically about 0.25 microvolt — so it is capable of snagging the weak DX stations for you.

The original views of the beginner's receiver showed the converter installed in the same enclosure as the speaker and power transformer. The converter in that unit required too much sheet-metal work, so it was completely redesigned to eliminate all such work except for a small mounting bracket. This second converter is electrically identical, and was checked out with the 80/40 receiver to verify performance.

The circuit is shown in **Fig. 1**. A dashed line separates the circuit into its two functions, bandswitched oscillator and mixer. The only bandswitching function in the mixer is to switch it in or out. Actual selection of any of three bands in the mixer portion is done by setting C1. The tuned output circuit, L7/C2, is set once in the middle of the 80-meter band and then left alone. The oscillator portion of the circuit requires a bit more explanation.

Oscillator

In this circuit, one section of the bandswitch selects the crystal, and the other switch section selects the proper tuned circuit for that crystal. If you are inexperienced at this construction game, you may have seen advertisements for crystals in the frequency range of 15 MHz and up, and may think the crystal will automatically oscillate at that frequency. Not so! These crystals are "overtone" crystals, which have a fundamental frequency of 1/3 to 1/5 of the output frequency. By the same token, lower frequency crystals will often operate as overtone crystals in the right circuit. The actual output frequency will not be precisely three or five times the fundamental, but will be close enough for our purposes. More about crystal choices later. In either case, we "force" the crystal to operate on the over-



Receiver Articles Available

This converter was designed as a companion to the Beginner's Receiver, described in February and March, 1979, *Ham Radio Horizons*. A Beginner's Transmitter was featured in July, August, and September, 1978. These back issues are available for $2.00 each, postpaid from *Ham Radio Horizons*, Greenville, New Hampshire 03048.

tone frequency by selecting an output tuned circuit operating on the desired frequency.

A test oscillator

A handy gadget for checking crystals is shown in **Fig. 2**. This is the same circuit as used in the converter, and you can build it almost entirely from scrap parts out of TV and broadcast radio sets. The circuit board need not be etched, but can be unclad board or perforated board, wired as in **Fig. 2B** and mounted on the back of the capacitor as in **Fig. 2C**.

You can check for oscillation by first setting the capacitor to *minimum* capacitance (plates unmeshed). Insert a crystal, apply voltage to the power supply leads, and connect an rf probe (such as the one described in part 2 of the receiver article) with the probe tip inserted in the pin of the *unused* crystal socket. The ground lead of the probe goes to the capacitor frame. Slowly rotate the capacitor toward the meshed direction until the rf-probe meter shows a deflection. The reason for starting with the capacitor unmeshed is that this combination of coil and capacitor will tune as low as 8.0 or 8.5 MHz, and if a crystal is made for that frequency, or higher, it will oscillate on its fundamental frequency when the tuned circuit is resonant.

Some crystals may operate in a fundamental mode but not in an overtone mode, particularly if they are rather inactive crystals. However, I find that almost all HC6/U or CR18/U crystals work fine. The shorter CR7/U crystals do not normally work too well in this circuit. They appear to need a parallel resonant, rather than a series resonant, mode. A test oscillator for these (CR7/U) crystals is shown in **Fig. 3A**, with a board layout in **Fig. 3B**. In operation, it is used exactly as the oscillator in **Fig. 2**. So if you have a collection, or source, of CR7/U crystals at very low prices, it would pay to investigate the possibility of using them. The circuit-board layout used in the converter will accommodate both circuits. In both circuits, keep the leads as short as possible. Both physical layouts are drawn to scale, and give you an idea of permissible lead length. **Fig. 4** is the schematic diagram of the alternative overtone oscillator. Notice the use of jumpers in both **Fig. 1** and **Fig. 4**. These are just bits of No. 22 solid, bare wire used for the interconnections needed to convert from one form of oscillator to another.

Fig. 5 shows how the two boards are mounted to the switch assembly. Notice that the switch wafers are mounted backwards, with their lugs toward the front-panel end of the switch. This makes wiring a bit easier. The oscillator circuit board should be completely wired before installing it on the switch. All components should be mounted, and pieces of No. 22 solid tinned bare wire soldered to the appropriate points on the circuit board to provide connections to the switch. The same size wire is used for connections from the oscillator board to the mixer board. This does not have to be shielded wire, since the distance is very short. You can

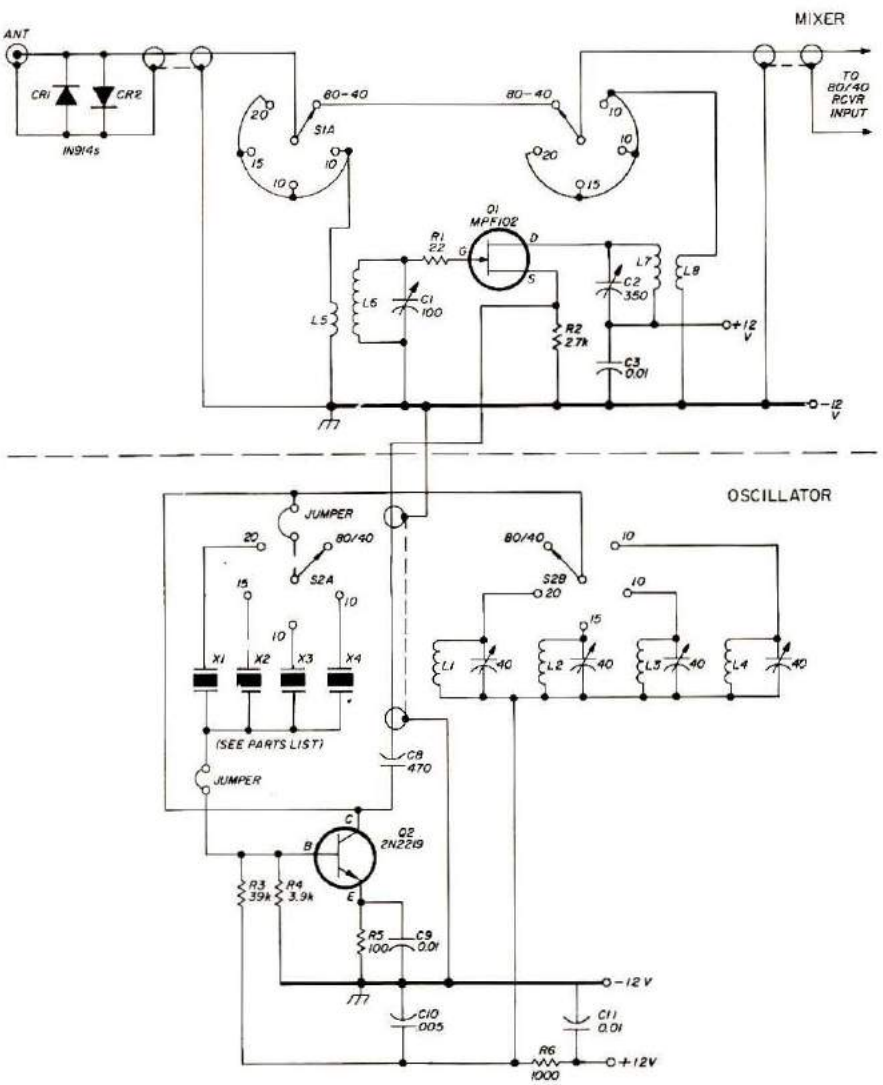
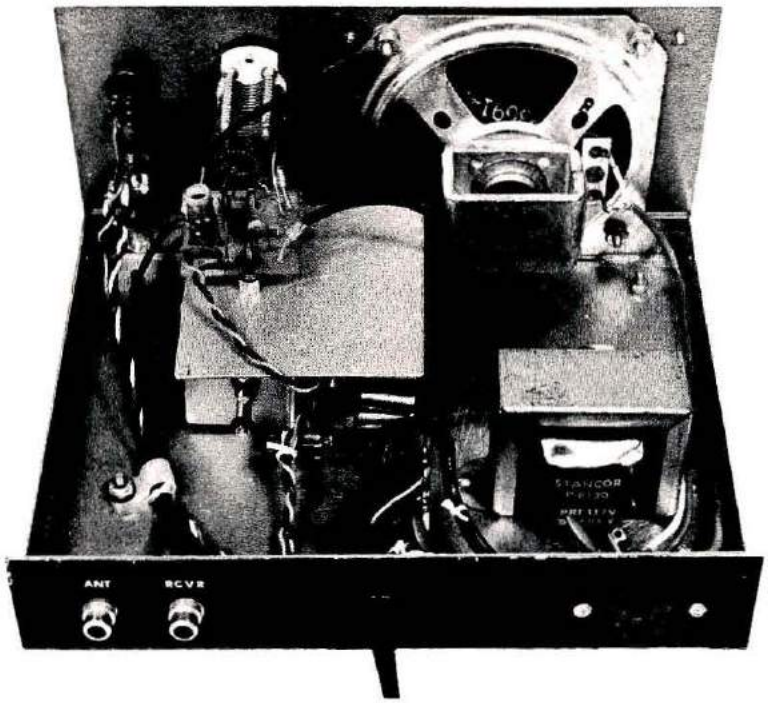


Fig. 1. Schematic diagram for the switchable converter. It was designed to work with the 80/40-meter beginner's receiver described in the February and March, 1979, issues of *Ham Radio Horizons*, but will work with any receiver that tunes the range of 3.5 to 4 MHz. See **Fig. 13** for a list of parts for the converter.



An interior view of the converter box. **The transformer** in the lower right corner supplies ac to the rectifier diodes in the receiver. The converter in this model is a prototype, used to engineer and "debug" the circuit. It will be much easier for you to build a converter using the PC boards shown in **Figs. 10** and **11**. The PC-board model fits in the same space as this earlier one, and mounts to the front panel by means of the threaded bushing on the switch shaft.

connect one set of power leads to the oscillator board, and from the same pads run another set of wires to later connect to the power points on the mixer board.

After all this work is done, thoroughly scrub the circuit board with a toothbrush and 90 per cent isopropyl alcohol to remove the flux residue. Inspect the board carefully to be sure every joint is perfect.

Troubles

I spent a couple of agonizing hours trouble-shooting this little converter — just to find one bad joint. The converter worked fine on 20, but not on 15 and 10 meters. First the rf-output of the individual crystals was checked at the mixer. Each band showed adequate oscillator injection. Next, output frequency was checked on each crystal. Again everything was okay. I thought perhaps the oscillators might be working marginally, and only showed output when the capacitance of the rf probe was added. So they were again checked by listening to the oscillator in a receiver with the probe on and off. Still the oscillators ran nicely. As a last verification, I listened in the receiver at each oscillator frequency as I turned the oscillator voltage on, to be sure that the oscillators started briskly. Again, no problem. Next, I recalculated the crystals to verify that the ones selected were correct for the desired range. Then I checked the signal generator on the general coverage receiver to verify its output was correct. At such moments, particularly at 3:00 AM — you begin to wonder who is crazy. All oscillator ranges were correct, and were feeding the mixer enough power on the correct frequency. The mixer stage is known to be working fine since it works as expected on 20 meters. *After* all that effort I checked the board! A careful check with the

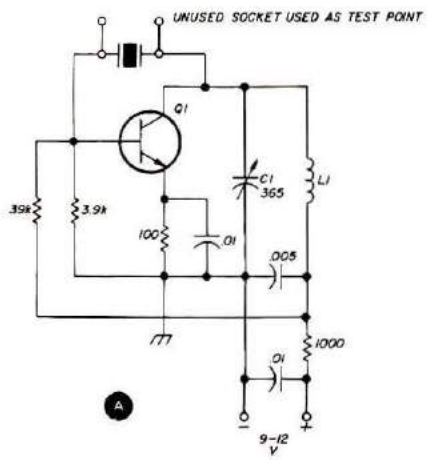
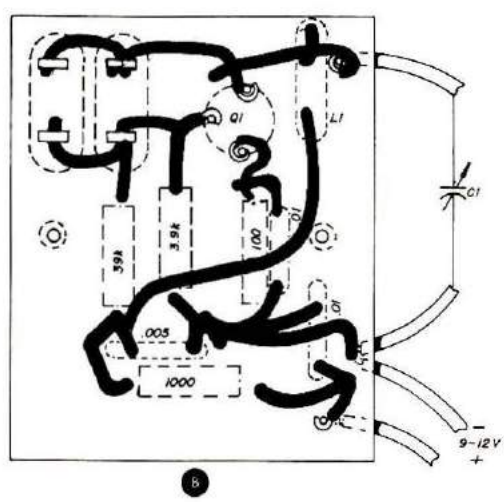
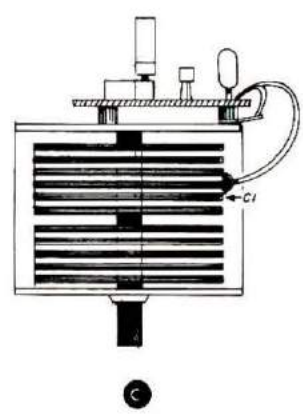


Fig. 2. This is a test oscillator you can build to check crystals for activity and frequency. It can be built on a piece of plain phenolic or perforated board, then bolted to the end of a broadcast-set variable capacitor, as shown at **C**. If the variable capacitor has one large and one small section, connect to the small one. L2 is 18 turns No. 24 (0.5 mm) enameled wire on T-37-6 core.

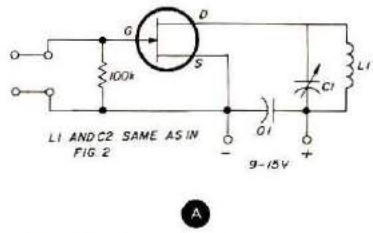




naked eye and plenty of light failed to show any error. When I used a magnifying glass I finally spotted one wire to the switch deck that was suspicious. (I left it for the following evening to show my boy, who is building some solid state gear. He had difficulty seeing the mistake, but one touch with the soldering iron and the converter came to life on all bands!) If I can goof, rest assured you can too! Take the time to *very carefully* examine the finished and cleaned board!

Now, begin the assembly as in **Fig. 6**. Notice that the switch screws are "going the wrong way." However, this is okay, because they temporarily secure the switch wafer while you wire the leads to the various switch lugs. Next, completely wire the mixer board, including the coaxial lines for input and output, wires to be connected to the switch deck, etc. Again, clean and carefully inspect the board.

On both the boards you have a number of wires attached to the foil side of the board as in



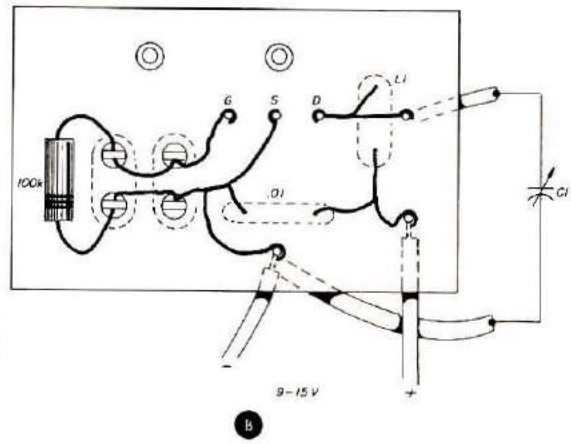


Fig. 3. Some crystals require a parallel-mode oscillator, such as this one. You can build it in the same manner as the one shown in **Fig. 2**, and fasten it to the capacitor frame just as with the other board.

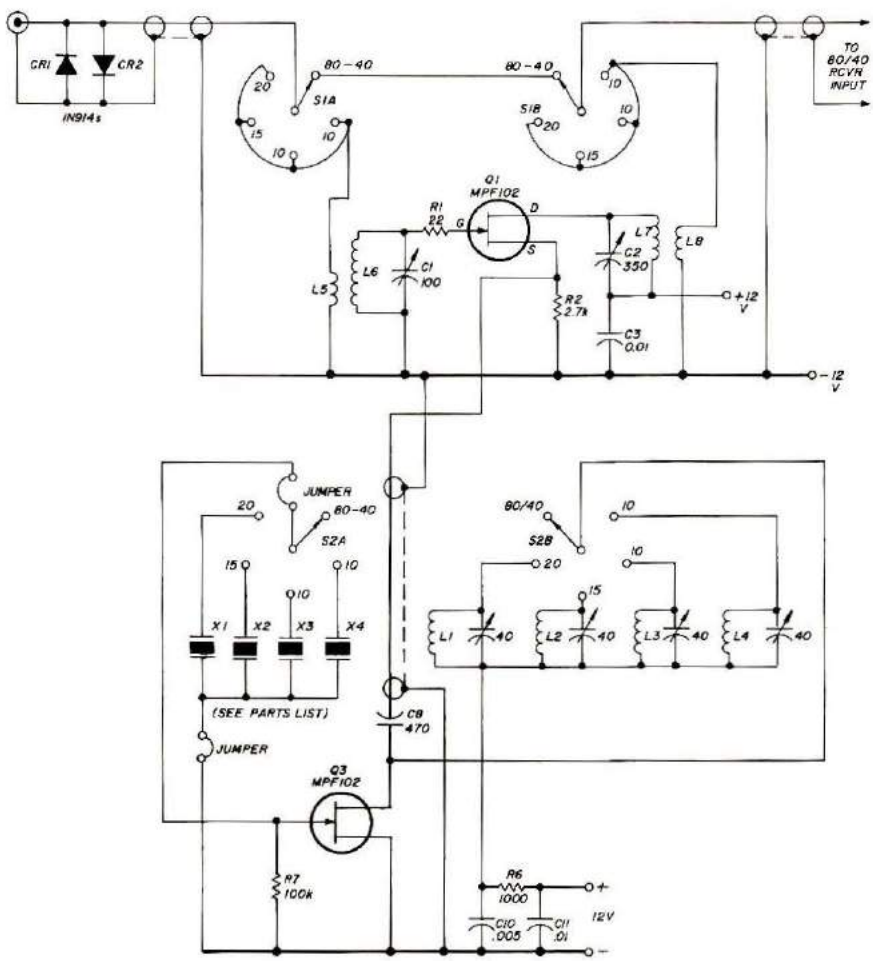


Fig. 4. If your crystals require the FET circuit of **Fig. 3** to oscillate in the overtone mode, use this circuit for the converter, instead of **Fig. 1**. The printed-circuit boards shown later will work for either one. All parts values are the same as in **Fig. 1**, unless otherwise noted.

Fig. 7A. When a wire is fastened to a pad like that, it is easy for you to exert enough pull to lift the pad from the board. To be safe, clinch a very short end of wire on the other side of the board as shown in **Fig. 7B**. Now assemble the mixer board and its wafer switch as shown in **Fig. 8**, and wire the switch wafer. Finally, you can slide the shaft down through the switch wafers to complete the assembly. This requires great care. Under no circumstances should you exert any force on the switch wafers! You can align the movable section of the rear wafer by sticking the shaft through the front wafer, sliding it down to the rear wafer, then rotating the shaft gently to match the hole in the rear wafer. Tighten the nuts just enough to take the "wiggle" out of the assembly, then try rotating the switch. If it binds, loosen the nuts, wiggle the wafers a bit and retighten. When it's finally assembled, switch operation should be crisp and smooth. This means you must be very careful to do a precise job of drilling the switch-screw holes and shaft-clearance hole in the circuit boards. You can make the screw holes just a little oversize; use a 3.5 mm (9/64 inch) drill instead of a 3-mm (1/8-inch) drill. The switch assembly, as supplied, has enough of the phenolic shock absorber washers, but not enough of the ceramic spacers.

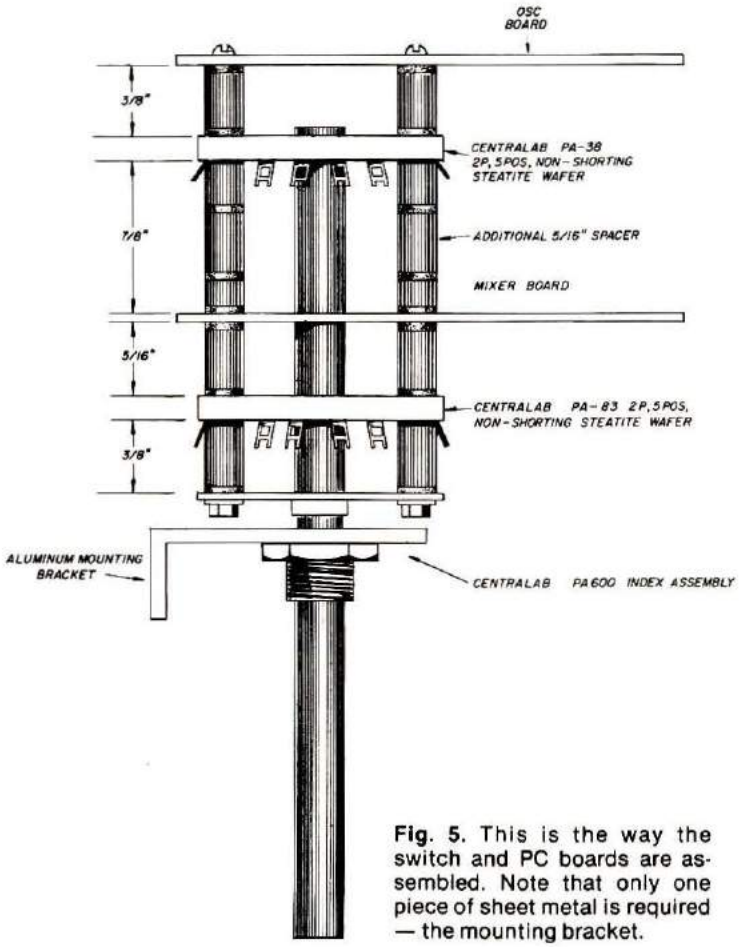


Fig. 5. This is the way the switch and PC boards are assembled. Note that only one piece of sheet metal is required — the mounting bracket.

You need two spacers 8 mm (5/16 inch) long (it is important that they be the same length). These can be made from 3mm (1/8-inch) I.D. tubing, such as automotive gas lines, or from brass tubing stocked by better hobby shops. Spacers from old switch-type TV tuners will do the job as well.

Testing

Now you can proceed with the checkout. With just the power leads connected, rotate the switch to the 80/40 position. In this position, no oscillator power is fed to the mixer. Connect a VOM (preferably 20,000 ohms-per-volt) or VTVM on the 10 Vdc range across R2 in the mixer. The positive meter lead goes to the source end of the resistor. This reading will vary quite a bit with different transistors. Perhaps you'll read 2 volts; note this reading. Insert the crystals in their correct sockets and switch to 20 meters. Again measure across the resistor R2 as you tune C4. As the oscillator pops into oscillation, the voltage across R2 increases. Notice that when you tune C4,

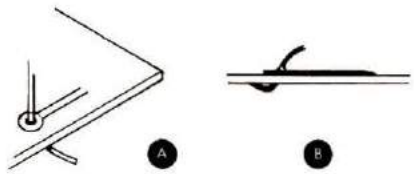


Fig. 7. The wires from the PC board to the switch wafer are on the foil side of the board. To prevent pulling the foil loose, let a short tail of wire stick through the hole **(A)**, and bend it over as shown **(B)**.

on one side of resonance the crystal seems to suddenly go into oscillation. As you continue tuning, the reading decreases on the other side (of resonance) rather gradually. Always leave the tuning on the side where changing C4 results in a gradual drop-off in voltage. You can afford to throw away a little output in order to gain this point of tuning, which is where the oscillator will start dependably every time you switch to that position.

In the same way, go to the 15-meter position of the bandswitch and tune C5 for the correct point of tuning. Next, switch to 10 meters and set C6 correctly. If you have included another 10-meter crystal, switch to that range and set C7 correctly.

Now you can connect the output of the mixer to your receiver. With an antenna connected to the converter and the receiver tuned between 3.7 and 4.0 MHz, rotate C1. You may hear 20-meter signals with the converter range switch set for 20. If so, adjust C2 for maximum signal strength, then (if you are using the 80/40

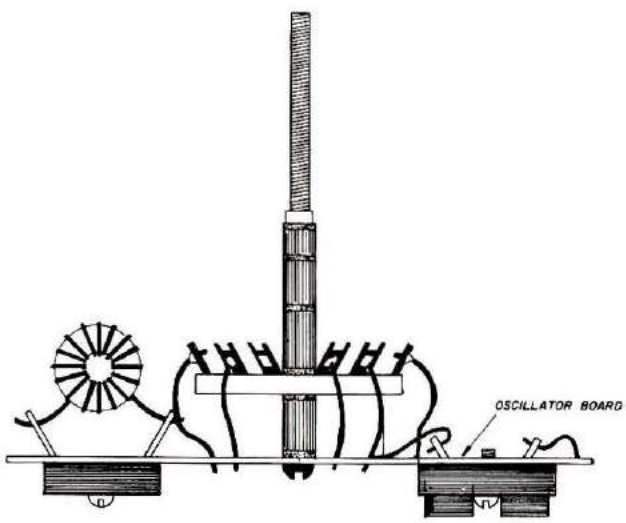


Fig. 6. This is the first stage of assembly after you have the oscillator board wired. The nut is only temporarily in place to hold the wafer and spacers while you complete the wiring.

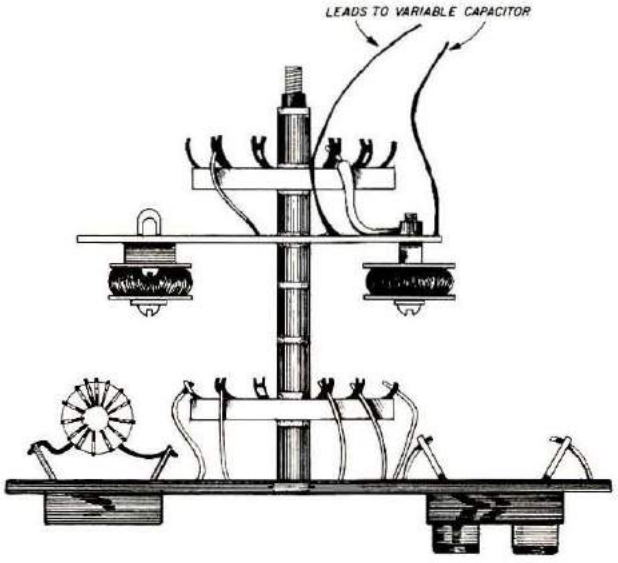


Fig. 8. This is the second stage of assembly, after the mixer board has been wired. Don't tighten the nuts all the way down — you'll need to move the wafers and boards slightly when you install the shaft and index assembly.

beginner's receiver) peak up the mixer input capacitor of that receiver — C1. Switch to 15 meters and all you should have to do is repeak C1 of the converter. Switch to 10 and again repeak C1 in the converter. If you are able to tune it up using only on-the-air signals, C2 in the converter can be set once and then left alone. It is rather noncritical. Best general results would be obtained if you tune the 80/40 receiver to about the middle of the 80-meter band, then, with the converter on any of the high bands, adjust C2 for a maximum. If you are unable to get it to tune using on-the-air signals, you can use a 40-meter crystal oscillator as a signal generator. A reliable circuit is shown in **Fig. 9**. Again, it can be built primarily from scrap TV and broadcast-set components. This is a Colpitts oscillator that runs on the fundamental frequency of the crystal. The tuned circuit, C4/L1, can be replaced with an rf choke, if desired, but high-frequency output will be reduced. The rf choke can be one of the windings from an old style 455-kHz i-f transformer, one of the 500-microhenry video chokes from a scrap TV, or even one of the windings from a 4.5-MHz TV i-f transformer. If you use a 40-meter crystal, you will get output on 40, 20, 15, and 10 simultaneously. Output on the higher frequencies will be on exact multiples of the crystal frequency. For example, a 7100-kHz crystal will also deliver output at 14200 kHz, 21300 kHz, and 28400 kHz. The oscillator need not be connected directly to the converter but can feed a clip-lead "antenna" lying near the input tuned circuit of the converter. You can listen to this oscillator on your 80/40 receiver to verify that it is oscillating. Again, it is not necessary to make a connection to the receiver. With this gadget you have a sufficiently powerful signal to tune up the mixer of the converter regardless of how much C1 and C2 are detuned. If you can't hear the signal from the converter as you tune the 80/40 receiver, it is probable that you have a wiring error in the converter.

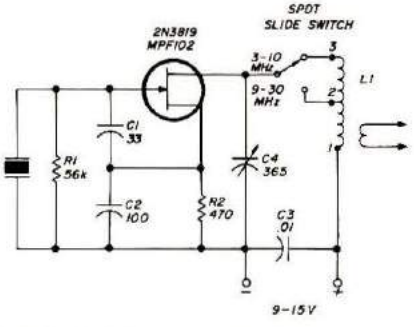


Fig. 9. This is a test oscillator you can use as a signal source to align the converter. Build it on a scrap of perforated board. To use the oscillator, plug in a crystal and listen for its harmonics on the converter/receiver combination. L1 is 43 turns No. 26 enamel covered wire on T-50-6 core. Tap at 16 turns from bottom. Link is one turn of same size wire.

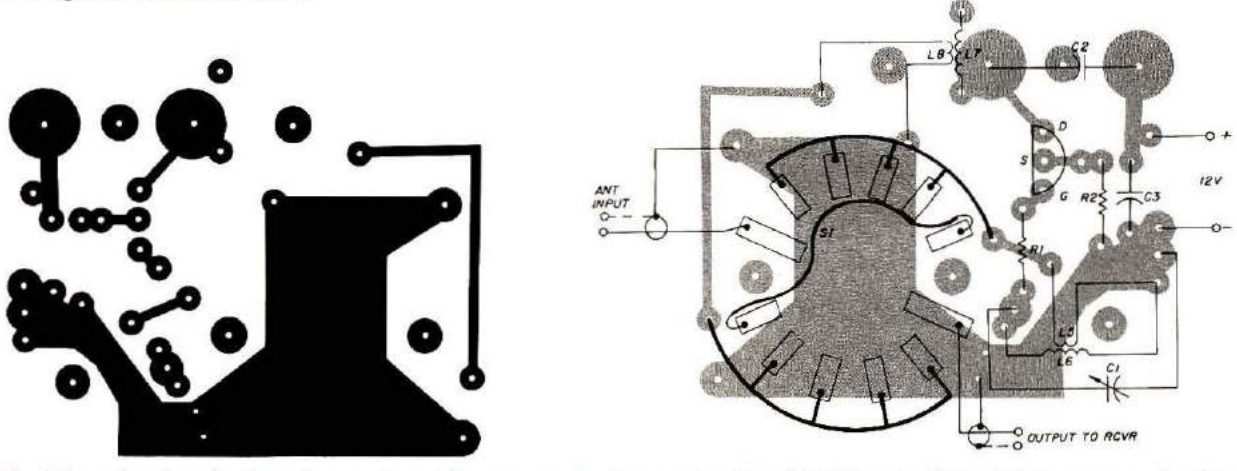


Fig. 10. PC-board pattern for the mixer section, left, and a parts placement guide, right. See **Fig. 15** for details on mounting the compression trimmer, C2.

Crystal choices

Now let's see how to choose the crystal frequencies so you'll know what to look for in surplus crystals. If your 80-meter receiver is similar to mine it will have some extra range; mine covered from about 3450 to 4150 kHz. This allows some leeway in selecting crystals. For 20 meters, select a crystal frequency on the high side of 20 meters, thus: 14 MHz plus 4 MHz = 18 MHz. For the other end of 20 meters: 18 MHz (crystal frequency) minus 3.5 MHz = 14.5 MHz. Thus you could select either an 18-MHz overtone crystal, or divide that by 3 (6-MHz fundamental frequency), and use it in an overtone mode. Perhaps you can't find an 18- or a 6-MHz crystal — possibly you can see a 5970-kHz crystal. Will it work? 5970 × 3 = 17910 kHz. 17910 minus 3500 = 14410 kHz; 17910 minus 4000 = 13910 kHz. Obviously that crystal will work nicely, allowing you to tune from 13910 to 14410 kHz.

Similarly, on 15 meters the converter oscillator operates on the "high side," so you can use the same technique: 21000 kHz plus 4000 kHz = 25000 kHz. So you could use a 25-MHz overtone crystal, or, 25 MHz divided by 3 = 8333 kHz. The top end of 15 would then be 25000 kHz minus 3500 kHz = 21500 kHz. Notice that this crystal allows only 50 kHz extra at the top end of 15 meters. It must be chosen a little more carefully than the 20-meter crystal. If you chose the 25-MHz (or 8333-kHz) crystal, there is another advantage: 25000 *plus* 3500 = 28500 kHz! and 25000 *plus* 4000 kHz = 29000 kHz. Thus the 15-meter crystal will also let you tune a 500-kHz portion of 10 meters. You may wonder how this can be, when the bandswitch is on the 15-meter position. Remember, the mixer input circuit is not bandswitched! You can put the bandswitch on 15 meters, then tune the mixer input capacitor,

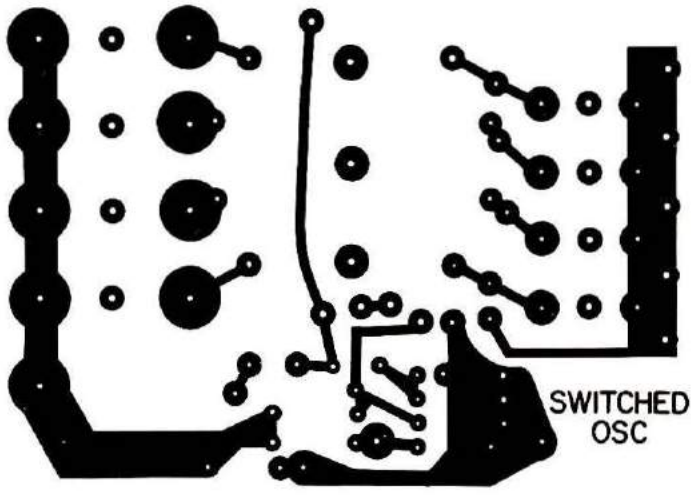
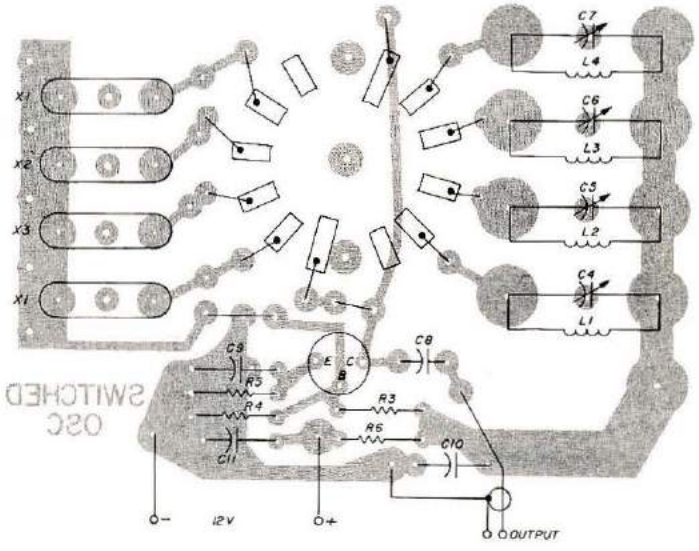


Fig. 11. At the top is the PC-board pattern for the oscillator section of the converter. The parts-placement guide (below) is for a bipolar transistor, as shown in **Fig. 1.**



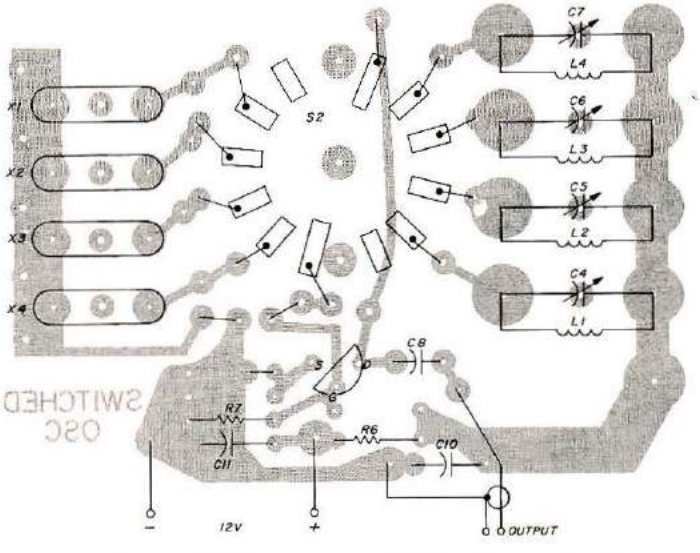
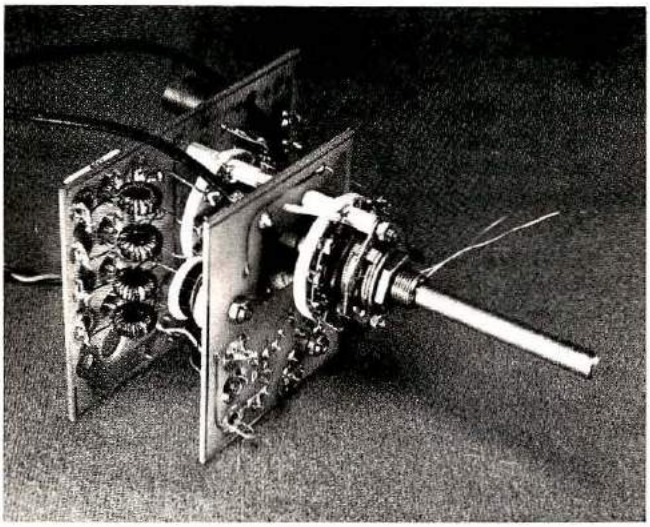
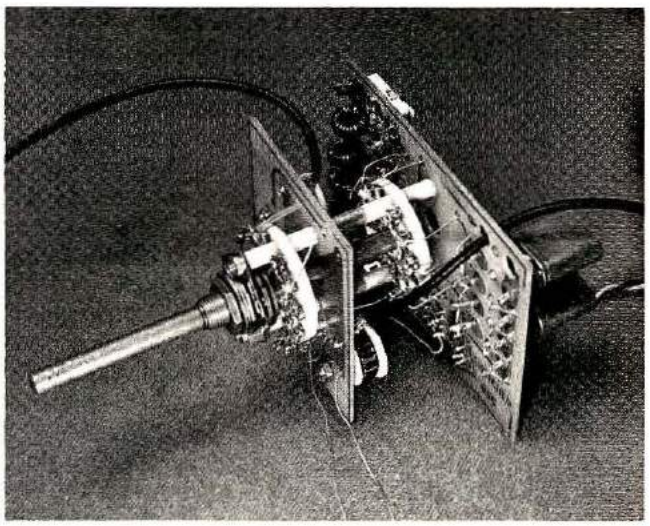


Fig. 12. This is the same oscillator board, but arranged to use an FET (**Fig. 4**) instead of a bipolar transistor.





Here are two views of the "real" converter. Note how the PC boards are mounted on the frame of the bandswitch. The two bare wires extending out to the right of the switch should be connnected to the input tuning capacitor, C1. This capacitor is adjusted by means of the knob marked "PEAK" at the top center of the front panel. In the photo at the left, you can see how the toroid coils are mounted by their leads, connected to the trimmer capacitors. The right-hand view shows the crystal sockets and their wiring.

C1, to 10 meters and receive 28.5 to 29 MHz!

On the first 10-meter switch position you'll then want to tune 28 to 28.5 MHz. You can operate the crystal on the "low" side of 10, so figure it thus: 28.5 minus 4.0 MHz = 24.5 MHz (24500 kHz).

This same 24500-kHz crystal plus 3500 kHz = 28000 kHz. So you can choose a 24.5 MHz overtone crystal (or that frequency divided by three = 8166 kHz). For the second 10-meter bandswitch position choose a range of 29 to 29.5 MHz. Again, figure it as: 29.5 MHz minus 4 MHz = 25.5 MHz. And, 25.5 MHz plus 3.5 MHz = 29 MHz. Thus, with just two crystals for 10 meters you'll get practically the entire band.

If you take time to work this out very carefully, you can calculate a range of acceptable

Fig. 13. Parts list for the converter. The crystals listed here are those used by the author — don't hesitate to try bargain crystals with slightly different frequencies. Examples of how to work out the coverage are given in the text.

Designation	Description
	Capacitors
C1	100 pF air variable (Hammarlund MAPC 100 or equivalent)
C2	70 to 350 pF; ARCO 428 mica compression trimmer
C3, C9, C11	0.01 μF, 25 V (or higher) disk ceramic
C4, C5, C6, C7	4 to 40 pF; ARCO 403 mica compression trimmer
C8	470 pF, 25 V (or higher) disk ceramic
C10	0.005 pF, 25 V (or higher) disk ceramic
	Diodes
CR1, CR2	1N914 or 1N4148 Silicon diode

Designation	Description
	Coils
L1	33 turns No. 24 (0.4 mm) e.c. on T-37-6 core
L2, L3, L4	26 turns No. 24 (0.4 mm) e.c. on T-37-6 core
L5	1 turn No. 24 (0.4 mm) e.c. over L6
L6	18 turns No. 24 (0.4 mm) e.c. on T-50-6 core
L7	34 turns No. 28 (0.3 mm) e.c. on T-50-2 core
L8	5 turns No. 28 (0.3 mm) e.c. over L7
Note: e.c. = enameled covered wire	
	Transistors
Q1, Q3	MPF 102, HEP 802, 2N3819, or 2N5459

Designation	Description
	Resistors
R1	22 to 56 ohm, ¼ watt
R2	2700 ohm, ¼ watt
R3	39k ohm, ¼ watt
R4	3900 ohm, ¼ watt
R5	100 ohm, ¼ watt
R6	1000 ohm, ¼ watt
R7	100k to 220k ohm, ¼ watt (used in Fig. 4)
	Switches
S1, S2	Centralab PA-83, 2-pole, 5-position, nonshorting steatite switch wafer with Centralab PA600 shaft and index assembly
	Crystals
X1	18 MHz overtone (see text)
X2	25 MHz overtone (see text)
X3	24.5 MHz overtone (see text)
X4	25.5 MHz overtone (see text)

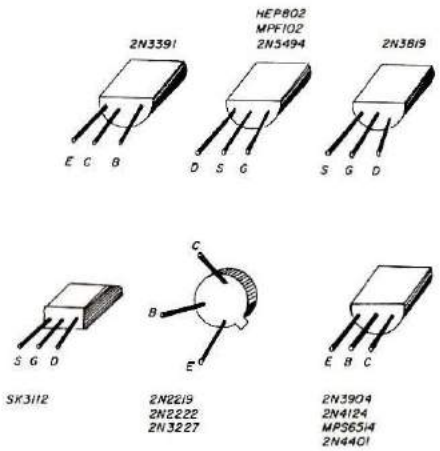


Fig. 14. Basing diagrams for the transistors used in the converter.

crystals for each band. Then, when you go to a radio club auction or flea market you may end up with a complete set of crystals for less than the price of one new crystal. All the crystals in the prototype receiver and the second version of the converter were lower frequency crystals operated in an overtone mode.

P.C. Boards

Finally, let's look at the board layouts: **Fig. 10** is the foil side of the mixer board. The components are on the other side, except for the bandswitch, and the variable capacitor is located off the board on the front panel. **Fig. 11** is the oscillator used in both converters. Again, it is the foil side of the board. All components are on the other side except for the bandswitch, and coils L1, L2, L3, L4. **Fig. 12** shows the alternative oscillator for use with an FET circuit. Again, this is the foil side, and components are on the other side except for the switch and coils.

In the recommended list of coil cores, do not substitute others unless you know the core materials and are able to recalculate the correct number of turns. I have built this converter many times in a number of different layouts,

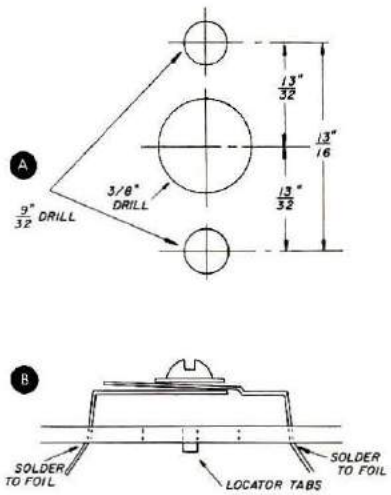


Fig. 15. The Arco compression trimmers are difficult to mount and solder to the board unless you make the holes the right size and at the right spacing. This layout will help. Be careful with the large drills and the thin PC board material — be sure to have a wooden block to support the board, and don't force the drill through.

and have always had success, so I don't forsee any problems unless you get components in the wrong holes, poor solder joints, or force the switch assembly together, thereby ruining the switch wafers. Since I have also used surplus crystals in practically all of my converters, I don't see many problems with crystals. FT243 crystals have given me a little trouble in the past, but are still usable. To use them in this layout would require about 1.5 mm (1/16-inch) greater spacing between crystal holders.

I should also mention how to mount the compression trimmer capacitors. **Fig. 15** shows the hole locations and dimensions, and method of mounting. Incidentally, this converter works well with a surplus BC454 80-meter Command receiver for either CW or ssb. Those old sets had exceptional stability — really state of the art.

In conclusion, I hope you enjoy the success I've had with this simple little converter, and I hope it encourages you to experiment further with homebrew, solid-state equipment. Happy tinkering!

HRH

Sources of Materials for the Converter

Variable capacitors, APC capacitors compression trimmers, toroid coil forms, rf chokes, enclosures	G. R. Whitehouse 15 Newbury Drive Amherst, New Hampshire 03031
Variable capacitors, compression trimmers, power transformers, rotary switches	Fair Radio Sales 1016 E. Eureka Box 1105 Lima, Ohio 45802
Resistors, fixed capacitors, transistors, diodes, PC board material	Gull Electronics 12690 Route 30 North Huntington, Pennsylvania 15642
Crystals, crystal sockets	JAN Crystals 2400 Crystal Drive Ft. Meyers, Florida 33901
Crystals, crystal sockets	Jess B. Lebow, Jr. 355 Mower Road Pickney, Michigan 48169
Diodes, transistors, FETs, integrated circuits, components	Adva Electronics Box 4148A Woodside, California 94062
Fixed capacitors, switches, resistors, transistors, FETs, integrated circuits	Digital Research Corporation Box 401247 Garland, Texas 75040
Transistors, diodes, integrated circuits	Integrated Circuits Unlimited 7889 Clairemont Mesa Blvd. San Diego, California 92111
Capacitors, diodes, transistors, integrated circuits	Bullet Electronics P.O. Box 19442 Dallas, Texas 75219

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Resistor/capacitor circuit provides osc over a range of freq with the desired crystal. 2 to 22 MHz, OF-1 LO, Cat. No. 035108. 18 to 60 MHz, OF-1 H, Cat. No. 035109.

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PAX-1 TRANSISTOR RF POWER AMP

A single tuned output amplifier designed to follow the OX or OF-1 oscillator. Outputs up to 200 mw, depending on frequency and voltage. Amplifier can be amplitude modulated 3 to 30 MHz, Cat. No. 035104. *Specify when ordering.*

$6.06 ea.

SAX-1 TRANSISTOR RF AMP

A small signal amplifier to drive the MXX-1 Mixer. Single tuned input and link output. 3 to 20 MHz, Lo Kit, Cat. No. 03512. 20 to 170 MHz, Hi Kit, Cat. No. 035103.

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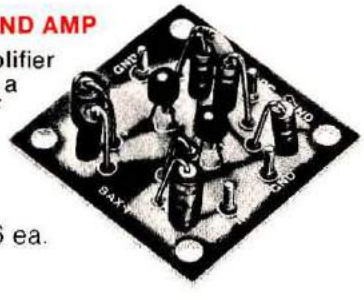

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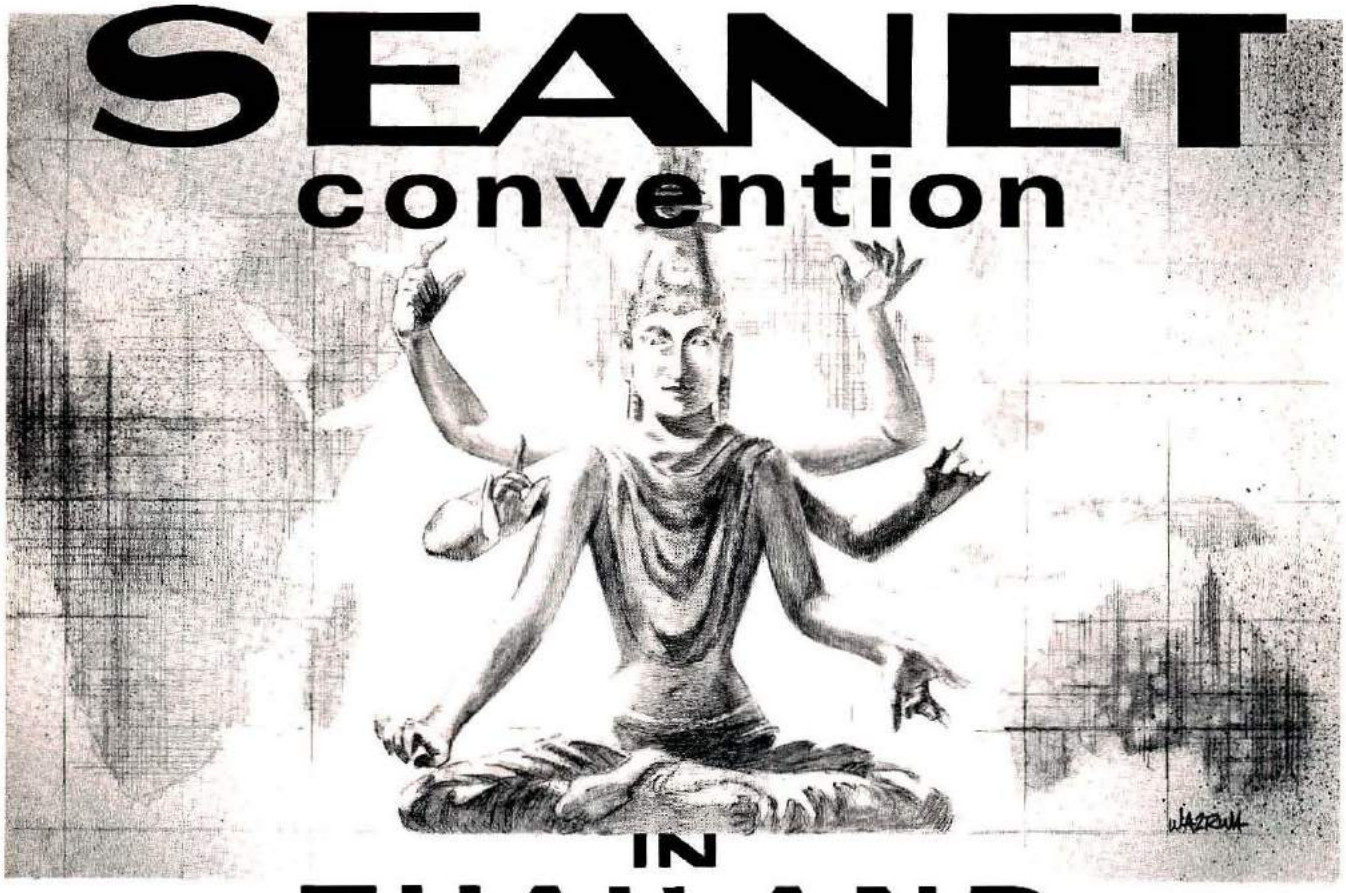
SEANET convention IN THAILAND



BY DOUG BLAKESLEE, N1RM

In 1976 my good friend WA1UHB attended the annual conference of the South East Asia NETwork (SEANET), which was held in Jakarta, Indonesia. He came back raving about how great it was. When the opportunity arose for me to go it took only a matter of microseconds to decide that if SEANET '77 was going to be held in Bangkok in November, I'd be there.

Such a decision must, sooner or later, be imparted to one's spouse. My wife is a veteran of more than a few ham conventions. So when I announced that I'd made plans to go to yet another, she answered, "That's nice, dear." (For those not married, this roughly translates to: "It's okay if you go as long as I don't have to.") She added, "Is this another of those affairs in New York City?" With no way out of that question, I told her it was the SEANET convention in Bangkok. "But . . . but . . ." she sputtered, "that's on the other side of the world." After some additional sputtering, she added, "And what's a SEANET, anyway?"

What's a SEANET, anyway?

Hams have a natural tendency to get together, both in person and on the air. The South East Asia NETwork wasn't formed; it just happened. When propagation wasn't too good to other parts of the world, amateurs in Asia and around the Indian Ocean got together for a rag chew. The ham population in this part of the world is sparse, so it was fun to talk with "close" neighbors.

The scope of SEANET is hard for someone like me to comprehend. I was broken in years ago as a net control operator on the Connecticut Phone Net covering a little state only 96 by 64 km (60 by 40 miles). SEANET covers more than one-third of the world with regular check-ins by stations from Hawaii to East Africa, from Japan to Australia. It serves as an on-the-air club for amateurs who often don't have enough local hams to form a club — who often don't have *any* local hams at all!

SEANET meets nightly on 14.320 MHz using usb (upper sideband voice) at 1200 UTC (0700 EST, 0400 PST). This club of the air has no officers, no dues, and no members — only "regulars" on the net. It's popular, to be sure: up to 150 stations check in each evening. Their general purpose is camaraderie among amateurs; but like most amateur networks, they provide a resource for emergency communications unmatched by

other services. For example:

Recently a distress call heard on SEANET made headlines. A 12-meter (39-foot) cutter, the *Brillig*, sailed by 28-year-old Cornelia "Cricket" Dellenbough and two companions, was waylayed on a voyage from Pattaya to Brunei. The distress call said *Brillig* was being fired upon by four gunboats, flying no flags, off the Vietnamese coast. (First press reports said two "fishing boats" were responsible.) The story caused international concern, and the next day SEANET stations reported an additional message from Cricket Dellenbough: she and her crew were being "escorted" to Saigon and they expected to be released shortly. No doubt the SEANET-generated reports, which were repeated by the world press, had much to do with the ultimate safety of *Brillig* and her crew. As I am writing this, negotiations are being completed with Vietnam for Cricket's release.

In late December 1971, some 25 SEANET members got together on Penang Island in West Malaysia for the fun of a convention. They started a trend. The spirit persisted, and the next year a group met in Bangkok. This convention was called the second SEANET, and it was institutionalized as an annual affair. Conventions followed in Singapore, Manila (Philippines), Kuala Lumpur (Malaysia), and Jakarta (Indonesia). SEANET '77 returned to Bangkok, and that's the subject of this story.

Getting there is . . .

The airlines once tried to convince us that "getting there is half the fun." Or maybe it was the steamship lines. Anyway, it was long before jumbo jets started leap-frogging continents and before the Japanese "Red Army" and other terrorist groups began hijacking some flights and blowing up others. With today's international airports resembling Stalag 17, complete with barbed wire, armed guards, and armored vehicles, the weary traveler is happy just to arrive in one piece.

The international-airline moguls have decreed that Japan is the gateway to the Far East; all of the popular flights go through Tokyo. It's a good stop on any ham itinerary because you can visit the famous radio-parts and equipment-sales district, Akihabara, a fabulous experience for those of us who must depend on Radio Shack and mail order. Businessmen in a hurry prefer the Pan-Am direct flight from New York to Tokyo. In my view, it's a good way to damage your physical and mental health. The Boeing 747SP (for Special Performance) used by Pan-Am is a technical marvel. It carries fewer passengers but a larger fuel load, two full crews, and

The boys from Penang who made the 24-hour train trip to Bangkok pose for a group photograph.

HM2KL led the Korean delegation.

flies 1.6 km (1 mile) higher than other 747s. In this marvelous flying machine you sit in a seat for 18 hours straight and can watch two movies. Let out in Tokyo, you find that midnight is noonday and vice versa, which causes the best case of jet lag known to man. An average person takes at least a week to get his internal clock reset.

Travel tips

My own survival plan for international travel includes the dictum *never sleep on an airplane*! So I fly from New York to Honolulu, have a late dinner — that wonderful island food — and a good sleep. Because of the time change, you tend to awaken early. But you have the opportunity for a swim and a leisurely breakfast before setting out. From Hawaii to Japan, I fly Japan Air Lines (JAL). The value of the Japanese yen *vs.* the dollar has made the Hawaiian Islands the favorite vacation spot for hordes from the Land of the Rising Sun. Factory workers and honeymooners pack every JAL flight, which practically assures that if you're not on a tour, you get bumped to first-class. I've made the trip four times and wound up in first-class every time. It's great to relax in a big

Three of SEANETs well-known members, Mayuree Chotikul, HS1YL, Father Moran, 9N1MM (under a portrait of the Queen of Thailand), and Dr. Edurado Garcia, DU6EG.

first-class seat, and enjoy Western and Oriental cuisine.

The morning flight from Honolulu arrives in Tokyo in the early afternoon, providing a chance to get downtown to a hotel before rush hour in the world's largest city. And what a rush hour it is!

The second stop on the way to Bangkok is Hong Kong. Out of Tokyo, get a window seat on the right-hand side of the aircraft. The sights along the China coast are not to be missed. The approach to Hong Kong's airport, flying between volcanic mountain peaks, then below the level of the skyscrapers on either side of the bay onto a single runway built on landfill, is an experience you'll appreciate — once the plane is on the ground.

From Hong Kong, it's another trip through security and another plane for the final destination, Bangkok. Today, the flight must head all the way around Vietnam and back up to Thailand.

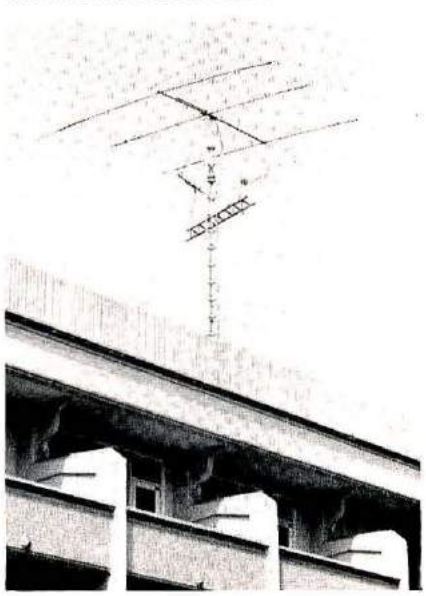
No one seemed to mind the extra hour of flying time caused by the wide sweep around what had been South Vietnam. The new rulers are very touchy about their air space. Who'd want to find out if there were any SAM missiles left about!

Every major international airport has a best way to get downtown. In London you take the airways bus; in Munich a taxi; in Tokyo the high-speed monorail. In Bangkok you take a "limousine." These limos are a Thai Airways concession and aren't limousines at all in our sense of the word. They're an odd collection of small Japanese cars with a back seat large enough for two pygmies, maximum. For someone like myself, with a 1.8-meter (6-foot) frame, the trip into town is a 45-minute ride with your chin resting on your knees.

The area around Bangkok is an absolutely flat river delta. First impressions are of a countryside with short but lush greenery, interspaced with puddles, rice paddies, and small streams. A fine, reddish-brown dust is everywhere, even immediately after a rain shower. It's a permanent part of the environment.

To the edges of the road, farmers work their paddies as they have done for endless generations. Sometimes all you see is a domed straw hat moving among the reeds; the worker is in water up to his chin. At each major intersection is a bus stop, a platform built over a rice paddy. Each platform is made of wood with a high, arched roof that has a sweep and curve as

The antennas for HSØSEA were mounted atop the Erawan hotel. The OSCAR antennas are on the crossbeam.



Two well-loved Malaysian Amateurs, 9M2EE, Sardjit, and 9M2DN, Keen.

elegant as any on the finest temple. There are no seats or benches; people wait for transportation while squatting, unmoving, like statues. The lack of movement, no doubt, is in deference to the high heat and humidity.

Bangkok's outskirts are made up of low, two- or three-story cement buildings where the first floor is invariably a shop, store, or garage. This type of construction is seen throughout Southeast Asia, from Taiwan to Singapore. As you get into town, the buildings get taller. The unique features of Bangkok are its temples and palaces — unique, breath-taking, beautiful. Hotels, restaurants, and even private homes have their own small temples — every bit as elaborate in gold and color as the large ones — like miniature doll houses mounted on poles near the entrance or front wall.

Soon my pint-sized limo swung into the entrance of the convention hotel, the Erawan. It's an older hotel, built years ago in the low rambling style of Thailand. Each room has a balcony and long windows, which can be opened to catch evening breezes. It's a country long on heat and humidity and short on breezes. Central air conditioning had been added to each floor of the Erawan. The hotel is run by the government, and run well. It surely has the finest service of any hotel I've seen anywhere in the world. The Erawan is mentioned frequently in John Le Carre's best-selling spy novel, *The*

Honorable Schoolboy. This new notoriety has attracted an interesting odd lot of guests, mostly Europeans.

SEANET '77

A large, blue banner over the main entrance of the Erawan proclaimed with huge gold letters, "Welcome to the delegates for SEANET '77." And welcome it was. Col. Kamchai Chotikul, HS1WR, president of the Radio Amateur Society of Thailand (RAST), welcomed each newcomer to the registration room. For 500 baht or some $24 (about the price of a banquet at a U.S. convention), we received a whole weekend of meals, banquets, and cocktail parties, plus entry to all convention events. In addition, we received a potpourri of Thai items including powder, hair tonic, a stamp collection, a handmade silk tie, a bottle of local cognac, a handmade fish mobile, and so on, as gifts. I'd just arrived and already I was wondering how to fit all the loot into my suitcase! Thailand is called the "land of a thousand smiles." All thousand were being used to welcome hams to SEANET '77.

A luncheon provided the opportunity to meet the delegates. These were among the better known:

HS1WR — Col. Kamchi Chotikul, "Kam," mentioned earlier, is president, mentor, and international good-will ambassador for RAST (having visited some 60 countries). Besides being a colonel in the Royal Thai Artillery, Kam is director of radio station HSAAA and owner of Kamchi Electronics, a manufacturing and importing firm. His wife, HS1YL, and daughter, HS1DC, are active hams and beautiful ladies. Their charm as hostesses permeated the convention.

Two girls in traditional Siamese costume dance during the Friday banquet.

9N1MM — Father Moran is a ham-radio legend. A Catholic priest, he's the long-time leader of the Saint Xavier School in Katmandu, Nepal. A ham for some 54 years, he's been one of the mainstays on 20-meter ssb and on SEANET. 9N1MM tends to drop in on conversations between U.S. amateurs when he hears someone he knows, just to say hello. Just as quickly, he can disappear before the entire band turns to a bedlam of stations calling for their first Nepal contact.

S79R — Carl, otherwise known as WB8JDR, is a rag chewer with an improbable call from an almost unknown corner of the world, the Seychelles Islands. Because of his location at the African end of the Indian Ocean, Carl is in a unique position to be net control for SEANET, and it is clearly his favorite pastime.

BV2A — Tim Chien is one-of-a-kind, the only amateur licensed to operate on Taiwan. His mild manners and easy laughter are infectious. When asked about the chances of

No convention is complete without an exhibit. Here equipment made in Thailand by Kamchai Electronics attracts delegates.

Carl, S79R, opens the Southeast Asia net using the special call HS0SEA. Carl is a regular net control from his station in the Seychelles Islands, in the western Indian Ocean.

other amateurs being licensed, he relates that his country is in a state of siege from mainland China, and, until these problems can be solved, ham radio will be in a holding pattern. Otherwise he has the same problems as the rest of us. He can't operate from his apartment, so he has another site — where his neighbors object to his antennas. A typhoon ate his triband beam some time ago, so he's been using a vertical antenna.

A7 — The Sultanate of Oman (located at the southern end of the Persian Gulf) sent a whole delegation led by A7XFE and A7XGX. They brought everyone — wives, children, girl friends, and two SWL (short-wave listeners). They promptly were christened the "green gang" because each had a green shirt with call or affiliation embroidered on the back, along with the emblem of the Sultanate.

The RAST gang accomplished the organization and implementation of the convention. The society is a collection of Thai, European, and American hams. (In general, Thais have two-letter HS calls, while others have three letters.) They were an odd mixture of people and backgrounds, but boy, what a convention they put on!

The largest delegation was the "boys from Penang." Penang, on the west coast of the Malay peninsula, has become a center for semiconductor assembly by U.S. companies. While the group, 15 in total, came from all over Malaysia, they met in Penang and took the train to Bangkok. It's a long way up the peninsula; the trip took 24 hours. You can't imagine a more tired, more happy, more enchanted group than the boys from Penang. Coming from many cultures and several different religions, they had occupied the train for a day and night, eating and talking ham radio. Arriving in Bangkok, they invaded the convention and continued talking radio with an enthusiasm that led some to believe that 9M2 and 9M6 amateurs never sleep.

Station HS0SEA

An operating ham station is usually a convention feature. The SEANET '77 station was, appropriately, given the call sign HS0SEA. Each attendee was invited to operate the station; a rare country with a special prefix was guaranteed to drive the prefix hunters wild. The station was located on the fourth floor of the hotel in a special room. The high-frequency gear was Collins, with additions for OSCAR work and an fm transceiver. The antennas were on a roof-mounted tower, so the triband beam was over 31 meters (100 feet) above ground.

The amateurs of Bangkok have experimented with a 2-meter fm repeater, although it was not working during the convention. A few hams were seen to be clutching hand-held transceivers; occasionally they talked into the little black boxes.

A small exhibit area was set up on the same floor as the station. The exhibits were mostly commercial communications equipment, accessories, and services. Even so, the exhibits were very well attended. A special favorite was the Kamchai Electronics stand, which featured a RTTY-to-video converter built by the firm. It was copying a news-service transmission and displaying the copy on a TV screen.

The convention really got under way Friday evening with a cocktail party in the hotel garden. The Erawan Hotel is constructed in a U shape, with the center consisting of a garden, a pool, an outdoor cafe, and a backdrop that looks rather like a temple. We learned the purpose of the backdrop on Saturday night. Just as the party was getting warm, the guest of honor and chairman for the convention, Sribhumi Sukhanetr, arrived.

In Thailand, as in most countries, the telephone company, the post office, and the local equivalent of the Federal Communications Commission are all one government agency. Mr. Sukhanetr is head of this government function which, in Bangkok, is called the Post and Telegraph Department. It's not useful to describe the past difficulties of ham radio in Thailand in this article. Suffice to say, RAST, ably led by

HS1WR, has been working hard for a close relationship with the government, lobbying hard for amateur radio.

When Mr. Sukhanetr agreed to serve as chairman of the convention, a breakthrough of major importance was achieved. Even more important for the future, he's become sufficiently interested in ham radio to join us — as HS1SS. Local television and newspapers covered the opening of the convention, a good public-relations effort by RAST.

The party then moved to the Erawan's banquet hall for formal opening ceremonies. Mr. Sukhanetr led a short Buddhist prayer ceremony consisting of lighting the candles at a small shrine. Then, a toast was made to the young king and queen of Thailand, and the national anthem was played. Thais have deep-felt allegiance to their monarchs.

Mr. Sukhanetr and Col. Chotikul then made their opening statements. This was done in a formal way, with a beautiful young lady bringing the speeches in a white envelope on a silver tray. The ceremonies wound up with S79R opening the net at 1900 local time, as usual. The ham gear was brought down to the banquet hall so that, whatever else, the net would go on as usual.

When the net was over, the banquet began. Consider the problem of the Erawan's chefs: The convention visitors not only came from many countries, but came representing five of the world's major religions. The meals had to be planned so that no religious dietary laws were violated. The first banquet, and every subsequent meal, was superbly done, and all religious traditions were observed. A native band started, with each musician sitting cross-legged at his wooden instrument. The music consisted of Thai classics. Then, wonderful surprise, two Thai dancers appeared in costumes right off a travel poster, wearing the tall, spiral gold headgear. The girls danced in bare feet, using the classic movements of feet and fingers — truly a sight to behold. Their fingers *must* be double-jointed, for often they lay back to the wrist in the dance movements! As a finale, the girls danced through the hall throwing handfuls of rose petals over the delegates. It's not often you can end your evening in a shower of rose petals.

All convention delegates were allowed to operate HSØSEA. Here, A4XGX from the Sultanate of Oman takes a turn at the mike. Dave is wearing his special "green gang" shirt.

Friends from Taiwan, Republic of China: Frank, W9ZNY and Tim, BV2A. Frank runs a business in Taipei and acts as antenna advisor for BV2A, the only licensed Amateur in Taiwan.

Saturday was taken up with technical talks and net meetings, the standard fare for any convention. The high point of the day was a film by the Japanese delegation of their latest DXpedition. In a hall filled with amateurs holding many of the world's rarest DX callsigns, a DXpedition was the big hit! Between sessions, delegates reviewed the exhibits and took turns operating HSØSEA.

Lunch was set up in the garden and the food tables again overflowed. A large, yellow, carved RAST emblem graced the table. I asked an HS amateur how the emblem was made. He replied that it was carved from butter by the hotel chef. I can only assume there was something lost in the language exchange, or they have a type of butter unknown in the West. In the high noon-time temperature of Bangkok's winter season, the butter we know would have turned to soup in minutes. But, the RAST emblem didn't drip or sag.

Saturday evening was a jewel, an oriental jewel in Bangkok (which claims to be the gem capital of the world). Friday evening (rose petals and all) was called formal, and HS1WR declared that Saturday would be informal, in the Thai tradition. The dinner tables were moved out into the garden. By evening, the winds

Our local temple dog recently ate 5 postmen, your QSL could have been among them. Could you please send a replacement QSL. Thank you in advance — UDO

This unusual QSL card is used by Udo Blaes, HS1ALB, to attract replies.

had blown the heat of the day to Vietnam or somewhere east. The evening was clear, providing a mantle of stars for our "informal" dinner. The meal was excellent, and the service was even better.

After dinner, the native band was back, this time with a large dance troupe. They performed classic Siamese dances from different parts of the country, using the Erawan's temple backdrop. Each dance sequence was performed with a unique set of costumes.

After the entertainment, the prizes and awards, a primary feature of any convention, were scheduled. There were no after-dinner speeches (U.S. convention planners take note!) SEANET sponsors an annual DX contest in which the rest of the world tries to work Southeast Asian countries. Winners of last year's contest were announced, and those who were present collected their awards. There were other special awards. The plaques, which were made in the Philippines, were the most magnificent I have ever seen. See you in the contest next year!

All evening, Kim, HM1KL, (who uses the phonetics "Korean Lady") was getting rave reviews. She came to the dinner dressed in a spectacular, traditional Korean costume. The RAST officials did a quick huddle and came up with a special award for the best costume. The boys from Penang, who had acted as a cheering section for Kim all evening, went wild with applause. I'm sure that when Kim became interested in amateur radio through her brother, she never dreamed that one night she would be crowned an impromptu Queen of Beauty in Bangkok. Many things are possible through the magic of ham radio.

The prizes

The prizes were next. There were a few door prizes, but the big items were all in the raffle. The raffle grand prize was a new Atlas 210X. All day there had been a long line at the raffle ticket counter, for radio parts are impossible to find in most SEA countries, and manufactured gear is very expensive. Dreams of a 210X were in many eyes.

RAST had a lot of raffle prizes, enough so that every third ticket holder got one. As prize after prize was awarded, the tension mounted.

I bought a ticket but didn't expect to win. In one hundred conventions, I hadn't won anything worthwhile. But I did win something this time: a book on antennas by Bill Orr, W6SAI. All evening I'd been sitting with Tim Chien, BV2A. Tim had been talking about his antenna problems earlier in the evening. After looking at the book for a minute, I said, "Tim, you take this book. At the moment you need it a lot more than I do." But he handed the book back, with his shy smile, replying, "I won't take it — unless you write something under the cover for me." I did, and when the evening was over, he left with the antenna wisdom of Orr tucked under one arm.

As for the Atlas rig, the gods of Siam smiled on a young man from Malaysia, an SWL (short-wave listener), who hadn't yet been able to earn his ham ticket. Again, the Penang cheering section went wild. It was a grand finale to see the main prize go to someone who could really use it.

Sunday morning was devoted to tours. HM2KL and a few others arose hours before sunrise to look for treasures at Bangkok's famous floating market. You must be up early because the vendors among the boat people will have closed shop and gone by 6 AM. Other visitors took tours of Bangkok. When you visit Bangkok, the "water" tour, the tour of the royal palace, and the temple tour are "musts." For the tourist with money, shops feature Thai silk, gems, wood carvings, ivory, and antiques.

On Sunday evening, Kam, HS1WR, invited the entire convention to his home. You need something more than the average home to hold a convention! Kam provided a bus for those who wanted to make the trip. In talking with a group of U.S. amateurs, Kam had promised them that they could use his station to work stations back home. He allowed that the band was usually open from his station to the U.S. Considering that Kam runs a kilowatt and has a six-element, full-size 20-meter beam antenna on a 140-foot tower, I'm sure he can make his own band openings, any time. **HRH**

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ROBOTS IN THE HAM-SHACK

BY
IRV GOTTLIEB, W6HDM

The word "robot" conjures various images and associations. For example, a goggle-eyed electro-mechanical monster programmed to perform tasks considered routine or boring by the flesh-and-blood masters who impart the programs. We tend to think that the critters can execute their programmed functions with a minimum of supervision. We recall that the science fiction writers have given robots abilities and inclinations quite different from those intended by their creators.

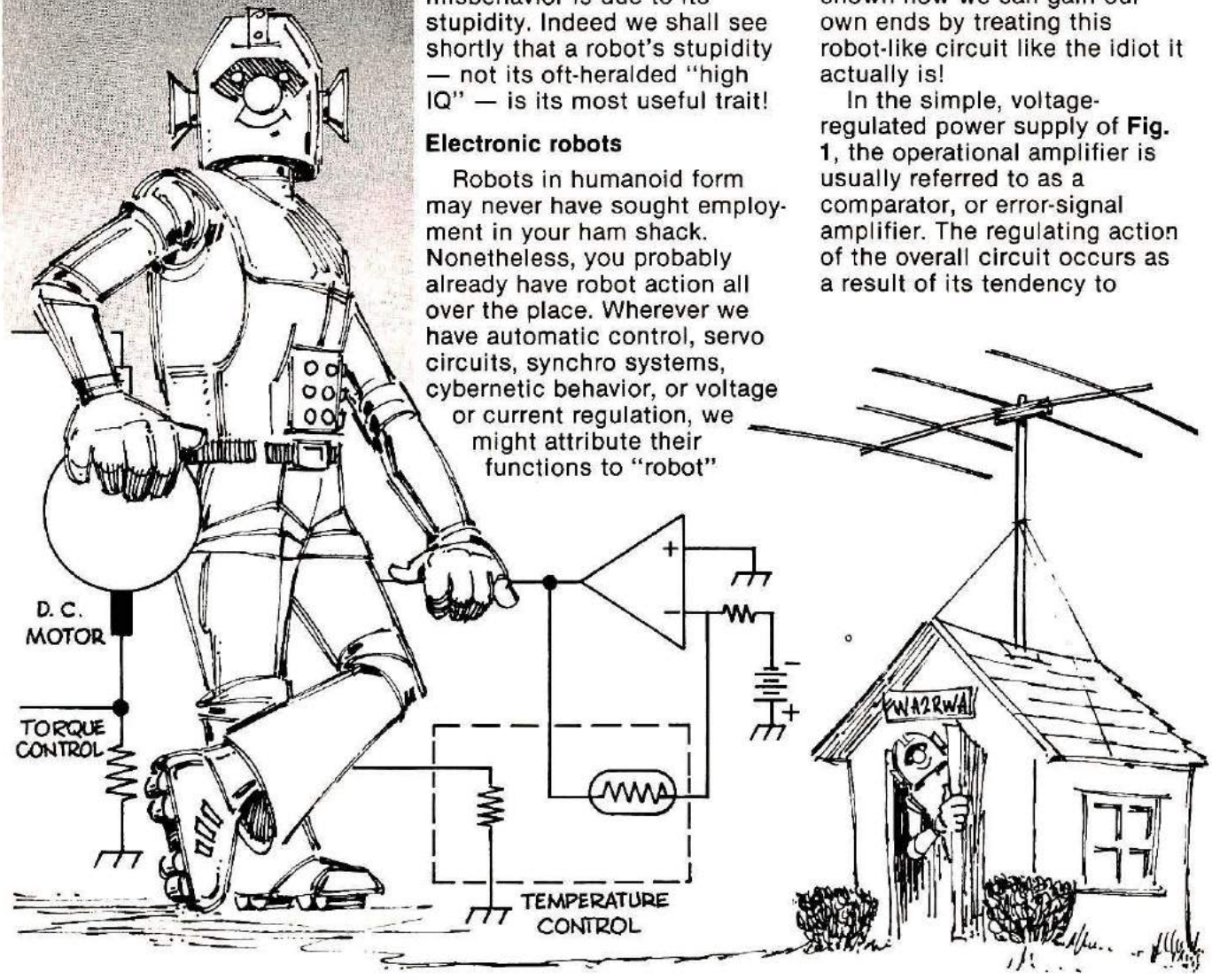
If a robot responds to its "instinctive" urge to push by shoving over a skyscraper, rather than by putting a lawn mower or vacuum cleaner through its paces, we say such misbehavior is due to its stupidity. Indeed we shall see shortly that a robot's stupidity — not its oft-heralded "high IQ" — is its most useful trait!

Electronic robots

Robots in humanoid form may never have sought employment in your ham shack. Nonetheless, you probably already have robot action all over the place. Wherever we have automatic control, servo circuits, synchro systems, cybernetic behavior, or voltage or current regulation, we might attribute their functions to "robot" action. Automatic gain control in the receiver, automatic level control in the transmitter, and your rotary-beam antenna-positioning circuitry are a few examples. And how about voltage-regulated power supplies? The automatic stabilization of dc operating voltage as a function of line and load variations is an application of robot action.

The regulated power supply is the basis of our discussion of robot action. The regulated supply has far more extensive skills than that of merely disciplining its own behavior. At the same time, it exhibits stupidity as mentioned above. Consider the following discussion of its operating principles. It will then be shown how we can gain our own ends by treating this robot-like circuit like the idiot it actually is!

In the simple, voltage-regulated power supply of **Fig. 1**, the operational amplifier is usually referred to as a comparator, or error-signal amplifier. The regulating action of the overall circuit occurs as a result of its tendency to



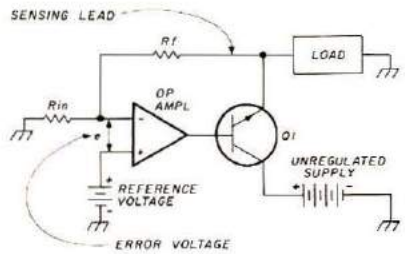


Fig. 1. A simple voltage-regulated power supply. Such an arrangement involves robot action in a "self-disciplined" mode of operation.

minimize the error voltage, e. Ideally, the action is such that e will be nulled to zero as the inverting terminal (−) is driven to the same voltage as the noninverting terminal (+). Actually, e will not quite attain zero voltage because the operational-amplifier gain isn't infinite and because inherent voltage and current offsets occur.

Suppose feedback resistance R_f is adjusted to provide a certain regulated voltage across the load. Thereafter assume that resistances R_{in}, R_f, and the reference voltage remain "steady as a rock." Suppose, however that the unregulated supply voltage increases. (Although shown as a battery for simplicity, the unregulated supply is generally a rectifier-filter arrangement operating from the ac power line.)

Any attempt the load voltage makes to increase is counteracted, because the accompanying increase in error voltage, e, causes a reduction of forward bias at the base of the series-pass transistor, $Q1$. In turn, this increases the resistance of the collector-emitter current path, thereby decreasing the load voltage. If the overall circuit amplification is high, the load voltage is restored very nearly to its set value. A similar action takes place if the load decreases.

If the voltage from the unregulated supply drops, or if the load increases, the converse sequence of events occurs, again restoring the load voltage to its set value. Indeed, a continual "hunting" process occurs. The error signal fluctuates above and below a near-zero value. If we label the connecting wire between R_f and the load as the sensing lead, we can attribute the feedback and regulating action to the fact that the load voltage is "sensed."

Current-regulated power supply

Let's now disconnect the sensing lead from the load and reconnect it as shown in **Fig. 2.** Assuming the added sensing resistance, R, is very small compared to the load resistance, the sensing lead now monitors a small voltage that's directly proportional to load current. The overall scheme thereby becomes a current-regulated power supply. The significant aspect of this arrangement is that the regulator circuit operates in the same way as in the voltage-regulated supply of **Fig. 1,** *i.e.*, it's too stupid to know that the monitored voltage is being produced in a different way.

General-purpose robot

We now find ourselves in an excellent position to apply a bit of logic ju-jitsu, so to speak. In so doing, we'll cause a regulator to perform as a robot in controlling and stabilizing many diverse functions. We accomplish this by setting up the regulator circuit as shown in **Fig. 3.** The salient feature of this arrangement is that the sensing lead is free to be used in various ways. (The output capacitor, C, hitherto omitted

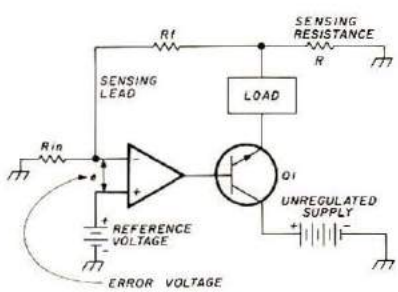


Fig. 2. Current-regulated power supply. A simple change in the sensing-lead connection allows the robot action of the circuit to stabilize load current rather than voltage.

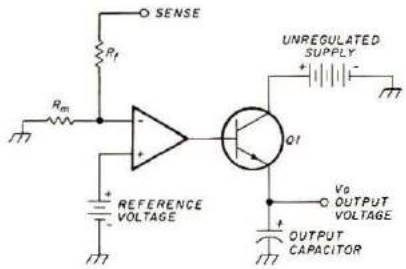


Fig. 3. The general-purpose robot — it's essentially a regulated power supply with remote sensing provision.

for simplicity, prevents feedback instability.) Designating **Fig. 3** as our general-purpose robot, let's explore what we can do by associating the robot with various circuits and systems.

Controlling light intensity: When the lamp and photocell shown in **Fig. 4** are appropriately connected to our robot, we have a useful scheme for controlling and stabilizing light intensity. Such a technique might be used for projectors, in slow-scan TV, photography, or in display illumination, and also by those who can use photometer methods for measuring rf power. The accuracy of such measurements can be greatly enhanced if a nonvarying standard of illumination is available.

Dc-motor speed control: the speed of a dc motor can be controlled and stabilized with the setup shown in **Fig. 5.** The dc tachometer is mechanically coupled to the dc-motor output shaft. The robot will vary the voltage applied to the motor so that constant tachometer voltage is maintained. Suppose the no-load motor speed is 1000 rpm and the tachometer generates 10 volts. When the motor is loaded, its speed may drop to, say, 900 rpm, whereupon the tachometer would produce only 9 volts. The robot counteracts this situation by increasing the motor voltage sufficiently to restore rotation at 1000 rpm, so that the tachometer again generates 10 volts.

If you now find you've run

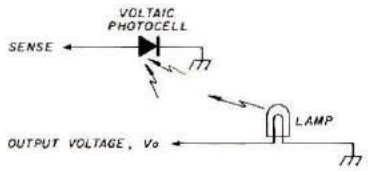


Fig. 4. Control and stabilization of light intensity. When used with the general-purpose robot of **Fig. 3**, this setup provides both constant and adjustable light intensity.

into a mental impasse, don't be dismayed — it's merely an indication that you've been paying close heed to our robot's operating behavior. It may appear strange that the stabilizing action applies to the sensed quantity (the tachometer output) rather than to V_o, the output voltage. However there's no inconsistency here with the more familiar regulating action of a voltage-regulated power supply.

In the voltage-regulated supply, even though we casually say the output voltage is regulated, the regulator accomplishes this *indirectly* by actually stabilizing the sampled portion of the output voltage — this just happens to stabilize the closely associated output voltage, V_o, also. But in the robot-motor setup, this one-to-one relationship between sampled (tachometer) voltage and output voltage does not exist. Rather, the output voltage has freedom to maintain the tachometer voltage, and thus the motor-speed, constant. Think it over!

In the setup of **Fig. 6**, the robot maintains constant current through the motor, thereby causing it to exert constant *torque*. The operation of this arrangement closely resembles that of the constant-current power supply of **Fig. 2**. Here, also, R is a very small resistance, and the sensing lead monitors the voltage drop developed across it.

An interesting feature of these two motor-control schemes is that the robot regulator impresses its "will" on the motors. That is, no matter what the textbooks show for the speed or torque behavior of the motors, when they are connected in the indicated circuits they exhibit either constant speed or constant torque characteristics. This means that any kind of dc motor can be used — permanent magnet, shunt, or series-wound types will be applicable. However, the manufacturer's horsepower rating must not be exceeded. In most instances the permanent magnet type will be easiest to implement.

Temperature control: Robot control and stabilization of temperature for an oven or heat chamber is shown in **Fig. 7**. An additional op amp is employed

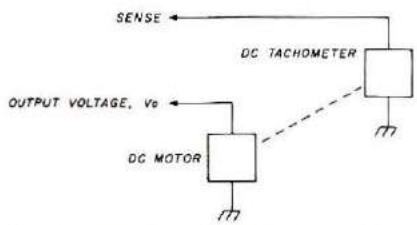


Fig. 5. Control and stabilization of dc-motor speed. Used with the general-purpose robot of **Fig. 3**, this setup provides both constant and adjustable motor speed.

to convert the resistance of the thermistor to a dc voltage. The robot then senses this voltage and controls the voltage delivered to the heater so that constant temperature is maintained within the heat chamber. The "set" temperature level can be adjusted either at the robot or at the resistance-to-voltage converter.

Between the two adjustments, you can obtain a reasonably wide temperature range. The fan helps distribute the heat uniformly throughout the

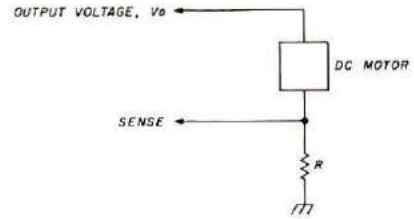


Fig. 6. Control and stabilization of dc-motor torque. Another arrangement that can be used with the circuit of **Fig. 3** to provide both constant and adjustable dc-motor torque.

chamber and speeds up the regulating action. A negative temperature coefficient thermistor can be used by interchanging the input and feedback resistances associated with the op amp. Not shown is a small power supply needed for the op amp.

Controlling microwave power: An increasing number of amateurs are experimenting with microwave communications. Although several good semiconductor devices are now available for generating these high frequencies, the traveling-wave tube (TWT) remains an eminently satisfactory oscillator, amplifier, and frequency multiplier. Once-costly hardware packages designed around these tubes are now often available from surplus at bargain-basement prices. And our robot is just as happy controlling microwave power from a TWT as it is regulating motor speed. (Frankly, it doesn't know the difference!)

The power output of a gridded TWT is governed by grid bias in a way analagous to that of a conventional vacuum tube, although the internal mechanisms giving rise to the

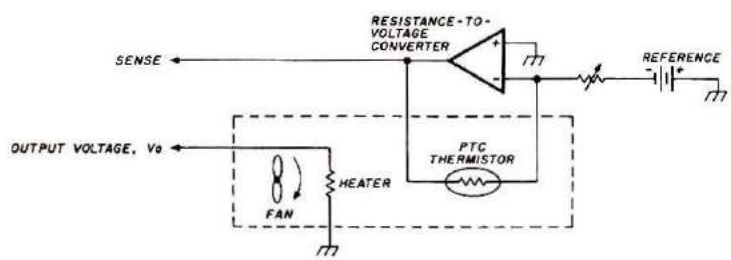


Fig. 7. Temperature control in a heat chamber. When associated with the general-purpose robot of **Fig. 3**, this setup provides both stabilization and adjustment of temperature.

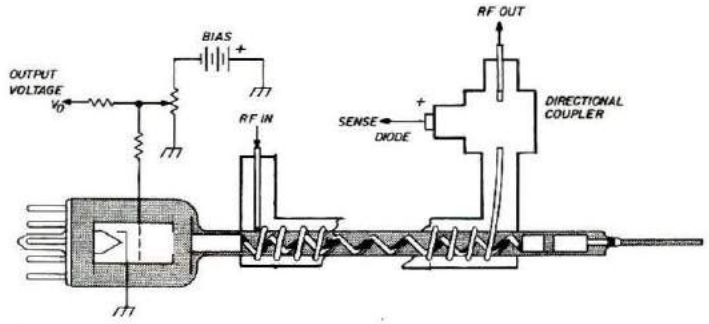


Fig. 8. Control and stabilization of microwave power. Still another use for the general-purpose robot circuit of **Fig. 3.** When used with the general-purpose robot, this arrangement provides management of microwave power from a traveling-wave tube (TWT).

relationship are somewhat different. In the setup of **Fig. 8,** the TWT grid is set at some nominal negative bias but can be made more or less so by V_o, the robot regulator output. The microwave output is sampled and rectified by a directional coupler and its accompanying diode. Thus a dc voltage representing the TWT output is available for the robot sensing lead.

From our previous examples of robot action, we can readily see that the proper conditions for stabilization and control exist in this scheme. Indeed, the same basic idea is applicable to conventional tubes operating at lower frequencies. For example, such output stabilization might merit consideration for signal generators used for test and calibration purposes. Or, perhaps more effective regulation of oscillation amplitude in the vfo could be attained with this method rather than by the lamp filaments often employed. (Amplitude stabilization of a vfo leads to improved frequency stability.)

Bench-type regulated power supply: The regulator portion of a typical bench-type regulated supply is illustrated in the simplified circuit of **Fig. 9.** Strapping options are commonly provided so that remote sensing of the load can be implemented. Obviously, the sense terminals can be used for various robot control techniques. Inasmuch as both plus and minus sense terminals are available, even greater flexibility prevails than with the op amp regulators shown in the previous robot applications. (Only the plus sense-terminal was available in those examples.)

Three-terminal IC regulators: Some of the three-terminal regulator ICs can also be used as robot controllers. Although not as amenable to circuit analysis as the regulated supplies with separate sense terminals, the overall operation is essentially similar. **Fig. 10** shows a popular three-terminal regulator in a robot arrangement that performs the same function as the setup of **Fig. 4.** The No. 1 terminal is ordinarily the ground or common connection when the IC is used as a simple voltage regulator. The fact that terminal No. 1 may be used for sensing can be gleaned from various circuits in which a dc voltage is applied to this terminal to change the "fixed" output voltage. However, not all three-terminal regulators will work equally well in this manner. In general, those which are prescribed as adjustable types are better bets for robot applications.

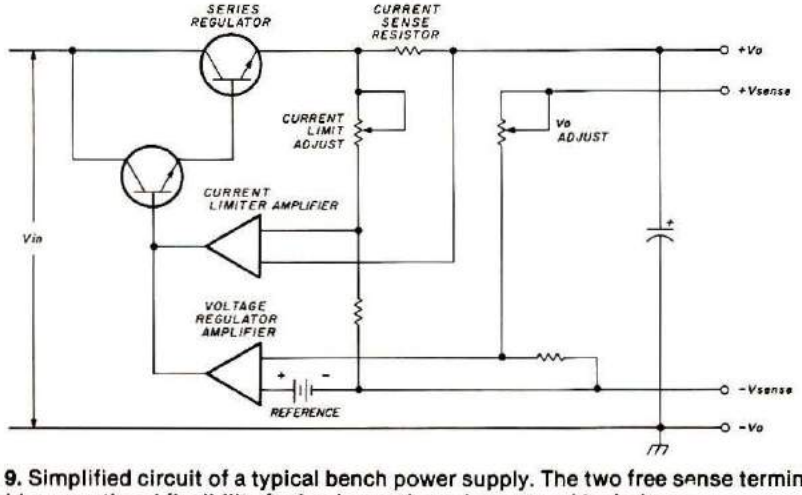
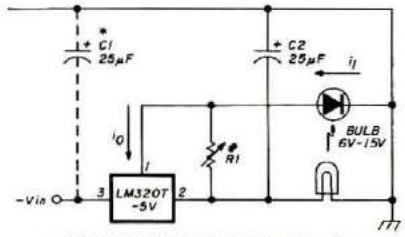


Fig. 9. Simplified circuit of a typical bench power supply. The two free sense terminals provide exceptional flexibility for implementing robot-control techniques.



* LAMP BRIGHTNESS INCREASES UNTIL $i_1 = i_O$ (1mA) = 5V/R1.

\+ NECESSARY ONLY IF RAW SUPPLY FILTER CAPACITOR IS MORE THAN 55 MM (2 INCHES) FROM LM320T.

Fig. 10. Control of light intensity with a 3-terminal IC regulator. This setup performs similarly to that of **Fig. 4.** (*Courtesy National Semiconductor Corporation.*)

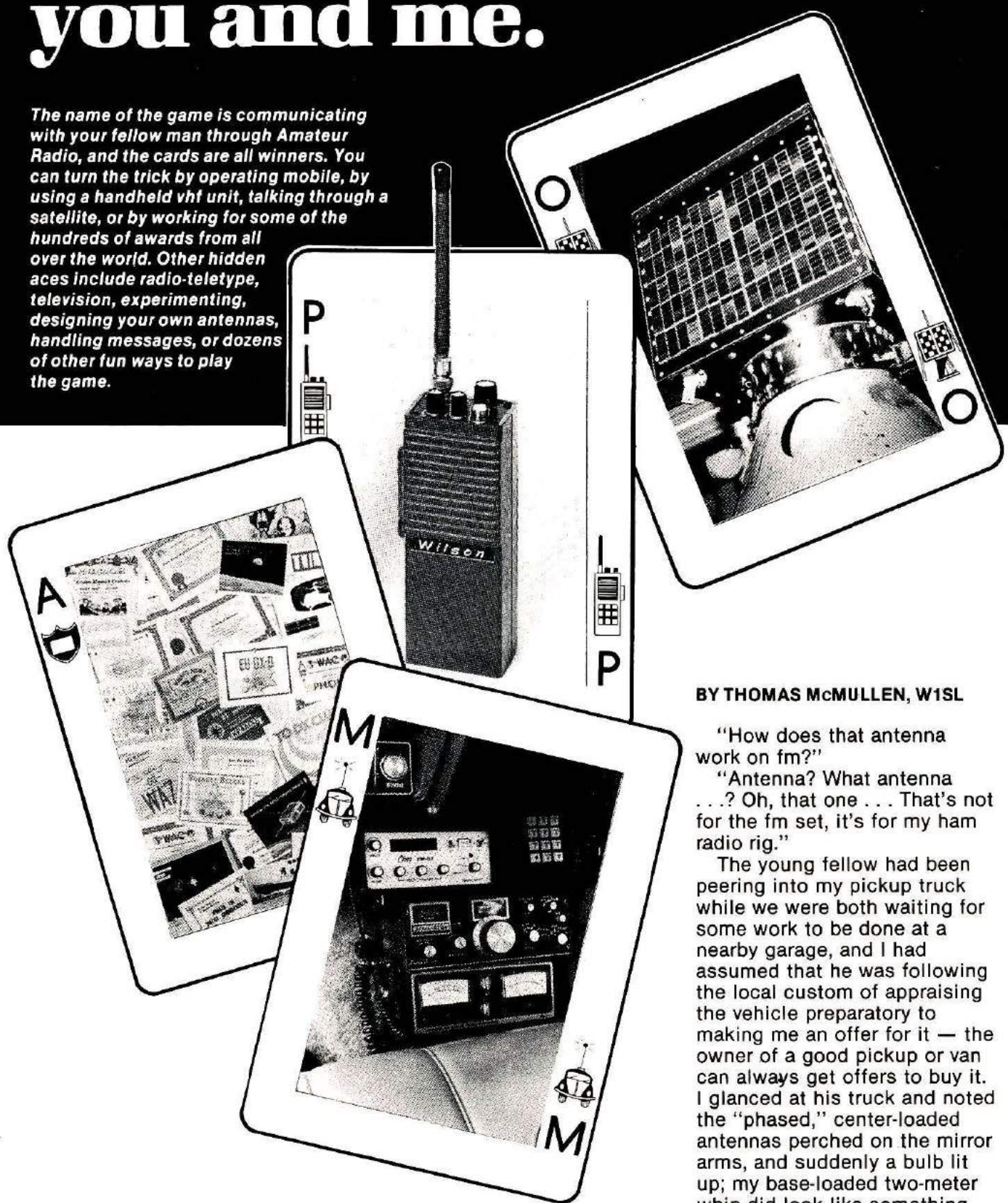
Conclusion

Sufficient information and an adequate number of examples have been given to enable the experimentally inclined ham to get the gist of robot control techniques. Surely, other novel and useful applications will reward the imaginative mind. In addition to the electrical and optical feedback paths shown, you might want to work with rf radiation, accoustic energy, and various transducers actuated by temperature, mechanical displacement, or low-frequency induction fields.

HRH

Amateur Radio for you and me.

The name of the game is communicating with your fellow man through Amateur Radio, and the cards are all winners. You can turn the trick by operating mobile, by using a handheld vhf unit, talking through a satellite, or by working for some of the hundreds of awards from all over the world. Other hidden aces include radio-teletype, television, experimenting, designing your own antennas, handling messages, or dozens of other fun ways to play the game.



BY THOMAS McMULLEN, W1SL

"How does that antenna work on fm?"

"Antenna? What antenna . . .? Oh, that one . . . That's not for the fm set, it's for my ham radio rig."

The young fellow had been peering into my pickup truck while we were both waiting for some work to be done at a nearby garage, and I had assumed that he was following the local custom of appraising the vehicle preparatory to making me an offer for it — the owner of a good pickup or van can always get offers to buy it. I glanced at his truck and noted the "phased," center-loaded antennas perched on the mirror arms, and suddenly a bulb lit up; my base-loaded two-meter whip did look like something

for CB, but he couldn't spot a rig in my car. The natural conclusion was that I was using the whip for fm broadcast reception.

"What kind of set?" he went on.

"A Kenwood TR-2200." Blank expression . . . the name didn't register.

"How many channels?"

"Twelve."

"I didn't know they made any with only twelve. I still got a 23, but I'll probably get a 40 pretty soon. How far can you get with that Kenwood CB?"

"No, not CB, Amateur Radio. I can cover a pretty good part of New England by talking through Amateur repeaters."

"Yeah? That sounds great. Where's the rig — I didn't see it. And what's this Amateur Radio stuff?"

"I left the rig at home for security, and Amateurs can talk all over the world, to other Amateurs."

Another blank stare. I felt compelled to reach him, somehow. No rig . . . no demonstration. Oh, well . . . I happened to glance toward the back of the garage where a radio was attempting to provide background music to accompany the thud of hammers on tires and wheel rims, the whine of electric drills, and the thump of the air compressor. Aha! A not-too-old Grundig a-m/fm/shortwave set.

"Hey, Eric, did you ever try that radio on short wave?" I asked the shop owner.

"Yeah, when I first got it, but I never could get Sweden on it, so gave it up."

"Mind if I try it?"

"Help yourself."

Crossed fingers. I hope it'll hit a ham band, and hope the band is open to some place interesting. Yep, it has the 19-meter broadcast band marked on the dial. Success! The 20-meter band is there, barely as wide as a whisker on this tuning system, and full of ssb. Oh-oh! I forgot about that. I turned to the inquisitive visitor, "You've heard sideband on your CB, haven't you?" He nodded. "Well, this is Amateur sideband, and the signals are probably from somewhere in Europe." Right on cue, a heterodyne from someone tuning up provided a carrier and a voice came through loud and clear: "CQ CQ CQ, THIS IS FRANCE, F9FT IN REIMS CALLING CQ C . . . The carrier went away, and so did the voice from France.

"Hey, that's neat," said my CB friend, "Get him again, I know French."

"I wish I could, but this set was made for entertainment and commercial broadcast stuff — it just doesn't work well with ssb signals. If I were at home we could talk to that French station."

"Yeah? Legally? You wouldn't get a visit from Uncle Charlie?"

"That's right. Amateurs do it all the time."

"Well, I'll be . . . Hey, tell me more."

How do you sum up a thing as interesting as Amateur Radio in the relatively short time my CB friend and I spent waiting in that service garage? There's just so much going on, so many people involved in so many different pursuits that the mechanic could have rebuilt both our trucks before I got it all told. I guess the first step is to talk about the people.

Who?

Amateur Radio takes in people from all parts of the world, all walks of life, and with almost every interest you can think of. Do you have to be a technical whiz to be a ham? No way! Anyone, and I do mean anyone, can become a ham with just a bit of study and practice.

Age? There's no limit. Some Amateurs are as young as 7 or 8, and others are at the opposite end of the time scale. I recently got a letter from a "new" ham who was 82. Handicaps are no hindrance, either. In fact, Amateur Radio brings the world right to the chairside of the shut-in. I just read a story about one Amateur who was so crippled with arthritis that he operated his rig by blowing on a special air-activated switch his buddies rigged up for him. He talks to the world and loves it!

You've heard of this thing called Morse code — I know because I saw you frown when you thought of it. Relax, it's not that bad at all. A few minutes a day with a cassette player and a stack of tapes and you'll have it made. A fellow I know learned the code well enough to pass the test just by listening to it in his car every day as he drove to work. It's easier than most languages; you don't have to worry about inflections and glottal stops and all those stumbling blocks that you hit when you want to learn French, Russian, German, or whatever. It may surprise you to learn that even people who cannot hear have mastered the Morse code. They learned to "feel" it vibrating against their fingertips from a special speaker hooked to their radio! So, when I say there are no limits set by age or ability, that's what I mean.

Something for everyone

One of the fascinating things about Amateur Radio is that you can find kindred souls to communicate with, no matter what your interests are. It covers the whole globe, and embraces so many people that you're sure to meet other hams who will be both interested and interesting. Are you into personal computers? Thousands of Amateurs are, and they often gather on the air for "brainstorming" sessions, comparing hardware and software and ideas.

How about controlling model planes, boats, or autos by means of radio signals? Ama-

teur Radio is a natural for that — hundreds of model fliers have found that the lack of crowding on the Amateur vhf bands makes possible hours of interference-free air time for their pet craft. Do you go for chess? There are plenty of other hams who do, and they often conduct games and tournaments right over the air — it's far faster than playing a game by mail, and the winner can usually count on a challenge from another ham who happened to be listening in.

Speaking of listening in — there are hundreds of "networks" of Amateur stations on the air every day, and if you'll listen to our 20-meter (14-MHz) band any weekend you can hear some intriguing communications. There is a Maritime Net, with stations calling in from ships at sea; a Post-Office Net, populated by Amateurs who work for, or have an interest in, the Postal Service; an RV Net for people who have campers, trailers, or self-contained recreational vehicles; and many, many more on-the-air get-togethers where Amateurs of similar interests swap information or just chat.

In addition to these "hobby within a hobby" networks, there are hundreds of stations that get together every night to pass messages along. They range from local coverage, such as a town, county, or area, up to continent-spanning hook-ups. Messages handled are, for the most part, greetings and relatively non-vital personal communications, and are both practice in the technique of handling messages and a form of acquainting the Amateur's neighbors with some of the good work we do. When a disaster strikes, such as a tornado, flood, fire, or earthquake, the Amateurs are ready and can put their skills to use immediately. Often an Amateur station is the first to get the word out in case of trouble, and teams of Amateurs handle messages relating to emergency supplies, medical aid, and the welfare of those in the afflicted area — sometimes for several days, until normal communications are restored. A California Amateur has just written a book about this helping-hand type of operation performed by Amateurs all over the world,* and there is even a monthly newspaper that reports these stories on a regular basis.†

No Language Barrier

In spite of the fact that Amateur Radio covers the whole world, embracing more than 300 countries, you'll find no language barrier. Whether you talk to Zaire, India, Japan, Nepal, Ecuador, Argentina, France, Poland, Hungary, or Russia, you'll understand the basic information they exchange with you. It's all part of a "universal" language that Amateurs have developed; an offshoot from the commercial radiotelegraph services. The vital parts of the exchange are in the form of coded signals and abbreviations. A group of three letters, such as RST, followed by numbers, can tell you how strong and readable your signal is, and its quality as well. A list of coded signals, each starting with the letter Q, covers most of the things one ham would want to tell another — for example, the signal QTH would be sent to mean "my location is . . .," and the signal QSB would be the same as saying "your signal is fading in and out." These messages can be sent either by voice or by Morse code, and represent a universal language among Radio Amateurs and many commercial radio operators everywhere.

Equipment

Is Amateur Radio expensive? Not necessarily. It depends upon what you want to do with it, and how much you feel like spending. By doing a bit of careful shopping and shrewd bargaining, you can pick up used equipment at less than

If you are in school, or live where a home station just isn't practical, then a club station may be the way to join the fun of Amateur Radio. Here is the Amateur Radio Club station at Michigan State University being given a workout by one of its student members. Many clubs provide help for newcomers who want to study for their license exams, and some of the stations (and operators) take part in contest operation with fierce, but friendly, competition.

*_Radio Angels_, by Paul Jerome Stack, WA6IPF; available from Ham Radio's Bookstore, Greenville, New Hampshire 03048, for $4.50 plus $1 shipping and handling.

†_Worldradio_, 2120 28th Street, Sacramento, California 95818; 12 issues for $6.75.

$200 for a basic station that will reach any part of the world; you might even find some gear for under $100. Do-it-your-selfers can buy kits costing from $100 or so up to nearly $1000. New equipment prices vary widely (from $200 to $2000), just as in any other hobby. But, you don't have to spend that kind of money for a station that you can have a lot of fun with. Many Amateurs have talked to every state in the U.S. while using homemade rigs that put out about as much power as a CB handheld unit — and they've gotten award certificates for doing so! At the other extreme, some Amateur stations have transmitters that use the full legal limit of 1000 watts, and have monster antenna arrays to go with the equipment. That's one of the beauties of our great hobby — you can mix and match to suit yourself. You're not stuck with one power level or one type of antenna. Nowhere else can you find such variety.

Take it with you

It has been said that ours is a mobile society, and you'll find that Amateur Radio has kept pace with it. Amateurs who commute to work, or who travel a lot for business or pleasure, usually take a small rig with them. Most often, it's a vhf (2-meter) hand-held or portable unit, and they use it to talk to other Amateurs who have similar equipment. A recent development called a repeater allows them to talk over distances of 30, 50, or even 100 miles from their car or from their office, hotel room, or at the beach. The repeater is a special station that receives a weak signal and amplifies it, then retransmits it again.

Portable equipment is not limited to the vhf bands, however. Many boating enthusiasts have equipment for the Amateur bands aboard as they set off for a weekend sail, a race, or a cruise to far-away places. They've found that this form of communications allows them to develop friendships that last much longer than the voyage.

Then, too, hikers and campers take Amateur Radio with them. Some have gear installed in their campers or vans, and some take small rigs in their knapsacks. It is not unusual to talk to a backpacker on top of a rugged mountain where he has fired up a rig no larger than a couple of sandwiches, hooked to a piece of antenna wire that seems no heavier than a spider's web. Yes, indeed, Amateurs are an active bunch.

Thanks to the many Amateur-built and maintained repeaters, a ham on foot can enjoy making contacts over distances that can range up to 50 or 75 miles. This operator is carrying a 5-watt rig that keeps him in touch with mobile or home stations no matter where he hikes.

OSCAR 7	
Saturday, April 7	
East (VA, PA, OH, MI)	0017 GMT (7:17 PM EST)
West (TX, CO, MT, UT)	0210 GMT (8:10 PM CST)
Sunday, April 8	
Midwest (FL, MS, IA, WI)	0109 GMT (8:09 PM EST)
West Coast (CA, OR, WA, AK)	0305 GMT (7:05 PM PST)
OSCAR 8	
Tuesday, April 10	
New England	0045 GMT (7:45 PM EST)
Midwest (FL, MS, IA, WI)	0225 GMT (9:25 PM EST)
West Coast (CA, OR, WA, AK)	0410 GMT (8:10 PM PST)
Friday, April 20	
East (VA, PA, OH, MI)	0135 GMT (8:35 PM EST)
West (TX, CO, WY, MT)	0315 GMT (9:15 PM CST)

Fig. 1. Some representative orbits of the Amateur Radio satellites OSCARs 7 and 8 during the month of April, 1979. The path will be over the states listed, and will be heard first in the states at the southernmost end of the path. The satellites will be travelling from south to north, and will take 10 to 15 minutes to traverse from the first state listed to the last (with the exception of Alaska — it'll take several additional minutes to get that far north). Amateurs transmitting through the satellites can be heard on the 10-meter band, between 29.4 and 29.5 MHz on the days listed. On other days, the output of the spacecraft will be near 146 or 435 MHz. For more information on Amateur satellites, write to AMSAT, Radio Amateur Satellite Corporation, P.O. Box 27, Washington, DC 20044.

There's A Satellite In Your Future

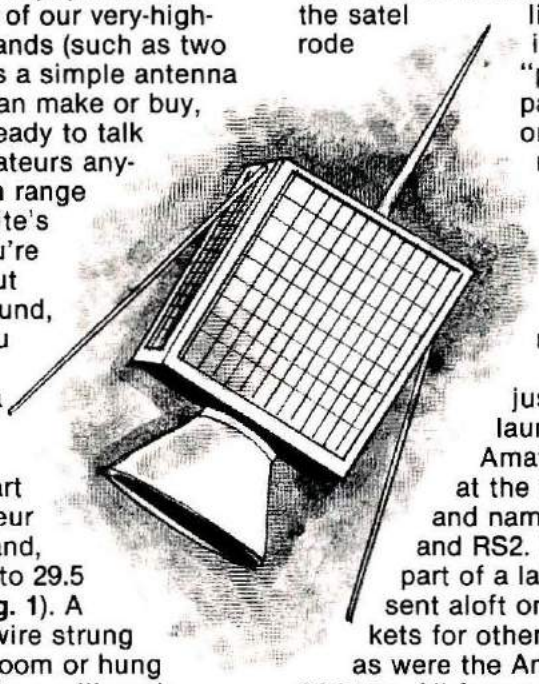
How would you like to join the Space Age? It's easier than you think. Radio Amateurs can talk through no less than four satellites that have been placed in orbit for their own use. Two of them were sent aloft by the Americans, and two more by the Russians.

These satellites orbit the earth several times a day, with an average interval of about 100 minutes between them. As the earth turns below the orbital paths, each of the satellites will come within range of your Amateur station two or three times each day, so there's

plenty of chance to try your hand at talking through them. You can do it with a comparatively modest station, too. Some low-powered equipment for one or more of our very-high-frequency bands (such as two meters), plus a simple antenna which you can make or buy, and you're ready to talk to other Amateurs anywhere within range of the satellite's signal. If you're curious about how they sound, how well you can receive them, tune a short-wave receiver to the upper part of the Amateur ten-meter band, around 29.4 to 29.5 MHz (see **Fig. 1**). A few feet of wire strung around the room or hung out the window, will work as an antenna when the satellite is nearly overhead on its way by. The ten-meter band serves as one of the "downlink" frequencies for the satellites — Amateur stations can talk "up" to the "birds" on either 145 MHz (two meters) or 435 MHz (the 70-centimeter band, in the "ultra-high-frequency" world).

To reach the satellites when they are not directly overhead, Amateurs have built antennas which will pick up signals from hundreds of miles away — and will transmit back to the spacecraft at the same distances, of course. These antennas are less complicated than most of the ones people use for TV reception, and they can be rotated and tilted to follow the path of the satellites as they go by.

The satellites launched by the United States are called OSCAR, for Orbiting Satellite Carrying Amateur Radio. The 7th and 8th ones put up are still there, doing their thing after many months in space, and show every possibility of continuing for years to come. Amateurs in Canada, Germany, Japan, Australia, and the United States combined their efforts to build and test the satellites, and they rode into orbit as "piggy-back" packages on one of NASA's rockets.



Another OSCAR is being built, and more are in the planning stage.

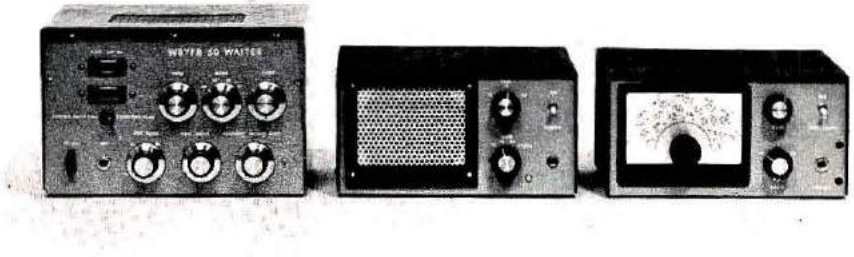
Russia has just recently launched two Amateur satellites at the same time, and named them RS1 and RS2. Both were part of a larger payload sent aloft on huge rockets for other purposes, as were the American OSCARs. All four satellites have rechargeable batteries and solar cells to keep them in top shape to operate the transmitters and receivers which relay the Amateur signals all over the world. Each satellite has an elaborate control system to turn various circuits and functions on and off, and each sends coded signals about the bird's health back to earth — signals that tell us how hot or cold it is inside the satellite, what the batteries are doing, how much current the equipment is using, and so on.

These signals are called telemetry, and have been used by many schools to demonstrate space-age physics in the classroom. By proper interpretation of the signals you can tell exactly where the satellite is, how fast it is moving, when it will appear again, how much sunlight it has received, and, by very precise measurement of distance and speed, you can even predict when its orbit will decay and allow it to enter the atmosphere and burn up (it'll be a long time coming, though, so don't wait up nights for it to happen).

So, there are plenty of scientific experiments you can do with the OSCAR and RS satellites, but the most important one is much more personal — you can talk to your fellow man and get to know him.

The Experimenter

So far, I've told you about using Amateur Radio to communicate with other Amateurs, for fun or in emergencies. There's another side to this great hobby that you shouldn't overlook — the experimenting. It's a natural for anyone who wants to try his hand at designing circuits, developing a piece of equipment, or just plain investigating "how does that work?" Did you ever get really interested in a lab experiment in school, and, just



Amateur Radio equipment does not have to be fancy, nor does it need to cost a lot. In addition to buying used equipment, and building kits, you can make your own transmitters and receivers, as shown here. The unit at the left is a 50-watt transmitter, described in a three-part series that started in July, 1978; the two smaller units are a receiver and the power supply/converter for it, from the February, March, and April, 1979, issues of *Ham Radio Horizons*.

as you thought you had a grip on things, your instructor said, "Okay, that's it for today. Clean it up and store it." Well, thousands of Amateurs have their own labs at home. Some build equipment from kits or from "scratch," and others try out ideas they've read about or dreamed up on their own. The only time limit is your endurance (or the patience of your family), and the possibilities are limited only by your imagination.

Can something useful come of such home-style experiments? You bet! Many of today's electronic circuits were first proved by Amateur experimenters, trying a pet circuit in the quiet of their hamshack or basement workshop. Other circuits have been improved upon by the ham who felt that "there must be a better way," or, "gosh, that thing costs a fortune — I wonder if I could get the same performance at a lower price." Additionally, there's no way of knowing just how many solutions to problems at his work were triggered by an experience or a bit of knowledge picked up from a ham's tinkering and operating pastime.

Talking pictures

Amateur communications is not limited to Morse code, or to talking, for that matter. Hams can send pictures to each other. Many of our bands permit sending photographs on a worldwide basis using what we call "slow-scan television." This is a system, developed several years ago by an Amateur, in which a complete picture is sent over the airwaves every eight seconds. There are networks of hams from many countries who meet on a regular basis every week to exchange favorite photographs, a "live" shot of themselves at their desk, or a live or still shot of their family or friends. They exchange information about other stations that may be joining them soon, or about new equipment or techniques to improve the quality of their signals.

On a more local basis, Amateurs can send regular "fast-scan" pictures, just the same as you receive on your TV broadcast set. Some of them have quite elaborate equipment and "studio" setups, and use modified commercial TV receivers to pick up signals from Amateur TV enthusiasts. They have recently developed a "repeater" method of relaying their pictures to gain coverage of large areas, such as New York City or Washington, D.C. and suburbs. This works in the same way as the repeater for the portable and mobile units used for voice communications — each Amateur directs his TV signal toward a tall building or tower where a receiver picks it up, amplifies the picture information, and retransmits it at a power level that will reach dozens of miles.

Interested?

I feel that I've only skimmed the surface of what you can do as a Radio Amateur, but I hope you get enough of the idea to become interested in joining us. It's not hard, really, and the rewards are great. There are all sorts of study aids available to help you along. Cassette tapes for your Morse code practice, study guides and handbooks for the Rules and Regulations, basic theory, operating procedures, and even books to help you build your own equipment if that's what turns you on.

A large section of our Bookstore here at Ham Radio is devoted to helping you get started in Amateur Radio, so if you would like to know more, just drop me a line — Tom McMullen, c/o *Ham Radio Horizons*, Greenville, New Hampshire 03048, and tell me you want to become a ham. I'll send an information package out to you right away. The package will tell you what to start with, what forms you'll need, and will include a catalog of dozens of interesting books that deal with the "hobby with a future" — Amateur Radio.

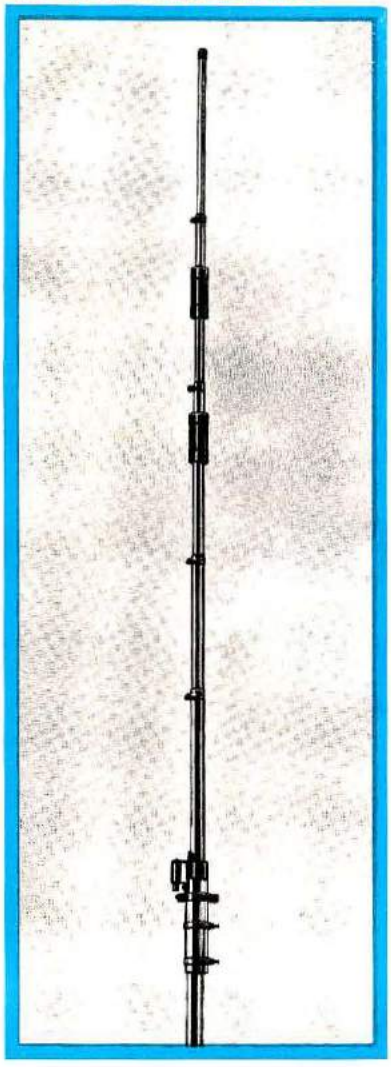
HRH

You can meet people in all parts of the world by Amateur Radio, and you can swap photographs with them as well. This is called slow-scan television (SSTV), in which you transmit or receive a complete picture once every eight seconds. The station shown here belongs to Bill DeWitt, W2DD, a well-known SSTV Amateur and author of many articles on the subject, one of which appeared in the November, 1977, issue of *Ham Radio Horizons*.

HF VERTICALS

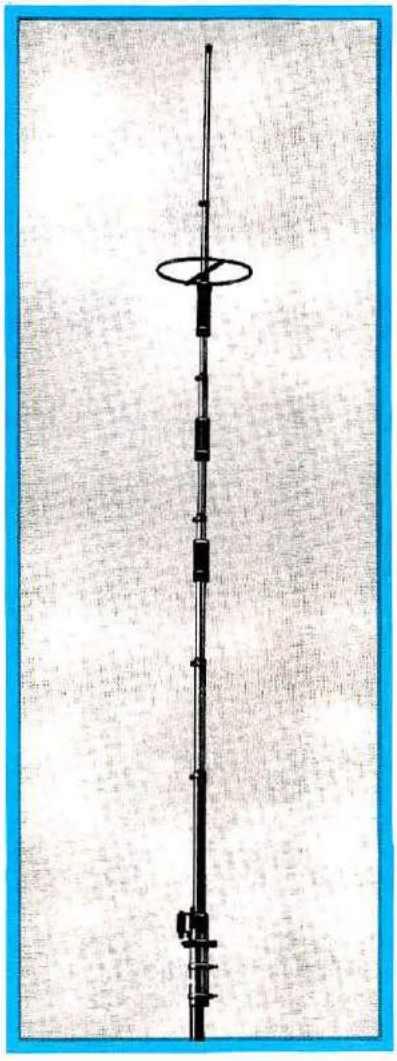
Cushcraft's new multiband vertical antenna systems have been optimized for wide operating bandwidth and provide the low angle of radiation which is essential for long-haul DX communications on the high-frequency amateur bands. The high Q traps which were designed especially for these verticals use large diameter enamelled copper wire and solid-aluminum air-dielectric capacitors; the trap forms are manufactured from filament-wound fiberglass for minimum dielectric loss and high structural strength. High strength 6063-T832 aluminum tubing with 0.058" (1.5 mm) walls is used for the vertical radiator. The massive 2 inch (50 mm) OD double-walled base section and heavy-duty phenolic base insulator ensure long life and durability. For maximum performance with limited space, choose a Cushcraft multiband vertical; all models may be roof or ground mounted on a 1¼" - 1⅞" (32 - 48 mm) mast. A good ground system is recommended for maximum performance.

10-15-20 METERS



ATV-3 Cushcraft's ATV-3 multiband vertical provides low VSWR operation for both SSB and CW on 10, 15, and 20 meters. Matched to 50 ohms; built-in connector mates with standard PL-259. Stainless-steel hardware is used for all electrical connections. The ATV-3 is a compact 166 inches (4.2 meters) tall. Rated at 2000 watts PEP.

10-15-20-40 METERS

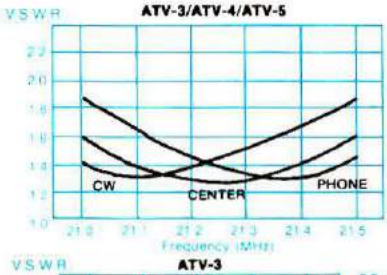


ATV-4 The Cushcraft ATV-4 four-band vertical antenna has been optimized for wide operating bandwidth on 10, 15, 20, and 40 meters. SWR is less than 2:1 over the CW and SSB segments of 10, 15, and 20. The 2:1 SWR bandwidth on 40 meters is approximately 240 kHz; may be quickly and easily adjusted to favor any part of the band. Coaxial fitting takes 50-ohm transmission line with PL-259 connector. Overall height, 233 inches (5.9 meters). Rated at 2000 watts PEP.

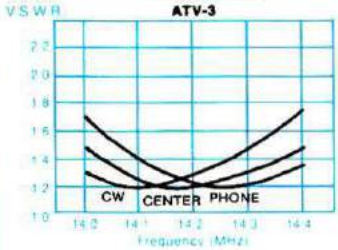
10-15-20-40-80 METERS

ATV-5 The ATV-5 trapped vertical antenna system has been engineered for five-band operation on 80 through 10 meters. The high Q traps are carefully optimized for wide operating bandwidth: 2:1 SWR bandwidth with 50-ohm feedline is approximately 1 MHz on 10 meters; more than 500 Khz on 15 and 20 meters; 160 khz on 40 meters; and 75 Khz on 80 Meters. Instructions are provided for adjusting resonance to your preferred part of the band, CW or SSB. Built-in coaxial connector takes PL-259. Nominal height, 293 inches (7.4 meters) Rated at 2000 watts PEP on **all** bands.

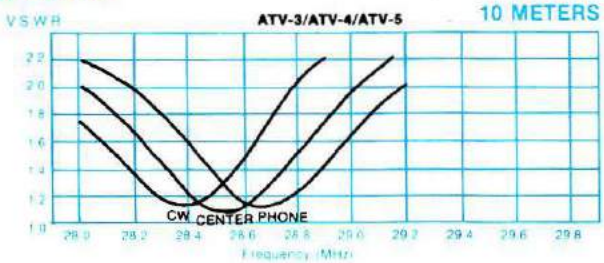
TYPICAL V.S.W.R.



15 METERS



20 METERS



10 METERS

cushcraft CORPORATION

Understanding and Using Propagation Information

BY THOMAS R. SUNDSTROM, W2XQ

"What's the band like?" "Are you hearing any DX? The bands are dead." "Can you hear anything?" "Did my antenna fall down?" Do these questions sound familiar? On the high frequencies you'll probably hear them echoed by DX hunters prowling the ssb or CW bands.

Have you wondered how you can tell what the band conditions are without tuning through the phone and CW segments looking for stateside or DX stations that might give a clue as to what's going on? There's an easier way to determine the state of propagation on the high frequency bands.

Propagation

High frequency communications that cover any distance depend upon skywave signals reflecting off the ionosphere. The state of activity in the several ion layers — the D, E, F_1 and F_2 layers — determines whether a signal on any given frequency will be reflected to earth.

Propagation forecasts are available in a variety of forms. Long- and short-range forecasts, some detailed and some general, predict the maximum usable frequency (MUF), above which signals will not reflect, and the approximate time of day during which certain areas of the world will be open for signal paths.

This article recaps some of the various sources of information and explains how to use that information.

Magazines

Propagation forecasts in the various magazines are usually written from 45 to 60 days in advance of the publication date. The forecasts are based on extrapolations of current data on sunspots and other measures of solar activity.

Forecasts can't account for short-run variations of solar activity. Longer-range solar disruptions can loosely be forecast by extrapolating the rule-of-thumb 27-day rotation of the sun. The propagation columns include *Horizons'* "DX Forecaster," *QST's* "How's DX?" charts, and *CQ's* "Propagation."

Other sources

A biweekly newsletter is available on a subscription basis; it offers detailed propagation forecasts. For further information, write Mail-A-Prop, Box 1714, Silver Spring, Maryland 20902.

Mail-A-Prop also supplies tapes for the recorded telephone Dial-A-Prop: 516-883-6223. Although not a toll-free call, the message is available twenty-four hours a day seven days a week. The message tape is usually changed each Tuesday morning before noon Eastern time.

The Ham Radio Publishing Group publishes the weekly newsletter *HR Report*; propagation information

appears on page 4 of each issue. In addition to the useful propagation information, this newsletter covers current news of amateur activities and regulations, new equipment coming on the market, personalities in the news, and DXpedition activities. Once a month an updated calendar of activities is included. See the ad in this issue for additional information.

The American Radio Relay League, through its station W1AW, runs a weekly propagation bulletin in its daily airing of news bulletins and OSCAR schedules. Check a recent copy of *QST* for a current schedule of the phone, CW, or RTTY bulletins.

WWV geophysical alerts

The problem with even a weekly forecast is that it can't account for daily or hourly variations in solar activity. The closest thing we have available to us is a daily report, with a portion of the message updated every six hours.

WWV, the National Bureau of Standards time and frequency station, broadcasts from a location near Boulder, Colorado, on frequencies of 2.5, 5, 10, 15, and 20 MHz. Among its many services are the geophysical alert messages aired at 18 minutes past the hour, 24 hours a day, 7 days a week.

Unlike the information sources described earlier, which are tailored to the radio amateur, the geophysical alert message is designed for the scientific community at large.

Let's look at a typical message, broadcast at 2018 GMT on July 22, 1978:

> "Solar terrestrial indices for 21 July follow: solar flux 136 and A index 5 . . . repeat . . . solar flux 136 and A index 5. The Boulder K index at 1800 UT on 22 July was 2. Solar terrestrial conditions for the last 24 hours follow: solar activity was moderate to low; the geomagnetic field was quiet. A solar flare occurred at 1857 UT 21 July. Forecast for the next 24 hours follows: solar activity will be low; geomagnetic field will be unsettled to active."

The message is changed each day at 0000 GMT (or, Universal Time). The first part of the message gives the solar flux from Ottawa at 2695 MHz, the A index value at Fredericksburg, Virginia, and the K index value at Boulder. The K index is updated every six hours, at 0000, 0600, 1200, and 1800 GMT. The second part of the message recaps the previous day's solar and geomagnetic activity, and a forecast for the current (GMT) day.

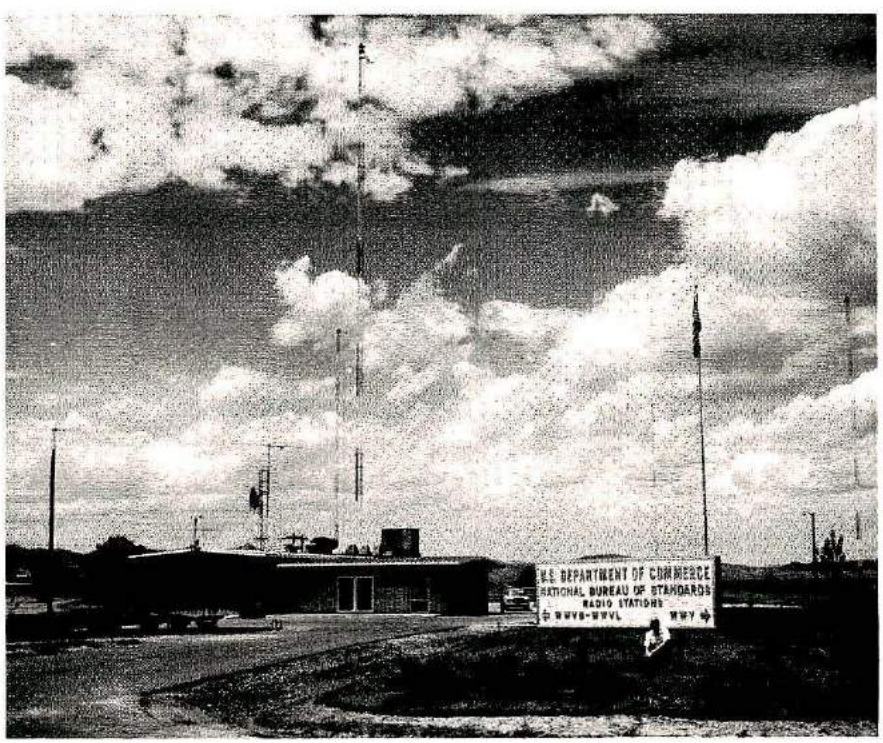
Solar flux: The solar flux is a measure of the intensity of solar electromagnetic radiation; a number of different frequencies are monitored by the Algonquin Radio Observatory in Ottawa, but 2695 MHz is normally taken as a standard. The solar flux has a range from about 60 to 400 units; there is a positive correlation to the sunspot number. The solar flux is normally a better indicator in the process of predicting MUFs than is the sunspot number.

A index: The A index is a measure of geomagnetic activity, ranging from 0 to 400 units. Zero units is extremely quiet and 400 units is very disturbed.

K index: The K index is a quasi-logarithmic index of geomagnetic activity ranging from 0 to 9 units. The K indices of the day are averaged to determine the A index for the 24-hour period. The reason why the average K index doesn't equal the A index later aired by WWV is that the former is measured at Boulder, and the latter is taken at Fredericksburg; there is a variation in radiation levels at different places on the earth.

Table 1 illustrates the relationship between the A and K indices. By comparing yesterday's A index with the current K index, you can see whether the geomagnetic activity is increasing, holding steady, or decreasing. You can also compare activity levels within the same day by noting successive six-hour K indices. The greater the difference of values (either up or down) in a

WWV transmits from a site near Boulder, Colorado, on 2.5, 5, 10, and 15 MHz. WWV is the only outlet that transmits the geophysical alert information at 18 minutes past each hour. WWV announces each minute in Universal Time, equivalent to GMT.



MONTH/YEAR_____ 19__

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SOLAR FLUX																	
A-INDEX																	
K-INDEX	0000 Z																
	0600 Z																
	1200 Z																
	1800 Z																
FLARE START (Z)																	

		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
SOLAR FLUX																
A-INDEX																
K-INDEX	0000 Z															
	0600 Z															
	1200 Z															
	1800 Z															
FLARE START (Z)																

A	K
0	0
3	1
7	2
15	3
27	4
48	5
80	6
140	7
240	8
400	9

Fig. 1. You can use this chart to record WWV radio propagation data on a daily basis. Use the information in the article to plan your DX activities.

short time interval, the more rapidly band conditions will change.

Usually the start of a radio communications disruption is relatively quick in changing conditions from good to bad, whereas the end of a disturbance — the recovery phase — is drawn out over a longer period of time.

Solar activity can be classified as very low; low; moderate; high; and very high. These terms relate to the state of the regions on the solar disk capable of producing disruptive flares. There is a positive correlation between the solar flux and solar activity. The terminology describing geomagnetic activity in terms of K and A indices is listed in **Table 1**.

Table 1. Relationship of the A and K indices transmitted by the National Bureau of Standards station WWV.

K	A	classification (geomagnetic activity)
0	0	quiet
1	3	quiet
2	7	quiet
3	15	unsettled
4	27	unsettled-to-minor storm level
5	48	minor storm level
6	80	major storm level
7	140	major storm level
8	240	major storm level
9	400	major storm level

The auroral zone

There are ever-present auroral zones over the north and south poles. When geomagnetic activity increases, so does the size of the auroral zones; when it decreases, the size of the auroral zones decreases, but at a slower rate.

If a skywave signal passes through the auroral zone, the signal is usually affected; a characteristic polar flutter is induced upon the signal. Amateurs on the East Coast will note the flutter on JA signals on 15 and 20 meters during East Coast evening hours; West Coast amateurs will notice the same rapid flutter on signals from Europe.

Given enough geomagnetic activity, the signal transversing the zone will not be reflected but will be absorbed. On the East Coast, the high-latitude great-circle path to Japan will be the first affected, then high-latitude paths into northern Europe will disappear. As the intensity of the geomagnetic storm increases, the reflection points of lower-latitude paths will be encompassed by the enlarged auroral zone.

If the geomagnetic storm is severe enough, there can be a total loss of skywave signals from the east, north, and west of the listener's location. Reflection points of skywave signals coming from the south may still be outside the enlarged auroral zone; the signals will seem to be stronger than usual, but this is because of the lack of other interference rather than enhanced propagation.

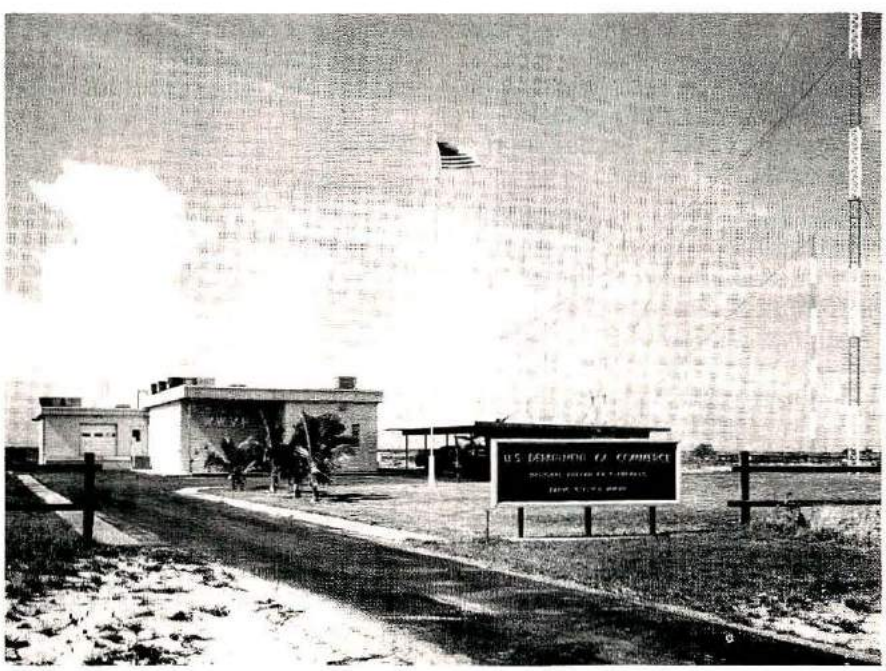
Using the information

The next step in using the WWV geophysical alert information is to develop a frame of reference for your location and equipment, including antennas. For example, the better your antennas, the longer you can get results despite worsening or marginal propagation conditions. No matter how much power *you* run, if you can't hear 'em, you can't work 'em.

An example: Given my location, antenna, and suburban environment, I find a solar flux of 150 is more or less the breaking point for determining if 20 or 15 meters will stay open all night during the summer. A flux of 140 during the quiet winter months means realistic 40-meter CW DX possibilities into JA and VK land at sunrise here (assuming the A index is low).

Similarly, I find that an A count (or its equivalent K index) around 30 takes out all but the Central- and South-American signals. With a flux of 150 and K of 4, I'd expect to find strong signals from the south on 15

WWVH, Kauai, Hawaii, also transmits on 2.5, 5, 10, and 15 MHz. No propagation information is transmitted over WWVH, but the female announcer can often be heard on the East Coast as she announces each minute, just ahead of the WWV announcement.



and 20 meters.

Characteristically, A counts of 10 to 20 usually mean northern Europeans (F-G-DL-SM-LA) are reduced in strength (JA has long since disappeared when the A index hits 5), and signals coming in on lower-latitude great-circle paths (such as EA-I-YU-UB5) from southern Europe and Russia dominate the high frequency bands during the evening hours.

In analyzing the forecast for July 22 illustrated above, I'd judge that 10 and 15 meters would be closed, and 20 may or may not propagate at night. The previous day's flux was 144, dropping eight points, and the forecasted activity went from moderate to low, dropping the MUF. Although the present absorption levels, with the low MUF, will wipe out paths over the northern Pacific for me, other areas of the world should be reasonable until the effects of the solar flare hit, by late in the GMT day of July 22. I'll probably wind up on 40 CW before the night is over, assuming the atmospheric noise from summer thunderstorms is not too severe.

By the way, it's possible to move too *low* in frequency. With a high flux count or geomagnetic activity, signal absorption of lower frequencies can occur, establishing a lower usable frequency (LUF). Sometimes the term window is used; it can be defined as the range of frequencies between the MUF and the LUF.

Operating aid: I've provided the chart in **Fig. 1** for those who are interested in recording the information broadcast by the National Bureau of Standards stations. It is designed for a one-month period. If you enter the data transmitted by WWV or WWVH in the appropriate squares, you'll find the chart quite useful in planning your DX activities, based on the information in this article.

What you'll find at your location, as I said earlier, will depend on your equipment and antennas. For example, during unsettled to minor storm level conditions I've heard good signals coming in from Cuba and Puerto Rico. These amateurs are still working European and Japanese amateurs, because CO and KP4 are farther south; the reflection points along their great-circle paths are at a lower latitude, outside the enlarging auroral zone. Those paths won't be affected until the geomagnetic storm intensifies.

In conclusion

Just remember that you don't have to be an engineer or an astrophysicist to use the propagation sources detailed above. All but the WWV geophysical alerts are in plain English for the radio amateur, and once you have constructed a set of references you'll be on your way to having one step up on those choosing operating frequencies on a hit or miss basis.

What makes this hobby fun is that there can be exceptions to the rules. Sometimes DX stations will suddenly show up and have very good signals in a short-run aberration in what otherwise seems to be absolutely impossible conditions. An occasional CQ in a seemingly dead band may produce a surprise. Beware of the normal, watch for the exceptions, and have fun.

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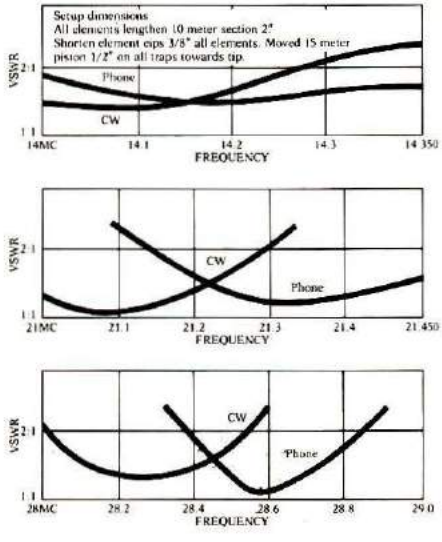

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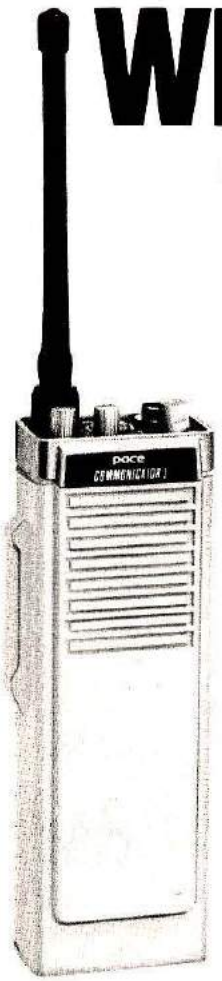

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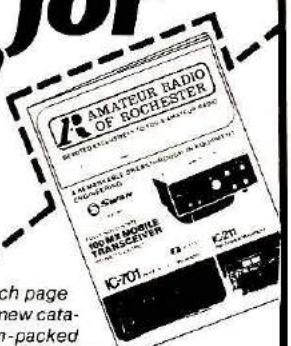

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BY WILLIAM I. ORR, W6SAI

The Doerle Shortwave Receiver

It's December, 1931. New York City is snowbound after weeks of bad weather and is in the midst of a paralyzing financial depression. Over 30 per cent of the work force is unemployed. The stock market has plunged to new depths of gloom. The radio industry is at a standstill. The broadcast-set construction boom had collapsed, and the ac-operated receiver had not yet reached the market in quantity.

In the lower New York City area, the many small radio distributors were in trouble. Some of them closed their doors forever, and the ones that had managed to stay open had few customers. Something was needed to break out of the dismal cycle of bad weather, unemployment, and economic stagnation. For the nation as a whole the bad weather would soon dissipate, but the economic picture looked black — all except for a handful of small, grimy, radio stores in the Vessey-Cortland-Dey-street area that had unexpectedly stumbled onto a gold mine that proved to be their salvation for a few years.

Shortwave radio! It caught the public's fancy some time in 1931. Young men, unemployed, with plenty of time on their hands, started the craze. For only a few dollars you could buy a small shortwave receiver that would literally "pull in the world." And the interest was aroused by an obscure radio fan in Oakland, California, who popularized a two-tube regenerative receiver.

Little is known today about Walter C. Doerle of Oakland. He's not listed in the telephone book, and he faded from fame about 1934. In any event, he designed and built a simple two-tube shortwave receiver and wrote about it for publication in the December, 1931, issue of *Short Wave Craft* magazine. The little set was inexpensive to built and sure-fire in operation. This was the right radio at the right time!

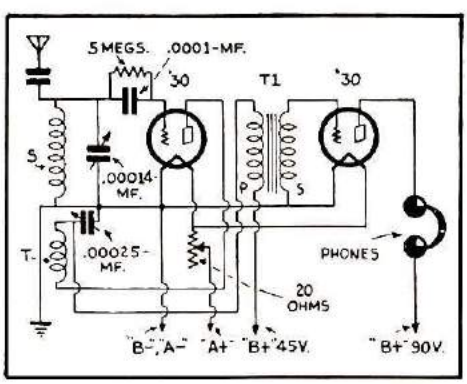

Fig. 1. Circuit used by Mr. Doerle for the 2-tube "globe circler."

No doubt Doerle was surprised at the explosive interest in his little radio! Requests for more information poured into the magazine, along with glowing reports of how the inexpensive, easy-to-build radio pulled in stations all over the globe. The Doerle receiver became famous overnight.

The Doerle receiver

After the original article on the receiver, Walter Doerle gradually faded from the scene. He wrote one or two other radio articles, but his fame was quickly taken over by a group of small radio stores on New York City's "radio row," who knew a good thing when they saw it. It's not known if Doerle made any financial profit from his radio, but his name became a household word for any simple shortwave set. "Doerle clubs" sprang up around the country and "Doerle circuits" were sold as kits and as complete radios.

Amazingly, most radio hams had never heard of the Doerle receiver. It seemed to be advertised only in radio magazines catering to the

shortwave listener (SWL) and the home constructor. But as shortwave listening became a popular pastime (much as CB radio is today), the Doerle designs were duplicated by the uncounted thousands.

The Doerle receiver was simplicity in itself (**Fig. 1**). It was a simple, two-tube regenerative receiver. One tube served as a regenerative detector and one tube as an audio amplifier. An "A" battery for the filament supply, and 90 volts of "B" battery, were required to run the receiver. **Figs. 2** and **3** show modified versions of the receiver.

Originally designed for the low-drain type 30 tubes, the receiver worked equally well with the cheap, plentiful type 201A tubes and a second-hand 6-Volt automobile battery for the filament supply. And later, the Doerle circuit would be redesigned for the new type 227 ac-operated triode tubes.

Doerle type regenerative receiver built from a 1938 kit. This battery-operated receiver uses a 1F4G as a detector, a 1H5G audio amplifier, and a 1C5G second audio stage. The 1F4G detector is in the center with a metal shield over the tube. Shortwave spectrum from 10 to 200 meters is covered with four plug-in coils. When wired up, the receiver worked right off the bat!

Building the Doerle receiver

Most builders ignored the Doerle kits, even though they sold for less than five dollars for the economy-model receiver. Two tubes could be obtained for less than 25 cents at a rummage sale or radio junk shop. The audio transformer? Free, or perhaps 15 cents from the same source. Tube sockets were easy to obtain and cheap, even if bought new. Coils? Wind them on bases from burned-out tubes. And the tuning condensers* could be bought new for less than a dollar, or could be cut down from larger condensers salvaged from an old battery receiver.

*Yep, they were known as condensers in those days. Today we call 'em capacitors. ***Editor.***

According to the pictorial drawing, the Doerle was built on a wooden base: plywood or "breadboard," measuring about 203 by 305 mm (8 by 12 inches). That gave plenty of room for parts. The parts were arranged so that the panel was reason-

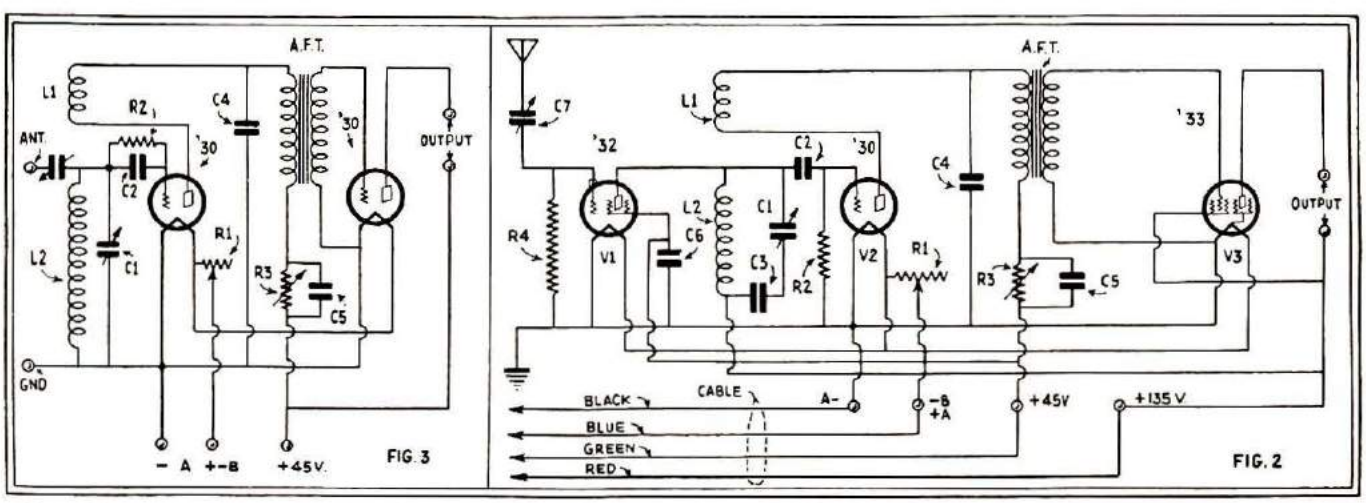

Fig. 2. The same two-tube receiver shows up in the schematic diagram at left, but with a few parts changes — note the variable coupling capacitor from the antenna terminal. Inevitably, the circuit was adapted for mobile use, shown at right with an rf amplifier ahead of the detector.

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Uses two of the new type 56 tubes or two 27's. Power is obtained from the Model ED pack listed below or from any good eliminator delivering 90-200 volts and 2½ volts. Or it may be run on a 2½ volt filament transformer and two 45 volt Batteries.

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Harrison Radio Company sold a Doerle receiver kit for less than five dollars. To save cost, regeneration was controlled by varying the detector plate voltage by potentiometer R3. The feedback capacitor, C4, was fixed.

ably symmetrical. The antenna coupling capacitor (oops! condenser) was cut from two small sheets of brass, or from a tin can if brass wasn't available.

Rarely mentioned was the phenomenon of hand capacitance. Touching the tuning or regeneration-control dial severely changed the reception frequency unless a grounded, metal panel was used. Since aluminum panels were expensive, most builders lined the back of the panel with aluminum cigarette-package paper and connected it to the ground circuit of the receiver.

The "smoke test"

Finally, the great moment is at hand! The receiver is complete and coils wound. You apply filament voltage carefully and examine the type 30 tubes in a darkened room to make sure the filaments are lighted. A recheck of the wiring is usually necessary at this point, as inadvertent application of the B voltage to the filament circuit guarantees instant burnout of the two tubes, each of which draws only 60 mA of filament current.

Reassured that all is proper, you then apply plate voltage and gradually advance the regeneration control. If you're lucky (and most builders were) you'll instantly hear a signal or two as you adjust the main tuning dial.

The long-distance reception pours in!

Tuning the Doerle receiver was an art. The tuning and regeneration control had to be adjusted simultaneously as the receiver was tuned across the band. Too little regeneration meant no signal; too much meant a howl in the headphones. The adjustment of the antenna capacitor was attempted, too — the plates being bent back and forth in relation to each other. More daring experimenters tried various values of "grid leak" (grid resistor). From 2 to 5 megohms seemed about right.

Once the tuning technique was established, the world was at the fingertips of the listener. Old standbys such as Rugby, England; VK2ME and VK3ME in Australia; and HVJ in the Vatican poured in along with lesser lights such as PCJ in Holland and VE9GW in Canada. The most sought-after station was a home-built 7-1/2 watt broadcaster in Costa Rica, on the air with a call "borrowed" from the U.S. Navy. The listener who heard NRH in Heredia, Costa Rica, was lucky indeed.

When SWLing was a fine art

Unlike today, radio amateurs in the prewar era received SWL cards from all over the world. Since ssb was unknown in those dear dead days, amateurs used simple amplitude modulation (a-m) which could be easily received on a simple Doerle receiver (just reduce the regeneration control). Collecting SWL reports was a hobby that was probably greater than amateur radio (there were about 30000 amateurs at that time). Ed Chorlain, operator of SU1CH in Cairo, Egypt, once complained that his 150-watt phone brought in more than 3000 SWL reports in a six-week period in early 1935! And the Indian post office finally refused to deliver the thousands of SWL letters and cards sent to VU7FY in Mysore State. United States amateurs were swamped with SWL reports, too. Most took the burden gracefully, especially if return postage was included. I remember the walls of my room when, as a high-school student, I roamed the shortwave bands as an eager SWL. When I got my ham ticket, I stripped the walls of

Doerle Radio Clubs sprang up all over the country in the 1930s. Homebuilt shortwave radio receivers were the rage, especially among the high-school set. This 1935 photograph shows the radio club of the Waupun High School of Wapun, Wisconsin. (*Photo reproduced from Short Wave Craft magazine*).

SWL cards, hoping to fill them with *real* QSLs from the contacts I hoped to make.

The Doerle becomes an industry

After the original excitement, the Doerle circuit gave way to more exotic receivers. Three-, four-, five- and six-tube Doerle receivers appeared on the market, some rigged up in good-looking, crackle-finished metal cabinets. Most, however, were merely the original circuit adapted to ac, with audio stages added to work a loud speaker. But they remained the first receiver of thousands of shortwave enthusiasts, many of whom became radio amateurs after their initial, thrilling exposure to shortwave radio through the sure-fire Doerle circuit.

By 1938 the Doerle fad had expired. The two-tube regenerative receiver, while still built by some beginners, was eclipsed by low-cost shortwave superheterodyne receivers. Modeled after the inexpensive broadcast receivers, the little superhets quickly took over the shortwave beginner's market. The depression was fading, more money was changing hands, and the radio enthusiast could afford a more expensive receiver. Soon the Doerle circuit was forgotten. But it had done its part to sustain the New York radio industry when the days were black and the future insecure.

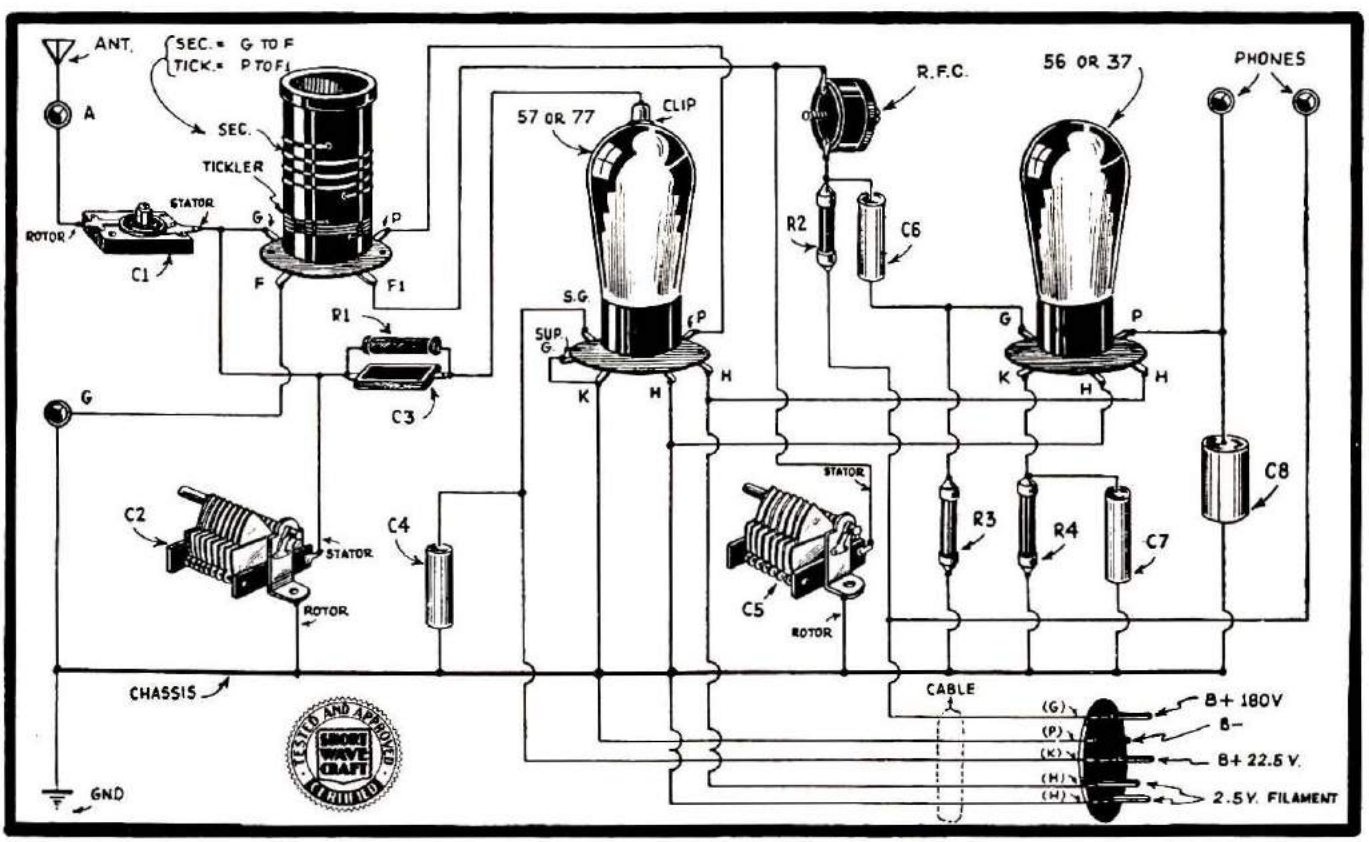

Fig. 3. The schematic diagram is typical of those seen in the early 1930s, and experimenters were helped by the clear picturized diagram" like the one above. Tube sockets were used for the plug-in coil forms, and carried their original filament, grid, and plate designations as a means of identifying where the wires were to be connected. Note the seal of approval of *Short Wave Craft* magazine, a means of inspiring builder confidence.

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Build a Doerle receiver today?

Why not? The Doerle is a fun radio and can be built for little or nothing if you have a good junk box, or are a good scrounger at a flea market. Choose one of the many circuits shown in this article. I suggest you make it on a piece of plywood and use a grounded aluminum panel to reduce the effects of hand capacitance. Probably the ac circuit is best today, as dc tubes are microphonic, hard to find, and require a hum-free filament supply. The ac circuit can use any of the following tube types: 227, 56, 76, 6C5, 6J5, or 6C4. Surely you have two of these in your junk box!

The audio transformer can be a replacement "three-to-one" type, and the rf choke can be a 2.5 millihenry pi-wound affair. If you feel like a pioneer, you can wind the coils on 4-prong tube bases or other insulating material, about 32 mm (1-1/4 inches) in diameter. The lucky scrounger might come up with a set of commercially wound coils made for these little receivers! As for the rf choke, the original Doerle used a home made one. It consisted of 300 turns of 0.13-mm (no. 36) double silk covered wire, close wound on a 13-mm (1/2-inch) diameter wood dowel rod. Operation of the choke can be checked by pressing the earphone cord in your hand when the set is operating. If no change occurs in the received signal, the choke is doing its duty.

Listening in today

Today's radio spectrum is far different from what it was in the early thirties. Hearing a signal was a significant feat then; today the powerful signals and heavy congestion of the short-wave channels make reception a problem of receiver overload. The little Doerle (in common with all regenerative receivers) is highly susceptible to signal overload. The pigmy antenna-coupling capacitor helps, but you should use a short antenna with this set — 5-6 meters (15-20 feet) of wire is sufficient. A longer antenna will lead to severe receiver blocking and overload. To prevent instability, moreover, the antenna should be firmly supported so it won't swing about in the wind. A moving antenna will affect the tuning of the receiver. An indoor antenna is suggested.

Why not have the fun of building a Doerle receiver? I can't think of any circuit that will provide more simple pleasure in construction and use than the Doerle circuit. You'll be surprised at how the signals pour in on the little set. The signals will not be loud, as the circuit lacks audio power. But the signals will be there, and the sensitivity of a regenerative set is equal to that of the more expensive receivers of 1978! With patience and experience, the Doerle receiver will

By 1933 "electrified" Doerle receivers were the big sellers. You could get one completely wired and tested for less than 15 dollars. Of course, tubes were extra, for $2.68 a set.

Fig. 4. The only published photograph of Mr. Doerle was in *Short Wave Craft* magazine for November, 1932. He is shown demonstrating his new DX receiver which was capable of driving a loudspeaker. Doerle's article describing the receiver was entitled "A 3-Tube Signal Gripper."

perform wonders for you and you'll gain appreciation of some of the heritage that's behind today's hobby of amateur radio.

Further reading

The formative years of radio (or electronics as we know it today) make interesting reading for newcomers and old timers alike. The bibliography that follows lists some articles published by *ham radio* and *Ham Radio Horizons* that describe how it used to be. Your local library probably has copies of some of the early radio magazines. During those years you could find these radio magazines on the news stands sandwiched between *Collier's, Liberty*, and *The Women's Home Companion*.

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Orr, William I., W6SAI, "The Golden Years of Radio," *Ham Radio Horizons*, May, 1978, pages 40-43.

Orr, William I., W6SAI, "The Golden Years of Radio — The Way it Was — 40 Years Ago," *Ham Radio Horizons*, March, 1977, pages 32-36.

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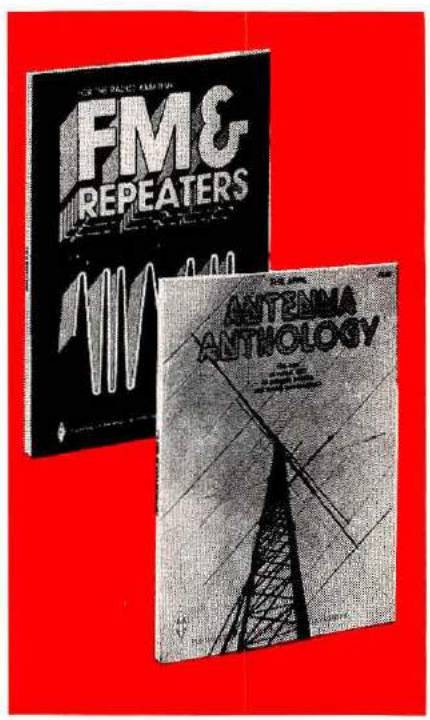

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Ham Radio's new Log Book has room for 2100 QSO's — that's over twice as many entries as other popular log books. There's sharp ruling too for all FCC-required information, plus extra space for the name and address of each station you contact all on a convenient horizontal format. For contesters, there is a consistent 30 entries per page for easy counts. In addition you'll find a handy frequency spectrum chart showing the exact band segment from novice to extra, plus a listing of all worldwide Amateur prefixes currently in use. And, it's all spiralbound to lay flat on your operating table. This is unquestionably the best log book value anywhere! 8-1/2 × 11. 80 pages. ©1978.

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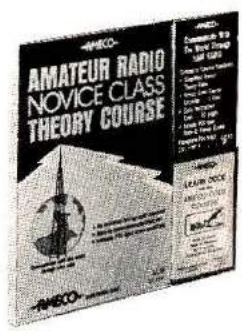

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Dear Horizons:

I just received my November issue and, as usual, found it contained several interesting and informative articles.

I particularly enjoyed "Signals from Safariland," by N. Steven-Hubbard . . .

I am only a Novice and may never get a General ticket. I work second shift in a truck manufacturing plant, and the classes for upgrading licenses, given by a local Radio Club, are held during evening hours — so I'm unable to attend. I do, however, want to renew my ticket . . .

I just read a letter to the "Post Box" from a ham who said you had the forms needed to apply for a license renewal. Could you please send me one of those forms? I will be very grateful . . .

Richard B. Swart, WB8SLV
Springfield, Ohio

Thanks for your letter, Richard. By the time you read this, you'll have the forms and, most likely, have renewed your license. I'm sure that with plenty of on-the-air experience and some study, you'll be able to get that General ticket even if you cannot get to classes. Good luck. ***Editor***

Dear Horizons:

I have been a reader of *Ham Radio Horizons* ever since it was first published. I am not a new ham, as I have been licensed since May, 1936. Still, I enjoy every article in *HRH*. In addition, my wife started to read it, and that generated enough interest to result in getting her Novice license and the call KA0BCP. Thank you, *Ham Radio Horizons*.

I have done some experimenting with very narrow-band fm, and I have been wondering if anyone else has had the inclination to get into this interesting method of modulation? If the receiver i-f bandwidth is narrowed to 500 Hz, I found that the fm deviation can be narrowed to the point where there is not much more bandwidth than that occupied by a good CW signal.

I would like to have other hams consider this idea, and see if we can stir up some interest in super-narrow-band fm. I know they will be amazed at the results.

Milton Sarchett, W0YBK
Ely, Iowa

Dear Horizons:

I first wrote to you after you published your first issue of *Ham Radio Horizons*. I was an Advanced Class licensee, and found your magazine very understandable.

Well, I've been an Extra for about a year now, and I still enjoy (and understand) *HRH*. To prove how great it is, I just renewed for another year (my subscription wasn't due to run out until 1982). If you keep up the good work, I may renew until 1984!

Mike Witenko, N8AX
Springfield, Ohio

Dear Horizons:

I am a new subscriber to your fine publication. The first issue I received was the December, 1978, Special Issue. I found many interesting articles.

I will never be a writer, nor do I want to be. Nonetheless, I read "Write That Article" with interest. Alf Wilson made some very good points.

Then I turned to another interesting article, "Camouflage Your 2-Meter Antenna" by Warren Hodges. I thought it was unique, to say the least. A problem came up. All items are marked, measured and described, just as the previously read article suggested, except one — just the one I wanted to know something about. On page 34, **Fig. 2**, you show a "hub." Of what material is this item made? Everything else is either aluminum or brass or stainless steel, but this piece, who knows? It seems to me that it must be an insulator. Am I right?

At this time I am a Novice. I'm trying to see that this status doesn't remain too long. In your DX forecaster I found new and wonderful things. With a little work I figured out the baffling page 97 — well, almost! On certain squares the band designation is followed by an *. That must have some significance, but what? I'm sure an experienced operator would have no trouble with this, but I'm not experienced.

Excellent article by Earl Savage, and an excellent article by Douglas Blakeslee. I like the magazine!

Arthur Dickett, WA2TUH
Thornwood, New York

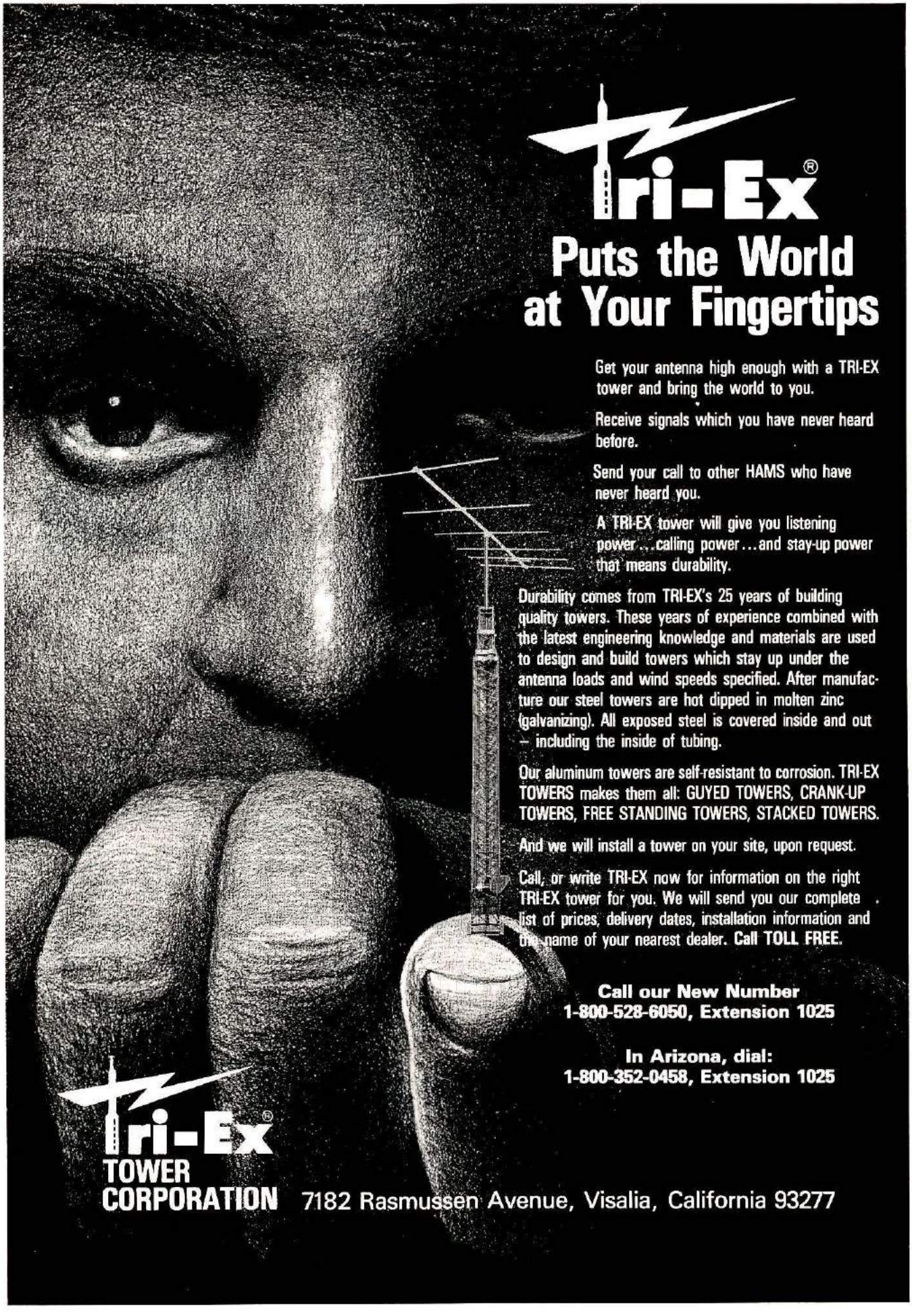
*Thanks for your comments, Arthur. I have a "gotcha" reply to that question about the weathervane antenna hub. At the top of page 35, **Fig. 3**, is a drawing of the "Aluminum Hub," clearly marked. As to the asterisk in the DX chart — you have a good point. When space permits, we include a paragraph at the end of the DX Forecaster page. This explains that the use of an asterisk indicates that you should check the next higher band as well, as there is a good possibility that it, too, is open. The December issue just didn't have enough space to include that helpful paragraph.* ***Editor***

Dear Horizons:

Since I started taking *Ham Radio Horizons* a little over a year ago I have found it to be much more valuable than any other Amateur magazine. You can pride yourself in good articles dealing in Amateur Radio. These articles are of more benefit than pages and pages of meaningless contest scores mixed in with excessive advertisements.

In addition to Amateur Radio I have gained an interest in stamp collecting. Where would a person find information about a group of Amateurs with an interest in stamps having a net? I've heard of Space Exploration and Medical nets, as well as others. Has there been an attempt by anyone to compile a list of special-interest nets, including enough information to help contact a member of the net? I feel it would be very useful and a way to link Amateur Radio to our other interests and occupations.

James H. Couey, WB0RIM
Towanda, Kansas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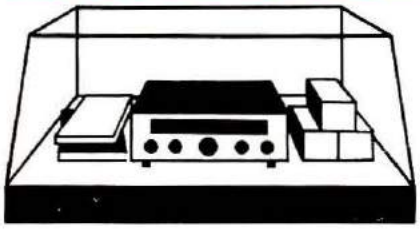

Fast-Scan ATV Transmitter/Converter

P.C. Electronics, of Arcadia, California, has put their ATV modules into a single attractive enclosure for those hams who are more interested in operating than building. All that is needed with the TC-1 is a Technician or higher Amateur license, a TV set tuned to channel 2 or 3, a 435-MHz antenna, and a video source. The video source can be a closed-circuit TV camera, computer video, teletype video, or video tape recorder.

The TC-1 ATV transmitter/converter contains a sensitive, varactor-tuneable, 420 to 450-MHz converter with output on TV channel 2 or 3. No modification to your TV set is necessary to receive fast-scan ATV because the same standards are used as in commercial broadcast. The transmitter section of the TC-1 runs 10 watts peak output on 439.25 or 434.0 (or any other ATV frequency by special order).

Computer alphanumerics, graphics, and color can be transmitted because the modulator has a bandwidth of 8 MHz. This allows you to play Star Trek or blackjack over the air.

Price of the TC-1 is only $399 delivered in the U.S. Options include AC/12 Vdc for portable work, $30; off-the-air video detector and monitor driver (to see the actual transmitted picture), $25; and on-carrier audio for those areas with an inband ATV repeater, $50. The 117 Vac, 50-60 Hz power supply is built in. UPS delivery prices are included to save you the trouble of trying to figure out the charges. Direct mail-order sales saves you the cost of dealer markup.

Send an addressed, stamped envelope for a catalog of modules, cameras, and monitors. Write P.C. Electronics, 2522 Paxson Lane, Arcadia, California 91006, or use *ad check* on page 78.

MIMIC Programmable Keyer

The MIMIC memory keyer is the newest of Daytronics Company's fine line of quality electronic keyers for the Amateur Radio operator. The MIMIC has four programmable memories which can each store an average of 60 letters, or about ten minutes of 5-wpm text total for all four memories. This is three to four times the memory capacity of other keyers. It is also a fully iambic keyer with both *dit* and *dah* paddle memories, self-completing characters, automatic spacing, automatic weighting, a built-in sidetone monitor, built-in regulated power supply (instead of batteries) that can operate from 115 Vac or 8 to 5 Vdc, and a fully RFI protected keying output that will key either grid-blocked or cathode-keyed tubed transmitters as well as all the solid state rigs.

Additionally, when you are recording into any one of the four memories, the sidetone from the internal speaker will change pitch when the memory is half full, allowing you ample time to finish your message before you run out of room in that memory.

The MIMIC has a triggered clock, which means that you have total control of the keyer and that you do not have to use precise timing or wait for the keyer to catch up to you in order to record your message into the memory without making mistakes. Also, should you pause while recording, the MIMIC's memory will not continue to chug along eating up memory space, but will insert a maximum of three spaces and then stop. It will resume only when you begin sending again.

The MIMIC is extremely easy to use and a pleasure to operate during contests as well as casual rag chewing. Recording into the memory is as simple as selecting the memory by pushing the desired MEMORY button,

pressing the WRITE button and sending your message exactly as you would for a QSO. The MIMIC senses letter and word spaces and inserts them automatically so that the message is an exact duplicate of what you sent. Pushing the END button erases the remainder of the memory so that any previously recorded message will not be sent. To send a recorded message, simply push the desired MEMORY button and push the SEND button. You can stop a message by simply pushing the RESET button.

The MIMIC is available in either kit form or an assembled and thoroughly tested version. The kit version is only $79.95, and the assembled version is only $99.95. Paddles are also available as a package deal of $104.95 for the kit and a set of paddles, or $124.95 with the MIMIC assembled. The paddles are a quality set and are fully adjustable for tension and spacing. They're a fine addition to your shack. For more information write Daytronics Company, P.O. Box 426, Selden, New York 11784; or use *ad check* on page 78.

J. W. Miller Catalog

A new 100-page catalog with specifications for more than 5,000 coils, filters, and communications essentials is now available from the J. W. Miller Division of Bell Industries, Compton, California.

Newest additions to their catalog include direct reading SWR/power meters, an rf speech-processor, and coaxial switches. Included also is the broad line of highpass, lowpass, audio, and ac power-line filters.

Catalog 79 gives detailed specifications for rf coils, chokes, filters, and related communication components. To assist in selection, coils are categorized by frequency from 0 through 500 MHz in the table of contents. Schematic diagrams for all shielded and unshielded coils, showing adjustment accessibility, are given.

For additional information, contact Jerry Hall, Operations Manager, Bell Industries, J. W. Miller Division, 19070 Reyes Avenue, P.O. Box 5825, Compton, California 90224, or use *ad check* on page 78.

New Astatic Microphone

A microphone designed for repeater-control and phone-patch operations has been introduced by the Astatic Corporation, Conneaut, Ohio. It's the new Astatic T²M amplified microphone with touch-pad encoder.

For fingertip convenience, the touch-pad encoder is an integral part of the microphone itself. It has a tactile twelve-key keyboard and provides visual feedback through a front-mounted LED.

Priced comparably to a conventional microphone, the T²M is of an advanced design that has such high-quality features as a preamplified electret element with tailored response and integral modulation control; a digital, integrated tone-generator circuit with 3.5795 MHz crystal for stable frequency control; and a mixer amplifier with up to 15 dB gain for impedance matching and audio and tone mixing.

The attractive Cycolac housing resists abusive treatment. It also features shielding to reduce external interference and rf feedback. The T²M operates from filtered 6 to 16 volt dc sources. Included is an eight-foot, three-conductor (one shielded) cable and coiled cord.

For additional information on the new Astatic T²M amplified microphone with touch pad encoder, write The Astatic Corporation, Conneaut, Ohio 44030, or use *ad check* on page 78.

EICO 4A4 Multimeter

EICO Electronic Instrument Company is adding a new multimeter, Model 4A4, to its Truvohm line of low-cost, high-quality factory-assembled VOMs.

The new multimeter is a 4000 ohms/volt general-purpose instrument with 17 ranges. The meter measures up to 1000 volts dc and ac, up to 250 mA dc, and up to 2 megohms resistance. Accuracy is ± 3 per cent on dc and ± 4 per cent on ac. It features a recessed selector switch and an easy-to-read 3-inch meter with mirror-back scale. The meter movement is diode-protected. The high-impact plastic case measures 12.7 × 8.8 × 3.6 cm (5 × 3-1/2 × 1-7/16 inches). Suggested price of the new Model 4A4 is $17.95, assembled and complete with batteries and test leads.

The EICO Truvohm line includes a highly sensitive 100k ohms/volt bench-size multimeter, a clamp-on ac current tester and seven other instruments ranging from a simple, inexpensive 1000 ohms/volt meter to a 20,000 ohms/volt mirrored-scale meter.

For further details, contact EICO Electronic Instrument Company, Inc., 108 New South Road, Hicksville, New York 11801, or use *ad check* on page 78.

Soldering-Tool Holder and Mini-Soldering Station

Edsyn, Incorporated, of Van Nuys, California, announces a low-cost soldering tool holder which also serves as a compact soldering station. Designated the Idle-Rest TL194 General Purpose Holder, the unit holds most available soldering tools due to its specially designed tool cradle. The exterior of the holder

remains within safe skin-touch temperature limits because of the low heat transfer characteristics of the molded Bakelite housing. Also, an efficient heat shield and ventilating-grill system helps keep heat concentrated to the soldering tip area.

The holder sits securely on the bench top without tipping. If desired, the integral fastener nut may be used for permanent installation to the bench top.

In addition, the holder contains a supply of desoldering wick and solder (included with purchase), parts or tip-storage tray, and a large tip-cleaning sponge which self-wets at the touch of a finger. The sponge may be removed if desired to obtain an additional storage tray for components or soldering supplies.

For more information, contact an authorized Edsyn distributor; for the name of the one nearest you, write Edsyn, Incorporated, 15958 Arminta St., Van Nuys, California 91406.

Chemtronics Desoldering Tool

Chemtronics Inc., of Hauppauge, New York, recently announced the latest addition to its popular line of solder and industrial-chemical products: the D5 Desoldering Tool. The unique new product, which features Chemtronics' highly effective desoldering wick in a specially engineered, refillable dispenser tool, helps technicians remove solder more efficiently while economizing on wick use. D5 may be used alone, or as an integral part of Chemtronics' new SD5 Solder/Desolder System.

The D5 Desoldering Tool consists of a 25 mm (1-inch) clear plastic cylinder which contains a visible supply of 152 cm (5 feet) of the company's specially formulated desoldering wick. Braid is fed to the wick through a Teflon* probe that extends from one end of the wick supply. The heat-resistant Teflon probe allows users to desolder with pinpoint accuracy and without burnt fingers, even in high-density circuitry. In addition, the D5 Tool's exclusive probe permits the user to shape or "web" the wick, providing maximum absorbency and further economizing on wick use. When the wick supply is exhausted, the user simply snaps the Tool's probe into the D5 Desoldering Tool Wick Refill.

Chemtronics' D5 Desoldering Tool uses the highest-quality braid in natural copper color, which permits the user to see the absorption of solder. The braid, which meets all MIL-specs and NASA publications requirements, is treated with a pure, water-white rosin flux

*Teflon is a registered DuPont trademark.

which is nonactivated and free from halogens and corrosive chlorides. This assures complete solder absorption without leaving harmful residue.

The pocket-sized D5 Desoldering Tool is available alone or as part of the SD5 Solder/Desolder System, where it telescopes or snaps in and out of a pound or half-pound spool of Chemtronics' solder. D5 wick refills are also available, in two diameters, allowing the D5 Tool to be economically reused for years. More information is available at Chemtronics distributors or directly from Chemtronics, Inc. Solder Products Division, 45 Hoffman Avenue, Hauppauge, New York 11787; or use *ad check* on page 78.

Fox-Tango Club Newsletters Free Tape Recordings

Blind amateurs who own (or who are interested in) Yaesu equipment can obtain free recordings of the Annual Sets of the International Fox-Tango Club's newsletters for the years 1976, 1977, and 1978 by sending blank 90-minute cassettes to Tom Warrenburg, Route 3, Box 625, Delavan, Wisconsin 53115. Tom, who is handicapped and struggling to pass the Novice examination, will transcribe the newsletters master tapes he has prepared, and return the cassettes. There is no charge of any kind in the U.S.; others send postage.

The newsletters contain much useful information about Yaesu equipment, including operation, modification, and servicing. Back issues are available through 1972 when the club was first organized by N4ML. Recordings of all back issues are being made and will be available on the same basis when completed.

More information about the club can be obtained by writing to N4ML, Box 15944, West Palm Beach, Florida 33406, or listening to the Fox Tango Net on Saturdays; 14.325 MHz beginning at 1700 UTC.

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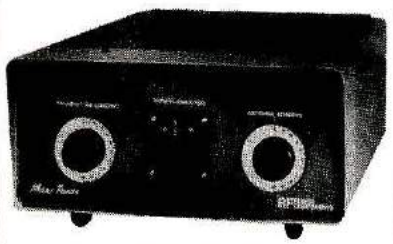

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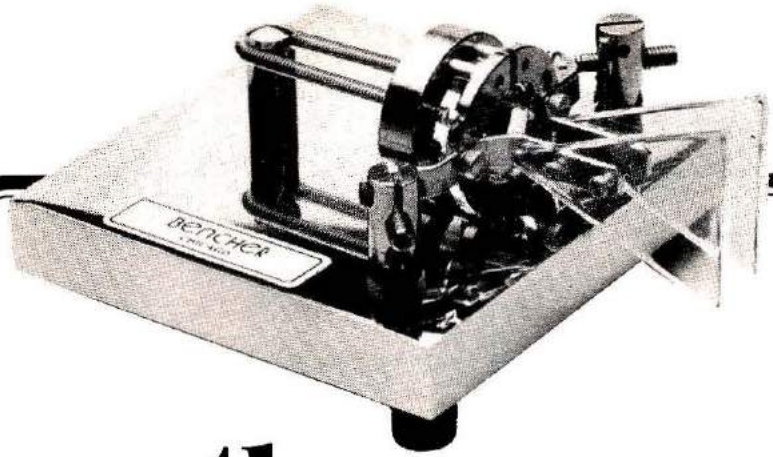

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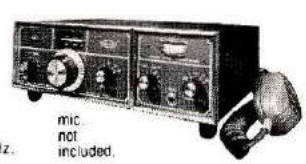

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FREQUENCY ALLOCATION CHART. See how the entire radio spectrum is used. 2 kHz to 200 GHz. Send $3.00. Collins Chart Co., Box 935, Coronado, CA 92118.

QSL CARDS 500/$10. 400 illustrations, sample. Bowman Printing, Dept. HRH, 743 Harvard, St. Louis, MO 63130.

NAMETAGS — 1½" × 2½" — One line $2.50. Each additional line $0.50. 12 colors. Tag-it Co., Box 2062, Indianapolis, IN 46206.

MICHIGAN: ARROW Repeater Association annual Swap and Shop Sunday, May 13, 1979 at the Saline Michigan Fairgrounds. Prizes, covered area for trunk sales, and indoor tables. Admission, including parking on the fairgrounds $2.00 at door, $1.50 advanced. Free admission for wives. Food service available. Talk-in on 146.37/.97, 223.18/224.78 and 448.5/443.5 MHz. For details write ARROW, P.O. Box 1572, Ann Arbor, Michigan 48106 or call George Raub, AD8X, (313) 485-3562.

QSO PARTY: NEW ZEALAND; ZL3 Canterbury Chapter of the International 10/10 Net. From 0000 GMT Saturday, March 31, 1979 to 1200 GMT Sunday, April 1, 1979 (36 hours). Contact each station only once, on the ten meter band only; exchange call sign, name, QTH, 10X number, if any, Canterbury Chapter number (if held) and your own local Chapter name and number, if any. Awards include trophy to highest scorer overall, and a pennant to the highest scorer in each U.S., Canadian, Australian, Japanese and New Zealand call area; to each Central and South American country; to each European, Asian, and African country; and in three Pacific Ocean zones. Logs must be received no later than May 15, 1979. Please write clearly, show name, call, address and 10X number. Send logs to ZL3ME — C.J. Bramley, 198 Greers Road, Christchurch 5, New Zealand.

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TEXAS: "Luckenbach DXpedition", 0800 CDT May 12, 1979 to 1200 CDT May 13, 1979, continuous. Call W5TEX. CW: 7.110 MHz and 21.110 MHz (± 5 kHz); FM: 52.525 MHz, 29.6 MHz, and 146.52 MHz; SSB: 3.9, 7.235, 14.285, 21.360, 28.625, 50.110 and 144.200 MHz; (± 5 kHz). Luckenbach sits nestled between two small rivers in the heart of the Texas hill country. Virtually untouched by modern civilization, this 1870's cowtown got its first pay telephone only last year. Luckenbach's general store/saloon/postoffice combination serves as a community center and gathering place for citizens to watch for the annual return of the mud dauber — a red hornet. Don't miss the fun of our "DXpedition". Send all logs and inquiries to Bob Schneider, AI5Q, 7206 Gumtree, San Antonio, Texas 78238.

STOP LOOKING for a good deal on amateur radio equipment — you've found it here — at your amateur radio headquarters in the heart of the Midwest. We may not have a toll free number but we'll save you more in the long run! We are factory-authorized dealers for Kenwood, Drake, Yaesu, Collins, Wilson, Ten-Tec, Atlas, ICOM, DenTron, MFJ, Tempo, Regency, Hy-Gain, Mosley, Alpha, Cushcraft, Swan, and many more. Write or call us today for our low quote and try our personal and friendly Hoosier service. HOOSIER ELECTRONICS, P.O. Box 2001, Terre Haute, Indiana 47802. (812) 238-1456.

MINNESOTA: Rochester Area Hamfest, Saturday, April 7, 1979 sponsored by the Rochester A.R.C. and Rochester Repeater Society. Doors open 8:30 AM at St. John's School gymnasium, 490 West Center Street, Rochester, MN. Large indoor flea market, prize raffles, refreshments, free parking. Talk-in on 146.22/.82. For more information write RARC c/o KØTS, 2514 N.W. 4th Avenue, Rochester, Minnesota 55901.

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OHIO: 10th Annual FM B*A*S*H*, 8 PM until midnight, Friday, April 27, 1979, at the Dayton Convention Center, Main at Fifth Street. Admission FREE to all hams and their friends. Food and C.O.D. bar available. Super floor show and drawings for fabulous prizes. For more information contact the Miami Valley F.M. Association, P.O. Box 263, Dayton, Ohio 45401.

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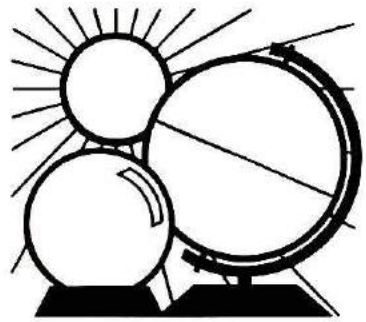


DX FORECASTER

A last-minute peek in the crystal ball shows April to be an excellent DX month with virtually all bands from 160 through 10 meters producing outstanding results for the DX chasers. A period between April 3rd and 10th is likely to be disturbed, with the days of the 7th, 8th, and 9th most likely to be involved in the ionospheric and geomagnetic "fireworks." Once again, a period between April 16th and 23rd may show some upsets — particularly around the 23rd, which is also the date of the full moon. For moonbouncers, perigee is also April 23rd. The rest of the month, with the possible exception of the 28th and 29th should be good for combing the bands of your choice. On these two days, keep an ear tuned to WWV for the solar-flux and geomagnetic-index information.

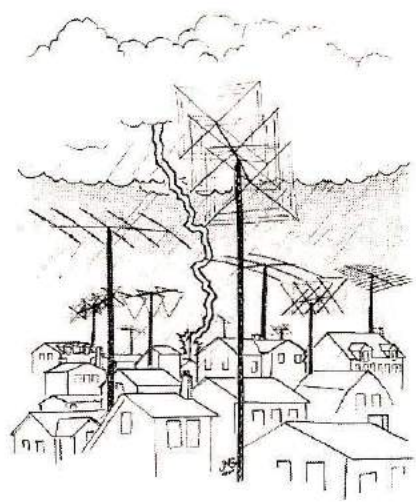
Band-by-band Propagation

As in March, 10 meters will be open much of the time every day, as will 15 and 20 meters, with the latter bands remaining open after local sunset and into the evening. Thunderstorm activity in April really makes 40 and 80 meters an uncomfortable, noisy place to listen, but on clear days and nights you will hear some long-skip signals coming through. The 160-meter band will be usable after dark, but is just about all through for any serious work until next fall. Local and short-skip stations will be workable however, depending on static levels.

Vhfers will like the 6-meter openings, which will be frequent as the muf moves ever upward in pace with the increasing sunspot activity. There will also be openings on 2 meters from a variety of possible sources such as storm-front propagation, and ionization of the E layer; a mixed bag of goodies that should make everyone happy to be licensed and operating.

Pay particular attention to the charts to tell you where to point your beam antennas for the best DX openings at various hours during each day. The highest usable bands will be shown, and the asterisk (*) means to look at the next *higher* band for possible openings along the path indicated.

HRH



There is no justice . . .

GMT	PST	WESTERN USA N	NE	E	SE	S	SW	W	NW	MST	MID USA N	NE	E	SE	S	SW	W	NW	CST	EST	EASTERN USA N	NE	E	SE	S	SW	W	NW
0000	4:00	15	—	15*	10	20	10	15	10	5:00	20*	20	15	15	15	10	10	10	6:00	7:00	15	20	10	10	15	15*	15*	10
0100	5:00	15	—	15	10	20	10	15	10	6:00	20*	20	15	15	20	10	10	10	7:00	8:00	15	—	15	15	15	15	15*	10
0200	6:00	15	—	15	15	20	10	10	15	7:00	15	—	20	15	20	15	15	15*	8:00	9:00	20	—	15	15	20	15	15	15
0300	7:00	15	—	20	15	—	10	15	15	8:00	15	—	20	20	20	15	15	15	9:00	10:00	20	—	20	20	20	15	15	15
0400	8:00	15	—	20	15	—	10	15	15	9:00	20	—	—	20	20	20*	20*	20*	10:00	11:00	20	—	—	—	20	15	15	15
0500	9:00	20	—	—	15	—	15	15	20	10:00	20	—	—	20	20	20	20	20	11:00	12:00	—	—	20	—	20	20	20	20
0600	10:00	20	—	—	15	—	15	15	20	11:00	20	—	—	20	—	20	20	20	12:00	1:00	—	—	20	—	20	20	20	20
0700	11:00	20	20	—	20	—	15	15	20	12:00	—	—	—	—	—	20	20	20	1:00	2:00	—	—	—	—	20	20	20	20
0800	12:00	—	—	—	20	—	15	20	20	1:00	—	—	—	—	—	20	20	20	2:00	3:00	—	20	—	—	—	20	20	20
0900	1:00	—	—	—	—	—	20	20	—	2:00	—	—	—	—	—	—	—	—	3:00	4:00	—	20	—	—	—	—	—	—
1000	2:00	—	—	—	—	—	20	20	—	3:00	—	—	—	—	—	—	—	—	4:00	5:00	—	20	20*	20	—	—	—	—
1100	3:00	—	—	—	—	20	20	20	—	4:00	—	—	—	—	—	—	—	—	5:00	6:00	—	15	15	15	20	—	—	—
1200	4:00	—	—	20	—	20	—	—	—	5:00	20	20	20	15	—	—	—	—	6:00	7:00	—	15	15	15	15	20	—	—
1300	5:00	—	20	20*	15	—	—	—	—	6:00	20	20*	15	15	20	—	—	—	7:00	8:00	20	10	15	15	10	20*	—	—
1400	6:00	20	20	15	15	—	—	—	—	7:00	20	15	15*	15*	20	20*	15	20	8:00	9:00	20	10	15	15	10	20	—	—
1500	7:00	15	15	15*	15*	—	15	20	—	8:00	15	15*	10	10	—	20*	20	20	9:00	10:00	20	10	15*	15	10	20	—	—
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1900	11:00	20	15	10	10	—	20	15*	20	12:00	20	15	10	10	—	20	10	20*	1:00	2:00	20*	10	10	10	10	10	15	20
2000	12:00	20	20	10	10	—	15	15*	15	1:00	20	15	10	10	—	15	10	15	2:00	3:00	15	15	10	10	10	10	15*	15
2100	1:00	20*	20	10	10	—	15*	10	15*	2:00	20	20	10	10	—	15*	10	15	3:00	4:00	10	15	15	15	10	10	15*	15*
2200	2:00	20*	20	10	10	15	10	10	10	3:00	20	20	10	15	15	10	10	10	4:00	5:00	10	20	15	15	15	10	10	10
2300	3:00	20*	—	10	10	20	10	15	10	4:00	20	20	15	15	15	10	10	10	5:00	6:00	10	20	15	15	15	10	10	10
	APRIL	CENTRAL ASIA	EUROPE	S. AFRICA	S. AMERICA	ANTARTICA	NEW ZEALAND	W. AUSTRALIA OCEANIA	FAR EAST		CENTRAL ASIA	EUROPE	S. AFRICA	S. AMERICA	ANTARTICA	NEW ZEALAND	AUSTRALIA	FAR EAST			FAR EAST	EUROPE	CENTRAL AFRICA	S. AFRICA	S. AMERICA	OCEANIA	W. AUSTRALIA NEW ZEALAND	AUSTRALIA

HAM CALENDAR

April 1979

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Old Natchez ARC Hamfest — Natchez Convention Center — Natchez, MS. Penn Wireless Association Tradefest '79 — Info: Charles Maier, 403x, 141 Bedford Road, Fairless Hills, PA 19030 1	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM 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 8PM PST 3540 kHz A-1 22 WPM 2	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz — 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 3	West Coast Qualifying Run 4	5	6	ARRL Hamfest — Columbia, MO ARRL Open CD Party — CW — 7-8 Rochester ARC/Repeater Society Hamfest — St. John's School Gymnasium, 400 W. Center Street — Rochester, MN Wellesley ARS Auction — Wellesley High School — Wellesley, MA — WA1YHV 7
Madison Area Repeater Association Swaptest — Dane Co. Expo Center Forum Building, Madison, WI 8	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 9	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz — 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 10	11	W1AW Qualifying Run 12	13	14
 See April 3, 4, 7, 12, 17 15	ORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM 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 8PM PST 3540 kHz A-1 22 WPM 16	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz — 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 17	18	19	20	ARRL "Open" CD Party — Phone — 21-22 EME Contest (144) — 21-22 Jackson ARC Hamfest — Manhattan Academy Gymnasium — Jackson, MS — 21-22 PHD ARA Hamfest — Kansas City Trade Mart, located at the Kansas City Downtown Airport — Kansas City, MO — 21-22 Trenton Computer Festival — Trenton State College — Trenton, NJ — 21-22 21
Delaware Valley Radio Assoc./Lawrenceville Amateur Repeater Group Flearmarket — New Jersey National Guard 112th Field Artillery Armory — Trenton, NJ Rock River RC Hamfest — Lee County 4-H Center, South of Dixon, IL, 1 mile east of Route 52 and 30 22	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 23	AMSAT Eastcoast Net 3850 kHz 8PM EST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz — 8PM CST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 7PM PST (0300Z Wednesday Morning) 24	25	26	Central Massachusetts ARA Auction/Flearmarket, Main South American Legion Post 341 — Worcester, MA — WA1LEA K1CON Continued below** 27	DAYTON HAMVENTION 28
DAYTON HAMVENTION W1AW Qualifying Run 29	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News 222.66/224.26 MHz via WR2APG and 21.400 MHz USB 30					**DAYTON HAMVENTION — Dayton, OH — 27-29 FM BASH — Dayton Convention Center — Main & 5th Streets — Dayton, OH — Info: Miami Valley F.M. Association, P.O. Box 283, Dayton, OH 45401 8PM at midnight the 27th

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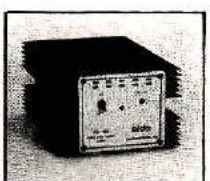

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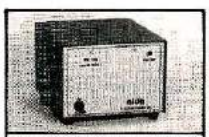

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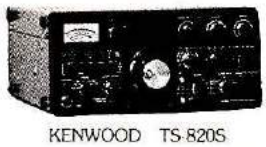
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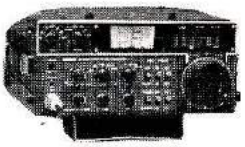
YAESU FT-901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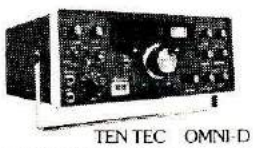
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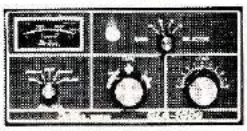
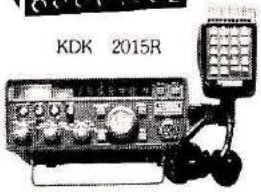

GLA-1000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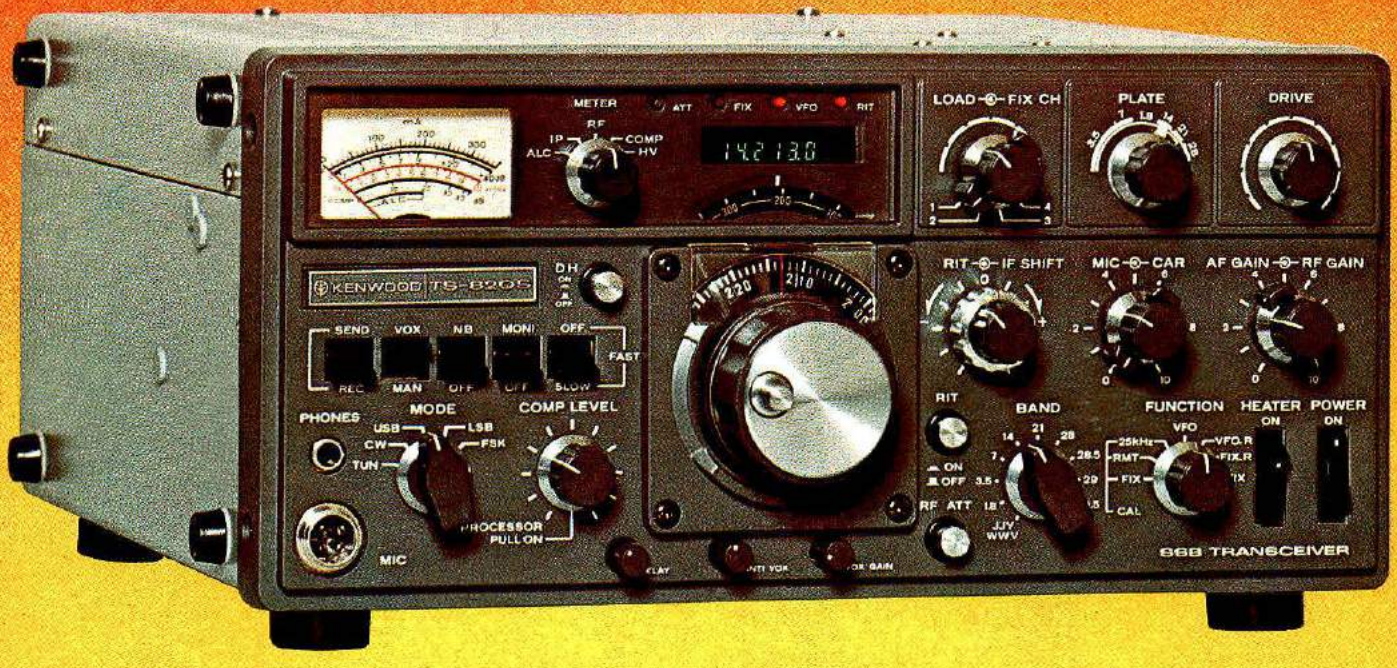

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