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73 MAGAZINE

FOR RADIO AMATEURS

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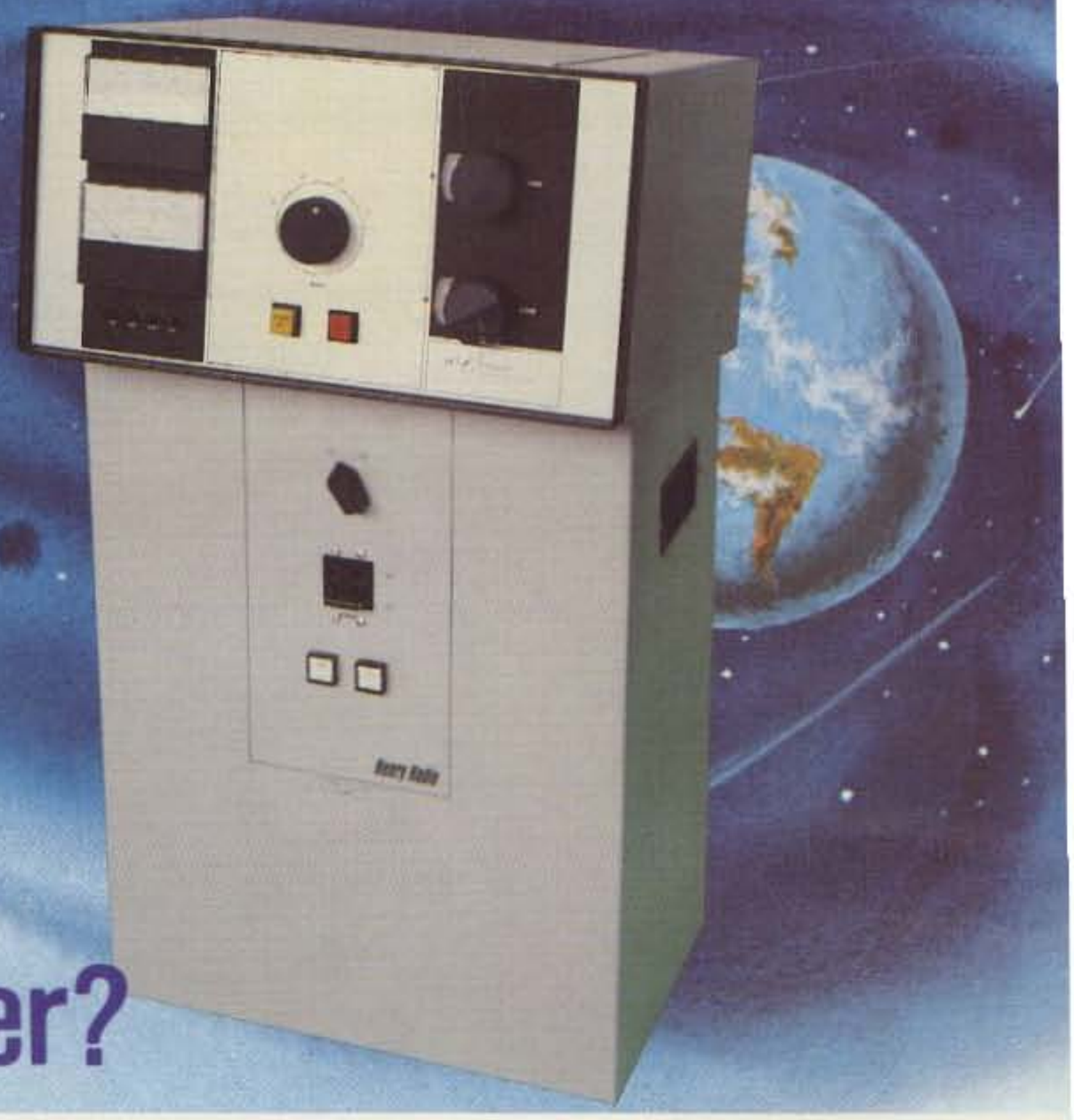

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The 2KD-5

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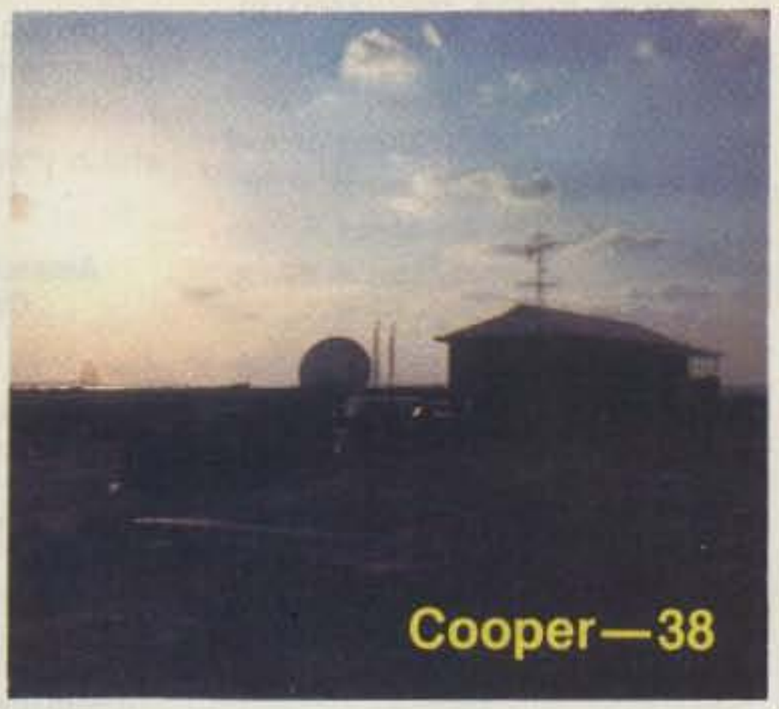

Cover: Photo by Paul Grupp KA1LR.

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

THE FCC ADVISORY COMMITTEE

In order to keep in closer touch with those being regulated, the FCC has established advisory committees, made up of people in the regulated industries, to work with them on needed regulations. In the amateur radio field, this group is the National Industry Advisory Committee, Amateur Radio Service Subcommittee (NIAC). The group has 17 members, of whom about two-thirds normally attend the yearly or twice-yearly meetings.

The most recent meeting was held at the FCC headquarters in Washington with eleven members present. More of the members are interested and influential amateurs than industry representatives, with the only true industry representatives being me from *73*, John Lindholm from *QST*, Chris Imlay from *QST*, and Alan Dorhoffer from *CQ*.

The recent meeting discussed aspects of getting local government cooperation for emergency communications, possible help from MARS stations, and so on. We had been asked for a report on high-speed transmissions for emergency communications and on the possibilities of developing more amateurs for emergency operations. I made the following report, which you may find of interest.

Amateur Radio Emergency Communications: The Future?

At the last NIAC meeting I discussed the matter of the lagging American technology in electronics. Since that time this has been a matter of continued interest in the general media, with articles in *The Wall Street Journal* and several other well-read publications.

It was my concept that much of the explanation for this increasing technology gap lies in the moribund nature of amateur radio in our country... particularly as compared with the vital and growing interest in amateur radio in Japan. I felt that this stemmed from the proposed "incentive licensing" rules of 1963, at which time amateur radio in the U.S. stopped its growth for an eleven year period. Indeed, had our ranks continued to grow at the rate at which they had been expanding from World War II until that time, we would have reached our present amateur population in about 1965.

The result of this has been a serious lack of the most precious lifeblood of amateur radio, the 14- and 15-year-old newcomers. Even the spurt of interest in the mid-1970s which resulted from the national enthusiasm for Citizens Band radio brought in more middle-aged recruits than youngsters. Unfortunately, *these* are not the type of amateurs who decide to dedicate their lives to careers in electronics or communications. Thus we have a rapidly aging group of amateurs, with the large part of them well beyond the age when we would expect them to contribute to the advance of American technology. This largely comes from people in their 20s and 30s, not in their 40s and 50s.

One possible solution to the problem would be to encourage the introduction of amateur radio into as many high schools as possible. This is the age recruit which we need... which our country needs. Without this group joining our hobby I feel that America can only face further humiliation at the hands of the Japanese engineers and technicans. Further, should any international conflict develop, we will have to be very sure that the next time we have Japan on *our* side. Indeed, if Japan had introduced the no-code ham license in the 1930s it is possible that the war could have turned out differently. We should remember that Hitler publicly regretted his stopping of amateur radio in Germany and ascribed much of the failure of Germany in the war to the resultant loss of technicians.

Since we all agree that another international war is unthinkable and impossible, there is no real reason to even worry about our technical people who might be needed in that instance. Still, that does leave us with a gradual falling behind in business as the Japanese, with their army of engineers and technicians, surpass us in calculators, watches, television sets, video recorders, video players and disks, tape recorders, hi-fi systems, amateur radio equipment, *all* communications equipment, telephones, test equipment... and so on.

It seems to me that the further we allow ourselves to fall behind in technology, the more we will fall behind economically. I have visited just about every part of the world in recent months and on every front I find the Japanese firms getting ahead of us. Despite the serious problems our Administration is having in trying to cut down on expenses, it may be time for a White House symposium on this critical situation, with some dramatic measures to tackle the problem.

There have been two major technological revolutions in the amateur radio field in the last twenty years. The first was the introduction of single sideband transmissions in the late 50s, which resulted in a change to that mode for virtually all phone shortwave communications on the amateur bands... and its use by the military. The second major technology change was the development of the FM transceiver and repeater which came along in the late 60s and developed through the 70s. Since then, despite great leaps ahead in digital and integrated circuit technology by industry, little change can be seen in our ham bands.

The groups of amateurs working for *73 Magazine* are hard at work on a new technology. This will be introduced on twenty meters, probably on 14,100 kHz, as an on-the-air bulletin board. It is our plan to have a radio transceiver system which will automatically answer queries from other stations on that frequency, sending at first a menu of the available material on the bulletin board.

As an example of how this would work, a station would send a call for W2NSD/1 and sign its call. W2NSD/1 would then respond with a list of options of information. Let's say the inquiring station opts for #1, a current DX advisory. W2NSD/1 would then

W2NSD/1 ON-THE-AIR SCHEDULE DECEMBER, 1981

1	80-40 Phone
8	20 RTTY
15	20 Phone
22	40-20 CW
29	20-15 Phone

On both phone and CW nights, look for us in the first 25 kHz of the General portion of each band. On the RTTY night, look for us between 14.090 MHz and 14.100 MHz. We'll be on the higher band first. Sessions run from 7:00 to 10:00 pm eastern time.

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come on and send all of the latest information on active rare DX stations, including their known frequencies, schedules, QSL information, name of the operator, and so on. At the end of the transmission the inquiring station would have an option of sending unlisted information for possible inclusion on the bulletin board. This would be received at W2NSD/1 and stored for editing by the operator. It then could be added to the #1 list of information.

Number two might be a list of contests during the next few weeks, with scoring information, where to send logs, where to get full details, and so on. Again, further information could be sent to W2NSD/1 at the end of the bulletin transmission.

Plans are to have lists of hamfests and conventions, the latest FCC releases, proposed rule changes, lists of nets and their frequencies, changes in repeater calls or channels, VHF information, RTTY information, SSTV information... and so on.

In addition to encouraging the use of advanced digital techniques over the air, these transmissions would be experimental in nature, helping amateurs develop systems capable of communications via ASCII at 300-, 1200-, and 9600-baud speeds. The response of W2NSD/1 would be set to match the calling speed of bulletin board users. 9600 baud can be sent within the confines of an amateur voice channel and, when you consider that this is approximately 8500 words per minute, it is an efficient means of exchanging information.

Let's carry this on to the next step. How does this have anything to do with emergency communications, the basic function of NIAC? Most of the emergency nets of today are on voice and are incredibly inefficient as far as handling volumes of traffic is concerned. Let's look into the future and see where our high-speed automatic digital communications experiment is taking us.

In a few years we may be using small keyboards on which we will be able to type messages. Indeed, these are already on the market, with the Radio Shack TRS-80 pocket computer selling for $230. Let's imagine that instead of just calling a net control station to send a message, the net calls each station in the net in turn and asks if there is any traffic. With digital calling, this polling of a net could be done in milliseconds, not minutes with endless repeating of callsigns. At 8500 words per minute, the net control could call each participating station and ask for traffic in less than a second. If a message has been typed on the pocket computer, the station would automatically dump it over the air when polled. The control station computer would read the address and pass the message along to the addressee instantly. With a network like this it would be possible to handle thousands of times as much traffic as at present with no losses or errors. Further, links with low-band long-range stations could be set up as part of the emergency network...even to linking through satellites via microwave transmissions.

This is not a gee-whiz dream of the future. Everything needed has already been invented, so all amateurs have to do is apply the technology we already have developed in the computer field to radio communications. This should be good for amateur radio in that it will generate a new interest in communicating via this new technology. It will be good for industry in that all amateurs will be wanting new equipment. And it will enable amateurs to provide an emergency communications system far beyond anything imagined a year or so ago.

We are taking the first step with W2NSD/1 in the establishment of the radio bulletin board. We will be asking the FCC for permission to experiment with 1200- and 9600-baud transmissions. We will be publishing a vast amount of information on this

Continued on page 180

Well...I Can Dream, Can't I?

by Bandel Linn K4PP

"We've discovered a new high-speed way to learn the code! This shot will make you a 25-word-per-minute man immediately!"

Reader Service for facing page ↙72↗

SATURN V

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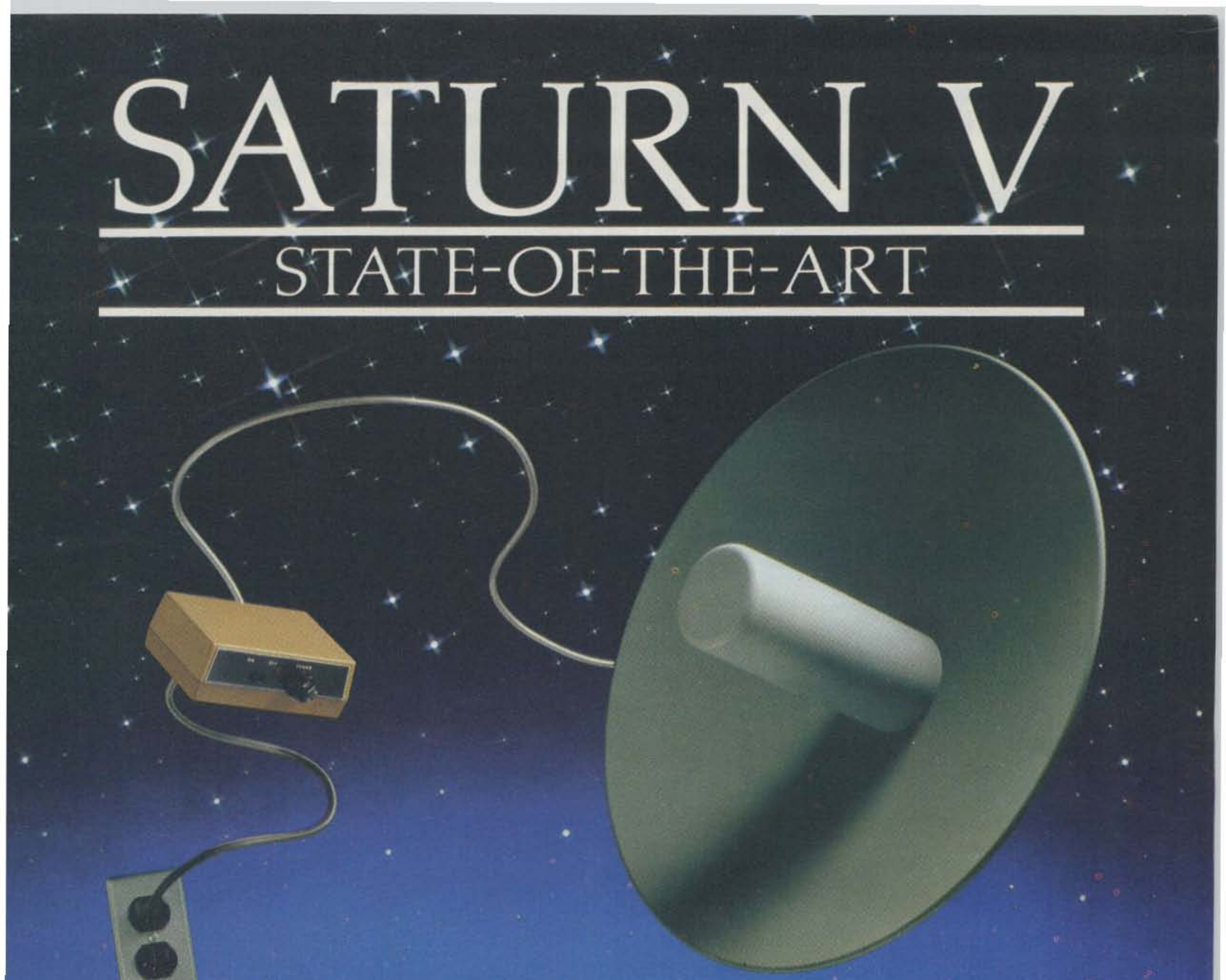

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Chris Brown KA1D
73 Magazine Staff

Cold Comfort

—an HT to the rescue at fifteen below

One thing was certain. This night would be very cold. As I hunched over my sputtering stove in the fading twilight, melting more snow for drinking water, I wondered how long my HT would continue to perform.

Before I had left on this winter backpacking trip to New Hampshire's White Mountains, friends had told me tales of liquid crystal displays freezing solid, then bursting, at zero degrees Fahrenheit, of fully charged nicads incapable of powering even the receiver portion of an HT at minus ten. Now, at 4:00 pm on this dull and snowy afternoon, the temperature was already minus eight degrees. I knew it would go much lower during the night. The question in my mind was, would the HT quit?

I was hiking alone in these frigid mountains, my only link to the outside world a compact package of imported electronics powered by a pitifully small battery pack. I intended to use my Kenwood 2400 HT to access a two-meter repeater located on a mountaintop eight miles away. In case of trouble, the HT would be my only way of yelling "Mayday."

Suddenly, I was aware of the sounds hanging in the frozen evening air: the roar of my small stove and the sweep of the wind-driven snow. Something was missing. The HT had been quiet for a long time. The reassuring CW ID of the Mount Washington repeater had not broken the squelch for at least half an hour. Preoccupied with stamping out a firm platform in the deep powder snow, setting up my mountain tent, getting the stove going, and making ready for the long night ahead, I had not noticed the HT's silence. Now that silence was overwhelming.

With clumsy, mittened hands I groped through my pack for the HT. I wiped the frost from the LCD readout and was relieved to see it indicating 6.055—the wrong frequency. I had inadvertently depressed the REV button while setting the frequency to 6.655 earlier and was listening on the repeater's input frequency instead of its output frequency. When I restored the switch to the normal position, I caught the tail end of the cheerful CW ID of K1OIQ/R. The repeater was still working and so was my HT. I went back to melting snow and supper preparations as the winter darkness slowly filled my campsite.

This trip had come about as a combination of my interests in winter mountaineering and amateur radio. And, by bringing an HT along, I was able to justify doing something I normally could not justify—making the trip alone. With the HT, I would always be able to reach the outside world and, in the event of trouble, would be able to let someone know where I was. I also thought it would be fun to yack with my fellow hams as I trekked through the Presidential Range in deep winter.

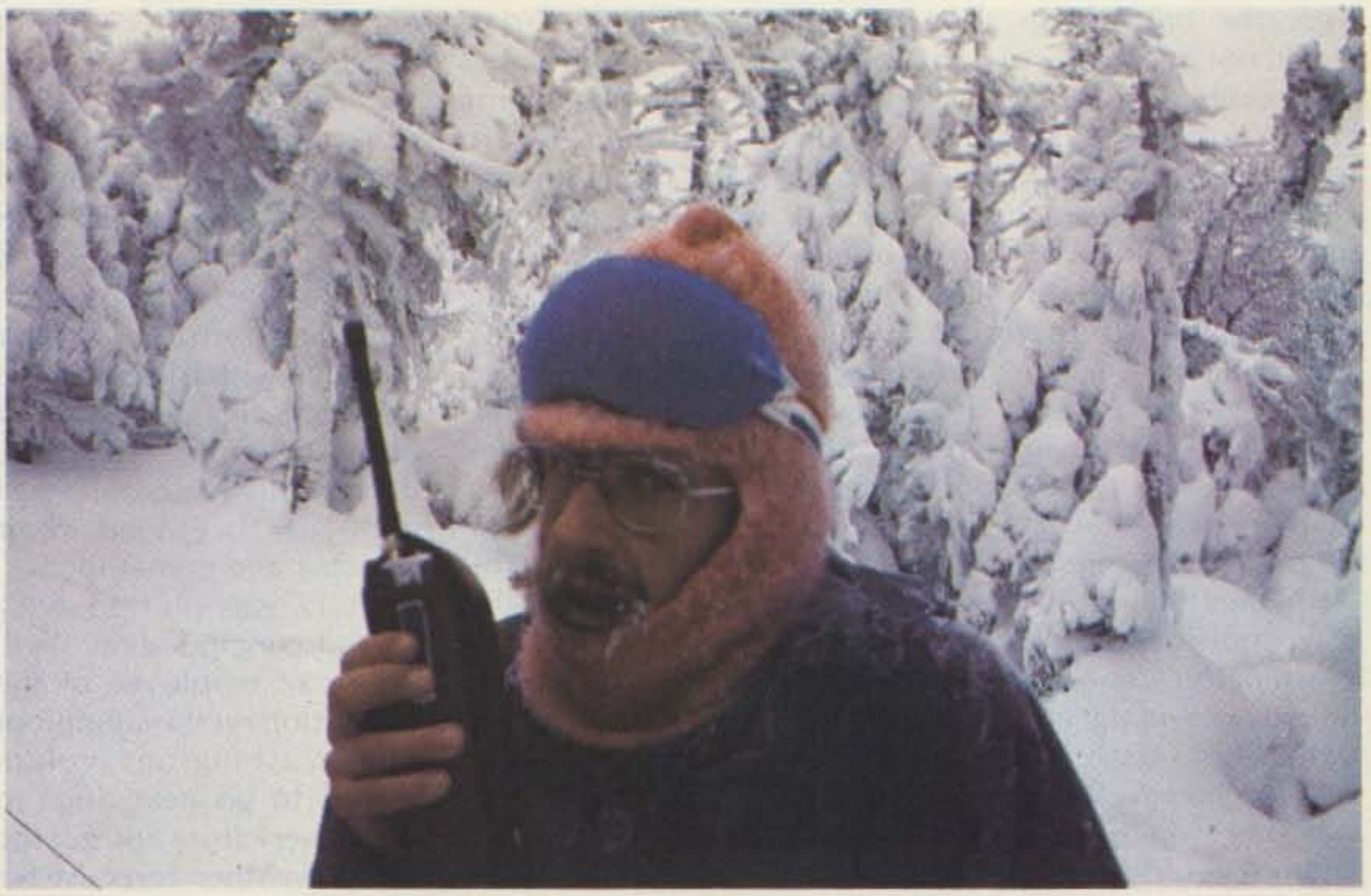
The Presidential Range lies in the White Mountains of northern New Hampshire. This wilderness area provides the most challenging winter hiking and climbing in New England. The region is known for its foul weather and, before the anemometer blew away, the highest wind gust ever recorded on the surface of the planet was clocked at an incredible 231 mph on Mt. Washington's summit. At 6,288 feet, Washington is no giant among mountains. Its reputation as a cruel place in winter, however, is first-hand knowledge to all eastern hikers and climbers who have spent time scuttling across its windswept slopes or scaling the walls of its icy ravines.

My plan was to hike into the national forest south of Mt. Washington, place a high camp at tree line on the Presidential Ridge, spend the night, and then hike down the ridge the following day. I hoped to pass over the summit of Mt. Washington before heading for civilization at Pinkham Notch Camp. I intended to cover a total of thirteen miles in two days, gaining most of my altitude the first day on the four-mile approach up the ridge.

Weather, of course, would play a major role in the success of any plan. The winter of 1980/81 was unusually cold in New England and the weekend I chose for my trip was no exception. I was well aware of the consequences that had befallen those foolhardy enough to be caught high on that exposed ridge in severe winter conditions. Wind-chill factors in excess of −100 degrees were common and, if the weather and winds did not cooperate, my plans would have to change.

I had no success persuading any of my friends to go with me. Perhaps the ominous weather forecasts which predicted snow on Friday night and Saturday with gradual clearing and plunging temperatures on Sunday dissuaded them. In any case, as I hiked along Saturday morning under my fully-loaded, forty-pound Kelty pack, I was glad to be alone. Working my way up through the forest, the only sounds intruding on my solitude were the rhythmic swish of my snowshoes through the powder and the occasional ID of the Mt. Washington repeater.

The Mount Washington repeater has the widest coverage of any machine in New England. Situated six thousand feet above sea level, it provides reliable communications over a 300-mile, five-state area. Though it shares its mountaintop with TV, FM broadcast, and commercial microwave installations, it has few intermodulation or desense problems.



A Sunday morning self-portrait at fifteen below zero.

The machine is privately owned and is open to the public. The only contribution requested from the large number of daily users is good operating practice. The machine is supported by equipment donations from hams in the north country, and maintenance and repairs are carried out by its licensee, Al Oxton K1OIQ and by Bill "Mac" Beal W1PNR. The central role Oxton and Beal play in the machine upkeep and maintenance is the key to its reliability in the harsh mountain environment.

Luckily for the users, both Al and Mac spend considerable amounts of time on the summit of Mt. Washington in the course of their duties as staff members of the Mount Washington Observatory. The Observatory, a non-profit research facility which operates year-round, is rich in folklore and ethereal nocturnal visitors. Rumor has it that at least one ghost is in residence on the summit; on wild nights when the wind is whining, he gives certain Observatory staffers the pleasure of his company. Oxton and Beal are more concerned with repeaters than rumors, however.

Their repeater is a VHF Engineering kit. A scratch-built control system provides tone decoders and interface for the autopatch, audio processing, link to another machine seventy miles away in Concord NH, and auxiliary inputs. Duplexers are by Sinclair and were provided by the Northeast FM Repeater Association. The special Gam half-wave vertical antenna, enclosed in a fiberglass radome, is fed with heliax cable cast off by the neighboring TV station. Transmitter output is 18 Watts, 20 Watts ERP. The repeater is voice-accessed and the trustees encourage users to say nice things when bringing the machine up. The dentist's office "Ahhhhhh" is frowned upon. Normal repeater power is drawn from ac mains, but the machine is capable of running on solar power and has even been run on wind power.

That night there was no shortage of wind for power generation on Mt. Washington. Though it bullied my tent, I was comfortable within the narrow confines of my mummy sleeping bag. Drawn tightly down across my face and around my shoulders, the bag provided a life-sustaining environment. The temperature within the bag was a humid seventy degrees. Four inches away, outside the bag's nylon and fiberfill walls, the temperature was flirting with the bag's minimum comfort rating, fifteen degrees below zero. I had placed two full-length closed-cell foam pads beneath me which provided 1-1/4 inches of insulation from the chilling, hard-packed surface of the snow. While I stayed on the pads, I stayed warm.

In addition to my 6'2" frame, I had managed to stuff a quart of water, the inner liners of my hiking boots, assorted articles of clothing, a bag of GORP (good old raisins and peanuts), my HT, a spare nicad pack, and a headlamp into the bag with me. These carefully chosen items

were the only things that would not be frozen solid in the morning and, as long as I didn't roll over too often, I was totally content.

I had been dozing in the bag for about two hours when the Granite State FM Net was called to order. This public service net handles national and regional traffic in two separate sessions and normally convenes at 7:00 pm on the repeater in Concord NH. Once the net is underway, the Concord and Mt. Washington repeaters are linked, providing coverage of the entire state. For some reason, however, the link was not functioning and, while I could hear the net proceedings from Concord on my HT, I was not able to check in. I wanted to pass a piece of routine traffic to a friend and fellow ham in Bozeman MT who had been a frequent companion on many previous winter trips. Without the link, however, it was doubtful that I would be able to get my traffic through.

Shortly after the net began, net control, N1ALM, briefly left the Concord machine and appeared on the Mt. Washington repeater asking if anyone had outgoing traffic for the net. As I gratefully passed the text of my message to him, we both had to laugh about the propensity we hams have for establishing and maintaining communications between weird locations. Like coral reefs, maximum security prisons, desert ghost towns, or mountainside campsites. Dana's check number matched mine on the first count and while I languished in my sleeping bag, my message began its relay to Montana.

Outside, the weather was deteriorating. The constant swish of built-up snow sliding off my tent and the increasing staccato of the wind did not bode well for the next day's planned route. The exposed ridge, lashed by the northwest wind, would be drifted with new snow making travel laborious and time-consuming. I lay mulling over my plans and reminded myself that the trip was supposed to be fun.

I was almost asleep when the squelch was broken by my own callsign. The gang at W2NSD/1, 100 miles south in Peterborough, was trying to raise me. We had agreed to keep an 8:00 pm sked Saturday evening and at 7:45 pm they were anxiously calling. Most of my fellow staffers were sure I was mad for making the trip in the first place and it was a skeptical and curious group that gathered at the *73* ham shack to hear of my progress.

After assuring them that I was not in a bar somewhere within range of the repeater, I filled them in on what I had been doing since leaving Peterborough. As we spoke to one another across the intervening miles, I imagined their world as it was at that moment: a warm, well-lit, fully-equipped ham shack crowded with friends enjoying themselves. It was very different from the cold, dark world I was in. For a moment, I envied their comfort and comaraderie.

AG1Z was on frequency when I concluded my sked. Willy, an employee of the TV station on the summit of Mt. Washington, volunteered to go next door to the Observatory and get the latest weather forecast for me. It was not good. The forecast called for bitter cold, widely-scattered snow squalls for the next twenty four-hours, and winds gusting to 100 mph. At that moment, it was minus twenty degrees on the summit and winds were gusting to 60 mph. I thanked him, admired his mettle, and then shut down the rig and fell asleep.

Sleep was fragmented and Sunday's dawn came slowly. The orange walls of my tent gradually picked up color as the sun rose behind an icy scrim of fog and blowing snow. I lay awake for a long time in my sleeping bag trying to psych myself up for the inevitable. The hardest part of any winter camping day is leaving a warm sleeping bag and getting into cold clothes, frozen boots, and an icy world. Despite being in my fourteenth hour in my bag, it was easier to lay there pondering the best (and quickest) scenario to follow in getting dressed than to actually get out of the bag and dress.

I snapped on the HT and passed time listening to the idle chatter of other early risers on this frigid New Hampshire Sunday morning. Occasionally, a clipped New England accent would comment on everyone's favorite topic, the weather.

"Ayup Marshall, a might cold here this mahnin. About twenty-five below. Acourse that's on the windy side of the bahn."

As my fellow hams had their second and third cups of coffee, I struggled to get my stove going. Repeated priming finally heated the generator up enough to sustain combustion and soon I too was contemplating the morning's cold over a hot cup of java.

It has snowed heavily during the night and the stubby, frozen shapes here at tree-line were a more appropriate landscape for a hobbit than a ham. The wind-driven snow had sculpted grotesque and beautiful figures during the night as it packed into the scrub growth and pucker brush and fresh drifts covered even the deepest of yesterday's tracks.

Once I was out of my bag, the morning cold kept me moving. Standing in one place for any period of time invited the relentless advance of the cold up through my boots and into my body. To keep warm, I busied myself with breaking camp—a reluctant sleeping bag was forced into its small stuff sack, dirty pots left to freeze were chipped clean of breakfast remnants, and my tent was folded and forced into my pack.

The weather was as forecast. Clouds and blowing snow swirled around me as I wrestled my pack onto my back. As soon as I had it on, the HT I had carefully zipped into a side pocket came alive. N1AHN, a friend I had spoken with the previous day, was calling to check on my progress. John was ten miles away in the village of North Conway. After a short chat with him, I moved off into the storm feeling good that a local was around and interested.

Conditions deteriorated

The winter landscape—more fit for a hobbit than a man.

with each foot of altitude I gained. By the time I was above the last of the scrub, it became obvious to me that I would not be able to continue the traverse. The poor visibility meant that I would be walking compass azimuths on that wild ridge and, should I have to backtrack, would be walking directly into the full force of the wind. Frostbite was a definite possibility and as I stood with my back to the gale, peering down the ridge, I had to remove my metal-frame eyeglasses because they were drawing heat out of my skin so rapidly that my cheeks and temples were losing sensation. My windpants and anorak hood drummed wildly in the wind, and through the tunnel vision of my wool balaclava, I saw a landscape no sane person would inhabit.

I couldn't resist moving a short distance down the ridge and breaking out the HT for a quick test, however. I lifted six distant repeaters from my high point and, as each one came up, I announced that KA1D/portable, Presidential Ridge NH, was listening. Thankfully, no one took the opportunity to chat, and I rapidly retreated toward the relative security below tree line.

While breaking my way down the trail, I managed to raise a friend and let him know of my change in plans. Ken W1NFE was located in Bretton Woods, a small hamlet at the foot of the mountains. We agreed that I would let him know when I was safely back at the trail head. I skied, slid, and slipped the four miles off that ridge thinking of hot showers, hot food, and cold beer. In a few hours, I was down.

The temperature at the trail head was minus fourteen, but it was warm when compared with the cold I'd felt up on the ridge. I flopped my Kelty on the snow and began fumbling through its labyrinthine pockets for my car keys. As I listened for what I thought would be the final time to the ID of the Mt. Washington repeater, it occurred to me that my Kenwood 2400 HT was one of the more reliable companions I have had the pleasure of hiking with. It didn't freeze up and performed well under less than ideal conditions.

Swirling clouds and wind-driven snow on the Presidential Ridge.

Unfortunately, I was not out of the woods once my hike was over. I twisted the key in the ignition and after a few lethargic turnovers, the engine fired to life. I smugly congratulated myself for the care I had taken in tune-up and battery maintenance while I habitually glanced at the oil pressure gauge. My smugness disappeared when I saw it resting on zero. I anxiously let the engine idle for ten seconds, twenty seconds, a long minute. The gauge never moved. Worse still, the tappets were growing gradually noisier. Apparently, my adventure was just beginning. I shut the engine down and sat in the cab with a sick feeling growing in the pit of my stomach. As I went through the mental gymnastics of what could be wrong, the inside of the windows began to frost up, enclosing me in an icy, translucent cave.

I ruminated on the situation for several minutes when that most noble of human traits, blind optimism, took hold. I simply said to myself, "This can't be happening. I'll just start this thing up and all will be well." So, I did and it wasn't. The oil pressure remained zero while the engine clattered away alarmingly. I admitted to myself that I had a problem.

Sitting in the sub-zero interior of a disabled vehicle thirty miles from the nearest garage with night coming on gets old quickly. The images of hot showers and hot food I had conjured up hours earlier on the trail were still fresh in my mind and I resolved to somehow escape the developing debacle. Then it dawned on me: For the first time in nearly twenty years of hamming, I had—if not an emergency—at least a large bummer on my hands which could be minimized by ham radio. I reached for the mobile rig, but before I could turn it on it occurred to me that I should be using the HT instead. This was the kind of situation I had brought it along for in the first place and it seemed fitting to use it to extricate myself now.

My first call was to W1NFE. Ken was the closest and he answered almost immediately. After I gave him a brief description of my problem, he took the situation in hand. A tow truck was reluctantly dispatched—no small accomplishment on a country Sunday afternoon. The cheapest motel in town was alerted to expect an unexpected guest and a few restaurant recommendations soon followed, too.

To say that the village of Twin Mountain was deserted when the tow truck pulled me in is an understatement of considerable proportion. Besides the garage man and me, only a few scroungy dogs roamed the windswept streets. Nothing could be done for the van that night, so I hoofed off toward the motel that Ken had suggested. One other guest was in residence, he too a victim of car trouble. After we commiserated briefly, I made a few phone calls to find all the area restaurants closed. I then went upstairs to settle into the stillness of my room, littering it with layers of damp clothes and thawing wool knee socks while I munched on the remnants of my trail lunch. Then I headed for the shower.

Sitting on the edge of the bed afterwards, flushed with the warmth of a very long shower, I resigned myself to an early and uneventful evening. I lavishly kicked the room's thermostat up another notch and stretched out on the bed waiting for something tolerable to appear on the only channel the rabbit-eared TV would receive. To my amazement, the phone rang.

W1NFE had tracked me down and was calling to invite me to share dinner and spend the evening with him and his family. At that moment, the world suddenly looked brighter. Ken soon arrived and we headed out to dinner in the twenty-below night, listening to the familiar voices on the Mt. Washington repeater. ■

World Class Performance and Features

The FT-ONE is the culmination of an all-out design project by Yaesu's top engineering team. Working without the usual cost constraints, Yaesu's design group is proud to unveil the instrument they "always wanted to design," a revolutionary blend of computer and RF technology.

GENERAL COVERAGE, ALL SOLID STATE

The FT-ONE is a full-coverage all-mode transceiver, equipped for reception on any frequency between 150 kHz and 29.99 MHz, with transmit coverage on all nine present and proposed amateur bands. In countries where permitted, the FT-ONE may be programmed to transmit throughout the 1.8-29.99 MHz range.

KEYBOARD FREQUENCY ENTRY

Fully digitally synthesized, the FT-ONE uses a front panel keyboard for initial frequency entry. Frequency change is then accomplished via the main tuning dial or the pushbutton scanner, with tuning in either 10 Hz or 100 Hz steps possible. Truly the contester's dream, the FT-ONE permits extremely fine tuning and instantaneous band change with equal facility.

DUAL VFO SYSTEM

Ten digital VFO's with memory are provided, in conjunction with an A-B selection scheme that allows instant recall of any transmit, receive, or transceive frequency desired. For split-frequency operation, such as on 7 MHz SSB, the operator may select TX on VFO-A and RX on VFO-B, automatically storing the calling and listening frequencies for each pile-up. For net operations, a non-volatile memory board is available as an option, to eliminate the possibility of dumping memory.

FULL CW BREAK-IN

Recent advances in solid-state technology have finally made full CW break-in reliable enough to be incorporated into a Yaesu product. Now you can select traditional semi-break-in (for use with amplifiers not equipped for full break-in) or full high-speed break-in. When using amplifiers so equipped, the keyer output lead may be interrupted via a rear panel jack and routed to the break-in sequencing input on your amplifier.

SWITCHING REGULATOR POWER SUPPLY

Extremely compact and light in weight, the switching regulator power supply reduces substantially the space required to produce the operating voltages used in the FT-ONE. Highly efficient and uniquely stable, the switching regulator supply provides superb reliability in a field of design long neglected by amateur manufacturers.

ELITE CLASS PERFORMANCE FEATURES

In addition to the full break-in and superb receiver filters, Yaesu's design team packed the FT-ONE with subtle virtues that others might have overlooked. Rear panel jacks allow the use of both an external receiver and an independent receive antenna, such as a 160 meter Beverage. While scanning, automatic halting on a received signal may be programmed. . . perfect for watching a band for openings. If you're a DX-peditioner, an optional Curtis 8044 keyer board is available, so you won't need an external keyer that only wastes suitcase space. And if your amplifier fan is louder than it should be, there's even a microphone squelch (AMGC) to reduce background noise pickup between words and sentences!

ONE YEAR FACTORY WARRANTY

Because of the level of attention to design detail, parts selection, and factory quality control, your FT-ONE is backed by a one-year *factory* warranty for the original purchaser at retail. Prompt and meticulous attention to your warranty needs will be provided by our Ohio And California Service Centers. In addition, all units sold in the United States will be inspected and tested after clearing Customs, and will include a Service Manual in the puchase price.

GAIN/INTERCEPT OPTIMIZED RECEIVER FRONT END

Utilizing up-conversion with a first IF of 73 MHz, the FT-ONE RF amplifier stage uses push-pull power transistors configured to produce a typical output intercept of +40 dBm. The first mixer utilizes a diode ring module followed by a low noise post amp, for optimum noise figure consistent with modern day intercept requirements. The result is a receiver with a typical two-tone dynamic range well in excess of 95 dB (14 MHz, CW bandwidth). Additional gain tailoring is provided via a PIN diode attenuator controlled from the front panel.

FILTERS READY FOR COMPETITION

Three filter bandwidths are available for CW operation (two for FSK!), using optional 600 Hz or 300 Hz crystal filters. Filter insertion losses are equalized for constant IF gain. Both IF Shift and Variable Bandwidth are provided, and two CW filters may be cascaded, for competition-grade selectivity. For SSB work, the Variable Bandwidth feature eliminates the need for costly 1.5 kHz or 1.8 kHz filters, as any intermediate bandwidth may easily be programmed using the standard, cascaded SSB filters. To top it all off, a high-performance audio peak and notch filter is standard equipment.

EXPANDED OPERATING DISPLAYS

Digital displays for the VFO Frequency, memory channel, and RIT offset are provided for quick frequency identification. The large front panel meter provides easy viewing of transceiver operating parameters, including final transistor collector current, input DC voltage, FM discriminator center tuning, speech processor compression level, and forward/reflected relative power.

NOT AVAILABLE AS OPTIONS

It's hard to believe that other manufacturers still insist on making such essential items as a noise blanker or speech processor extra-cost options. We find that these are less expensive to incorporate and more reliable in operation when installed on our assembly line. No AC power supply is available as an option for the FT-ONE, either; it's equipped for operation from 100/110/117/200/220/234 volts AC, or 13.5 volts DC. And it goes without saying that there will not be an external VFO offered for the FT-ONE — we're confident that ten VFO's are quite enough!

Experience the FT-ONE in your Authorized Yaesu Dealer's showroom today.
This may be the last Amateur transceiver you will ever own. ↩83

Warranty policy available upon request. SASE, please.

Specifications subject to change without notice or obligation.

FT-ONE

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Paul S. Grupp KA1LR
73 Magazine *Staff*

The Rex Bassett TLM-2 Mobile Mount

—banish your fear of flying

The Rex Bassett TLM-2 mobile mount, with a VAC-20 antenna.

HF mobile operation is near and dear to my heart, and I am always in search of better ways to cope with the necessarily large and bulky equipment. One of the biggest problems seems to be mounting the antenna. Whether you use the ubiquitous Hustler system, the Rex Bassett antennas, or motorized wonders like Cubic's, you need something to mount it on that will support the considerable load the antenna presents while motoring down the highway. The mounts offered by the manufacturers are rarely confidence-inspiring. Mechanical integrity and protection of the coax connection are the primary areas that need attention.

The TLM-2 mount from Rex Bassett solves the problems in both areas, as long as your antenna fits a standard 3/8-24 mount. Best of all, it doesn't require a band around the bumper (which won't fit many small cars). The mount resembles an inverted teacup, with a thick gray finish applied. All hardware exposed to the elements is stainless steel. On the bottom of the mount is a threaded SO-239 connector. A single hole is drilled through the bumper or rear deck, and the mount is screwed down with hefty hardware and a thick rubber washer. Once installed, this mount isn't going anywhere—it's rock solid! The SO-239 connector on the other side of the mounting surface is also an important advance. If you mount the antenna on the rear deck of your car, problems with water-logged coax are a thing of the past. Installed on the bumper, the coax will need some sort of protection from the elements. I have used Coax-Seal (available at most dealers) with great success.

Rex Bassett's antenna products have acquired a reputation for intelligent design and rugged durability. The TLM-2 mount continues that tradition. For more information, contact *Rex Bassett Electronics, Inc., 1633 N.E. 14th Avenue, Fort Lauderdale FL 33305.* Reader Service number 476.■

Reader Service for facing page ←81→

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- The ten channel memory is easily addressable and you have two banks of five channels each. You can even use both banks at once for odd splits.
- Standard 600 hz shift up or down. Band scan or memory scan. Memory scan is easy. There is also band scan with upper and lower limits you can choose yourself!
- Built in nicads for the memory retention which has drain in nano-amps, not milli-amps. The internal battery will hold the memory for up to one year! No other radio offers you this feature.
- Fast and easy dialing. Full solid state dialing and you can choose from the front panel either a fast or slow dial rate.
- No relays are used, only solid state switching. This eliminates a trouble spot many radios encounter.
- KDK has also eliminated another trouble spot by completely hand wiring each radio. No internal plugs to become intermittant and no wire wraps either, just good solid wiring.
- KDK gives you one of the hottest receivers you can find. By using UHF (not VHF) dual gate MOS-FETs with electronic auto tuning for the RF amplifier and the first mixer, you have a combination of ultra sensitivity and maximum quietness.
- The audio output stage in the 2025A Mk II uses an integrated circuit which has internal protection against over-voltage and shorted output conditions. Plus it is a high audio output chip – just what you need in a noisy mobile situation.
- The transmitter uses direct VCO varicap modulation for true FM. Your transmitted audio sounds as it should; crisp, clear and natural.
- The power output stage of the 2025A Mk II will not break down even with an infinite VSWR load, and uses heavy duty solid state antenna switching with a four stage low pass filter. All this gives you an exceptionally clean, spur free output.
- KDK has included an adjustable sub audible tone circuit which can also be used for CTCSS or tone burst on transmit. Again, more features!
- Size is 2 7/10" high – 7 1/8" wide – 9 1/2" deep.
- You can switch from 25 watts to 3 watts low power.
- And, of course, the DC cable is included along with the microphone and mobile mounting bracket.

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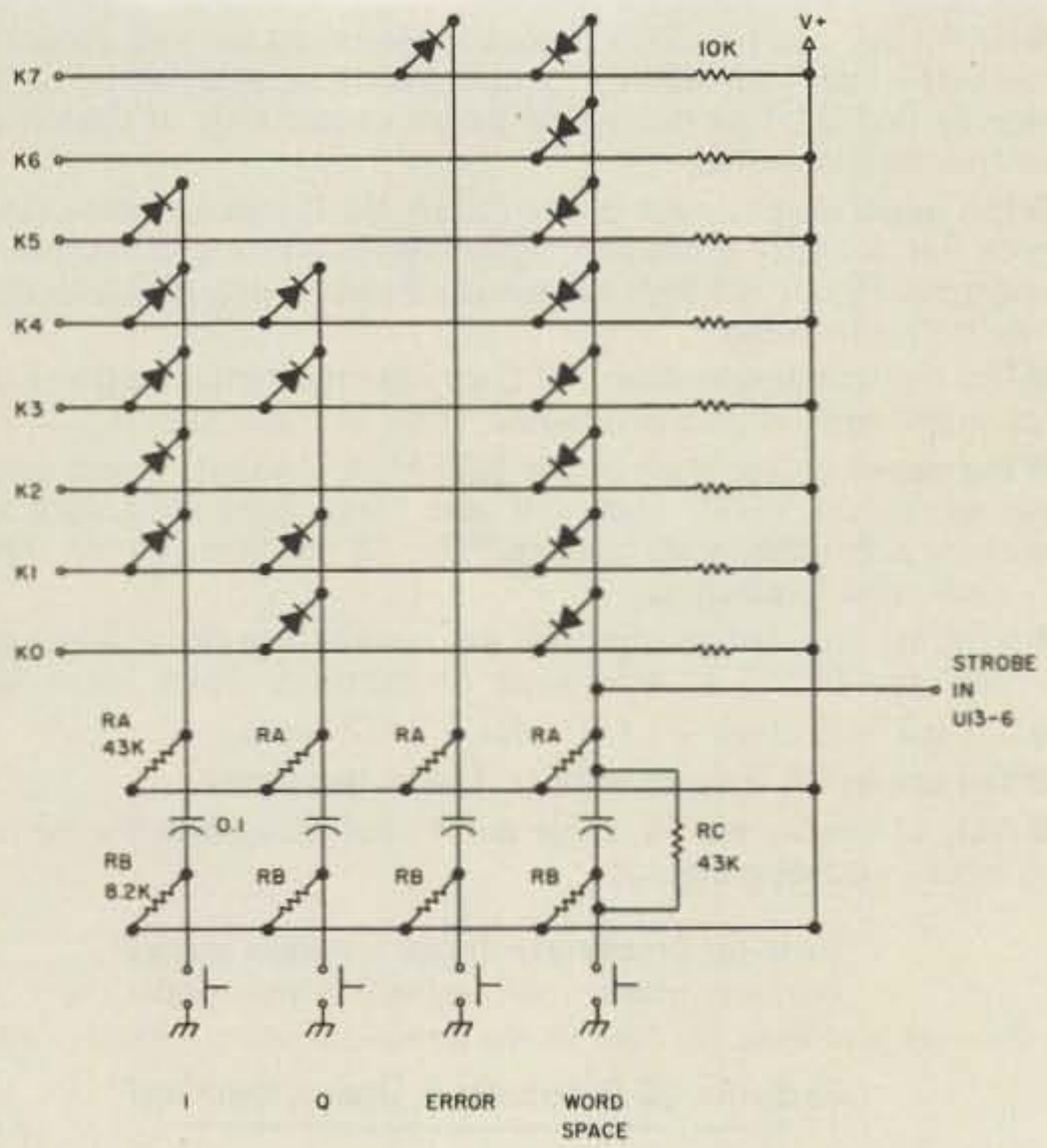

Fig. 1. Wiring diagram for modified diode matrix. R_A and R_B values are not critical; however, a large deviation will cause erratic operation. R_C prevents truncated characters should other keys be struck while the space bar is down. Resistors—¼W; diodes—1N914/1N4148; capacitors—0.1 disc.

Considering operational features versus IC count, cost, and ease of construction, the Morse keyboard designed by Crom WB9WRE is one of the best keyboard bargains available (*73 Magazine*, February, 1979, p. 84). The author suggests several options, and the design readily accommodates others. One such option, to make typing easier, is described in this article.

I found the basic keyboard awkward to operate because of the key-interlock feature which disables all other keys while one is depressed. Although other keys may be struck, nothing will come out—and that was my problem: striking the next key too soon resulted in omitted characters.

The answer is n-key rollover. With n-key rollover, second, third, etc., keys may be struck while the first and/or succeeding keys are still held down, yet code will go out in perfect sequence (the capability exceeds the demand).

The technique used by Horowitz W1HFA for his Compucoder (*QST*, June, 1975), two resistors and one capacitor in each keyswitch lead, was adapted for this modification, as shown in Fig. 1. Essentially, the functional difference between the original WB9WRE diode matrix and the modified one is the duration of the key-switch input. The static, or rest, condition of data buses K0-K7 and the strobe input is high in both cases. When a key is struck, diodes in the key-switch line take selected data buses low to form the 8-bit binary code representing the character keyed. One or more of the low data buses take the strobe input

Here's a Concept You Haven't Seen In Amateur Radio For A Long Time— Low Price.

The right design — for all the right reasons. In setting forth design parameters for ARGOSY, Ten-Tec engineers pursued the goal of giving amateurs a rig with the right features at a price that stops the amateur radio price spiral.

The result is a unique new transceiver with selectable power levels (convertible from 10 watts to 100 watts at the flick of a switch), a rig with the right bands (80 through 10 meters including the new 30 meter band), a rig with the right operational features plus the right options, and the right price for today's economy—just $549.

Low power or high power, ARGOSY has it. Now you can enjoy the sport and challenge of QRPp operating, and, when you need it, the power to stand up to the crowds in QRM and poor band conditions. Just flip a switch to move from true QRPp power with the correct bias voltages to a full 100 watt input.

New analog readout design. Fast, easy, reliable, and efficient. The modern new readout on the ARGOSY is a mechanical design that instantly gives you all significant figures of any frequency. Right down to five figures (± 2 kHz). The band switch indicates the first two figures (MHz), the linear scale with lighted red bar-pointer indicates the third figure (hundreds) and the tuning knob skirt gives you the fourth and fifth figures (tens and units). Easy. And efficient—so battery operation is easily achieved.

The right receiver features. ***Sensitivity*** of 0.3 μV for 10 dB S+N/N. ***Selectivity:*** the standard 4-pole crystal filter has 2.5 kHz bandwidth and a 2.7:1 shape factor at 6/50 dB. Other cw and ssb filters are available as options, see below. I-f frequency is 9 MHz, i-f rejection 60 dB. ***Offset tuning*** is ± 3 kHz with a detent zero position in the center. ***Built-in notch filter*** has a better than 50 dB rejection notch, tunable from 200 Hz to 3.5 kHz. An optional noise blanker of the i-f type has 50 dB blanking range. ***Built-in speaker*** is powered by low-distortion audio (less than 2% THD)

New TEN-TEC Argosy $549

The right transmitter features. ***Frequency coverage*** from 80 through 10 meters, including the new 30 meter band, in nine 500 kHz segments (four segments for 10 meters), with approximately 40 kHz VFO overrun on each band edge. ***Convertible power:*** 100 or 10 watts input with 100% duty cycle for up to 20 minutes on all bands. ***3-function meter*** shows forward peak power on transmit, SWR, and received signal strength. ***PTT*** on ssb, ***full break-in*** on cw. PIN diode antenna switch. ***Built-in cw sidetone*** with variable pitch and volume. ***ALC control*** on "high" power only where needed, with LED indicator. ***Automatic*** normal sideband selection plus reverse. ***Normal 12-14V dc*** operation plus ac operation with optional power supply.

The right styling, the right size. Easy-to-use controls, fast-action push buttons, all located on raised front panel sections. New meter with lighted, easy-to-read scales. Rigid steel chassis, molded front panel with matching aluminum top, bottom and back. Stainless steel tilt-up bail. And it's only 4" high by 9½" wide by 12" deep (bail not extended) to go anywhere, fit anywhere at home, in the field, car, plane or boat.

The right accessories—all front-panel switchable. Model 220 2.4 kHz 8-pole ssb filter $55; Model 218 1.8 kHz 8 pole ssb filter $55; Model 217 500 Hz cw filter $55; Model 219 250 Hz cw filter $55; Model 224 Audio cw filter $34; Model 223 Noise blanker $34; Model 226 internal Calibrator $39; Model 1125 Dc circuit breaker $15; Model 225 117/230V ac power supply $129; Model 222 mobile mount, $25; Model 1126 linear switching kit, $15.

Model 525 ARGOSY —— $549. Make the right choice, ARGOSY—for the right reasons ***and*** low price. See your TEN-TEC dealer or write.

TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862

low, firing the strobe which loads the FIFO.

The work of the keyswitch is now complete. In the original version, the keyswitch provides a direct ground which retains the 8-bit code on the data buses and holds the strobe input low, preventing reset until the key is released. Conversely, there is no direct ground path in the modified version. The keyswitch discharges the capacitor, sending a negative-going pulse to form the 8-bit code and trigger the strobe. When the negative-going pulse is complete, the data buses and the strobe input revert to the static (high) state and are ready for the next keystroke. The depressed key is inert until released; after release, the capacitor recharges and the key may be used again (there is no discernible delay).

Foolproof key debouncing is a bonus feature of this modification. The keyswitch panels I used were removed from old computer terminals that had individual magnetic reed-switch modules mounted on rails. Some of the switches, outwardly identical to all others but used for special or dual functions, caused sporadic character iterations. I tried numerous strobe pulse widths, and even a 555 wired as a one-shot, without result. A partial cure, effective for some but not for all of the aberrant keys, was finally achieved using capacitor conditioning on the strobe-input line. These keying anomalies completely disappeared after the keyboard was modified.

With due respect to WB9WRE, it's a matter of opinion whether his—or any other—keyboard makes CW music; some would say that only a bug in the hands of an expert can do that! Music or not, this keyboard will play a better tune after this simple modification.■

Photo A. Aluminum angle stock bolted to the sides supports aluminum top, bottom, and rear panels. The top was painted with epoxy spray enamel; clear epoxy protects the transfer lettering on the keys and controls. The digital display is for the QRQ, QRS digital speed indicator. (See article by W7BBX, 73 Magazine, June, 1980, p. 50).

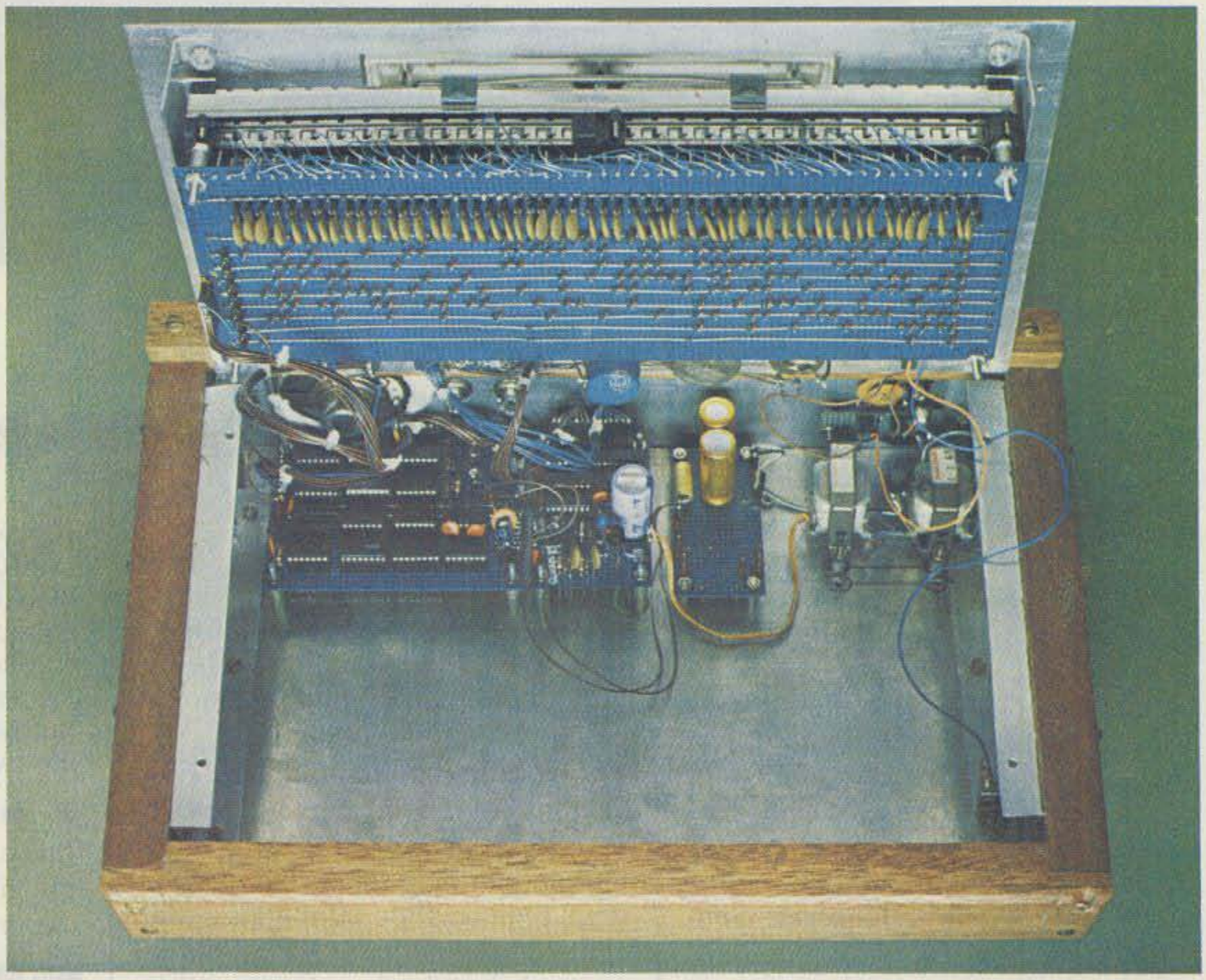

Photo B. The n-key rollover components are at the top of the diode matrix. Vector T-44 Miniwrap posts are used to support the data buses and to terminate keyswitch leads. The keyboard logic, speed meter, and regulator boards are below. All interconnections are made with single row headers.

Reader Service for facing page ↙54→

BAUDOT • ASCII
SPLIT SCREEN • MORSE
CODE • SSTV GRAPHICS
BUILT-IN DEMODULATOR
ADVANCED OPERATING FEATURES

This terminal has it all in one compact package at one low price.

THE ROBOT 800 SPECIALTY MODE TERMINAL.

If you have been shopping around for RTTY equipment, you probably have asked yourself: "How can I get high performance, multiple-mode capabilities without spending a fortune?" Robot Research has answered this question through the use of microprocessor technology. The Model 800 is the most complete specialty mode terminal ever offered for under $1000; yet it has features and performance capabilities which put it in the class of systems costing twice this amount or more! All that's needed to have a complete operating system is the addition of a standard TV monitor.

HOW DID WE DO IT?

The most advanced RTTY systems on the market are designed for multiple applications. As a result, these systems are burdened with exotic features which are seldom used on amateur radio. These "features" add to the cost, complicate operation, and in some cases even compromise performance!

The 800 does not attempt to double as a hobby computer, or a time-share terminal. It was designed expressly for use as a specialty mode communcations terminal for amateur radio, and nothing else! By focusing our attention on this simple concept, we are able to provide a product which works better, costs less, and is easier to operate than those systems which try to do "everything" and end up doing nothing very well.

ONE EXAMPLE:

The single most important factor which affects RTTY receive performance is the quality of the demodulator. In the 800, we do not allow for a wide variety of shift frequencies through the use of tuneable filters. There are only two shifts which are used in amateur RTTY, and tuneable discriminator filters are both expensive and are poor in performance. The 800 uses separate mark and space discriminator filters for each of these two shifts which are precisely tuned at our factory. Even though the center frequency for the mark filter is the same for both wide and narrow shifts, the bandwidth is different and therefore requires separate filters. By giving careful attention to these details, we can equal or exceed the performance found only in expensive stand-alone terminal units.

WHAT ABOUT FEATURES?

The Model 800 has all of the advanced operating features such as split-screen, word and line editing, message memories, autostart, SELCOM, and many others. In addition, the 800 has a complete set of operating aids such as an on-screen status line, graphic tuning indicator, and a side-tone oscillator. To get a complete picture of all of the features which the 800 offers, we suggest that you contact us for a full-color brochure, or visit one of our dealers for a demonstration.

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WILSON SYSTEMS TOWERS

— FACTORY DIRECT —

FACTORY DIRECT $1174.95

ST-77B Features:

Max. Height: 77′
Min. Height: 24′
Weight: 700 lbs.
Winch: 1500 lbs.
Cable: 6400 lbs.
Requires RB-77B & will be totally freestanding

Recommended Rotor: High Gain Roto-Brake

FACTORY DIRECT $674.95

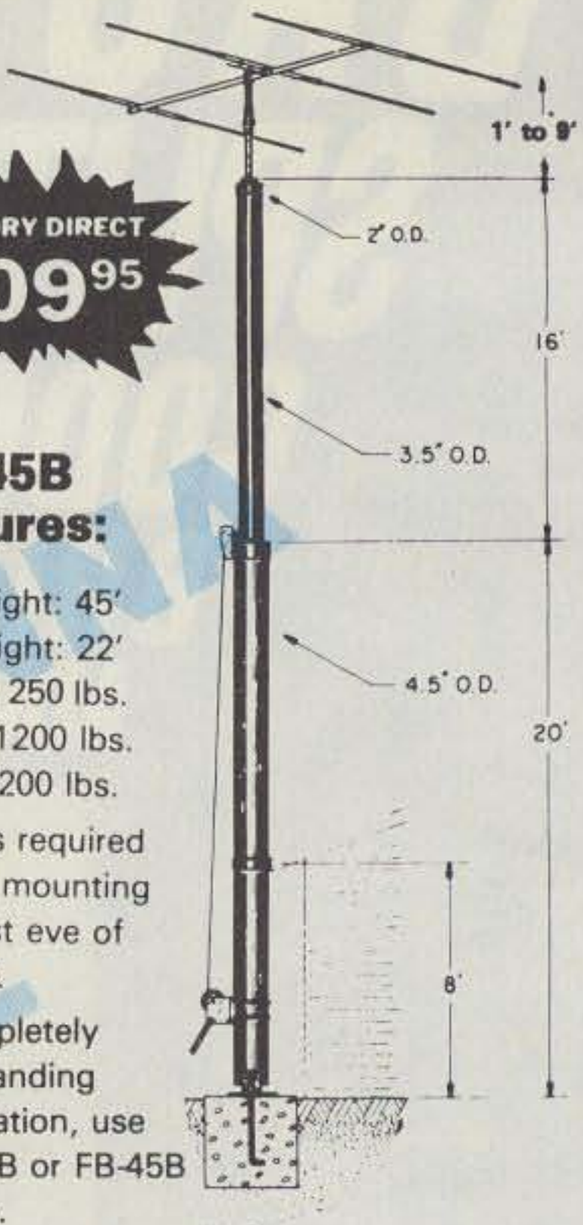
MT-61B Features:

Max. Height: 61′
Min. Height: 23′
Weight: 450 lbs.
Winch: 1200 lbs.
Cable: 4200 lbs.
No Guys required when mounting against house.
For completely freestanding installation, use RB-61B or FB-61B below.

FACTORY DIRECT $409.95

TT-45B Features:

Max Height: 45′
Min. Height: 22′
Weight: 250 lbs.
Winch: 1200 lbs.
Cable: 4200 lbs.
No Guys required when mounting against eve of house.
For completely freestanding installation, use RB-45B or FB-45B below.



WIND LOADING			
Tower	Height	Sq. Ft.	
ST-77B	69	16	Square Footage Based on 50 MPH Wind
	77	10	
MT-61B	53	18	
	61	12	
TT-45B	37	18	
	45	12	

BASE CHART		
TOWER	WIDTH	DEPTH
TT-45B	12″ x 12″	30″
FB-45B	30″ x 30″	4½′
RB-45B	30″ x 30″	4½′
MT-61B	18″ x 18″	4′
FB-61B	3′ x 3′	5½′
RB-61B	3′ x 3′	5½′
ST-77B	See Below	Bases
RB-77B	3½′ x 3½′	6′

Wilson Systems uses a high strength carbon steel tube manufactured especially for Wilson Systems. It is 25% stronger than conventional pipe. The tubing size used is 2″ & 3½″ -.095; 4½″ & 6″ -, 8″ -.134. All tubing is cold dip galvanized. Top section is 2″ O.D. for proper rotor and antenna mounting.

The TT-45B and MT-61B come complete with house bracket and hinged base plate for against-house mounting. For totally freestanding installation, use either of the tilt-over bases shown below.

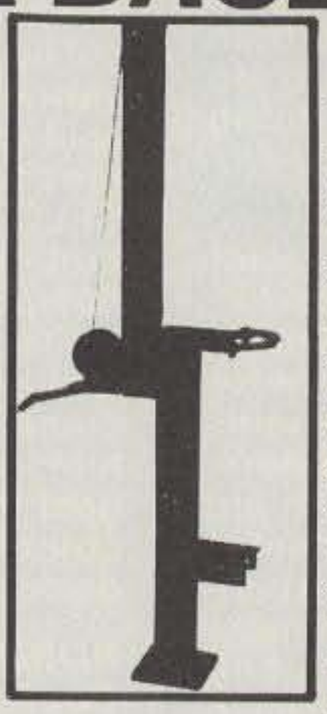
The ST-77B cannot be mounted against the house and must be used with the rotating tilt-over base RB-77B shown below.

TILT-OVER BASES FOR TOWERS

FIXED BASE

The FB Series was designed to provide an economical method of moving the tower away from the house. It will support the tower in a completely free-standing vertical position, while also having the capabilities of tilting the tower over to provide an easy access to the antenna. The rotor mounts at the top of the tower in the conventional manner, and will not rotate the complete tower.

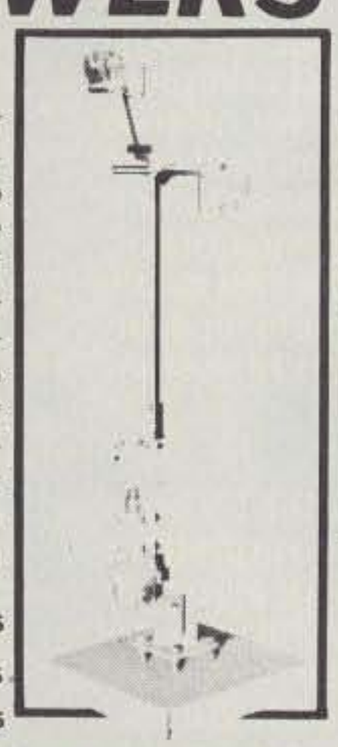
FB-45B.. 112 lbs... $209.95
FB-61B.. 169 lbs... $299.95



ROTATING BASE

The RB Series was designed for the Amateur who wants the added convenience of being able to work on the rotor from the ground position. This series of bases will give that ease plus rotate the complete tower and antenna system by the use of a heavy duty thrust bearing at the base of the tower mounting position, while still being able to tilt the tower over when desiring to make changes on the antenna system.

RB-45B.. 144 lbs... $289.95
RB-61B.. 229 lbs... $379.95
RB-77B.. 300 lbs... $569.95



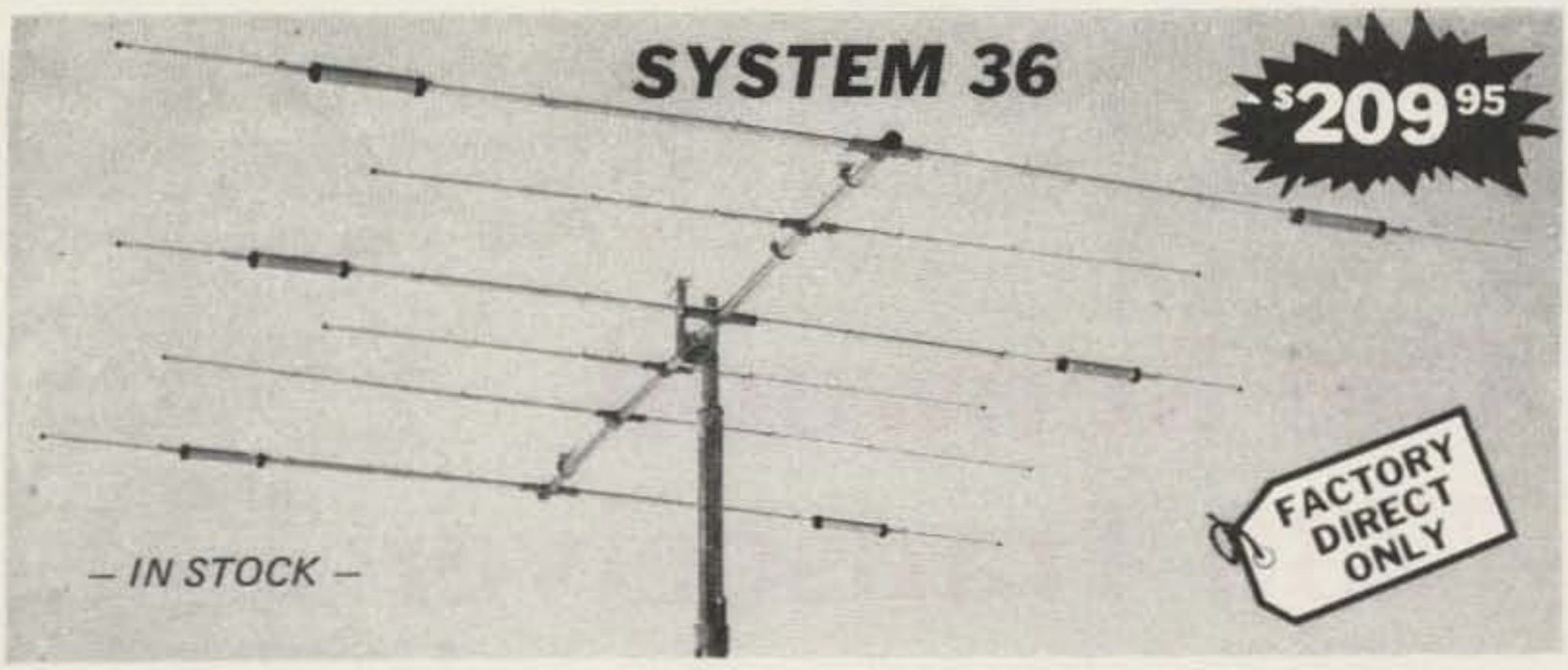
Tilting the tower over is a one-man task with the Wilson bases. (Shown above is the RB-61B. Rotor is not included.)

ORDER FACTORY DIRECT 1-800-634-6898

Prices Effective 9-1-81 thru 9-30-81
Specifications Subject to Change Without Notice

WSI WILSON SYSTEMS, INC.
4286 S. Polaris Ave., Las Vegas, Nevada 89103

WILSON SYSTEMS INC. MULTI-BAND ANTENNAS



A trap loaded antenna that performs like a monobander! That's the characteristic of this six element three band beam. Through the use of wide spacing and interlacing of elements, the following is possible: three active elements on 20, three active elements on 15 and four active elements on 10 meters. No need to run separate coax feed lines for each band, as the bandswitching is automatically made via the High-Q Wilson traps. Designed to handle the maximum legal power, the traps are capped at each end to provide a weather-proof seal against rain and dust. The special High-Q traps are the strongest available in the industry today.

SPECIFICATIONS

Band MHz	14-21-28	Boom (O.D. x Length)	2" x 24' 2½"	Wind Loading @ 80 mph	215 lbs.
Maximum power input	Legal Limit	No. of Elements	6	Maximum wind survival	100 mph
Gain (dBd)	Up to 9 dB	Longest Element	28' 2½"	Feed method	Coaxial Balun (supplied)
VSWR @ resonance	1.3:1	Turning Radius	18'6"		
Impedance	50 ohm	Maximum mast diameter	2"	Assembled weight (approx)	53 lbs.
F/B Ratio	20 dB or better	Surface area	8.6 sq. ft.	Shipping weight (approx)	62 lbs.

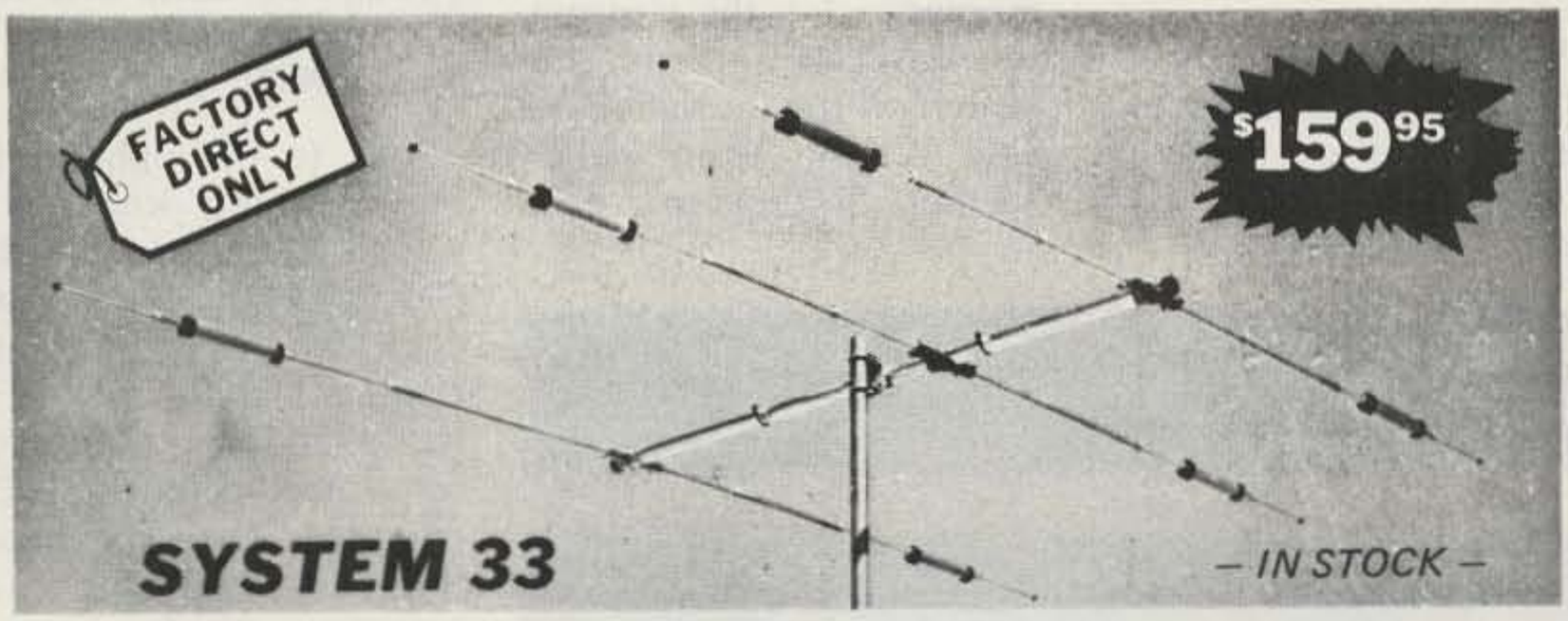
NEW!

ADD 40 OR 30 METERS TO YOUR TRI-BAND WITH THE NEW 33-6 MK

$59.95

– IN STOCK –

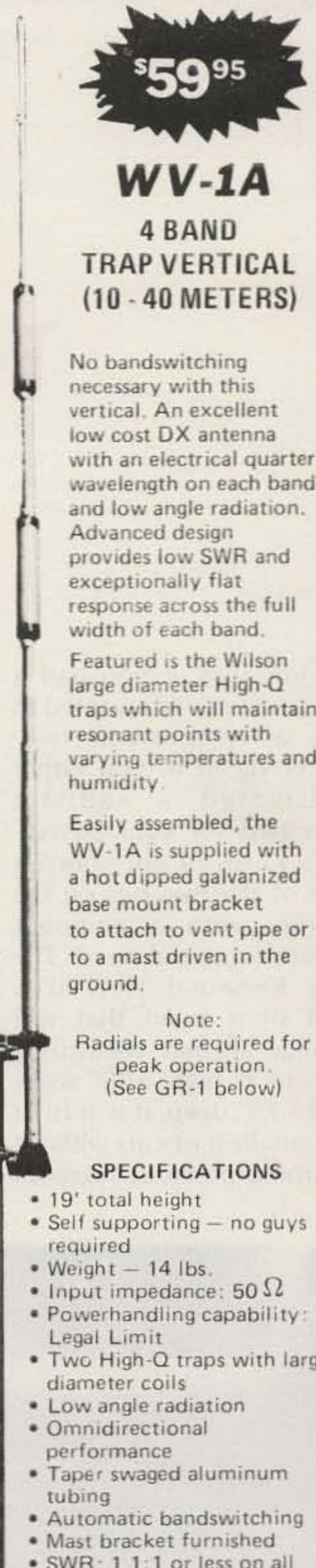
Now you can have the capabilities of 40-meter or 30 meter operation on the System 36 and System 33. Using the same type high quality traps, the new addition will offer 200 HKZ of bandwidth at less than 2:1 SWR. The new 33-6 MK will fit your present SY36 or SY33, and using the same single feed line.



Capable of handling the Legal Limit, the "SYSTEM 33" is the finest compact tri-bander available to the amateur. Designed and produced by one of the world's largest antenna manufacturers, the traditional quality of workmanship and materials excells with the "SYSTEM 33". New boom-to-element mount consists of two 1/8" thick formed aluminum plates that will provide more clamping and holding strength to prevent element misalignment. Superior clamping power is obtained with the use of a rugged 1/4" thick aluminum plate for boom to mast mounting. The use of large diameter High-Q traps in the "SYSTEM 33" makes it a high performing tri-bander and at a very economical price. A complete step-by-step illustrated instruction manual guides you to easy assembly and the lightweight antenna makes installation of the "SYSTEM 33" quick and simple.

SPECIFICATIONS

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



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WV-1A

4 BAND TRAP VERTICAL (10 - 40 METERS)

No bandswitching necessary with this vertical. An excellent low cost DX antenna with an electrical quarter wavelength on each band and low angle radiation. Advanced design provides low SWR and exceptionally flat response across the full width of each band.

Featured is the Wilson large diameter High-Q traps which will maintain resonant points with varying temperatures and humidity.

Easily assembled, the WV-1A is supplied with a hot dipped galvanized base mount bracket to attach to vent pipe or to a mast driven in the ground.

Note:
Radials are required for peak operation.
(See GR-1 below)

SPECIFICATIONS

- 19' total height
- Self supporting – no guys required
- Weight – 14 lbs.
- Input impedance: 50 Ω
- Powerhandling capability: Legal Limit
- Two High-Q traps with large diameter coils
- Low angle radiation
- Omnidirectional performance
- Taper swaged aluminum tubing
- Automatic bandswitching
- Mast bracket furnished
- SWR: 1.1:1 or less on all bands

GR-1

$14.95

The GR-1 is the complete ground radial kit for the WV-1A. It consists of: 150' of 7/14 stranded aluminum wire and heavy duty egg insulators, instructions. The GR-1 will increase the efficiency of the GR-1 by providing the correct counterpoise.

WILSON SYSTEMS, INC.

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Paul Grupp KA1LR
73 Magazine Staff

The Kenwood TR-7730 Transceiver
—let's get small!

Time was, if you had a small car and wanted to put a synthesized two-meter rig in it, you either cultivated a sadistic disregard for your passenger's knees or got yourself one of the two rigs on the market with a compact separate control head. The new Kenwood TR-7730 is part of a trend that will change all that. Measuring a mere 2" high, 5.75" wide, and 7.75" deep, it will fit in the smallest of cars without usurping precious legroom and is even compact enough to fit in the extra radio slot located in the console of many newer cars. One might suppose that a great deal was sacrificed to cram everything into such a small package. Surprisingly, this is not the case. Without further ado, let's take a tour of what the TR-7730 has to offer.

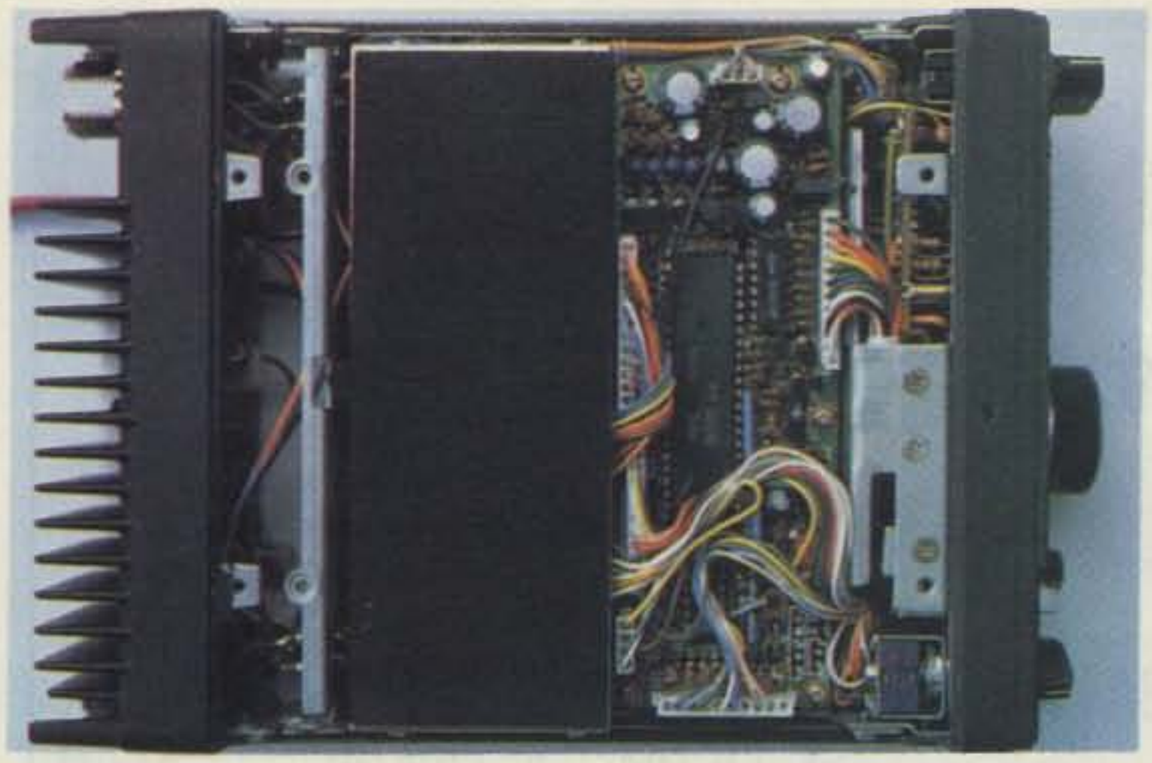
The Features

Starting in the upper left-hand corner of the front panel, we find the memory channel selector and two square push-buttons—one marked "M" and the other marked "MR". The "M" button loads the frequency shown on the digital display into one of the five memories. This frequency can later be recalled by pressing the "MR" button and choosing the desired position on the rotary selector. On memories 1-4, the transmitter offset is set with the switch on the far right-hand side of the front panel. Memory 5 programs both transmit and receive frequencies, allowing access to repeaters using non-standard splits.

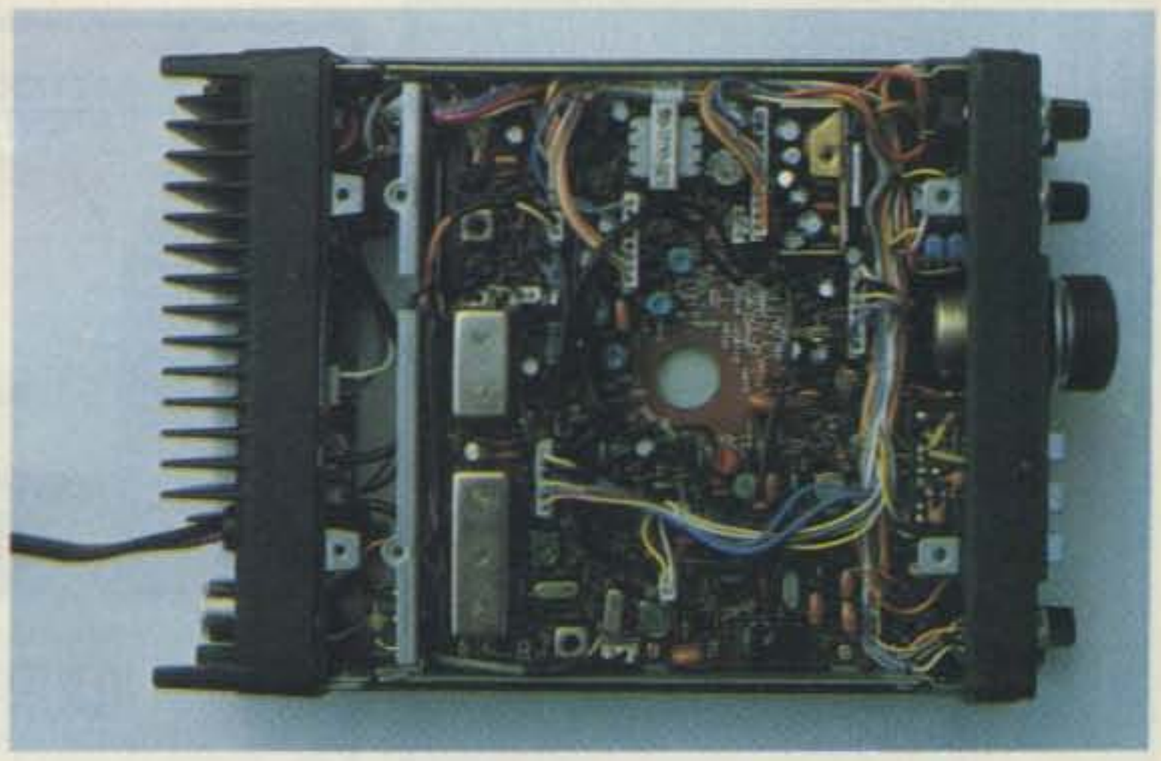
Beneath the memory controls are the combination power switch and volume control and the squelch. Directly to the right of these is the main tuning knob, which steps through the band in a similar manner to the knob on the TR-9000.

Just to the right of the main tuning knob is a switch which selects either 5- or 10-kHz steps with each click of the main tuning knob, a high/low power selector, and an on/off switch for a user-installed CTCSS encoder. Directly above these are three switches associated with the scanning circuitry. Pressing the "Scan" switch starts the 7730 scanning up the band. It will stop on any signal that breaks the squelch and resume scanning when the signal drops. If you hold down the scan button continuously, the rig scans at twice the normal rate. If you wish to remain on a frequency, press the PTT switch on the mike or the "Hold" button on the front panel. Pressing the "MS" switch scans the five frequencies programmed into

The Kenwood TR-7730.



Top view of the Kenwood TR-7730.



Bottom view of the Kenwood TR-7730.

the memories. The scan and hold switches work in both the band- and memory-scanning modes. The up/down switches on the microphone function only in the band-scanning mode.

All displays are of the LED variety. There is a bar-graph S/rf-meter similiar to that on the TR-7800, although the display on the TR-7730 seems to be less prone to flickering. Above this are three LEDs. The one on the far right lights to indicate that a repeater offset has been selected, the middle when the unit is transmitting, and the left when a signal that breaks the squelch is present. To the left of this is the main frequency display.

Most of the rear panel is dedicated to a heat sink for the final amplifier. In a cluster on the left side are the antenna connector, power cable, speaker jack, and a three-prong jack for a memory backup power supply.

Big Rig Performance

Kenwood wisely avoided compromise in the rf stages in their down-sized rig. The transmitter and receiver stages are strikingly similar to those in the TR-7800. Space was saved by shrinking the control circuitry, replacing some discrete components in the audio chain with ICs, and simplifying the final stage. Specifications are virtually identical for the two rigs. Sensitivity is rated at better than .5 uV for 30 dB S/N. Selectivity is spec'd at 12 kHz at 6 dB down and 25 kHz at the −60-dB point. In the high-power mode, our unit exceeded its rated 25 Watts at all frequencies between 144 and 148 MHz. Output in the low-power position is continuously adjustable, making it easy to match the rig to amplifiers requiring only 10 Watts or so of drive. As with most commercial rigs, the deviation level was set slightly high for the close-talking most hams use to improve signal to noise in a car, but was easily readjusted.

In actual use, the TR-7730 is a champ. It worked perfectly the moment it came out of the box. Both transmit and receive audio have the usual Kenwood characteristics—high fidelity with no sacrifice of intelligibility. The squelch is extremely sensitive and seems to latch up resolutely, without the mushiness encountered on many rigs. The controls are thoughtfully shaped and located—most of us should have no trouble putting the TR-7730 through its paces in a dark moving vehicle. The bar-graph S-meter, which first struck me as being a gimmick of questionable utility, turned out to be extremely useful. It's a lot easier to read at a glance than a D'Arsonval movement.

The only thing more enjoyable than using this rig is deciding where to install it! It's so small that the possibilities are almost endless. After considerable debate, I removed the AM radio from my Dodge Colt's dashboard and cut away the plastic faceplate with a fine-toothed saw and a couple of files. I didn't know whether or not the rig would actually fit until the faceplate was completely cut away. Behind the dash I found two metal braces, offering plenty of support. The fit is so tight that I didn't have to screw the rig down. I connected the remote speaker jack to the in-dash speakers supplied with the car.

Not for the squeamish, an in-dash or console installation can nevertheless be extremely satisfying. I used to enjoy having my car look like a mobile NASA control center, with rigs hanging everywhere, but I get even more pleasure from the clean setup I now have. If you decide to try an in-dash installation, just be sure that there is plenty of air circulation available. Inadequate cooling can kill a rig.

I used the Kenwood MC-46 DTMF mike, and I must admit I have a love/hate relationship with it. On the plus side, it has all 16 tones, which is useful, and the audio quality of the condensor mike element is unquestionably superior to the mike packed with the rig. On the negative side of the ledger, the mike is small! It took me a couple of days to learn how to handles it without inadvertently pushing one of the buttons on the pad. The hang-up hook resembles those on other microphones I own, but it is slightly smaller, so it won't stay put in either of the mike holders in my car. The small size no longer bothers me, but I am still looking for something to hang the mike on when I am not using it. My advice is to check out the mike carefully before buying, and if it seems too small to cope with, pick up a Kenwood MC-45. You'll need to rewire the mike connector, but the 45 is a solid, full-sized microphone, sure to please the most ham-handed ham! The MC-46 has some nice features, though, and is probably well worth the effort required to get used to it.

Nothing is perfect, of course, and the TR-7730 is no exception. I found three relatively minor things I would like to see improved. First, the main frequency display is anything but easy to read. No doubt the location I chose for the rig

Continued on page 196

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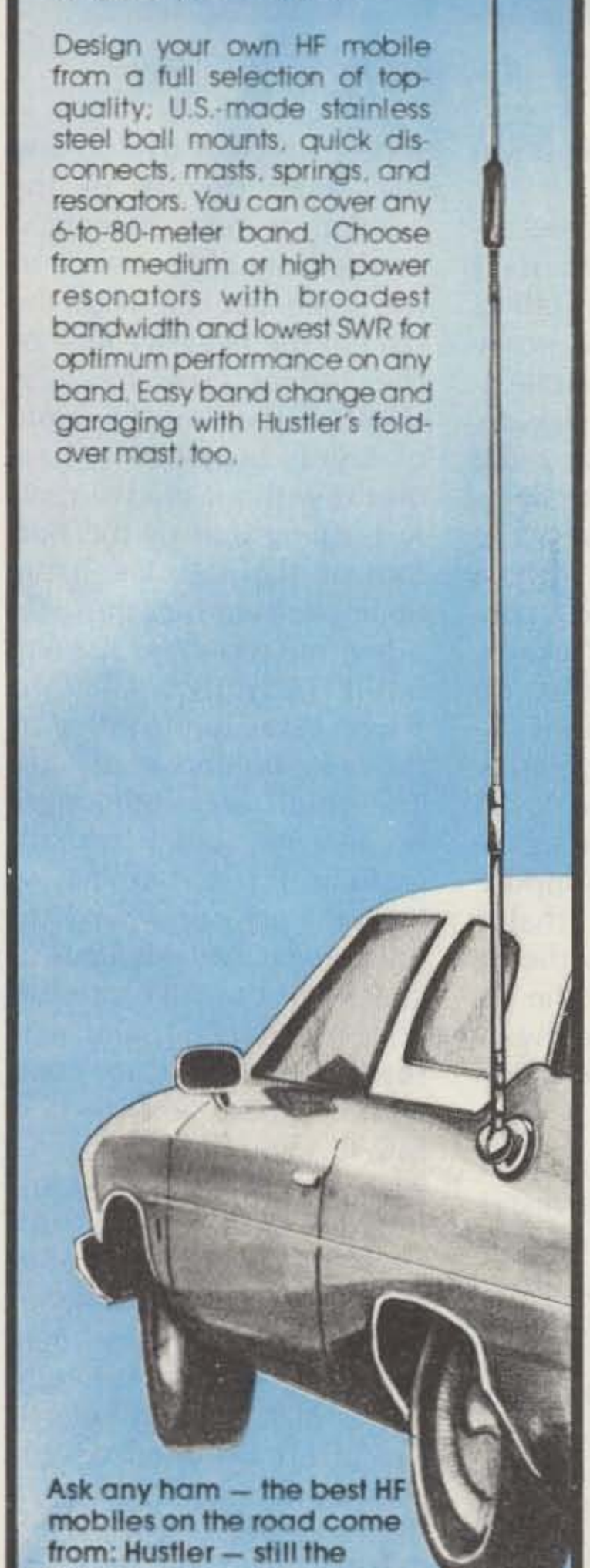

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Mini-coax	19¢/ft
Alliance HD73 Rotor	109.95

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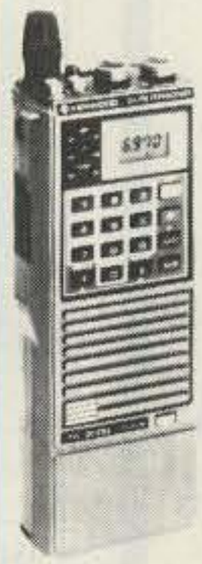

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DONS CORNER

Our service men note the new rigs coming out, and they are plentiful. Seem to be almost failure proof the first leap out of the factory. The design is better. Quality-control seems to preclude the old warning "wait until a few get out" before purchasing; plus, the dealers seem to be getting better service info feedback from the factory, faster than ever.

Word of Advice: Buy from a dealer that is **AUTHORIZED** or can guarantee you local service. Don't get stuck with a unit that "must be factory repaired" unless that factory so stipulates. This month's best buy - Alpha Amps at cheaper than ever prices.

Try our Service Department — you'll like it! Five People: One Tech for KWM380's only; one for digital equipment; one for tube sets; one for older Collins/Drake; one for general repair - odds and ends that you don't want to do. CALL US! Least we can do is tell you whether to put it on the shelf or send it to us.

See you next month!

P.S. Turns out Tang (our spy in Japan) was snortin' Saki when he reported on the Kenwood TS-840. It flat doesn't exist, never has, never will. I put him on probation.

KWM 380
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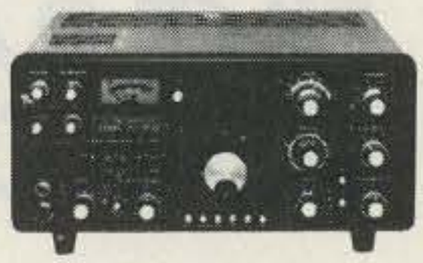

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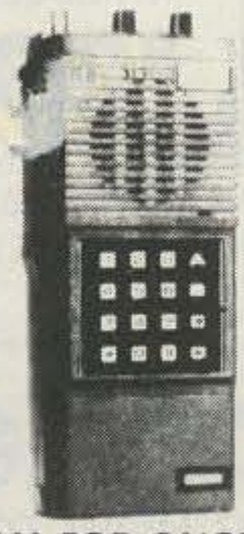

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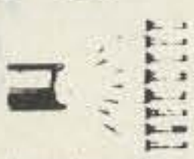
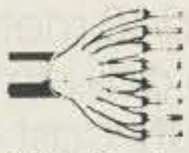
BELDEN

	Part Number	MHz	db 100 ft	db 100 m
RG8/u Dbl Shield	9888 65 ¢/ft.	50	1.2	3.9
		100	1.8	5.9
		200	2.6	8.5
		300	3.3	10.8
		400	3.8	12.5
RG8/u Foam 81VF	8214 36 ¢/ft.	50	1.2	3.9
		100	1.8	5.9
		200	2.6	8.5
		300	3.3	10.8
		400	3.8	12.5
RG8/u Regular 66VF	8237 32 ¢/ft.	100	2.4	8.0
		200	3.6	9.8
		400	4.7	15.4
		900	7.8	25.6
RG 213 Non-contaminating	8267 43 ¢/ft.	100	2.4	8.0
		200	3.6	9.8
		400	4.7	15.4
		900	7.8	25.6



8448 27 ¢/ft.

No. of Cond — 8
AWG (in mm)
6 22 (7 - 30)
2 18 (16 - 30) (1.19)



9405 45 ¢/ft.

No. of Cond — 8
AWG (in mm) —
2 16 (26 - 30)
6 18 (16 - 30) (1.17)

Belden Mini RG-8 (9258)-19¢/ft.

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- SIZE: Unbelievable! Only 6¾" by 2⅜" by 9¾". COMPARE!
- MICROCOMPUTER CONTROL: All frequency control is carried out by a microcomputer.
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- PUSHBUTTON FREQUENCY CONTROL FROM MICROPHONE OR PANEL: Frequency is selected by buttons on the front panel or microphone.
- 8 CHANNEL MEMORY: Each memory channel is reprogrammable and stores the frequency and offset. Memory is backed up by a NICAD battery when power is removed.
- INSTANT MEMORY 1 RECALL: By pressing a button on the microphone or front panel, memory channel 1 may be accessed immediately.
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- PROGRAMMABLE BAND SCAN: Any section of the band may be scanned in steps of 5 or 10 kHz. Scan limits are easily reprogrammed.
- DISCRIMINATOR SCAN CONTROL (AZDEN EXCLUSIVE PATENT): The scanner stops by sensing the channel center, so the unit always lands on the correct frequency. COMPARE this with other units that claim to scan in 5-kHz steps!
- THREE SCAN MODES WITH AUTO RESUME: "Sampling" mode pauses at busy channels, then resumes. "Busy mode stops at a busy channel, then resumes shortly after frequency clears. "Vacant" mode stops at a vacant channel and resumes when signal appears. If desired, auto resume may be prevented by pressing one button. COMPARE!
- REMOTABLE HEAD: The control head may be located as much as 15 feet away from the main unit using the optional connecting cable. COMPARE!
- PL TONE OSCILLATOR BUILT IN: Frequency is adjustable to access PL repeaters.
- MICROPHONE VOLUME/FREQ. CONTROL: Both functions may be adjusted from either the microphone or front panel.
- NON-STANDARD OFFSETS: Three accessory offsets can be obtained for CAP/MARS or unusual repeater splits. CAP and Air Force MARS splits are BUILT IN! COMPARE!
- 25 WATTS OUTPUT: Also 5 watts low power to conserve batteries in portable use.
- GREEN FREQUENCY DISPLAY: Frequency numerals are green LEDs for superior visibility.
- RECEIVER OFFSET: A channel lock switch allows monitoring of the repeater input frequency. COMPARE!
- SUPERIOR RECEIVER: Sensitivity is better than 0.28 uV for 20-dB quieting and 0.19 uV for 12-dB SINAD. The squelch sensitivity is superb, requiring less than 0.1 uV to open. The receiver audio circuits are designed for maximum intelligibility and fidelity. COMPARE!
- ILLUMINATED KEYBOARD: Keyboard backlighting allows it to be seen at night.
- TRUE FM, NOT PHASE MODULATION: Transmitted audio quality is optimized by the same high standard of design and construction as is found in the receiver. The microphone amplifier and compression circuits offer intelligibility second to none.
- OTHER FEATURES: Dynamic microphone, built-in speaker, mobile mounting bracket, external remote speaker jack (head and radio) and much, much more. All cords, plugs, fuses, microphone hanger etc. included. Weight: 6 lbs.
- ACCESSORIES: CS-ECK 15-foot remote cable . . . $39.95 CS-6R 6-amp ac power supply . . . $59.95. CS-AS remote speaker . . . $18.00. CS-TTK touch-tone® microphone kit (wired and tested) . . . $45.00

5

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Joe Ham: The Consumer

—do you fit the mold?

In spinning the dial across the various amateur bands, it is not unusual to find a QSO concerning radio equipment. A typical QSO might be as follows:

"...I am running a Satellite TS6 with a Pacific Kilowatt 2 linear amplifier. My antenna consists of stacked verticals, 33 elements, up about 100 feet. I also have a Demosthenes speech processor..."

It appears that there is much interest in the types of radios and accessories being used as well as the reason for purchasing specific radio products. Although there have been many formal studies concerning consumer behavior, the radio amateur as a consumer has been neglected.

The purpose of this article is to present some exploratory research findings on the influence of consumer behavior on the buying habits of radio amateurs.

Methodology

The data in this study were gathered from questionnaires sent to 300 radio amateurs in each of the ten United States call areas. The amateurs were selected by random sample from the *1980 Radio Amateur Callbook*. The sample included amateurs from each of the fifty states, divided into three license class classifications—General, Advanced, and Extra. Two amateurs were taken from each class for each state. The study was primarily limited to HF SSB radio equipment.

The HF SSB Radio

An important part of the study dealt with the types of HF SSB radios owned by the radio amateur, age of radio, where purchased, and purchasing influences. The following is a list of HF SSB radios, including manufacturer and model number, that were most fre-

Purchased	Number of Amateurs (%)
1 year (or less)	23
2 years	20
3 years	14
4 years	10
5 years (or more)	33
Total	100

Table 1. HF SSB radios—when purchased.

Source of Purchase	Number of Amateurs (%)
Local Franchised Dealer	52
Mail-order	32
Another amateur	10
Other (includes factory, swap meet, hamfest)	6
Total	100

Table 2. Where radios were purchased.

Reasons for Purchase	Number of Amateurs (%)
Reputation of dealer (including service)	40
Price	44
Store personnel	10
Other (includes availability, location of dealer, etc.	6
Total	100

Table 3. Reasons for purchasing radio from dealer, etc.

Stuck with a problem?

Our TE-12P Encoder might be just the solution to pull you out of a sticky situation. Need a different CTCSS tone for each channel in a multi-channel Public Safety System? How about customer access to multiple repeater sites on the same channel? Or use it to generate any of the twelve tones for EMS use. Also, it can be used to access Amateur repeaters or just as a piece of versatile test equipment. Any of the CTCSS tones may be accessed with the TE-12PA, any of the audible frequencies with the TE-12PB. Just set a dip switch, no test equipment is required. As usual, we're a stickler for 1day delivery with a full 1 year warranty.

- Output level flat to within 1.5db over entire range selected.
- Immune to RF.
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak.
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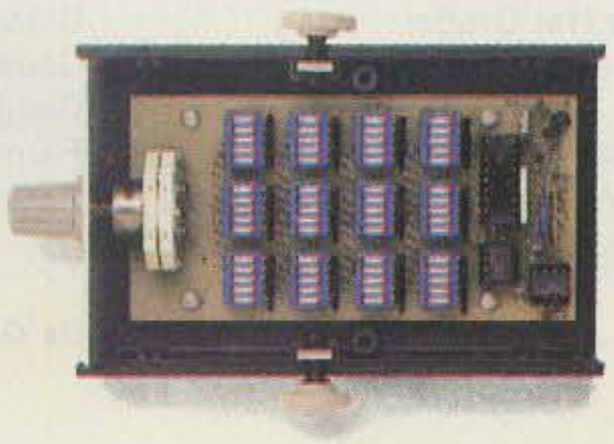

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67.0 XZ	85.4 YA	103.5 1A	127.3 3A	156.7 5A	192.8 7A
71.9 XA	88.5 YB	107.2 1B	131.8 3B	162.2 5B	203.5 M1
74.4 WA	91.5 ZZ	110.9 2Z	136.5 4Z	167.9 6Z	
77.0 XB	94.8 ZA	114.8 2A	141.3 4A	173.8 6A	
79.7 SP	97.4 ZB	118.8 2B	146.2 4B	179.9 6B	
82.5 YZ	100.0 1Z	123.0 3Z	151.4 5Z	186.2 7Z	

- Frequency accuracy, ±.1 Hz maximum −40°C to +85°C
- Frequencies to 250 Hz available on special order.
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2175	941	1633	1750	2000	2300	2550
2805			1800	2100	2350	

- Frequency accuracy, ±1 Hz maximum −40°C to +85°C
- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

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Reasons for Purchase	Number of Amateurs (%)
Reputation of Manufacturer (including quality)	45
Features of the radio	40
Convenience in operation	12
Other (includes American-made, prestige, size, performance)	3
Total	100

Table 4. Reasons for purchasing a particular brand of radio.

Purchasing influences	Number of Amateurs (%)
Advertisements	42
Friend (Amateur)	31
QSO	15
Store display	10
Other (includes store salesman, family, used in contest)	2
Total	100

Table 5. Other purchasing influences.

quently mentioned in the survey*: Collins KWM2; Drake TR4C, TRF; Heathkit HW-101; Icom 701; Kenwood 120S, 520S, 820S; Swan Astro 150, 102BX; Ten-Tec Triton IV, Omni A,D; Yaesu FT-101, 101E.

It is interesting to note that only 25% of the amateurs surveyed had solid-state radios. The reason for this is probably because of the age of the sets. Table 1 indicates that although 33% of the amateurs have had their sets for 5 years or more, 23% have purchased new radios within the past year.

Why A Specific Radio Was Purchased

The buying environment is an important part of consumer behavior. Not only *where* a purchase was made, but *why* it was made are basic factors to consider.

As shown in Table 2, most of the amateurs bought their radios from either a local franchised dealer or by mail-order. The reasons for this are illustrated by Table 3. It can be observed that the reputation of the dealer, including service, and price are considered to be the prime reasons for buying a set from a particular place.

As discussed previously, the reasons *why* an amateur purchases a particular radio are important factors to consider in consumer behavior. Table 4 indicates that the reputation of the manufacturer, quality, and features of the radio are important elements considered by the amateur when purchasing an HF SSB radio.

Additional factors that influence an amateur's buying habits are illustrated in Table 5. It is interesting to note that 42% of those surveyed felt that advertising played an important part in influencing their final purchasing decision. Additional purchasing influences include friends (31%), QSOs (15%), and store display (10%).

Antennas

There are probably more on-the-air discussions concerning antenna systems than any other piece of amateur equipment. The purchase of an antenna, therefore, is an important factor to consider in relation to amateur buying habits. According to Table 6, the triband yagi beam appears to be the antenna most purchased by radio amateurs. 48% of the amateurs surveyed used this type of antenna. Table 6 also indicates the reasons *why* a specific antenna is being used.

Types of Antennas	Number of Amateurs (%)	Reasons for Purchase
Triband yagi beam (3 elements or more)	48	Efficiency and gain. Work all bands. Best value for money. Low noise.
Dipole	22	Fits limited space.
Vertical	10	Low profile. Good construction.
Quad	10	Better DX.
Monoband yagi	7	
Minibeam	2	
Longwire	1	
Total	100	

Table 6. Antenna systems and reasons for purchase.

Radio Accessories

An important part of amateur purchases includes radio accessories. The most popular accessories being used by the amateur are linear amplifiers, speech processors, audio filters, tuners, and keyers. Other accessories include monitor scopes, frequency counters, phone patches, and computers.

Occupations

Occupation is a basic index of social behavior. The results of the study show that people from all walks of life are presently enjoying the hobby of amateur radio. The occupations of radio amateurs as given in the survey include those shown in Table 7.

Conclusion

As previously discussed, this survey should be considered merely as exploratory in nature. The study was limited by the size of the sample obtained. This, however, is only a beginning in looking at the radio amateur as a consumer. ■

Journalist-Poet	Veterinarian
Architect	US Army (Captain)
Salesman	Astronomer
Computer Programmer	Auto Mechanic
Asst. V.P. Operations (Railroad)	Photographer
Engineer	US Air Force
Lawyer	Housewife
Real Estate Broker	Plant Manager
Florist	Telephone Installer
Electronics	TV Broadcast Engineer
Post Office Department	Marketing Product Manager
US Navy	US Coast Guard
City Government (Administrator)	Musician
Business Executive	University Professor
Teacher (1st Grade)	Glass Blower
Accountant	College Baseball Coach
Dentist	Clergyman
Retail Bicycle Store Manager	Farmer
Social Worker	Retired
Research (Medical)	

Table 7. Occupations of hams.

*It is not the purpose of this article to rate any one manufacturer's product over another. Also, not all sets mentioned in the study are listed; only those radios that were most frequently mentioned are given here.

Radio Activity

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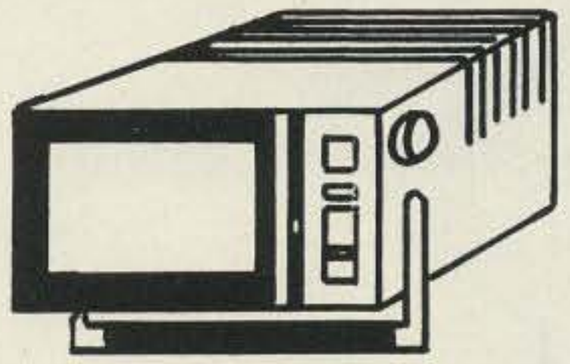

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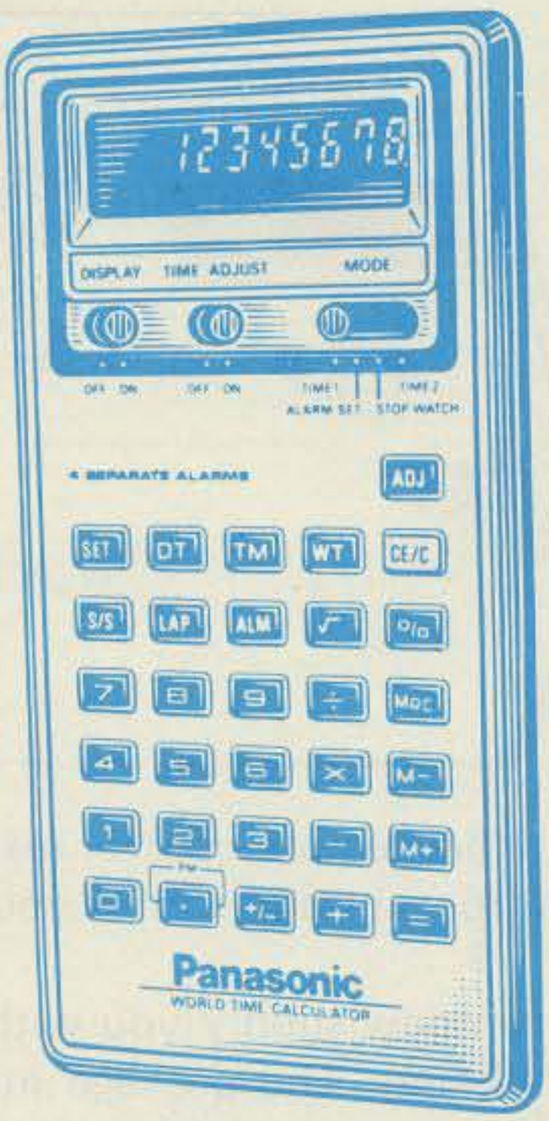
PANASONIC EAH-S3 ULTRA LIGHT (1.2 OZ) HIGH QUALITY HEADPHONE SYSTEM. $25.00 PPD

PANASONIC JE-8336U WORLD TIME CLOCK/CALCULATOR. LOCAL AND UTC TIME, DAY AND DATE PLUS TIME IN 20 DX ZONES. FOUR 24 HOUR ALARMS TO KEEP YOU ON SCHEDULE. STOPWATCH FUNCTION WITH LAP AND COUNTDOWN TIMING. 8 DIGIT LCD CALCULATOR HAS PERCENT, SIGN CHANGE, AND MEMORY FOR FIGURING CONTEST SCORES. $59.00 PPD



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✓See List of Advertisers on page 162

Wilson Microwave Systems

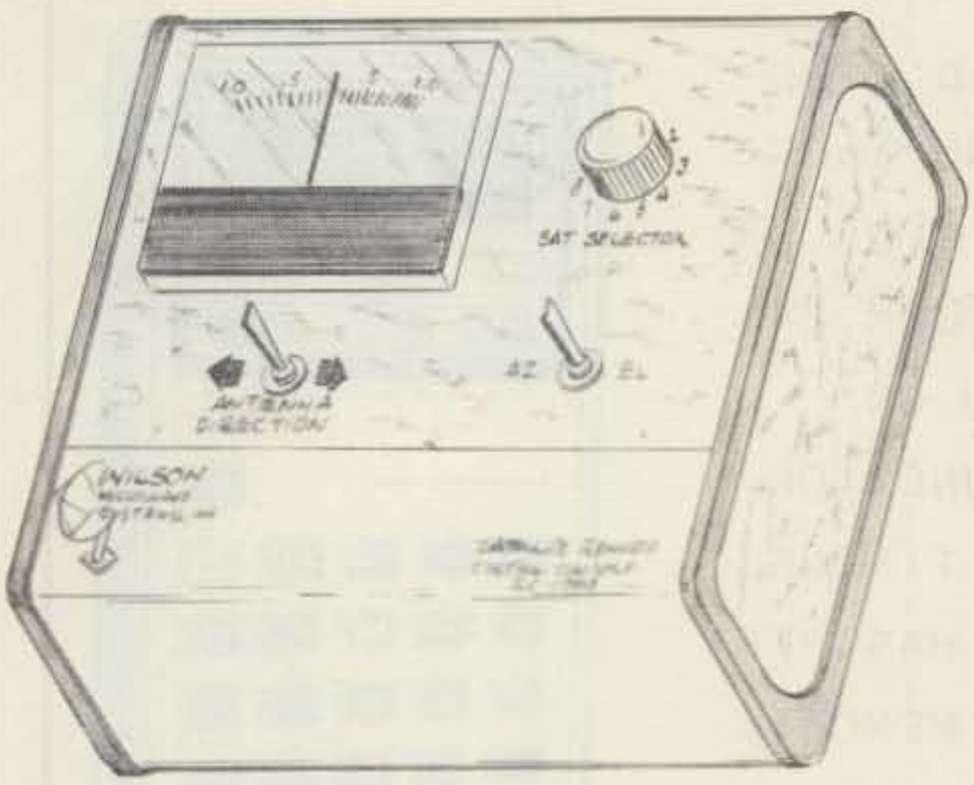
Wilson Microwave Systems uses the latest state of the art method of manufacturing the parabolic designed antenna. Resistance to distortion and instability is increased with the addition of a full screen mesh sealed within the ¼" thick fiberglass.

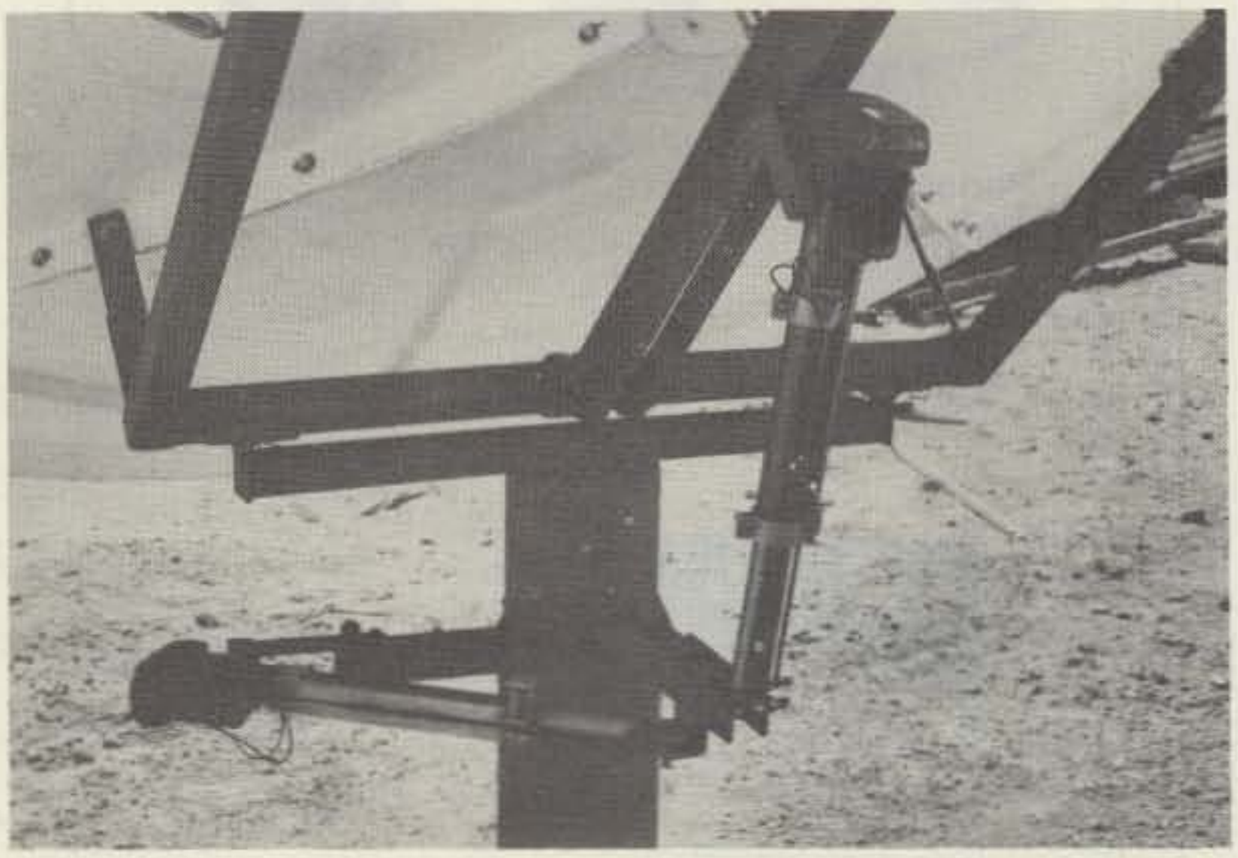
Wilsons unique "Vari-Mount" provides the easiest installation and mounting method available today. The 4pc construction of the dish provides easier handling, less installation time, and greatly reduced shipping costs.

With the exclusive 4 point Williams' mount, you are assured a quicker installation and that the antenna will be more securely fastened to the Vari-Mount. The antenna struts aid in stabilizing the fiberglass for operational reception in winds of up to 50 - 60 MPH.

A ball bearing race allows easy turning of the antenna in changing to the different satellites. A scale is included on the base to assist in their location.

For those areas that require a larger dish than the 3.35 meter, Wilson offers an addition that will increase the size to 4.0 meter. It is easily bolted to the outer edge and maintains the strength, while increasing the performance.





The optional remote control feature allows you to control movement of the azimuth and elevation positions of the antenna from the comfort of your easy chair – without having to go outside. This feature may be added later.

Wilson can now supply you with a complete system for turnkey operation that includes everything that is required for installation. The package includes the fiberglass 11' antenna featured above, receiver, 120° LNA, modulator, and all cables required. Many options are available.

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Bob Cooper: Profile of a Pioneer

Editor's Note: In just three decades, television has won the hearts and minds of American society. *Newsweek Magazine* reports that the "average family member spends more than seven hours a day tethered to the tube." Innovations like community antennas, cable TV, and now reception directly from the satellites have nurtured our passion for video. Perhaps you prefer an evening of rag-chewing on 75 meters or chasing DX on the low end of 20 to watching the one-eyed monster—even so, you can't deny the impact that television has had on everyone's lives.

Tim Daniel N8RK
73 Magazine Staff

Six meters is open. My little portable SSB rig is hooked to a jury-rigged VHF TV antenna and I'm copying stations as far away as Florida. As I tune across the band, I find a pileup that rivals anything you hear on 20 meters. Eventually the furor dies down and I hear a weak but copyable signal:

"This is VP5D; the name is Bob and my location is Providenciales, one of the Turks and Caicos Islands."

The voice goes on to say that this is not a DXpedition, but rather a permanent station, so if you don't work it today, there will always be another chance.

VP5D is Bob Cooper, also known as W5KHT. When Bob is not handing out reports on six or ten meters, he is likely to be pursuing another form of electronic magic. Bob, you see, dreams about making high-quality, universally-available television a reality.

Cooper is the father of home satellite television. In just five short years, Bob ushered home reception of satellite TV from being a five-figure investment to the point where you can assemble a complete system for about $2000. Along the way, he wrote dozens of articles, including one for *73*, he had a column in *QST*, and he received coverage in publications like *Mother Earth News* and *TV Guide*. Coop's fame extends beyond the written word; he has appeared on Japanese TV news and more familiar programs like "PM Magazine."

To trace Bob Cooper's attachment to video, we have to go back to the infancy of commercial television. The Cooper family lived just far enough away from the nearest station to make reception a difficult task. As a youth, Coop combined his ham-radio-based knowledge of electronics with an enthusiasm for the growing world of TV. After all, building beams and preamps for VHF TV was not too different than home-brewing gear for six meters.

Bob's college training in broadcast journalism eventually led him to the cable TV industry where he was involved with the publication of trade magazines. When the satellite TV era began, Bob was already the veteran of the original TV explosion and the development of cable TV.

Coop's first exposure to satellite TV came at a cable TV trade show in 1975. Soon after, he began to work putting together a system of his own. By scrounging in the true ham radio fashion, he was able to build one of the first home satellite TV receiving systems for far less than the $25,000 asking price.

Along the way, Bob met other pioneers like Stanford University professor Tay Howard W6HD and Bob Coleman K4AWB who were working towards the same goal. Since new equipment was so expensive, these trailblazers relied on surplus units or, failing that, they home-brewed. There were no plans to follow, no kits to buy—only imagination and patience.

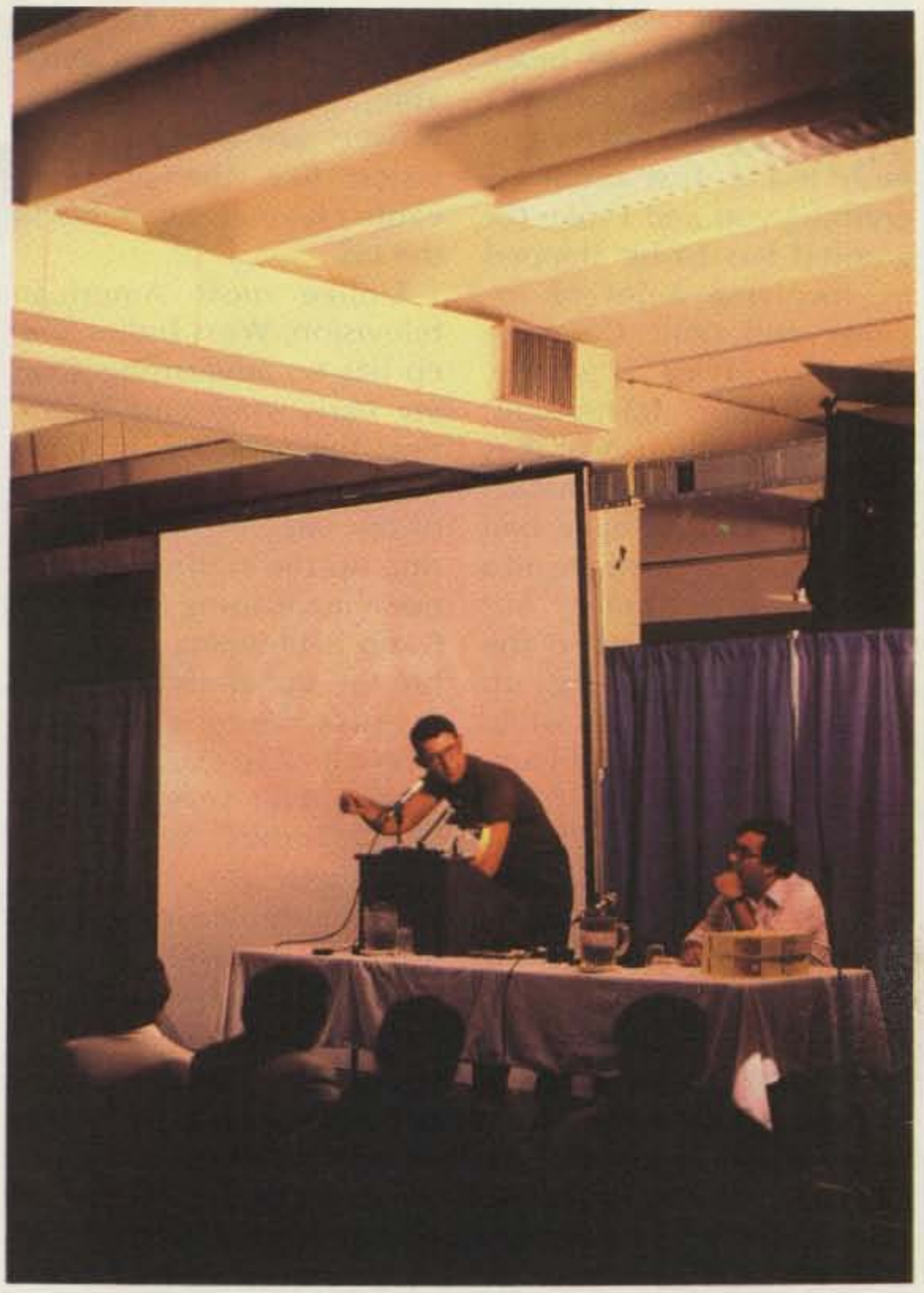
What Bob and a handful of other experimenters were accomplishing was of only passing interest to the professionals in the satellite TV field. The industry was content to keep satellite TV veiled in mystery and expense. Cooper, realizing the potential for the mass appeal of home satellite television receive only (TVRO), decided to go public. He did it in a big way. The *TV Guide* article in October, 1978, and subsequent coverage on the CBS Evening News alerted millions of people about the new technology.

Overnight, Coop was besieged with thousands of inquiries. He had created a demand which he is still striving to meet three years later. In those early days, there was no gear aimed at the home market. Before long, garage industries, often started by hams, sprang up. It was (and still is) a seller's market and anyone with a background in electronics had a tremendous advantage.

A digest for satellite TV enthusiasts, publishing manuals, and sponsoring seminars turned into a full-time endeavor and Bob made the plunge, committing all his talents to the

Bob VP5D.

Bob utilizes his extensive knowledge of the broadcast and cable TV industries to make high-quality TV a reality, despite the remote location. To Bob's left is a vertical interval switching unit which allows him to change signal sources rapidly, without any glitching. The monitor displays a computer-generated time, weather, and community information report. This is just one of the several ways that West Indies Video offers a local flavor to its programming.



The thrice-annual Satellite Private Terminal Seminars (SPTS) are sponsored by Bob Cooper. They offer an outstanding way for both hobbyists and dealers to find out the latest information about this dynamic industry. Approximately 1000 persons gathered at the August, 1981, seminar in Omaha. They had the opportunity to listen to such experts as Steve Gibson, who has combined the technology of computers and satellite TV for some very exciting results.

young industry.

The early days were not all milk and honey. The first Satellite Private Terminal Seminar (SPTS) in Oklahoma City was almost cancelled. A last-minute court hearing decided that the freedom to share information superceded a cable TV supplier's desire to keep the subject a mystery. (The legal questions that surround the satellite TV explosion are just beginning to see a thorough airing.)

Cooper was in on the growth of the industry from the start. *Coop's Satellite Digest* has become the favorite source for update information about the technology and the satellites themselves. How-to manuals, priced from $30.00, sell briskly. The thrice annual SPTS events are attracting over a thousand participants who gladly pay the $150 admission price. Coop had started the wave rolling back in 1978 and he managed to climb on top for a very successful ride. He let others manufacture the equipment, sell the dishes, and install them. His bag is information, something that a young industry can't live without.

New Beginnings

In 1980, the stage shifted from Oklahoma to a small, unknown island in the Caribbean. Just as the home satellite TV industry began to gain momentum, Coop pulled up stakes and moved his family to Providenciales, part of the tiny nation of Turks and Caicos. Besides donning a new callsign, VP5D, Cooper was on the brink of yet another video revolution.

The Coopers fell in love with the serene, isolated beauty of the Turks and Caicos on a vacation visit. It became harder and harder to return home on subsequent visits, so Bob and his wife Susan began thinking about making the island their new home. The prospering monthly magazine, manuals, and seminars gave the Cooper family the independence to choose a life in a home alongside a deserted beach, far from the hustle-and-bustle blacktopped world that most of us know. Bob was more than willing to escape the day-to-day hassles of being an industry leader so that he could concentrate on writing and video work.

The turning point came when Coop presented the plans for his new home to the island officials. Their curiosity about the satellite dish (doesn't everyone have a dish in the backyard?) led to a proposal that Bob share his signals with the rest of Providenciales. Cooper, who was familiar with the long, involved TV broadcasting license procedures in the US, was easily convinced. There were no existing rules for television broadcasting in Turks and Caicos. Being the first to attempt such a project meant that Bob would be able to write the book as he went.

The first priority, after moving to "Provo," was getting West Indies Video off the ground. A 16-foot dish was erected to catch program material relayed through SATCOM F1. The satellite downlink receiver provides a baseband video signal that modulates an "STL" (studio-to-transmitter link), in this case, a low-power transmitter on channel 7. The STL signal is aimed at a pair of yagis located on Provo's highest point, Blue Hill. From this "mountaintop" location, the signal is translated to be broadcast on channel 4 with 8.5 Watts of output power.

From the project's beginning there was a dual challenge. Establishing a reliable, high-quality TV ser-

vice is a major task by itself. Compounding those headaches are the drawbacks that accompany life on a remote island. Just about everything you and I take for granted has to be shipped in, involving a lot of expense and time. Commercial air service is spotty, barge traffic infrequent, and mail delivery takes three weeks, if you're lucky.

Many families have had the misfortune to move into a half-finished home, but how many have faced the challenge of setting up house in a TV station while the workmen are still hammering and sawing? The construction of a real home took a back seat to finishing the station. The control room doubled as an office, while the sound stage served as a bedroom for the two Cooper children.

The system on Provo evolved in stages. At first, the remote transmitter was powered by automobile batteries that required weekly recharging. Later, a solar-cell array took over, reducing the visits to once a month.

Until programmable switching equipment is installed, someone must be present in the control room every time a change in the program source is made. When Bob is gone, this task falls on his twelve-year-old son, Kevin VP5DX.

Except for the fact that only one channel is available, Turks and Caicos viewers are watching television like the premium cable channels available in the US.

Unlike most American television, West Indies Video has no advertising. During early stages of operation, the company is giving away the service. Because of the large expense of setting up the station and the poor advertising potential, Coop is planning to scramble the signal and charge a monthly fee for a decoder.

With 750 subscribers spread over seven islands, West Indies Video has chosen to use an addressable scrambler. After payment is received, the decoder will be activated for another month by a burst of digital transmissions. No money, no TV.

The islands' version of the Nielsen ratings is the phone calls that Bob and his family receive from dissatisfied viewers. Anyone wanting to invoke the wrath of an entire nation can do so by stopping broadcast of wrestling and boxing on Friday and Saturday nights. The most frequently heard complaint is that programs are not available 24 hours a day. It seems as though TV has taken the people of Turks and Caicos from being bored and isolated to being entertained and informed.

The low-power television (LPTV) concept which Cooper has proven in Turks and Caicos shows great promise for revolutionizing TV in the United States. The FCC is now allowing communities to enjoy specialized (educational, regional, religious, commercial) programming broadcast by 10- to 100-Watt UHF and

This is the site of the Cooper family's dream come true. Soon after this photo was taken, work began on a second building that will separate their home from the studio.

August 14, 1981

Dear Satellite Enthusiast,

We all have different dreams and aspirations. For the Cooper family, it had long been our hope that we would one day be able to move, permanently, to some quiet, out-of-the-way Caribbean island where our children could be raised to be self-sufficent, productive young people and where we could, as a family unit, make real and useful contributions to the development of "our island."

Very few people have ever heard of the Turks and Caicos Islands. A country with around 7,000 total population is not often in the headlines. Many maps do not show us to be here; the popular Caribbean tourist guidebooks seldom notice that we exist. Those that do mention us often make the incorrect assumption that the Turks and Caicos are an extension of and a part of the southeastern Bahamas.

Getting here is very difficult. Mail service is extremely poor; telephone service is only slightly better. But within 30 days of our arrival here, the Turks and Caicos had live (satellite-delivered) television. There was no national sport prior to our arrival; now, due totally to satellite television, professional wrestling is the national spectator sport. Nobody here had ever seen or heard world leaders before; they had never seen a baseball game, a play, or a movie. They had no idea what Sesame Street was, or where it was. They had never heard of James Bond or Barbara Walters. They were as far removed from the 20th century as a people could be.

We take the responsibility of providing high-quality television to our country very seriously. We spend as much or more time making careful program selections as we do working out the intricate technical parameters of building a high-quality electronic service.

Satellite television can, in varying forms and shades, do much the same thing for areas closer to you than the Turks and Caicos, as it has done for our country. The satellite service has changed the complexion of the world in just a few short years. In the next five years, we will see such dramatic improvements and expansion of service that our efforts today will seem very primitive by reflection.

This is *the growth field* of the 80s and beyond. This is where the most exciting opportunities of your lifetime are to be found. The opportunities in this young field are totally unlimited. You can do anything you want to do, if you carefully learn the basics, carefully plan each step, and carefully select where and how you will do it.

Welcome to the 21st century. And if you are ever down our way, stop in and say hello to us on the shores of Grace Bay! We are the third satellite antenna on the left.

Bob Cooper

It takes a big dish to pull in studio-quality signals in the Turks and Caicos Islands. Bob, on the left, is with W2NSD/1 and WA1KPS.

VHF stations. Satellites will be the popular, low-cost way to distribute the video and audio to the local LPTV stations. Owning and operating these stations will not require the investment that accompanies one of the full service stations.

Ham radio operators have a long history of pioneering and popularizing new methods of communication. Concepts like single sideband, and now satellite television, have been transformed from expensive and complex mediums into something that is easily understood and affordable.

For individuals like Bob Cooper, radio is accompanied by "magic," whether the challenge is receiving a 4.0-GHz satellite signal or a pileup on six meters. ■

✓See List of Advertisers on page 162

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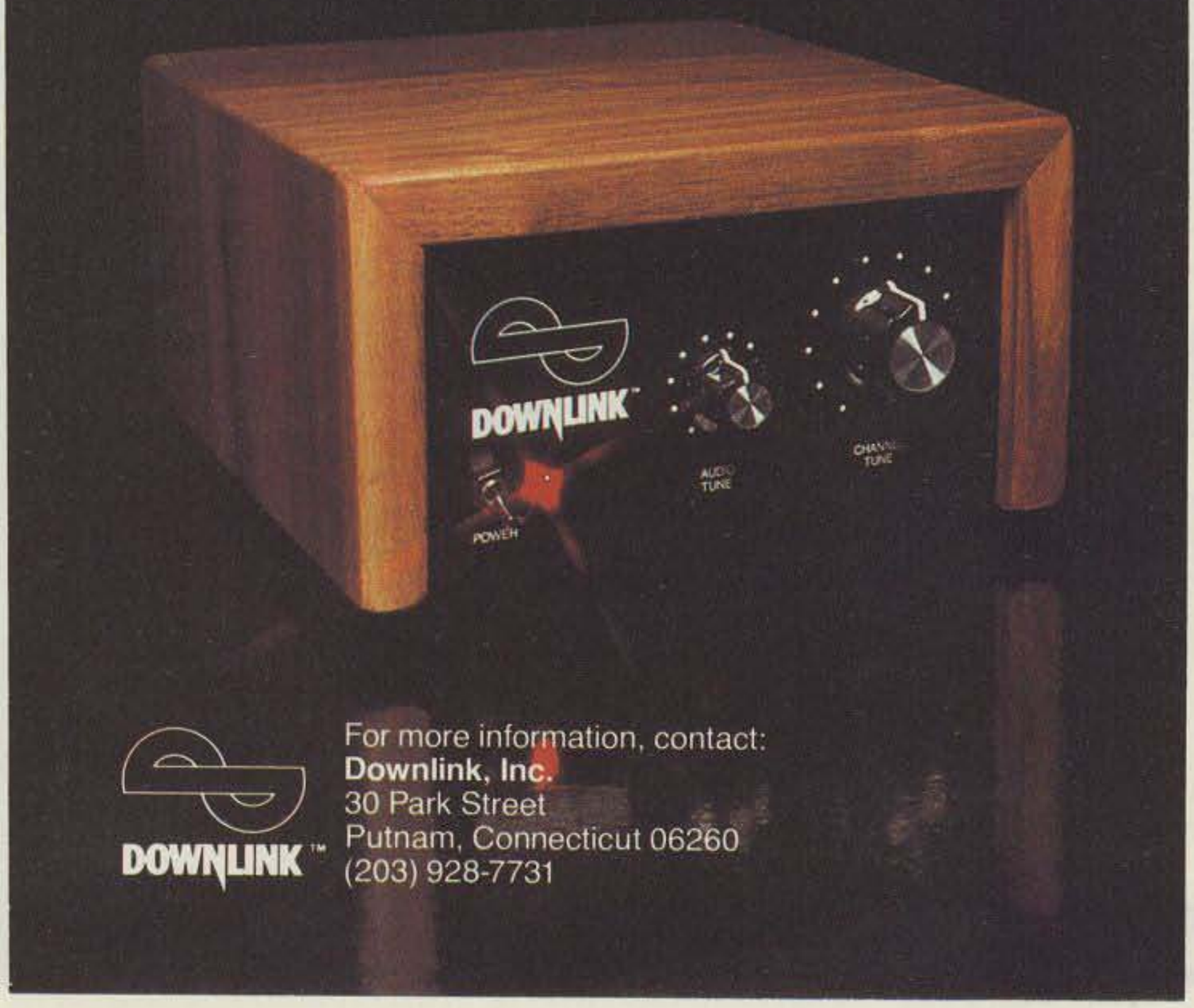

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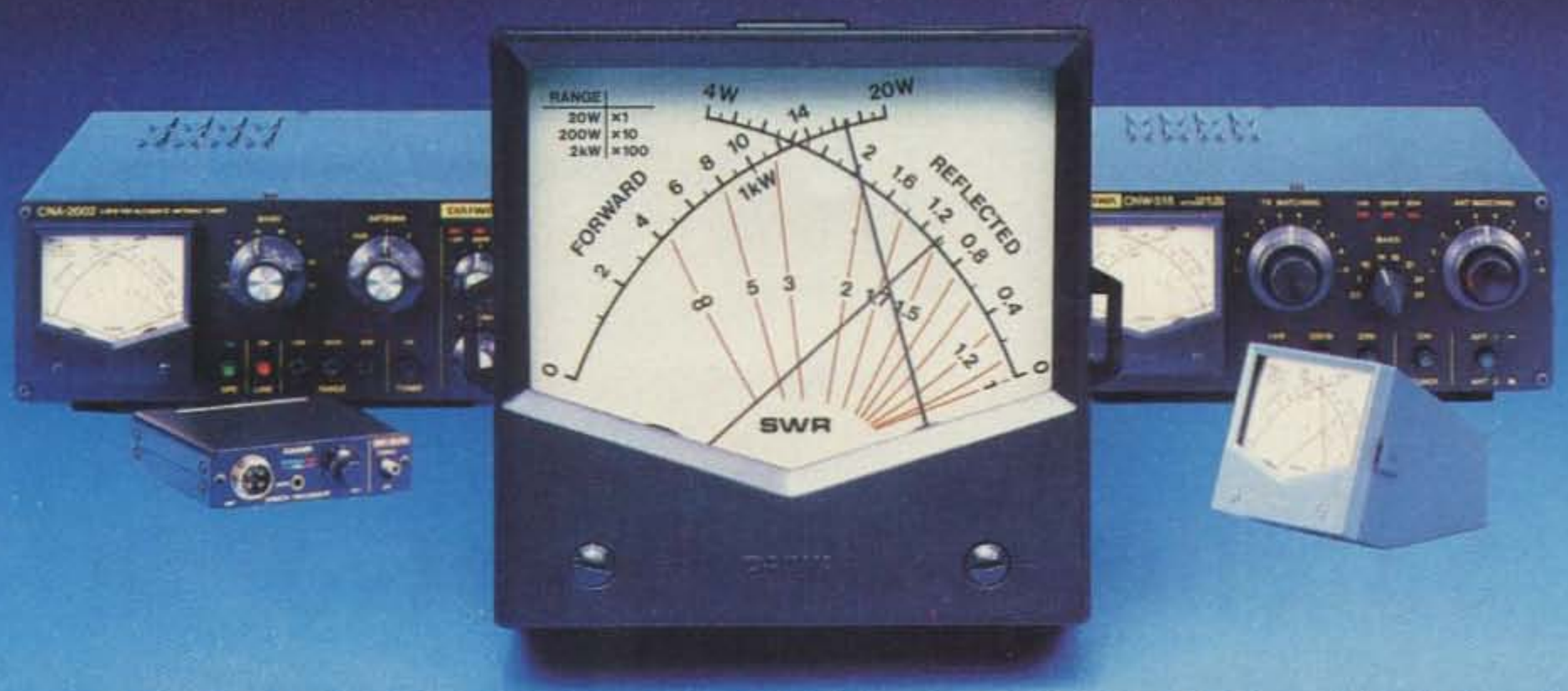

A REVOLUTION IN CONVENIENCE

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Cross-Needle Meters CN-520 / CN-540 / CN-550

DAIWA cross-needle precision is now available in a compact case. Get forward power, reflected power and SWR readings at a single glance—from a meter that fits anywhere!

CN520 - Frequency: 1.8-60MHz • **Power range:** Forward 200/2kw, Reflect 40/400 watts • **Detection Sensitivity:** 40 watts minimum • **Accuracy:** ±10% at full scale • **Dimensions:** 72W x 72H x 95D m/m

CN540 - Frequency Range: 50-150MHz • **Power Range:** Forward 20/200 watts, Reflected 4/40 watts • **Detection Sensitivity:** 4 watts minimum • **Accuracy:** ±10% at full scale • **Dimensions:** same as CN-520

CN550 - Frequency Range: 144-250MHz • **Power Range:** Forward 20/200 watts, Reflected 4/40 watts • **Detection Sensitivity:** 4 watts minimum • **Accuracy:** ±10% at full scale • **Dimensions:** same as CN-520

Active Audio Filter AF-306

By electronically filtering unwanted signals, the AF-306 gives you clean, distinguishable copy. Featuring its own internal speaker, the AF-306 Active Audio Filter is easy to install, easy to operate.

Input: 2.8v (4v max.) • **Output power:** 1 watt @ 8 ohms • **Distortion:** less than .2% • **S/N ratio:** better than 50dB • **Low Cut Filters:** 400Hz, 800Hz, 1100Hz • **High Cut Filters:** 1100Hz, 1600Hz, 2500Hz

Automatic Antenna Tuner CNA-2002

Leading the way in convenience is the Daiwa CNA-2002 2.5 kW (PEP) Automatic Antenna Tuner. Cross-Needle Metering and optimum matching in under 45 seconds make it the perfect compliment to any state-of-the-art amateur station.

Frequency Range: 3.5-30 MHz including WARC bands • **Tuning Time:** less than 45 seconds • **Power Rating:** SSB-2.5kw PEP, CW-1kw (50% duty), AM-500 watts, RTTY, SSTV-500 watts (10 minutes) • **Output Impedance:** 15-250 ohms (unbalanced) Dummy Load: 100 watts 1 minute (installed) • **Metering Ranges:** Forward power - 20/200/2000 watts, Reflected power - 4/40/200 watts, SWR-1:1-infinity • **Power Requirements:** 11-16 vdc @ 200 ma.

Manual Antenna Tuners CNW-518 / CNW-418

The serious amateur wants to achieve the best antenna match possible. That's why DAIWA offers two manual antenna tuners that maximize power transfer—and offer cross-needle metering as well.

CNW-518 - Frequency Range: 3.5-30MHz including WARC bands • Power rating: 1kw CW (50% duty) • **Output Impedance:** 10-250 ohms (40-10 meters), 25-100 ohms (80 meters) • **Insertion loss:** less than .5 dB

CNW-418—Same as above except—**Power rating:** 200 watts CW

Infrared Cordless Microphone RM-940

DAIWA ingenuity is also evident in the RM-940, an Infrared cordless mobile microphone system. Audio and transmit/receive switching are carried on a safe infrared beam. Experience the freedom of cordless mobile operation. Ask your Daiwa dealer for a demo today!

Microphone: Electret Condenser type • **Continuous Operating Time:** 5 hours minimum • **Charging Time:** 8 hours max • **Usable Distance:** 3.5 feet—microphone to sensor • **Power Requirements:** Controller—13.8 vdc @ 80 ma, Microphone—2.5 vdc @ 30 ma.

Speech Processor RF-670

DAIWA innovative thinking led to the development of the RF-670 Photocoupler Speech Processor. Its unique design gives your signal the boost it needs to cut through bothersome QRM. Get RF-type processing performance with the RF-670's economic photocoupler design.

Clipping Level: 20dB max • **Frequency response:** 300-3000Hz (-10dB) • **Clipping Threshold:** less than 2mV at 1kHz • **Bandwidth:** 2400Hz at 6dB down • **Distortion:** less than 3% at 1kHz, 20dB clip • **Output level:** 40mV max • **Mike imp.:** 600-50k ohms • **Power requirement:** 13.5v @ 60ma • **Dimensions:** 90 x 25 x 93 m/m

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DA100 - 5/8 wave • Length: 1,360 m/m • 146 MHz
DA200 - 7/8 wave • Length: 1,870 m/m • 146 MHz

Gutter Mount

GM500 - Frequency Range: 1.8MHz-500MHz • **Power Rating:** 1kw • **Dimensions:** 86W x 54H x 37D m/m

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Exclusive U.S. Agents for these Daiwa products. Dealer inquiry invited.

DAIWA
Amateur Radio Innovations

Satellite Channel Guide
— part II

Numbers in parens immediately following programming description indicate *audio subcarrier(s)* used for that particular service.

WU WESTAR 1 (99° W)
Polarization: All Horizontal

TR—1(1)
Occasional Transmissions—sporting events, news, and network feeds (6.2/6.8)
The Transtar Network (est. mid-Oct., 1981)

TR—3(5)
Occasional Transmissions—sporting events, news, and network feeds (6.2/6.8)
PET (Penthouse Entertainment Television)—adult-oriented programming (est. Oct. 1, 1981)

TR—5(9)
Selec TV—STV feed: first-run movies, concert specials, & sporting events (6.8)
Occasional Transmissions—sporting events, news, & network feeds (6.2/6.8)

TR—6(11)
Occasional Transmissions—sporting events, news, & network feeds (6.2)

TR—8(15)
PBS (Public Broadcasting)—schedule A programming (6.8)

TR—9(17)
PBS (Public Broadcasting)—schedule B programming (6.8)

TR—11(21)
PBS (Public Broadcasting)—schedule C programming (6.8)

TR—12(23)
PBS (Public Broadcasting)—schedule D programming (6.8)
PBS Occasional Feeds (6.8)

ATT/GTE COMSTAR 1/2 (95° W)
Polarization: ODD—Vertical; EVEN—Horizontal

TR—1
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—2
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—4
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—6
Bravo—performing and cultural arts programming (6.8 stereo)

TR—7
NCN (National Christian Network)—religious (6.8)
Escapade—"R"-rated sex and action-oriented movies only

TR—9
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—10
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—13
Home Box Cinemax (East)—time-structured HBO (6.8)
Occasional Transmissions—remote feeds (5.8/6.2/6.8)

TR—14
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—15
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—17
TBN (Trinity Broadcasting Network)—religious (6.8)

TR—18
Home Box Office (East)—first-run movies, sports, & entertainment specials (6.8)
Occasional Transmissions—remote feeds (5.8/6.2/6.8)

TR—19
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—21
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—22
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

TR—24
Occasional Transmissions—teleconferencing, sporting events, news, & network feeds (5.8/6.2/6.8)

Audio Services on COMSTAR 1/2

TR—7
Family Radio Network (East) (5.8)
Family Radio Network (West) (7.7)

WU WESTAR 3 (91° W)
Polarization: All Horizontal

TR—2(3)
Hughes Sports Network—sports events feeds (6.2/6.8)
Occasional Transmissions—sporting events, news, & network feeds (6.2/6.8)

TR—3(5) **XEW-TV,** Mexico City—Mexico's leading network station (6.2)

TR—5(9) **Occasional Transmissions**—sporting events, news, & network feeds (6.2/6.8)
Private Screenings—sexploitation "R"-rated movies (6.2)

TR—6(II) **CBS** Network Contract Channel—live/taped network feeds (6.2/6.8)
CBS Cable Network (est. 10-12-81)

TR—7(13) **Robert Wold Communications**—occasional transmissions: sporting events, news, & network feeds (6.2/6.8)
HTN (Home Theatre Network)—quality G and PG movies (6.8)

TR—8(15) **SIN** (Spanish International Network) (6.2)

TR—9(17) **SPN** (Satellite Program Network)—variety entertainment (6.8)

TR—10(19) **ABC** Network Contract Channel—live/taped network feeds (6.2/6.8)

TR—11(21) **CNN** (Cable News Network) Contract Channel—news & sporting events feeds (6.2/6.8)

TR—12(23) **Occasional Transmissions**—sporting events, news, & network feeds (6.2/6.8)
EWT (Eternal Word TV Network)—religious (6.8)
Studio "B" (Academy of Health Science)—medical (6.8)

Editor's Note: This guide is reprinted with the permission of WESTSAT Communications. WESTSAT publishes the *Satellite Channel Chart*® six times a year. Subscriptions via first class mail are available directly from WESTSAT Communications, PO Box 434, Pleasanton CA 94566. Part I of 73's Satellite Channel Guide appeared in the November, 1981, issue.

Satellite Television Glossary

— part I

Editor's Note: Reprinted with permission of Reed Publications. This glossary is part of the 86-page *Satellite Television Handbook* available for $7.95 (add $2.00 for 1st class) from Global TV, PO Box 219-H, Maitland FL 32751. Part II of the glossary will appear in the next issue of *73 Magazine*.

Active Device. An electronics component made using transistors to amplify or control a signal. *See Passive Device (next issue).*

Adjacent Channel Interference. Signal distortion because other signals in nearby frequencies are not properly filtered. A bandpass filter allows only the selected frequency band to pass through it removing adjacent channels.

AFC (Automatic Frequency Control). A satellite TV receiver feedback circuit which prevents the tuning oscillators from drifting away from the center frequency of the selected channel due to temperature change or other instabilities. A phase-locked loop demodulator usually provides an AFC output back to the LO.

AGC (Automatic Gain Control). A satellite TV receiver feedback circuit which controls the gain (amplification) of the i-f amplifiers so that the signal input to the demodulator will be constant, despite incoming signals of varying strength from different satellite transponders. AGC can be overridden by a manual gain control to make signal strength measurements in most receivers.

Alignment. The process of tuning (or tweaking) a circuit to compensate for the approximate tolerances of the components during assembly, using test equipment.

AM (Amplitude Modulation). An easy method of transmitting program signals on a carrier frequency where the relative strength (amplitude) of the carrier is made proportionally equal to the amplitude of the program signal. AM is simpler but more susceptible to noise than FM. Satellite TV uses FM for both audio and video modulation, but the user's TV set takes the satellite TV receiver's output and detects the video as AM, the audio as FM.

ANIK 1. A Canadian TV satellite operated by TELSAT. It has 12 transponders in the vertical format only and is located at 104 degrees west longitude on the geostationary orbit belt.

ANIK B. A Canadian TV satellite in the ANIK series located at 109 degrees west longitude. It has 12 vertical transponders.

Aperture Efficiency. The ratio of captured signal to the theoretical maximum for a given dish antenna/feed combination. The design goal is 100% aperture efficiency, but most TVRO dishes perform at only 50-80% to attain low noise characteristics and ease of construction. Some VHF/UHF antennas, on the other hand, can approach the 100% goal with an array of reflective elements.

ARO (Audio Receive Only). Small dish antennas used by radio networks for music and news programming distribution from TV satellites (mostly WESTARS). Dishes 2 meters and smaller have been considered by radio broadcast stations.

Artwork. A printed circuit design term which describes the printed circuit pattern of etched and conductor surfaces on a PC board.

Attenuator. A passive device which causes a known insertion loss in the signal transmission line. It is commonly used to prevent a very strong signal from overloading a receiver. They are also used as test equipment and in VHF/UHF broadcast reception to eliminate weak ghost signals.

Audio Subcarriers. The sound in a TV satellite composite signal is encoded in a narrow portion of the

video carrier, usually a high-fidelity FM signal at 6.2 or 6.8 MHz as measured after the main signal has been demodulated. Other satellite subcarriers can carry digital and text information as well.

Azimuth. Compass direction from due north measured in degrees clockwise, True north can be found by sighting the star Polaris at night, or by applying a local correction for magnetic deviation to a compass reading.

Azimuth-Elevation Mount. An inexpensive movable dish antenna mount and aiming system. It works like an oarlock where one pivot allows rotation in the horizontal plane about the azimuth angle from due north. The other pivot is the elevation above the horizon. This mount can be more difficult to aim than a polar mount. *See Polar Mount (next issue).*

Balun. An impedance-matching passive device located between a 75-Ohm coaxial cable and a 300-Ohm device, such as a TV set or VHF/UHF antenna.

Bandpass Filter. A type of electronic frequency filter which severely limits signal frequencies above and below the selected frequencies, preventing adjacent channel interference. Satellite TV receivers use these also to remove noise from around the edges of the selected channel, usually 30 MHz wide.

Baseband. This is the output signal of a video camera, videotape recorder, or satellite TV receiver before remodulation (so that it can be viewed on an ordinary TV set). A signal in a satellite TV receiver goes from 4 GHz through the downconverter to become i-f and then through an FM demodulator to become baseband. American NTSC TV bandwidth is 4.2 MHz at baseband.

Beamwidth. The beamwidth of a dish antenna is the angle of sky which can be illuminated (picked up or sent out) by the dish. Within that arc satellites can be seen from the TVRO dish. Large dishes have narrow beamwidths which reduce noise from its sides. Small dishes have wider beamwidths and are noisier, but easier to aim.

Bias. That part of an amplifier circuit which provides power for a transistor and supplies the energy for its output signal. On an LNA, the bias circuits are on a separate PC board.

Bipolar. A type of silicon transistor used in LNAs and other high-frequency, low-noise devices. They are superior in noise quality to ordinary transistors but are inferior to FETs, especially GaAsFETs.

Black Box. An engineering abstraction in which a device is considered only for its effect, not for its construction. Naive users can treat satellite TV components as black boxes until they are ready to learn more about them. They need to know only what they require and how to hook it together.

Blanking Pulses. That part of a video TV signal which for an instant blanks out the screen, enabling the electron beam to fly back to the start of a horizontal line or vertical frame. This is wasted time as far as information transmission is concerned and some methods for multiplexing data channels into a TV picture use the vertical blanking interval.

BNC Connector. Easy to lock coaxial cable fittings which interface signals in the i-f portions of a satellite TV receiver. They work well in the 70-MHz range.

Breadboard Circuit. A prototype of an electronic circuit in which changes are easily made, facilitating construction and debugging of the design.

Broadcast Satellite. A form of international frequency allocation where only the uplink stations are identified (licensed). *See Fixed Satellite for comparison.*

C Band. A loose military designation for 3.7-4.2-GHz microwave frequency band used for the downlinks of satellite TV signals. Wavelengths are between 8.10 and 7.14 centimeters (3.19 and 2.81 inches).

C/N (Carrier to Noise) Ratio. The ratio of the carrier strength and noise strength measured in dB. The higher the C/N, the higher the S/N and quality of the resulting TV picture. Above 11 dB is superior, above 7 dB is good, and below that the picture quickly becomes extremely noisy. *See also S/N (next issue) and FM Improvement (below).*

Cable TV. *See CATV below.*

Carrier. A strong signal occupying a communications channel which is modulated (AM, FM, etc.) to transmit program information. In an abstract sense, the carrier transports the program material from the transmitter to the receiver.

Cassegrain Antenna. A folded beam antenna which enjoys the advantages of a long focal length (high aperture efficiency and gain) without the disadvantages of lengthy and awkward feed supports. The subreflector is hyperbolic in cross section and is precisely adjusted to concentrate the incoming microwave fronts to a feedhorn located at the center of the dish. If the subreflector is elliptical in cross section, the antenna is also called Gregorian.

CATV (Community Antenna Television). Commonly known as cable TV, it has a central antenna tower (VHF/UHF/FM) together with a satellite TV dish antenna and captures high-quality broadcasts for subsequent sale through a signal distribution system, typically using coaxial cables to each home.

CCIR (International Radio Consultative Committee). A division of the ITU (International Telecommunications Union) which formulates international standards for radio communications, including the pre-emphasis and de-emphasis of satellite TV signals in a receiver.

CITT (International Telegraph and Telephone Consultative Committee). A division of the ITU (International Telecommunications Union) which formulates international standards for telegraph and telephone communications including uplinks and downlinks of satellite TV. *See also CCIR.*

Channel. A frequency band allocation which defines the limits of the contained broadcast carrier signal. In the USA, channels are allocated by the FCC.

Chip. An integrated circuit or section of a silicon wafer.

Chip Capacitor. A leadless capacitor small enough to be soldered directly on microstrip or stripline microwave PC boards. They must be used instead of ordinary capacitors because the leads would alter the inductive characteristics of the circuit. They are used to build LNAs.

Chroma. That part of the video signal which contains the color information.

Circular Polarization. Right- or lefthand screw sense of microwave signal polarization used by INTELSAT. A hybrid mode feed should be used to avoid the 3-dB

loss with standard linear (vertical and horizontal polarization) feeds.

Circulator. *See Isolator.*

Close-Captioned TV. A text service for the hard-of-hearing TV audience which decodes a text subcarrier and displays it at the bottom of the TV frame on the accompanying video picture. It does not interfere with the standard audio FM subcarrier.

CNR (Carrier to Noise Ratio). *See C/N.*

Coaxial Cable. A signal transmission line that is made using a center conductor separated from a shielding cylindrical outer conductor by a dielectric, usually polyethylene, sometimes air, in a low-loss application.

Commercial TVRO. A strong dish capable of withstanding hurricane force winds, an LNA with a lengthy MTBF (Mean Time Between Failures) and good noise figure, a drift-free, low-distortion receiver, and a high-quality modulator, all operating at a 3-dB margin above the receiver's FM threshold. This system supplies programming for sale through MATV or CATV distribution.

Common Carrier. An operator or lessor of satellite TV transponders which in turn leases them to other parties or transmits programming for others without controlling or owning the content. 4-GHz satellite TV is not legally a broadcast service and the FCC does not make the satellite TV common carriers (RCA Americom, Western Union. . .) abide by the constraints of broadcasting law.

Comparator. In an FM demodulator using a phase-locked loop (PLL), this is the electronic component which compares the phase relationship of the input signal with the signal from the tracking local oscillator (LO). The output signal from the comparator is proportional to the phase error between the two input signals and is used to control the LO.

Composite TV Signal. This is a combination of video picture, color, audio, and synchronization information.

COMSTAR I. An American satellite which can carry video but is operated by the telephone company, AT&T. Since it is underutilized, eventually it will carry more video. It has 24 transponders, 12 which are vertical linear polarized and 12 which are horizontal linear polarized. It is located at 128 degrees west longitude.

COMSTAR II. An American satellite, second in the COMSTAR series, which has leased 11 transponders to RCA for cable video programming. It also has 24 transponders and is located at 95 degrees west longitude.

COMSTAR III. An American satellite, third in the COMSTAR series, which like its sisters can be expected to carry more video programming in the future. It also has 24 transponders and is located at 87 degrees west longitude.

dB (decibel). A ratio expressed logarithmically which allows easy calculation of losses and gains. Two signals, S1 and S2, can be compared using dB according to the following equation: $dB = 10 \log (S1/S2)$. Often S2 is a known reference level. If a signal is 3 dB over the reference, then it is twice as strong; if it is −3 dB under the reference, then it is half as strong.

dBi. Decibel gain of an antenna over a reference antenna.

dBm. Decibel power of a signal over a 1-milliwatt reference.

dBW. Decibel power of a signal over a 1-Watt reference.

De-emphasis. A selective restoration of the high-frequency end of a satellite TV channel within the satellite TV receiver. This is performed after the FM carrier is demodulated to baseband. *See also Pre-emphasis (next issue).*

Detector. A demodulator circuit in a receiver which extracts the program signal from the carrier.

Dielectric. An electrical insulator which can carry an electric field when near a conductor. It is used to make transmission lines, microwave PC boards, and capacitors.

Diplexer. A section of waveguide which joins two microwave signals in an uplink Earth station.

Dipole. An active antenna element located in the feed which collects the concentrated satellite TV signal and conducts it to the LNA. It is called a probe in this case.

Directional Coupler. In an MATV or CATV signal distribution system, this passive device drops a signal line for a subscriber's TV set from the main trunk line. It is a superior performance signal splitter from the high level (strength) trunk line.

Discrete Components. Unlike an integrated circuit (IC), in this assembly technique each part is built separately and then assembled.

Discriminator. An FM demodulator circuit in a satellite TV receiver.

Dithering. *See Energy Dispersal Waveform.*

DOMSAT (Domestic Satellite). Distinguishes US and Canadian satellites from INTELSATs.

Double Conversion. This downconversion technique converts from 4 GHz to the final i-f (typically 70 MHz) in two stages instead of just one, so that potential image noise from the first mixer stage is eliminated. *See also Single Conversion (next issue).*

Downconversion. The process of converting the 3.7-4.2-GHz microwave signal down into a frequency range in which signal processing components are less expensive. Typically, this is a VHF frequency of 70 MHz.

Downconverter. A microwave part (consisting of local oscillators (LO), mixers, and bandpass filters) which accomplishes downconversion. This is the front end of a satellite TV receiver.

Downlink. The communication path from a TV satellite to its ground (Earth) stations.

Duroid. The brand name of a microwave printed circuit board specified in many LNA and downconverter plans. Mostly D-5880 226-127 from Rogers Corp. has been used.

Dynamic Range. The weakest through strongest signals that a receiver will accept as input. Signals which are too weak cause excess noise and signals which are too strong cause overloading and possibly modulation distortion.

East Coast Feed. Satellite TV programming scheduled for the convenience of US east coast viewers (Eastern Time Zone).

EIRP (Effective Isotropic Radiated Power). A measure of the relative strength of the satellite TV signal ex-

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pressed in dBW. The USA ranges from 30 in Florida to 37 dBW at boresight in the midwest. Home satellite TV reception becomes much less expensive at 34 dBW and above. Footprint maps showing relative signal strengths in EIRP are filed at the FCC and ITU before the TV satellite is launched.

Elevation. Angle above the horizon measured in degrees. Zero is the horizon and ninety degrees is directly overhead. Elevation angles are used to aim the dish antenna at a TV satellite.

Energy Dispersal Waveform. This is a triangular-shaped signal at 30 Hz synchronized with the vertical blanking interval in the TV signal from the satellite which ensures that the signal will average its power out over the whole channel, even when just the carrier is present. This waveform is removed by the receiver after FM demodulation.

Etched PC Board. Acid is used over a mask (artwork) to dissolve away excess copper conductor leaving a conductor pattern on the PC board.

F/D. Focal-length-to-diameter ratio of a given dish antenna. Generally higher ratios yield better aperture efficiencies, but may be more susceptible to sidelobe noise.

FCC (Federal Communications Commission). The US agency which regulates communications, including satellite TV.

Feed. The antenna feed is a section of shaped waveguide which correctly collects the dish's reflected microwave signal and conducts it to the LNA's probe. Generally, a feed is uniquely designed for each dish antenna type.

Feed. A programming term which means a stream of programming material, for example, in the process of transmission over the TV satellite. Examples of its usage are: sports feed, east coast feed, and network feed.

Feedline. Coaxial cable running from the LNA to the satellite TV receiver.

FET (Field Effect Transistor). A low-noise, high-frequency transistor amplifier which has a current source, gate, and drain. The gate is a voltage-controlled resistor which regulates the power flowing from the source to the drain.

Field-Strength Meter. A CATV and TV test device used to measure power levels on a transmission line or VHF/UHF antenna.

Fixed Satellite. A form of international frequency band allocation where all the sending (uplink) and receiving (downlink) stations are identified. This is the current status of the 4-GHz TV satellite system. *See also Broadcast Satellite above.*

FM Improvement. The potential noise reduction in an FM signal due to the demodulation process in a satellite TV receiver. This figure is at most 38.6 dB and is attained above the FM threshold. Below this point it rapidly drops from 37.6 dB. Above threshold: S/N = C/N + 38.6 dB.

FM Threshold. An input signal level which is just enough to enable the demodulator circuits to extract a good picture from the carrier. With test equipment, static threshold is the point at which S/N drops more than 1 dB from the straight graph line: SN = C/N + 38 dB. Typically, FM threshold is 7-8 dB in a satellite TV receiver with threshold extension.

Footprint. A signal strength map showing the EIRP contours of equal signal from a TV satellite transponder on a given part of the Earth's surface.

Frequency Agile. This is a feature of satellite TV receivers which enables them to tune in all the 12 or 24 channels from a satellite. Receivers sold without this feature are dedicated to one channel and can be tuned by switchable crystals.

Frequency Coordination. A service which uses computers and a USA database to resolve potential or existing conflicts between various users of the same 4-GHz microwave band. The long-lines (long-distance) division of the Bell networks uses 4-GHz microwave towers throughout the USA. A TVRO looking in the direction of a transmitter may be jammed unless shielding can be used.

Frequency Modulation (FM). A method of transmitting program material which is more interference-free than AM. The frequency of the carrier signal is made proportional to the amplitude of the program signal.

Frequency Reuse. *See Polarization (next issue).*

Front-to-Back Ratio. The ratio in dB of the antenna gain in the forwards direction to the antenna gain in the rear direction. It is a measure of the noise potential from the rear.

G/T (Gain over Noise Temperature). A TVRO measure of quality expressed in dB. The higher this figure, the better the system. It can be improved by increasing gain or by decreasing the system noise. G/T (degrees Kelvin) = antenna gain/log (antenna noise temperature + LNA noise temperature).

GaAsFET (Gallium Arsenide Field Effect Transistor). This low-noise device, although expensive, is used in the highest quality LNAs. The term is pronounced gasfet.

Geostationary. Dubbed the Clarke Orbit in honor of Arthur C. Clarke who first described it. This circular orbit above the equator is precisely the altitude at which any size satellite will revolve around the Earth once every 24 hours. From the ground below, it thus appears parked in space overhead, and from above, one-third of the Earth's surface can be seen. TV satellites are separated by 4 degree intervals on this orbit to avoid mutual interference 38,000 km (22,300 miles) high.

Ghost. One or more dim copies in a TV picture caused by reflected VHF or UHF broadcasts. Also called multipath distortion, this is not present in satellite TV signals because extremely directional dish antennas are used.

GHz (Gigahertz). The standard abbreviation for billions of cycles per second. 3.7-4.2 GHz is the microwave frequency band allocated for satellite TV in the USA.

Global Beam. An INTELSAT antenna downlink pattern covering a third of the Earth's surface. They are boresighted at the middle of an ocean to provide service to nations all the way around the ocean basin.

Guard Channel. Unused portions of the frequency spectrum which are located between program channels to prevent adjacent channel interference.

Harmonics. Spurious signals produced by an oscillator circuit which occur at integral multiples above the resonant frequency of the oscillator. They appear

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like overtones on a single piano note. They can cause design problems in a receiver circuit unless proper filters are used to remove unwanted harmonics.

HBO (Home Box Office). The most popular pay-TV network which is distributed on SATCOM F1.

Headend. The point on a signal distribution system where UHF/VHF/FM and satellite TV signals are captured, combined, and fed into the system.

Hemispherical Beam. An INTELSAT antenna downlink pattern consisting of two overlapping spot beams to cover a hemisphere.

High Pass Filter. A circuit which features high impedance for relatively low frequencies and low impedance for high frequencies, in effect blocking the low-frequency component in a signal. *See also Low Pass Filter and Bandpass Filter.*

Horn Antenna. A type of satellite TV antenna which is shielded against sidelobe interference. The incoming signal is reflected 90 degrees into a cone-shaped feedhorn. They are much more expensive than a dish antenna of the same aperture.

IC (Integrated Circuit). A solid state complex device which is mass produced on single silicon chips.

I-f (Intermediate Frequency). For satellite TV receivers, this is usually 70 MHz and is the frequency at which most of the signal processing takes place because the design is simplified and 70-MHz parts are less expensive than 4-GHz equivalents.

I-f Strip. A PC module which amplifies and filters the output signal of the downconverter in a receiver and inputs it to the FM demodulater. Its gain is controlled by the AGC circuit.

Image Noise. When a signal is downconverted using a mixer and LO, noise can be passed through the system that is on the mirror image frequency from the selected channel with the LO frequency as the point of symmetry. Subsequent bandpass filters remove this noise in double-conversion downconverters. A preselector filter in single-conversion receivers does the same thing.

Impedance. The relative ease with which signals pass through a device or conductor measured in Ohms.

Impedance Matching. The design of a signal interface such that the signal transmitted through it is maximized and the reflected signal is minimized. Standard impedance for LNAs is 50 Ohms and for satellite i-f circuits 75 Ohms. Most signal distribution systems interface at 75 Ohms impedance.

INTELSAT. International (primarily non-communist) satellite agency whose member nations lease transponder capacity on its satellite system. It provides at least some TV in all parts of the world, but signal EIRP is often quite less than US domestic satellites.

Isolator. A device which is a one-way valve for microwave signals which prevents stray receiver signals from leaking out past the LNA onto the antenna. It also facilitates the design of the LNA by impedance matching the feed probe to the first LNA amplifier stage. Most LNAs have an isolator attached between the CPR-229 feed flange and the main amplifier box.

Kelvin. The scientific temperature scale which measures thermal noise characteristics of microwave devices. Performance improves with decreasing noise temperature. 0° K equals −273 degrees Celsius and −459 degrees F. The Kelvin scale starts at absolute zero and is graduated like the Celsius scale.

Launch Vehicle. A NASA term for the rocket used to place satellites in orbit. For TV satellites this is usually the Delta, although the Space Shuttle will take over this job in the 1980s.

Level (High or Low). In communications, level means the same as amplitude or relative strength.

LO (Local Oscillator). A closely-connected frequency source which is typically controlled by a resonating crystal or by an input voltage. *See also VCO and VTO (next issue).* They are a major component of downconverters and demodulators in receivers.

Lobe. An area of strong reception in a graph of antenna gain versus angle off boresight. In highly directional dish antennas, the front lobe is high gain and the side and back lobes are much weaker.

Look Angle. Pointing angles for aiming an antenna at a TV satellite for a given site. This term is also used when referring to antenna elevation alone. It is important when considering possible site obstructions or extra antenna noise due to a low elevation (look angle).

Low Pass Filter. A circuit which features high impedance for relatively high frequencies and low impedance for low frequencies, in effect blocking the high-frequency component in a signal. *See also High Pass Filter and Bandpass Filter above.*

Luminance. That part of a video signal which controls the brightness of the image on the TV screen.

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TVRO Receivers: The Inside Story

—Satellite Central, part II

Getting 4-GHz signals down to watchable video is no easy feat. Noted satellite TV pioneer Paul Shuch N6TX once observed that there are perhaps as many receiver designs as there are receiver designers. Despite the fact that satellite TV is new, we've already experienced at least two generations worth of improvements in receiver design philosophy. Both methods employ your garden-variety superheterodyne conversion principle. But that's about the only similarity.

The major hassle is dealing with the microwave signal itself. The components are either too expensive and hard to get or they are incredibly fragile and roll over and turn belly up when you approach them with a soldering iron! So the logical solution is to convert the troublesome 4-GHz signal down to something we can massage with parts we can understand, like coils and capacitors rather than pea-sized chip caps and PC board traces that are alleged to be tuned circuits! There will be plenty of time for that later. For the time being, let's just get our feet wet.

Referring to Fig. 1, we have a typical dual-conversion receiver design. This is the "classic" or "by-the-book" method used by most commercial firms today. A voltage-tunable local oscillator (LO) mixes with the incoming 4-GHz signal down to a 400- to 1200-MHz first intermediate frequency (i-f). This is in keeping with the spirit of a textbook approach of selecting an i-f about one-tenth of the incoming signal (the "divide-by-10" rule). After some needed amplification, the signal is mixed again down to what is known as baseband (because we're done with conversion), amplified even more, and then detected with either a PLL or discriminator circuit. Baseband is generally 70 MHz, an industry standard.

So Much For Basics

The key points worth noting here are conversion to a lower frequency where we can crank in lots of easy-to-find gain...and sticking to the rules. But why do that? Well, conversion makes a lot of sense. After all, the incoming signal may very well be around −50 to −60 dBm at 4 GHz and a 564 PLL detector chip wants something quite different before it will deliver pictures.

But who made the rules about dividing by 10 and that nonsense? The guys that got there first, of course. They did some arithmetic and made a discovery of some importance. A single-conversion design has problems if you chose a first (and only) LO just 70 MHz from the desired signal. You get down to baseband a lot quicker, but you get something else in the bargain...the image signal as seen in Fig. 2.

Remember from last month's Satellite Central that the satellite band (3.7 to 4.2 GHz) is 500 MHz wide. So even an LO spaced some distance away, whether above or below the

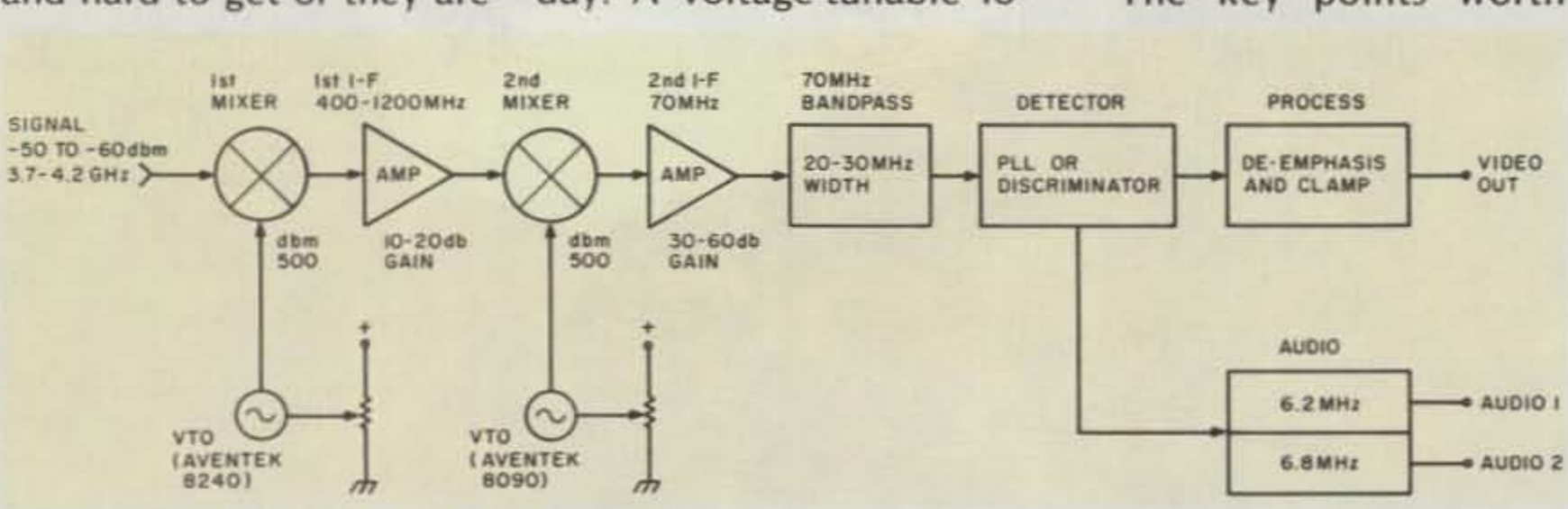

Fig. 1. Dual-conversion design. The first VTO mixes with the downlink signal into the first i-f amplifier. The second VTO is fixed. Gain distribution may vary in different designs. The 70-MHz bandpass filter must be flat in the passband for best results.

desired frequency, can still convert an undesired image signal to baseband.

Now you could filter out the image on the front end, but you would have to make the filter track with the LO to remove all images as you tuned. At these frequencies, a tracking filter is no easy beast to tame. So rather than wrestle with the problem, receiver designers such as Stanford professor Taylor Howard W6HD adopted the dual-conversion philosophy and proceeded to knock 'em dead with the first low-cost TVRO! The design has become a sort of standard of this new industry with several manufacturers duplicating it piece by piece, even to the last resistor, probably because Howard made his complete design available to anyone.

An Interesting Turn of Events

As an historical note, Howard designed his receiver with available components. The key word here is "available." While you could indeed call Avantek and order an 8240 voltage-tuned oscillator (VTO) or call Vari-L for a DBM-500 mixer, you also could sit around and tear pages off your calendar while waiting for delivery! I had time to traipse all over California scouting up surplus dishes as the clock ticked away.

Clearly, something had to be done. Several amateurs, most notably Robert Coleman K4AWB, made an interesting discovery. Not only were surplus mixers lying around, but single conversion could be made to work! A quick doodle with pencil and paper suggested it might be worth the trouble.

If we want to receive transponder 17 on SATCOM 1, its frequency is 4040 MHz. Setting the LO down 70 MHz, to 3970 MHz, will indeed pull transponder 17 into our 70-MHz i-f, but also the image frequency as well, which is 70 MHz below the LO. Now it happens that's dead-on transponder 10 at 3900 MHz. So it can't possibly work! Or can it? We know that RCA and COMSTAR birds have 24 transponders. And we also know that the odd-numbered transponders (such as transponder 17) are vertically polarized. But if the even transponders are horizontally polarized (such as transponder 10), then our receiving antenna will be cross-polarized to the interfering signal and hopefully ignore it!

So it appears that single conversion does indeed work despite the prospects of image noise. There is a limit. As a rule, cross-polarization may only reduce the image signal 20 dB, but recent efforts at image-reject mixer design and a new tracking filter eliminate this annoyance, as seen in Fig. 3.

Baseband At Last

Nearly all of the foregoing problems are a result of wideband FM video detection circuitry not working too well at high intermediate frequencies. However, it can be made to work. A few manufacturers have designed excellent discrete PLL circuits that work at 700 MHz, making signal conversion a piece of cake. But 70 MHz remains as the i-f most used at the moment.

As I mentioned before, quite a few receiver designs utilize a 564 PLL detector chip at the end of the 70-MHz i-f chain. The problem here is that the 564 is rated to only 50 MHz. Still, a handful of 564s will always yield several that work at higher frequencies, depending on the source. But a drastic improvement is 564 operation can be had by cleverly dividing the 70-MHz i-f signals by two with a cheap JK flip-flop chip like a 74LS112 and operating it at 35 MHz!

Other detector designs in use today are quadrature detectors and linear discriminators. They offer advantages and disadvantages when compared to the PLL. While the PLL offers excellent performance at receiver threshold and below, it takes second place to the discriminator and quadrature-type detector when signals are well above threshold. Remember from last month that we must try for a carrier-to-noise ratio of about 10 dB or better for clear pictures. (That translates to at least a 12-foot dish and a 120° LNA for most locations in the USA.) Still, you don't need nearly as much gain for a PLL as you do a discriminator.

To work properly, the discriminator must see a signal that is amplified well into limiting. This is the main reason why quality receivers look bad compared to cheapy models when tested on marginal systems.

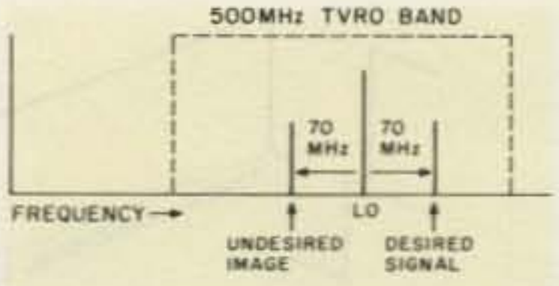

Fig. 2. An in-band LO can produce an undesired image signal. Luckily, this image is cross-polarized to the desired signal. It's not enough for perfect pictures, so other methods are necessary to ensure adequate image rejection.

SATELLITE TV HAM NET!

Tune in Sundays at 1800 GMT on 14.311 MHz for the Satellite TV Net. Lindsey Riddle W5JG in New Orleans is Net Control. Then Ken Rae WB0POP takes the reins at 1900 GMT. You'll be amazed at what you can learn in just an hour or so.

But just cranking up the gain is not enough, as some experimenters will tell you, because not all i-f amplifiers will limit symmetrically. A weak location or a smaller dish can still be made to work, thanks to the PLL.

But suppose you've dug deep into your pocketbook and found enough money to allow you to build your system so it operates well above threshold? Then the discriminator or quadrature detectors really shine because the PLL can sometimes break up an other-

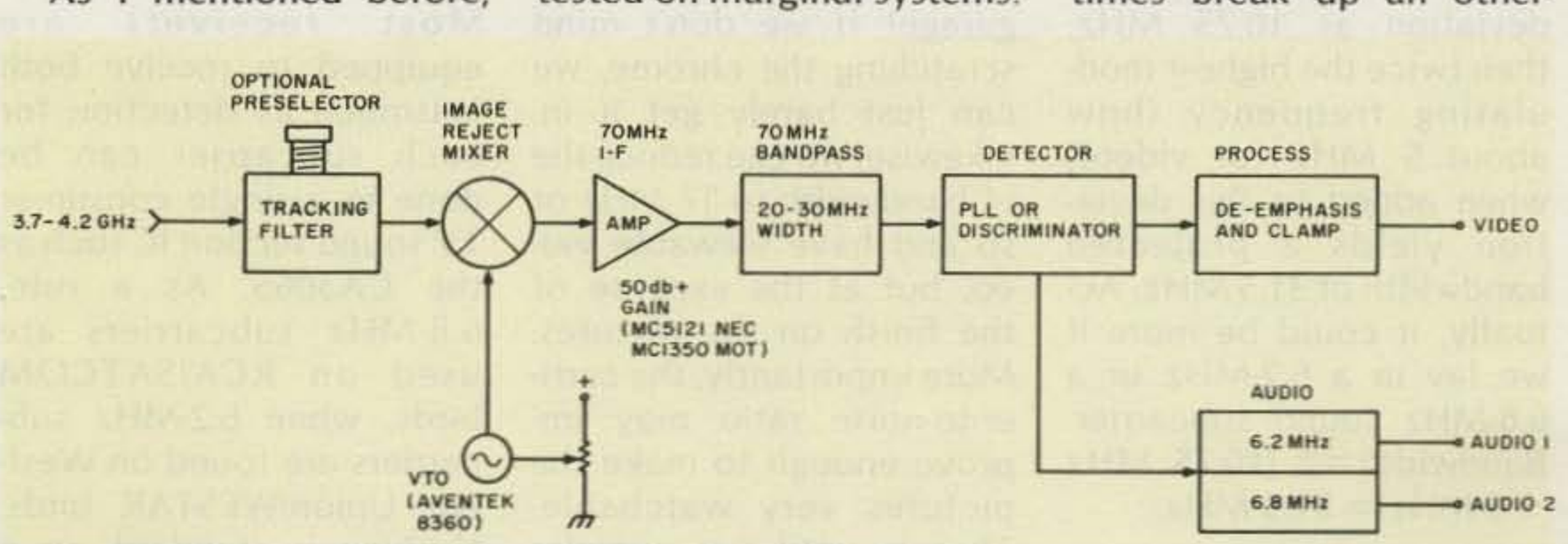

Fig. 3. Single-conversion design. The problem with single conversion is that an image signal can be detected. Tracking filters and clever image-reject mixer design can reduce the image by 20 dB or more. A good high-gain LNA will overcome mixer losses in this design.

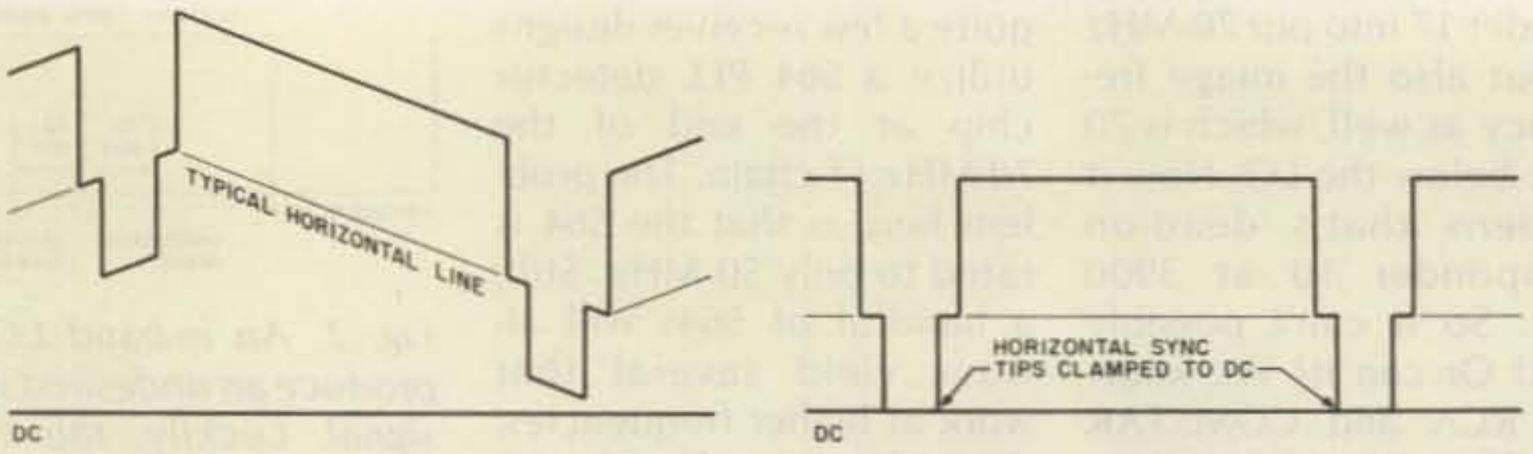

Fig. 4. (a) Video demodulator output showing video riding on energy dispersal wave. (b) Energy dispersal wave eliminated by dc clamp circuit.

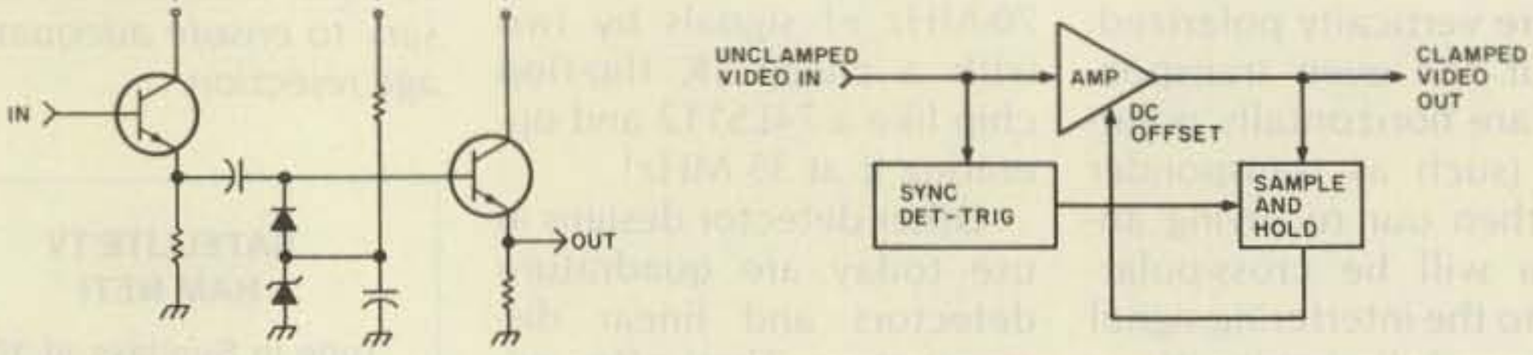

Fig. 5. Typical diode clamp circuit used in economy receivers vs. feedback clamping taken from voltage samples of the video signal during the sync pulse interval.

wise fine picture when tracking wide deviations. You see an annoying streaking effect in the video. Tweaking the bandwidth can help to cure this problem.

Now if the PLL works pretty well at the 35-MHz reduced i-f, you might wonder what would happen if we divided again and again down to nearly dc. Perhaps the only problem with that idea is that we bump into Carson's rule along the way. Simply stated, the practical bandwidth of a frequency modulated signal should be equal to twice the sum of the maximum frequency deviation and the highest modulating frequency. If we know the typical frequency deviation as 10.75 MHz, then twice the highest modulating frequency (how about 5 MHz for video?) when added to this deviation yields a projected bandwidth of 31.5 MHz. Actually, it could be more if we lay in a 6.2-MHz or a 6.8-MHz sound subcarrier. Bandwidth = 2 (10.75 MHz + 5 MHz) = 31.5 MHz.

Watching Intelligent Noise

Okay, how wide an i-f is necessary? It really depends on your carrier-to-noise ratio (C/N). If you have a small dish in a weak footprint, you may very well be at threshold or below. A wide i-f bandwidth will only make matters worse because you will appear to be seeing more noise than video. While our eyes tend to integrate enough to discern intelligence, nice and clear pictures are what we really want. If you worked out the downlink equations we discussed last month, you well know that restricting the bandwidth by more than Carson's rule can make a big improvement in C/N. But there is a limit.

The problem then is to figure out how to squeeze a wide car into a narrow garage! If we don't mind scratching the chrome, we can just barely get it in. Likewise, we can reduce the i-f bandwidth to 17 MHz or so and have viewable video, but at the expense of the finish on the pictures. More importantly, the carrier-to-noise ratio may improve enough to make the pictures very watchable. That is until you wonder what happened to the definition and why the frizzy effect when flat color fields are transmitted. Clearly, there is a limit to bandwidth restriction. Whatever was out there at those wide deviations is gone now!

You can reduce the distortion somewhat if you turn down the color and watch everything in black and white, but that's taking a giant step backwards. In fact, you might just as well turn down the sound, too, because all you'll hear is the sound of birdshot being dropped on a cookie sheet! Nothing takes the place of a large dish and a good LNA . . . nothing.

Beyond Detection

The sound channel is easy to detect. It is merely an FM subcarrier that may be 6.2 MHz or 6.8 MHz. Most receivers are equipped to receive both inasmuch as detection for each subcarrier can be done in a single consumer TV sound section IC such as the CA3065. As a rule, 6.8-MHz subcarriers are used on RCA/SATCOM birds, while 6.2-MHz subcarriers are found on Western Union/WESTAR birds. Nothing is standard, so a switchable or tunable sound subcarrier detector is necessary.

Other subcarriers may be located above video on some transponders. Background music and slow-scan services as well as data transmissions can be found. We will be sure to look at methods of recovering these signals in future installments of Satellite Central.

Satellite TV signals are pre-emphasized according to a CCIR curve. This amounts to a 10- to 12-dB boost on the high end of the video. An LC network smoothes the curve back out as well as wiping out the sound subcarriers before further video amplification.

Fig. 4(a) shows the output of a typical detector after de-emphasis. Notice the unclamped video appears to be riding on a triangular wave at the frame rate. This is known as the energy dispersal waveform and is mixed in at the uplink transmitter. It is simply a way to keep the main carrier moving during the unlikely loss of video. That way, every microwave link in the country on that frequency doesn't get sprayed with an interfering carrier from space. As a practical matter, it's quite the other way around. In any event, a clamp nails the energy dispersal waveform down to dc in Fig. 4(b) and we have clean video. If this waveform is not removed, the picture will flicker at the 30-Hz rate.

Some TVRO receivers have modulators in them so the detected video and sound can be fed directly to a TV set. Others may only have a one-volt audio and video output. While a cheap TV game modulator can be used to get the picture into channel 3 or 4 of your TV, the results leave much to be desired. Sometimes it's simply the result of poor design. But poor shielding is the likely culprit. The modulator output

↙See List of Advertisers on page 162

manages to find a way back into your 70-MHz i-f chain (remember that channels 3 and 4 would fall into the i-f bandpass of 55-85 MHz). The solution is to skip the re-modulation process and feed the audio and video into a quality TV monitor or a regular TV modified for audio and video input. On the other hand, an effortless method is to simply feed the TVRO receiver into a video tape recorder and use its internal modulator!

Obvious Differences

While price may be the major obstacle to designing an ideal receiver, experience with the problems you're likely to encounter runs a close second. As we learn more about what can and can't be done, we can make adjustments to our thinking and our design. For example, the VTO used in most receivers is a real hassle. You have 500 MHz worth of tuning spread over about a 270-degree twist on the pot. That's a lot for manual tuning (over 470 standard broadcast bands!), so afc is needed, if not for sheer operator ease, then for the very small amount of drift you'll likely encounter. Fancy receivers use a synthesizer and eliminate the problem. That takes more parts, which adds to the price . . . but not too much if you do it yourself!

You can sometimes discern a quality receiver design from an economy version by observing how well the energy dispersal clamp circuit functions. While simple receivers use a simple diode clamp, more expensive (and better designed) versions employ voltage feedback methods such as seen in Fig. 5.

By far the most interesting difference in receivers today is the concept of splitting them up into pieces as some economy-minded manufacturers have done. This eliminates the need for expensive coax to carry the 4-GHz signal from the LNA to the receiver. They simply mount the mixer, VTO, and first i-f at the dish and run the lower i-f to the house on RG-59. Some really clever LNA manufacturers are building the whole works into a single LNA and downconverter, calling it an LNC!

Tricks Worth Trying

If you want to try your hand at receiver design, go ahead with the certain knowledge that much of the foregoing works well enough to be a good point of departure for your own design fantasies. Microwave genius Steve Birkill G8AKQ, of Sheffield, England, downconverts into a broadbanded UHF TV tuner. He does the first conversion to UHF at the antenna so that RG-59 can be used rather than the expensive 4-GHz stuff. The UHF tuner then performs the second conversion down to an i-f the PLL can handle.

The cost of tuners like Steve's is around 25 bucks. Some of the newer varactor tuners are very broadband except for a coil in the last stage. A few moments of work are all that's necessary to modify the stage for the wide bandwidth needed for good pictures. Does the idea sound interesting? Then how about following the tuner with a very cheap TV IC amplifier chip such as the MC1350 for your i-f amplifier? And if you don't like that PLL, then why not use an MC1357 FM quadrature detector chip instead? Rex Rhoads, an engineer with RCA, has done it with excellent results. By the way, the construction cost of his entire receiver using this very conventional circuitry (no secret chips or tricks) is way under $100!

The time is right for you to join in the fun of receiving TV from space. If you have a question regarding the topics we cover here, feel free to drop me a line (letters only, no calls please). Sorry, I can only answer mail that is accompanied by an SASE.

You can find out more about receivers by reading two back issues of *73:* November, 1979 ("The Satellite TV Primer," Bob Cooper) and December, 1979 ("Low-Cost Receiver for Satellite TV," Paul Shuch). ■

The Nelson Parabolic TVRO Antenna Manual
by Nelson Ethier
reviewed by:
S.F. Mitchell WA4OSR and Richard Christian WA4CVP

As the foreword in the *Manual* states, author Ethier has no formal microwave training, but "he is an excellent student of obscure textbooks and an avid do-it-himselfer. . ."

The Nelson Parabolic TVRO Antenna Manual starts with a general discussion of parabolic dish design and describes the relative advantages of a parabolic antenna over the spherical antenna. These advantages include the fact that the focus never changes and that the entire surface works to collect the signal. A brief review of noise, noise measurement (dB and degrees K), calculation of antenna gain, wavelength, and formulas to find parameters follows. Nelson then gives the arguments for different focal ratios and the reasons why he selected an f/d (focal point to diameter) ratio of 0.375.

Very detailed treatment is given to the calculation of the parabolic curve for his antenna. The formula and a method of laying out the curve on graph paper is presented along with a table with the curve calculated in one-half-inch steps for a 10-foot dish with a .45 f/d ratio or a 12-foot dish with a .375 f/d ratio. These calculations are very simple and can be done on a calculator with a square root function.

The most informative part for us was the section on choosing the antenna to suit the needs of a particular site. A brief discussion of the significance of the carrier-to-noise ratio (CNR) and an example of its calculation gives you an idea of the type of picture quality you should be able to obtain at your location.

The material between page 11 and the *Manual*'s end on page 31 is devoted to the actual construction of a 12-foot parabolic antenna, feed, feedhorn, and polar mount. The antenna is built on a form which must be fabricated with plywood and fiberglass rods. The form is constructed and covered with 0.020 sheet aluminum which must be cut and formed. Fiberglass is then applied to the back of the aluminum. Reinforcing ribs of wood and urethane are then added and a second layer of fiberglass is applied. The finished antenna appears to be quite sturdy. Although no estimate of the antenna's cost is given by Ethier, we estimate that it would cost between $750 and $1000 and require as much as two months of steady work to complete.

Pages 23 to 29 describe the fabrication of the feed, feedhorn, and mount. The feed itself is an aluminum tripod bolted to the rim of the dish. It appears that this system, which involves using an antenna rotator to turn the horn, may put undue stress on the feed assembly.

Overall, we feel that the *Manual* gives a lot of good information, but it gives very little that we haven't seen elsewhere. The best part of the manual is the first ten pages where antennas and system requirements in general are discussed. The actual construction of the antenna may not be practical since a commercial antenna can be as cheap, if not cheaper. *The Nelson Parabolic TVRO Antenna Manual* is well worth $15.00, but at the $30.00 cover price we feel that it is very expensive. *The Nelson Manual* is available from the publisher, Satellite Television Technology, PO Box G, Arcadia OK 73007.

This review is reprinted from *'Lite News*, PO Box 973, Mobile AL 36601.

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The Standard for Comparison

New AZDEN® PCS-300

2-M Handheld FM Transceiver

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BUSY AND VACANT SCAN MODES • Scan for either an occupied or empty frequency.

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DIGITAL S/RF AND MEMORY ADDRESS METER • Shows relative signal strength on receive, relative power on transmit. Also shows memory address.

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TRUE FM • Not phase modulation – Unparalleled audio quality.

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STANDARD ACCESSORIES • Heavy duty NICAD battery pack (500 mAh), belt clip, hand strap connector, flexible rubber antenna, earphone, ac charging unit, and special stand for table-top operation.

OPTIONAL ACCESSORIES • Deluxe leather case, mobile dc charging cord, external speaker/microphone, and PL tone module.

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TS-130S/V

"Small wonder"...speech processor, N/W switch, IF shift, digital display

The compact, all solid-state HF SSB/CW mobile or fixed station TS-130 Series transceiver covers 3.5 to 29.7 MHz, including the three new bands.

TS-130 SERIES FEATURES:

- 80-10 meters, including the new 10, 18, and 24-MHz bands. Receives WWV.
- TS-130S runs 200 W PEP/160 W DC input on 80-15 meters and 160 W PEP/140 W DC on 12 and 10 meters. TS-130V runs 25 W PEP/20 W DC input on all bands.
- Built-in speech processor.
- Narrow/wide filter selection on both CW (500 Hz or 270 Hz) and SSB (1.8 kHz) with optional filters.
- Automatic selection of sideband mode (LSB on 40 meters and below, and USB on 30 meters and above). SSB REVERSE switch provided.
- Built-in digital display.
- Built-in RF attenuator.
- IF shift (passband tuning).
- Effective noise blanker.

OPTIONAL ACCESSORIES:

- PS-30 base-station power supply.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.
- AT-130 compact antenna tuner (80-10 meters, including three new bands).
- SP-120 external speaker.
- VFO-120 remote VFO.
- MB-100 mobile mounting bracket.
- PS-20 base-station power supply for TS-130V.

Optional DFC-230 Digital Frequency Controller
Frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Four memories and digital display. (Also operates with TS-120S, TS-530S, and TS-830S.)

PS-30 SP-120 TS-130S VFO-120

SP-230 TS-830S VFO-230 AT-230

TS-830S

"Top-notch"...VBT, notch, IF shift, wide dynamic range

The TS-830S has every conceivable operating feature built-in for 160-10 meters (including the three new bands). It combines a high dynamic range with variable bandwidth tuning (VBT), IF shift, and an IF notch filter, as well as very sharp filters in the 455-kHz second IF. Its optional VFO-230 remote digital VFO provides five memories.

TS-830S FEATURES:

- LSB, USB, and CW on 160-10 meters, including the new 10, 18, and 24-MHz bands. Receives WWV.
- Wide receiver dynamic range. Junction FETs in the balanced mixer, MOSFET RF amplifier at low level, and dual resonator for each band.
- Variable bandwidth tuning (VBT). Varies IF filter passband width.
- Notch filter (high-Q active circuit in 455-kHz second IF.
- IF shift (passband tuning).
- Built-in digital display (six digits, fluorescent tubes), analog dial, and display hold (DH) switch.
- Noise-blanker threshold level control.
- 6146B final with RF negative feedback. Runs 220 W PEP (SSB)/180 W DC (CW) input on all bands.
- Built-in RF speech processor.
- Narrow/wide filter selection on CW.
- SSB monitor circuit to check transmitted audio quality.
- RIT (receiver incremental tuning) and XIT (transmitter incremental tuning).

OPTIONAL ACCESSORIES:

- SP-230 external speaker with selectable audio filters.
- VFO-230 external digital VFO with 20-Hz steps, five memories, digital display.
- AT-230 antenna tuner/SWR and power meter/antenna switch 160-10 meters, including three new bands.
- YG-455C (500 Hz) or YG-455CN (250 Hz) CW filter for 455 kHz IF.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter for 8.83 MHz IF.
- KB-1 deluxe heavyweight knob
- (VFOs for TS-830S, TS-530S, TS-130 Series, and TS-120S are compatible with all four series of transceivers.)

KENWOOD

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TS-530S

IF shift, digital display, narrow-wide filter switch

The TS-530S SSB/CW transceiver covers 160-10 meters using the latest, most advanced circuit technology, yet at an affordable price.

TS-530S FEATURES:

- 160-10 meter, LSB, USB, CW, all amateur frequencies, including new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- Built-in digital display (six digits, fluorescent tubes), with analog dial.
- IF shift tunes out interfering signals.
- Narrow/wide filter selector switch for CW and/or SSB.
- Built-in speech processor, for increased talk power.
- Wide receiver dynamic range, with greater immunity to overload.
- Two 6146B's in final, allows 220W PEP/180 W DC input on all bands.
- Advanced single-conversion PLL, for better stability, improved spurious characteristics.
- Adjustable noise-blanker, with front panel threshold control.
- RIT/XIT front panel control allows independent fine-tuning of transmit or receive frequencies.

OPTIONAL ACCESSORIES:

- SP-230 external speaker with selectable audio filters.
- VFO-240 remote analog VFO.
- VFO-230 remote digital VFO.
- AT-230 antenna tuner/SWR/power meter.
- MC-50 desk microphone
- KB-1 deluxe VFO knob.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.

MC-50

SP-230 TS-530S VFO-240 AT-230

TS-660

"Quad Bander"...dual VFOs, memory, scan, IF shift, FM, SSB, CW, AM

The TS-660 is a unique, all-mode transceiver designed for operation on 6, 10, 12, and 15 meters.

TS-660 FEATURES:

- FM, SSB (USB), CW and AM operation.
- 10 Hz step digital VFO. The frequency step is determined by mode of operation.
- F. STEP switch allows alternative step size in each mode.
- Dual VFOs built-in.
- 5 channel memory stores frequency and band information.
- Memory scan scans all bands, skips channels not in use.
- UP/DOWN push-button frequency control on microphone.
- UP/DOWN bandswitch.
- Frequency lock function switch.
- IF SHIFT circuit built-in.
- Fluorescent digital display shows Tx/Rx frequencies.
- Squelch circuit for FM, SSB, CW and AM.
- CW semi break-in circuit, with CW side tone.
- 10 W RF output on SSB, CW, FM. 4 W on AM.
- Two antenna terminals provided.
- RIT control. • Noise blanker.

OPTIONAL ACCESSORIES:

- PS-20 power supply.
- SP-120 external speaker.
- MB-100 mobile mounting bracket.
- YK-88C normal CW, (500 Hz) filter or YK-88CN narrow band CW, (270 Hz) filter.
- YK-88A AM (6 kHz) filter.
- VOX-4 speech processor/VOX unit.

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Digital world clock with two 24-hour displays, quartz time base

The HC-10 digital world clock with dual 24-hour display shows local time and the time in 10 preprogrammed plus two programmable time zones.

R-600

"Now hear this"... digital display, front speaker, easy tuning

The R-600 is a high performance, general coverage communications receiver covering 150 kHz to 30 MHz in 30 bands, at an affordable price. Use of PLL synthesized circuitry provides high accuracy of frequency with maximum ease of operation.

R-600 FEATURES:

- 150 KHz to 30 MHz continuous coverage, AM, SSB, or CW.
- 30 bands, each 1 MHz wide, for easier tuning.
- Five digit frequency display, with 1 KHz resolution.
- 6 kHz IF filter for AM (wide), and 2.7 kHz filters for SSB, CW and AM (narrow).
- Up-conversion PLL circuit, for improved sensitivity, selectivity, and stability.
- Communications type noise blanker eliminates "pulse-type" noise.
- RF Attenuator allows 20 dB attenuation of strong signals.
- Tone control.
- Front mounted speaker.
- "S" meter, with 1 to 5 SINPO scale, plus standard scale.
- Coaxial, and wire antenna terminals for 2 MHz to 30 MHz. Wire terminals for 150 KHz to 2 MHz.
- 100, 120, 220, and 240 VAC, 50/60 Hz. Selector switch on rear panel.
- Optional 13.8 VDC operation, using DCK-1 cable kit.
- Other features include carrying handle, headphone jack, and record jack.

OPTIONAL ACCESSORIES:

- DCK-1 DC Cable kit.
- SP-100 External Speaker.

R-1000

"Hear there and everywhere"... easy tuning, digital display

The R-1000 is an amazingly easy-to-operate, high-performance, communications receiver, covering 200 kHz to 30 MHz in 30 bands. This PLL synthesized receiver features a digital frequency display and analog dial, plus a quartz digital clock and timer.

R-1000 FEATURES:

- Covers 200 kHz to 30 MHz continuously.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock with timer to turn on radio for scheduled listening or control a recorder through remote terminal.
- Step attenuator to prevent overload.
- Three IF filters for optimum AM, SSB, CW. 12-kHz and 6-kHz (adaptable to 6-kHz and 2.7-kHz) for AM wide and narrow, and 2.7-kHz filter for high-quality SSB (USB and LSB) and CW reception.
- Effective noise blanker.
- Terminal for external tape recorder.
- Tone control.
- Built-in 4-inch speaker.
- Dimmer switch to control intensity of S-meter and other panel lights and digital display.
- Wire antenna terminals fo; 200 kHz to 2 MHz and 2 MHz to 30 MHz. Coax terminal for 2 MHz to 30 MHz.
- Voltage selector for 100, 120, 220, and 240 VAC. Also adaptable to operate on 13.8 VDC with optional DCK-1 kit.

OPTIONAL ACCESSORIES:

- SP-100 matching external speaker.
- HS-6 lightweight, open-air headphone set.
- HS-5 and HS-4 headphones.
- DCK-1 modification kit for 12-VDC operation.

SP-100 R-1000 HS-5

KENWOOD

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut, Compton, California 90220

TR-2500

BIG performance, small size, smaller price!

The TR-2500 is a compact 2 meter FM handheld transceiver featuring an LCD readout, 10 channel memory, lithium battery memory back-up, memory scan, programmable automatic band-scan, Hi/Lo power switch and built-in sub-tone encoder.

TR-2500 FEATURES:

Extremely compact size and light weight 66 (2-5/8) W x 168 (6-5/8) H x 40 (1-5/8) D, mm (inches), 540 g, (1.2 lbs) with Ni-Cd pack.
LCD digital frequency readout, with memory channel and function indication.
Ten channel memory, includes "M0" memory for non-standard split frequencies.
Lithium battery memory back-up, built-in, (estimated 5 year life) saves memory when Ni-Cd pack discharged.
Memory scan, stops on busy channels, skips channels in which no data is stored.
UP/DOWN manual scan in 5 KHz steps.

CONVENIENT TOP CONTROLS

- 2.5 W or 300 mW RF output. (HI/LOW power switch.)
- Programmable automatic band scan allows upper and lower frequency limits and scan steps of 5 KHz and larger (5, 10, 15, 20, 30 KHz...etc) to be programmed.
- Built-in tuneable (with variable resistor) sub-tone encoder.
- Built-in 16 key autopatch encoder.
- Slide-lock battery pack.
- Repeater reverse operation.
- Keyboard frequency selection across full range.
- Extended frequency coverage; 143.900 to 148.995 MHz in 5 KHz steps.

- Optional power source, MS-1 mobile or ST-2 AC charger/power supply allows operation while charging. (Automatic drop-in connections.)
- High impact plastic case.
- Battery status indicator.
- Two lock switches for keyboard and transmit.

STANDARD ACCESSORIES:

- Flexible rubberized antenna with BNC connector.
- 400 mAH heavy-duty Ni-Cd battery pack.
- AC charger.

OPTIONAL ACCESSORIES:

- ST-2 Base station power supply and quick charger (approx. 1 hr.).
- MS-1 13.8 VDC mobile stand/charger/power supply.
- TU-1 Programmable "DIP switch" (CTCSS) encoder.
- SMC-25 Speaker microphone.
- LH-2 Deluxe top grain cowhide leather case.
- PB-25 Extra Ni-Cd battery pack, 400 mAH, heavy-duty.
- BH-2 Belt hook.
- WS-1 Wrist strap.
- EP-1 Earphone.
- RF power amplifier. (To be announced.)

TR-7850

40 W, 15 memories/offset recall, scan, priority, autopatch (DTMF)

Kenwood's remarkable TR-7850 2-meter FM mobile transceiver provides all the features you could desire, including a powerful 40 watts output. A 25 watt version, the TR-7800 is also available.

TR-7850 FEATURES:

40 watts output, with selectable high or low power operation.
15 multifunction memory channels, easily selectable with a rotary control, M1-M13 ... memorize frequency and offset (±600 KHz or simplex).
M14 ... memorize transmit and receive frequencies independently for non-standard offset. M0 ... priority channel, with simplex ±600 KHz or non-standard offset operation.

- Internal battery back-up for memories. Requires four AA Ni-Cd batteries, (not supplied).
- Extended frequency coverage, 143.900-148.995 MHz in 5 or 10 KHz steps.
- Priority alert. Beep alerts operator when signal appears on priority channel.
- Built-in autopatch encoder (DTMF). All 12 plus four additional DTMF signaling tones. (With simultaneous push of REV switch.)
- Autoscan of memories and entire band. Scan resumes automatically.
- Front panel keyboard.
- Compact size.
- UP/DOWN manual scan of entire band and memories, using UP/DOWN microphone (supplied).
- Repeater reverse switch.
- Separate digital displays for frequency and memory channel.
- LED S/RF bar meter.
- Tone switch.

Matching accessories for fixed station operation:

- KPS-12 power supply (for TR-7850)
- KPS-7 power supply (for TR-7800)

SP-40

Compact mobile speaker
Only 2-11/16 W x 2-1/2 H x 2-1/8 D (inches)
Handles 3 watts of audio

KENWOOD

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1111 West Walnut, Compton, California 90220

The TR-7730 is available in two variations: a 16-key autopatch UP/DOWN microphone (MC-46) version, and a basic UP/DOWN microphone version.

TR-7730

Miniaturized, 5 memories, memory/ band scan

The TR-7730 is a very compact 25 watt, 2-meter FM mobile transceiver, reasonably priced.

TR-7730 FEATURES:

- Dimensions: 5-3/4 W x 2 H x 7-3/4 D, inches. Weighs 3.3 lbs.
- Extended frequency coverage, 143.900-148.995 MHz, in 5 or 10 KHz steps.
- 25 watts RF output power, with HI/LOW power switch.
- 5 memories for operation in simplex or repeater modes.
- Memory scan, plus automatic band scan.
- UP/DOWN manual scan on microphone (supplied).
- Four digit LED frequency display.
- S/RF bar meter. LED indicators for BUSY, ON-AIR, REPEATER offset.
- Tone switch for internal tone encoder (not Kenwood supplied).
- Offset switch, ±600 kHz. Non-standard offset uses fifth memory.

OPTIONAL ACCESSORIES:

- MC-46 16-key autopatch UP/DOWN microphone.
- SP-40 compact mobile speaker.
- KPS-7 fixed station power supply.

TR-8400

Synthesized 70-cm FM mobile rig

- Covers 440-450 MHz, in 25 KHz steps, with two VFOs.
- Transmit offset switch for ±5 MHz. Non-standard offset uses fifth memory.
- HI/LOW power switch selects 10 or 1 watt RF output.
- Similar to TR-7730 in other features, including five memories, memory scan, automatic band scan, UP/DOWN manual scan, four digit display, S/RF bar meter, LED indicators, tone switch, and same optional accessories.

- MC-46 16-key autopatch UP/DOWN microphone.

TR-9000

"New 2-meter direction"...compact rig with FM/SSB/CW, scan, five memories

The TR-9000 combines the convenience of FM with long distance SSB and CW. It is extremely compact . . . perfect for mobile operation. Matching accessories are available for optimum fixed-station operation.

TR-9000 FEATURES:

- FM, USB, LSB, and CW.
- Only 6-11/16 inches wide, 2-21/32 inches high, 9-7/32 inches deep.
- Two digital VFOs, with selectable tuning steps of 100 Hz, 5 kHz, and 10 kHz.
- Digital frequency display. Five, four, or three digits, depending on selected tuning step.
- Covers 143.9000-148.9999 MHz.
- Band scan . . . automatic busy stop and free scan.
- SSB/CW search of selectable 9.9-kHz bandwidth segments.
- Five memories . . . four for simplex or ±600 kHz repeater offsets and the fifth for a non-standard offset (memorizes transmit and receive frequency independently).
- UP/DOWN microphone (standard) for manual band scan.
- Noise blanker for SSB and CW.
- RIT (receiver incremental tuning) for SSB and CW.
- RF gain control.
- CW sidetone.
- Selectable RF power outputs . . . 10 W (HI)/1 W (LO).
- Mobile mounting bracket with quick-release levers.
- LED indicators . . . ON AIR, BUSY, and VFO.

OPTIONAL ACCESSORIES:

- PS-20 fixed-station power supply.
- SP-120 fixed-station external speaker.
- BO-9 System Base . . . with power switch, SEND/RECEIVE switch (for CW), memory-backup power supply, and headphone jack.
- MC-46 16-key autopatch UP/DOWN microphone.

PS-20 TR-9000 BO-9 SP-120

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TL-922-A

Maximum legal power on 160-15 meters

The TL-922A linear amplifier provides maximum legal power on the 160-15 meter Amateur bands.

TL-922A FEATURES:

- 2000 W PEP (SSB)/1000 W DC (CW, RTTY) input power on 160, 80, 40, 20, and 15 meters, with 80 W drive.
- Excellent IMD characteristics.
- Pair of EIMAC 3-500Z high-performance transmitting tubes.
- Safety protection.
- Blower with automatic turnoff-delay circuit.
- Variable threshold level type ALC.
- Two meters, one indicating plate current, and the other indicating grid current, relative RF output, and high voltage.

SM-220

High-performance oscilloscope for various monitoring functions

The SM-220 Station Monitor provides a variety of waveform-observing capabilities, and an optional pan display.

SM-220 FEATURES:

- Monitors transmitted SSB and CW waveforms from 1.8 to 150 MHz.
- Monitors signal waveforms in receiver's IF stage.
- Functions as high-sensitivity, wide-frequency-range (up to 10 MHz) oscilloscope.
- Tests linearity of linear amplifiers (provides trapezoid pattern).
- Allows observation of RTTY tuning points (cross pattern).
- Built-in two-tone (1000-Hz and 1575-Hz) generator.
- Expandable to pan-display capability for observing the number and amplitude of stations within a switchable ±20 kHz/±100 kHz bandwidth.

OPTIONAL ACCESSORIES:

- BS-8 pan-display module for TS-180S, TS-530S, TS-830S, and TS-820 Series.
- BS-5 pan-display module for TS-520 Series.

ACCESSORIES

A wide selection of optional accessories is offered for optimum operating flexibility. In addition to the optional items listed with each piece of equipment described in this catalog, the following accessories are also available:

PC-1 phone patch with hybrid circuit and VU meter for null and audio gain measurements.

MC-60 deluxe dual impedance (50KΩ/500Ω) desk microphone with 4-pin connector. Also available with UP/DOWN switch, in 6 or 8-pin connector versions.

KB-1 deluxe, heavyweight, aluminum knob for TS-830S, TS-530S, TS-180S, TS-820S, and R-820.

RD-20 50Ω RF dummy load, (DC-500 MHz) 50 W intermittant, 20 W continuous.

DM-81

Dip meter performs many RF measurements

The DM-81 dip meter is highly accurate and features, in addition to the traditional inductive-coupling technique, capacitive coupling for measuring metal-enclosed coils and toroidal coils.

DM-81 FEATURES:

- Measuring range of 700 kHz-250 MHz in seven bands.
- Built-in storage compartment for all seven coils, capacitive probe, earphone, and ground clip lead.
- All solid-state and built-in battery.
- HC-25U and FT-243 sockets for checking crystals and marker-generator function.
- Amplitude modulation.
- FET for good sensitivity.
- Absorption frequency meter function.
- Earphone for monitoring transmitted signals.
- Capacitance probe for measuring resonant frequencies without removing coil shields, and also for measuring resonant frequencies of toroidal coils.

HS-6 lightweight, open-air headphone set.

MC-46 16-key autopatch UP/DOWN microphone.

OTHER ACCESSORIES:

MC-50 dynamic dual-impedance (50 kΩ/500Ω) desk microphone.
MC-30S (500Ω) and **MC-35S** (50 kΩ) dynamic noise-canceling hand microphones.
HS-5 deluxe 8Ω headphone set.
HS-4 8Ω headphone set.

KPS-21 13.8 VDC fixed-station power supply, 21A intermittant, 16A continuous.

NOTE: **Prices and specifications of all Trio-Kenwood products are subject to change without prior notice or obligation.**

KENWOOD
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The Ace Portable Synthesized VHF Receiver

—for those times when listening is enough

Karl T. Thurber, Jr. W8FX
317 Poplar Drive
Millbrook AL 36054

The sight of a 2-meter handie-talkie (HT) strapped to the belt has long become a telltale sign that the wearer is an amateur radio operator—whether it be at a hamfest, on the street, in a public place, or wherever. There's no question that the personal two-way portable has revolutionized amateur radio with a "go-anywhere" mobility and convenience that was unheard of just 8 or 10 years ago.

Nevertheless, there are times when even the smallest of amateur HTs are a bit much to tote around. In many situations, sporting an obvious HT marks one as a nut, freak, or fuzz and can even set one up for a ripoff. Frequently, it's not absolutely necessary to be able to transmit; a small monitor receiver may do the trick. What is, in fact, needed in many situations is an ultra-small, programmable, synthesized monitor that is truly of pocket-sized dimensions.

A few years back, the Henry Radio Co. took a giant step forward in this area by marketing a line of low-cost pocket receivers, available in several models: a VHF-high band scanning radio, a 12-channel non-scanner, a two-channel VHF-high monitor/paging receiver, and a single-channel UHF receiver. These four radios, available with accessory continuous tone-controlled squelch system (CTCSS) and two-tone decoders, filled a variety of needs as monitor or pager receivers for hams, volunteer firemen, auxiliary police, civil defense personnel, and the like. The sets, with sensitivity typically in the range of 0.8 microvolts for 20-dB quieting and including an internal nicad pack, were not only shirt-pocket size, they were small enough to fit in the palm of the hand. Their main drawback, common to all such fixed-tuned, crystal-controlled receivers, was the fact that they were just that, *fixed tuned*, meaning that additional (expensive) crystals were required for expanded frequency coverage. For example, in the case of a 12-channel VHF receiver, $60 worth of crystals at $5 a shot would be required for full utilization. The same technical developments in frequency synthesis that caused the crystal-controlled HT to go out of favor have had almost the same effect on monitor receivers such as these, as

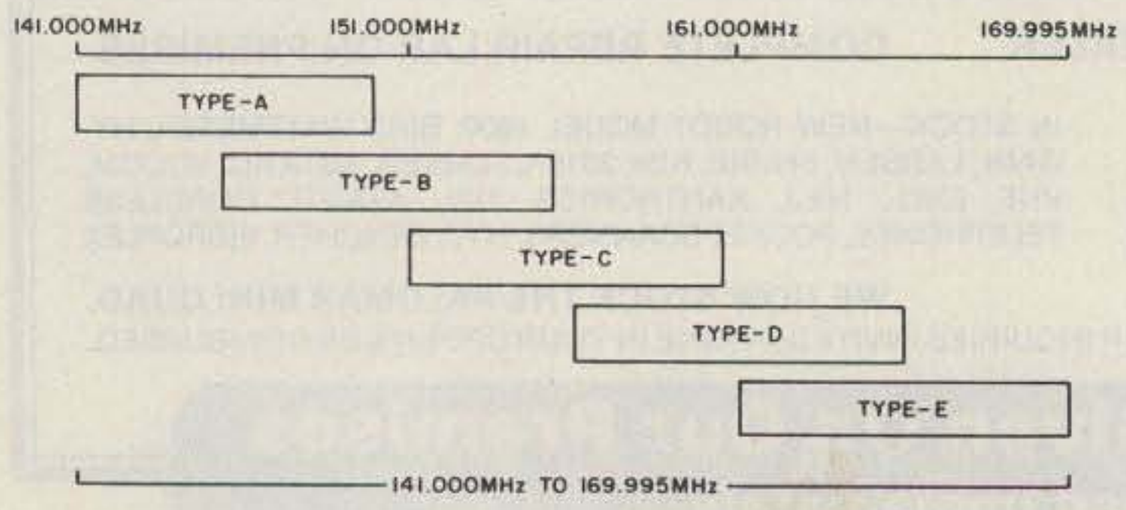

Fig. 1.

well as mass-market police and fire monitor table radios and scanners of the type made by Bearcat, Regency, and Radio Shack.

A recently introduced VHF FM PLL synthesized monitor, the AR-22, manufactured by AOR, Ltd., of Tokyo and sold in the US by Ace Communications, Inc., of Tustin CA, has effectively harnessed the new technology and made practical a wide-range VHF communications receiver in a coat- or shirt-pocket package. The new radio, which is 5¼" H × 2½" W × 1" D, weighs but 7.1 oz. (200 grams) with the battery pack installed. The AR-22 is designed specifically for applications where people on the move must reliably monitor transmitted VHF signals, even under adverse conditions. The AOR unit is capable of covering the VHF frequency spectrum from 131.000 MHz to 179.995 MHz and is offered in five discrete ranges emphasizing monitoring requirements of different radio services including amateur, police, government, marine, railroads, etc. As can be seen from a look at Fig. 1, the two receiver configurations of most interest to amateurs are Type A, covering 141.000 to 149.995 MHz, and Type B, covering 146.000 to 154.995 MHz. The maximum frequency coverage of each set is listed as 8.995 MHz with little or no degradation of performance at the band edges.

Designed for FM reception, the radios feature PLL frequency systhesized, dual-conversion superhet circuitry with low-noise CMOS logic to cover the 8.995 MHz range specified, in 5-kHz increments.

The direct frequency readout enables positive

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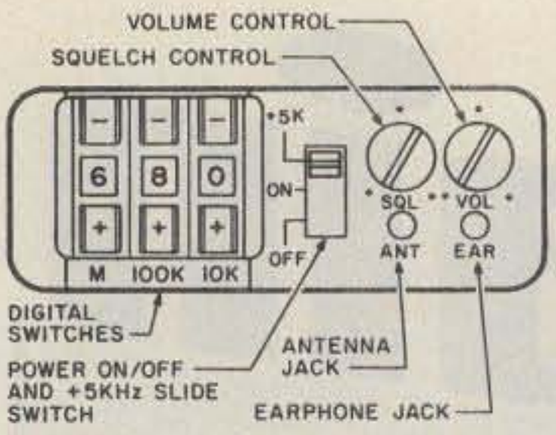

Fig. 2.

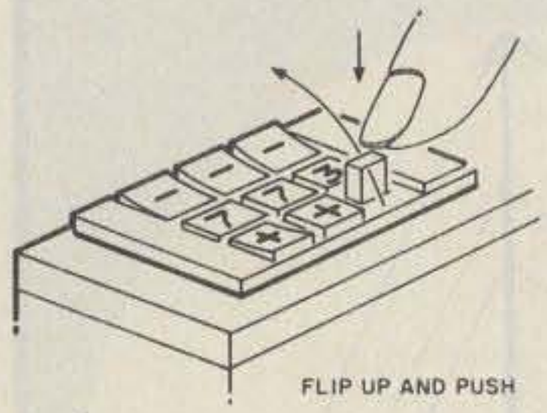

Fig. 3.

frequency control without the battery drain introduced by LEDs or LCDs.

The two most significant digits are factory-programmed. For example, in the Type A (2-meter) receiver, the base is 140.000 MHz; this does not require reprogramming. As indicated in Fig. 2, the third, fourth, and fifth digits are individually controlled and set by the three-section digital thumbswitch on the radio's top panel. The slide switch allows for 5-kHz reception increments—this feature allows the receiver to monitor the exact transmitted frequency or to be set for standby at a predetermined frequency. The receiver is set to the desired frequency using the (+) or (−) flip-up push-button located adjacent to the digit to be changed—the button is simply flipped up (+ or −), then pushed down to set the desired frequency (see Fig. 3).

The receiver's specs are impressive and are, in fact, comparable to good amateur HTs. Claimed sensitivity is 0.2 microvolts EIA for 12 dB SINAD, with an audio squelch sensitivity of 0.2 microvolts. The radios incorporate what the manufacturer calls "electric stage tuning" for nearly 9-MHz-wide coverage. As such, the input and rf stages of the set are tuned electronically by variable tuning diodes which are inserted into each stage to obtain maximum sensitivity as well as maximum selectivity and out-of-band spurious and image signal rejection. Adjacent channel rejection is spec'd at ±12.5 kHz at 60 dB down, while spurious and image attenuation is about 50 dB. Frequency stability is excellent, within ±10 ppm (parts per million) over the operating temperature range of −10 degrees C to +60 degrees C.

The physical construction of the little unit is very sturdy. The set is designed and tested to operate under adverse, knockabout conditions. The high-impact ABS plastic case housing protects against physical shock, while the double-sided glass-epoxy printed circuit board ensures a tight ship inside.

Audio output is sufficient, considering the physical size and power limitations imposed. Rated audio output power is 100 mW into an 8-Ohm load at 10% THD (total harmonic distortion); power consumption is but 25 mA with receiver squelched, rising to 100 mA at the rated 100 mW audio output level. The internal battery furnished is a rechargeable 4.9-volt, 225-mAh nicad pack.

For a refreshing change, there are no accessories that must be purchased to achieve acceptable and convenient operation. Included are a wall-type charger for charging the 225-mAh nicad battery pack, the pack itself, standard 7" and mini (4") helical (rubber duck) antennas, a 20" wire lead antenna, and an earphone. The only optional accessories offered by the manufacturer are a leather carrying case and vehicular charger.

The set's full set of specs is given in Fig. 4. How did the little radio perform on the go?

We selected the "B" model, which covers 146.000 to 154.995 MHz, for purchase. This choice allowed us to cover both the populous top 2 MHz of 2 meters, plus a 7-MHz chunk of the adjacent public service and commercial bands, allowing bonus coverage of local police, fire, highway, paging, mobile radiotelephone, and taxicab frequencies. The radio's battery was found fully charged upon receipt (in use it takes about 10 hours to fully charge the radio with the set turned off). The fact that the battery was charged allowed us to check out the radio's performance within a few minutes of unpacking it. When used with the standard-size (7") rubber duck antenna, we found reception to be entirely adequate from medium- to high-level signal sources, actually about equivalent to that expected of the typical amateur HT when using a rubber duck antenna. Reception on the smaller (4") mini-duck was, predictably, not as good, but represented a good space-saving compromise when receiving strong local signals. The 20" wire lead antenna did not seem to offer any improvement in reception over the larger rubber duck.

Technical Data

Frequency Range	131.000 MHz to 179.995 MHz
Maximum Frequency Coverage	8.995 MHz with no degradation of performance
Receiving Mode	Frequency Modulation, 16F3
Receiver System	PLL frequency-synthesized dual-conversion superheterodyne
Usable Sensitivity	0.2 uV EIA 12 dB SINAD
Audio Squelch Sensitivity	0.2 uV at threshold squelch, adjustable
Selectivity	Adjacent channel rejection ±12.5 kHz) greater than 60 dB
Spurious and Image Attenuation	Less than 50 dB
Frequency Stability	Within ±10 ppm over the operating temperature range
I-f Frequencies	1st 10.7 MHz, 2nd 455 kHz
Audio Output Power	100 mW into 8-Ohm load at 10% THD
Power Consumption	25 mA at receiver squelched 100 mA at 100 mW audio output power
Operating Temperature Range	−10° C to +60° C
Battery	Rechargeable nicad battery pack, 4.9 volts and 225 mAh
Physical Size	5¼"(H) × 2½"(W) × 1.0"(D) without knobs
Weight	7.1 oz. (200 grams) with battery pack
Frequency Selection	3 digits of digital push switches and slide switch
PCB	Double-side glass-epoxy printed circuit board
Housing	High-impact ABS plastic case

*Specifications subject to change without notice.

Fig. 4.

Frequencies were easily and rapidly punched in using the three digital push switches and slide switch (for 5-kHz split-frequency operation). The volume and squelch controls, located behind the earphone and antenna jacks, respectively, on the top of the radio, are very small and were very difficult to operate with the antenna and/or headphone plugs installed. Fortunately, for most purposes, these controls can be set and forgotten except for occasional minor adjustment. Audio quality was excellent and was of more than adequate volume for most applications; there was no trace of case vibration even at high audio levels.

Other than the minor inconvenience caused by the size and placement of the two top-panel controls (volume and squelch), no significant drawbacks were noted in operation. The synthesized feature was found to be very handy, for the same reasons that practically the only HTs sold today are synthesized models. All that seems to be missing is a scan feature, LED or LCD frequency display, and a belt clip—all, perhaps, in the next model. The one real disappointment we noted was in the instructions, which bordered on the unreadable. Fortunately, the radio's operation was straightforward and didn't require resorting to the instructions—usually a last resort, anyway, to most hams! No schematic diagram was supplied.

The little radio fills a real need for an inexpensive, frequency-agile portable monitor receiver; at $150, it represents a worthwhile investment. For more information, contact *Ace Communications, 2832-D Walnut Ave., Tustin CA 92680.* Reader Service number 478.■

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MICROLOG

ACT-1

$995*

We proudly announce our Amateur Communications Terminal, the ACT-1. It's the best value in the Amateur Radio market for your RTTY/CW requirements. Check the combination of features and proven MICROLOG quality. You'll agree, the ACT-1 is a "Tough ACT to follow." Microlog Corp. 4 Professional Dr. Suite 119, Gaithersburg, MD 20760, Tel. 301-948-5307 Telex 908778.

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• SIMPLE DIRECT CONNECTION to your Transceiver. • COMPLETE SYSTEM, built-in Demodulator & AFSK Modulator with keyboard programmable tone pairs from 500 to 3000 Hz. • SPLIT-SCREEN operation with keyboard selectable line location • 1400 character text buffer. • TEN, 40 CHAR. programmable message memories, plus ID's WRU & SELCALs. • RANDOM CODE generator & hand key input for practice. • Baudot 60 to 132 WPM. • ASCII 110 & 300 baud. • SYNC-LOCK & NON standard speed ASCII operation from 10 to 200 baud, (slow speed = noise immunity). • RECORDER INTERFACE for "BRAG-TAPE" or recording off-the-air. • CODE CONVERTED Printer output in Baudot or ASCII. • SSTV/GRAPHICS transmit. • FULL 63 KEY Computer grade keyboard.

*9" monitor $199.

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satellite
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CONSIDER THE ATR-6800

You know of its reputation in Amateur Radio. But did you know of its world-wide uses in commercial/industrial communications networks? ATR-6800's are communicating over land-lines, via satellite, and on HF/VHF radio links all over the world. They're teaching Morse Code on military bases around the country and operating as TELEX & TWX terminals. We offer engineering expertise for your particular requirement be it Data Encryption, Computerized Training or any special interest. ATR-6800 with 9" video monitor and one plug-in Applications Module . . . $2495. Companion MX-80 printer . . . $699. Contact the "REAL-WORLD" at MICROLOG CORP. 4 Professional Drive, Suite 119, Gaithersburg, Md. 20760. TEL: (301) 948-5307. TELEX: 908778. You'll be pleasantly surprised.

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Paul Danzer N1II
2 Dawn Road
Norwalk CT 06851

Beginner's Guide to Antennas
—not just for Novices

For a number of years I have been teaching a ham radio licensing class on a more or less regular basis, and as many instructors have found, the class itself is only a start.

As the students receive their licenses, they invariably return with a set of questions which point out the difficulty of translating the knowledge, newly won, into practical use. The following conversation has been repeated dozens of times and is aimed at the universal problem of selecting and erecting an antenna for a new ham station.

Question: I just received my license and got a good buy on an allband rig. I am out of money, don't have much time, and want to get on the air as quickly as possible. What antenna and what bands should I start with?
Answer: Put up a 40-meter dipole. This will give you a chance to make a large number of contacts, day or night, weekday or weekend. In addition, you can load it up on 15 and work DX if the sunspot cycle is in a favorable position. See Fig. 1.

Q. Can I use insulated wire?
A. Sure—as long as you remove the insulation at the point where you connect the feedline. Also, make sure that the wire you select does not stretch. If it does stretch, you will have to keep cutting the wire back to the proper length periodically. Your best bet is to buy copper-coated steel wire. The copper gives you good conductivity and the steel core keeps it from stretching.

Q. I have a roll of "thin" coax (RG-58 or RG-59). Can I use it instead of buying the more expensive RG-8?
A. In the HF ham bands (80 through 10 meters), as long as you have a fairly short feedline run, say, 100 feet or less, you won't notice any difference.

Q. Gotcha! We learned that the feedline impedance should be 70 Ohms for a dipole and some of these coax cables have a 50-Ohm impedance. Can I still use them?
A. Again, for short runs of feedline in the HF bands, there will be no noticeable difference. The swr might be a tad higher, but this won't make any difference. Just one caution on coax: You can buy some relatively inexpensive coax that was originally sold to undiscriminating and unsuspecting CBers. It normally costs half or 2/3 of the cost of brand-name coax, and as you can guess, there is a good reason for the lower price. Be suspicious. Cut away a short section of the outside insulation and see how much of the inside insulator is covered by braid. If there are large spaces and you can see a good part of the inside insulation, be careful. You may be invit-

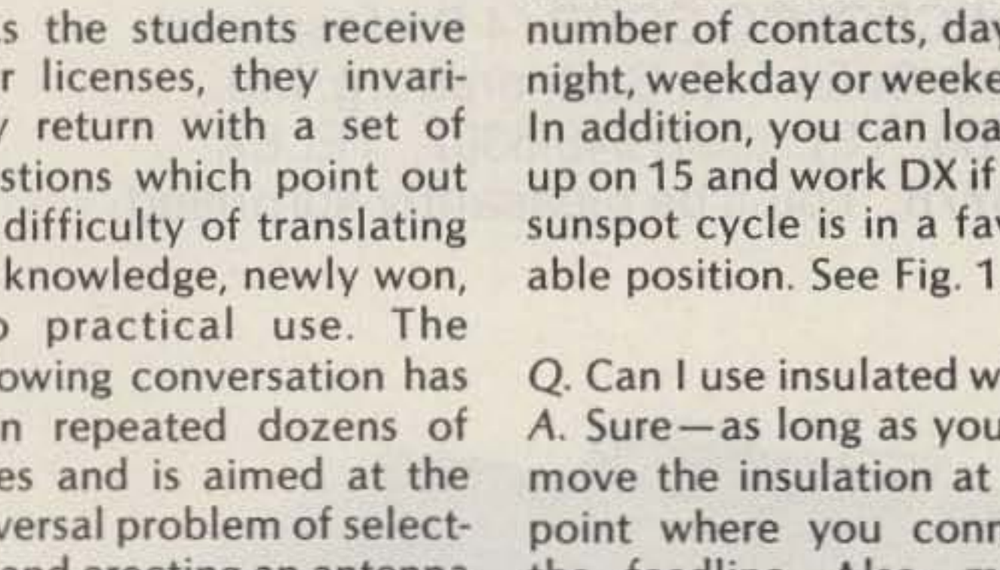

Fig. 1. For 40 meters at 7.125 MHz. L = 468/7.125 = 65.68', or 65' 8".

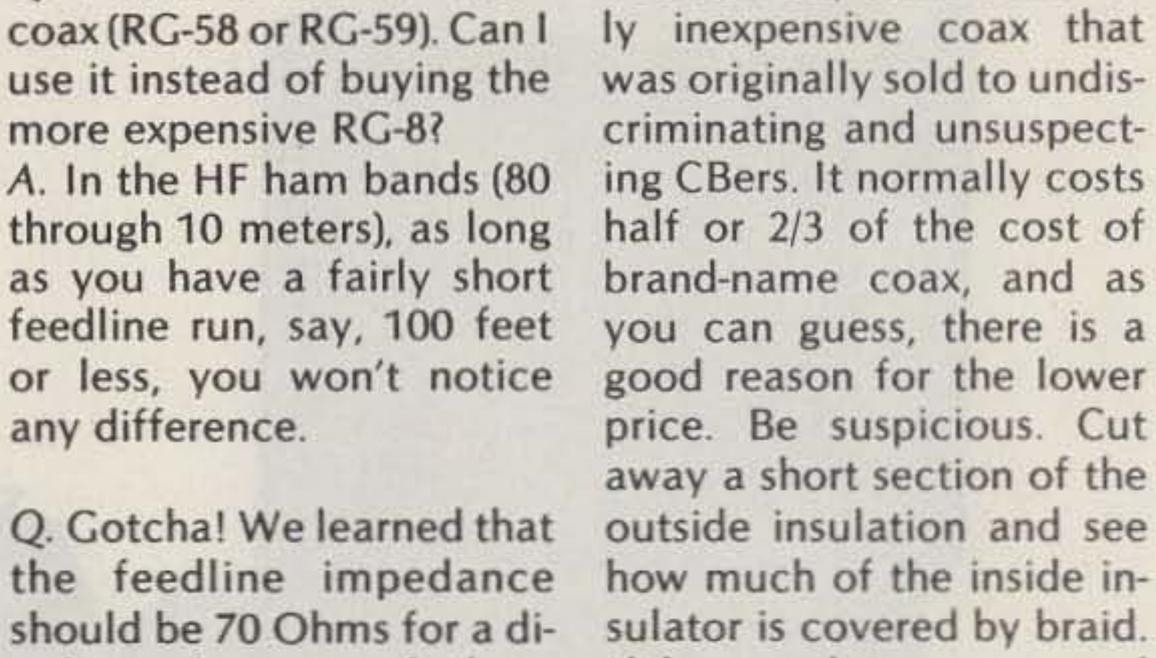

Fig. 2.

ing problems if you decide to use it.

Q. But what about the swr? Can I operate with a 2:1 or 2.5:1 swr?

A. Well, for many years the most popular ham antennas used an swr of 5:1 or 10:1. These antenna/feedline systems used open-wire line, and the key here is low losses in the feed. If your rig will operate with a high swr, there is no reason to fight to get the swr down to the nice round value of 1:1 as long as the loss in the feedline is low. Again, in the HF bands with short feedline runs, an swr of 3:1 won't affect your signal at all.

Q. Will my rig operate with a 3:1 swr?

A. Most rigs with tube finals will, as long as you don't keep the key down for long periods. Solid-state finals are a different problem. Most have swr protection, which means they sample the swr and reduce their power if the swr goes too high. Given a choice, I would try for an antenna with a low swr. But if it means spending 5 minutes tuning up every time I QSY (change frequency), I would accept the higher swr in the interest of convenience and extend the life of the finals by not keeping the key down so long tuning.

Q. What about antenna tuners? In fact, I have read about tuners (matchboxes), low-pass filters, swr bridges, and coax switches. They are all connected to the rig. In what order do you connect them and why?

A. See Fig. 2. Start at the coax jack of the rig and connect the low-pass filter with as short a coax jumper as possible. This means that harmonics will be attenuated before they have a chance to run around long pieces of coax and possibly radiate. Next in line is the swr bridge, since you are interested in matching the rig to whatever follows. The tuner is the next item, followed by the switch and the antennas themselves. Thus, you select an antenna with the switch, utilize the tuner to make the antenna and feed look like an acceptable load, and monitor the swr (and relative power out) with the bridge.

Incidentally, it might be a good idea to make up a tuning chart for each of the frequencies you use. Write down the frequency, settings of the controls on the rig, settings of antenna tuner controls, and antenna selected. When you want to QSY, simply set all controls as shown on the chart, and then tweak them to get maximum power out and minimum swr. Normally, if you operate all over a band, you don't have to log these settings any more than each 50 or 100 kHz on 80 and 40, every 100 or 200 kHz on 20 and 15, and 500 kHz on 10.

Q. I live in a small valley surrounded by hills. Are there any special precautions I should take in selecting an antenna?

A. On 80 and 40, a dipole, inverted vee, or longwire will work fine. However, on 20, 15, and 10, you might *not* want to pick a very high gain beam or quad. A really good beam or quad radiates at a low angle, almost horizontally, and will simply pump your precious rf into the hills. Antennas such as the popular triband beams have to sacrifice some of this low-angle characteristic in order to operate on three bands. As a result, more of the rf is sent up at a slightly higher angle (up to perhaps 40 degrees, or so) and this will probably top the hills around you. Alternately, seriously consider tilting the beam or quad so that it radiates up to clear the hills.

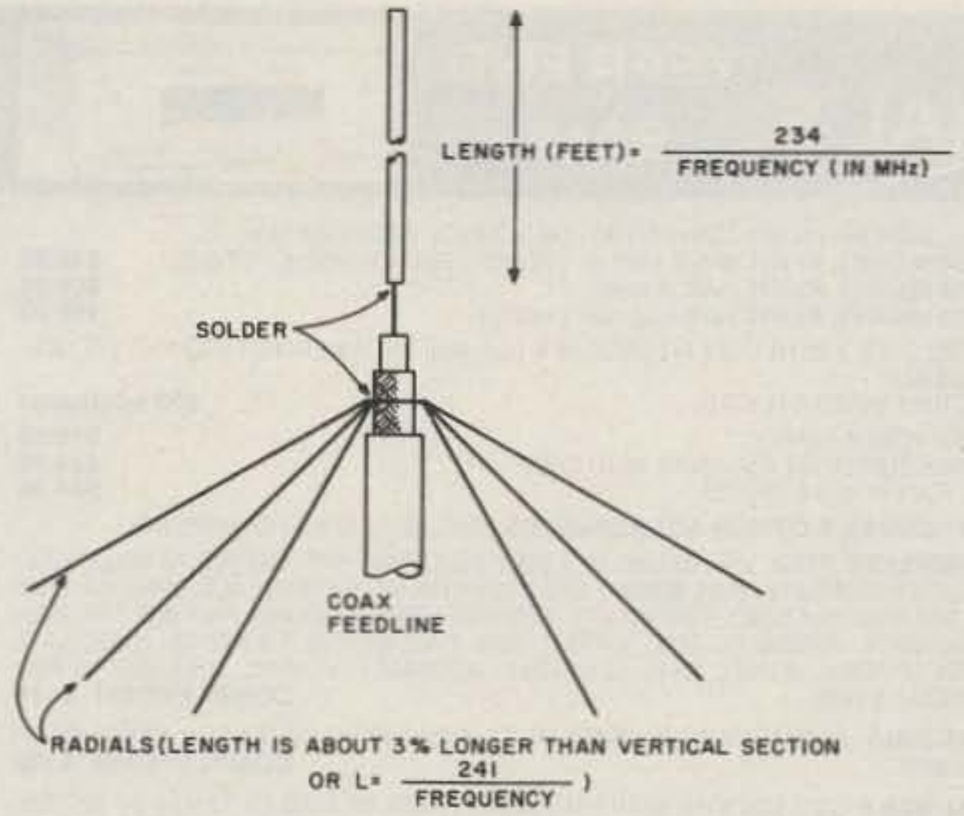

Fig. 3.

Q. I can't put up a big antenna. I don't have the space or my XYL/husband or neighbors would object to a big tower. How about one of these vertical antennas? See Fig. 3.

A. Verticals, especially full-size verticals, work fine. But they do require radials. Each radial is about a quarter wavelength long, and while you would like over 100 radials, you should have as many as you can put up for each band you will operate. I suggest 2 each as a minimum on 80 and 40, and 4 each as a minimum on 20, 15, and 10.

Q. But I thought verticals were good where you don't have much space?

A. They will work with only the coax feed acting as a single radial. However, they work much better when you add radials cut to the proper length, and they work best when you have a very large number of radials. Every experienced ham has a story of how he worked DX on a 10' wire hanging out the window. But for the most consistent and best results, verticals need radials, and lots of them.

Q. What about mobile whips? Can I mount one on the house and use it? Cars don't have radials.

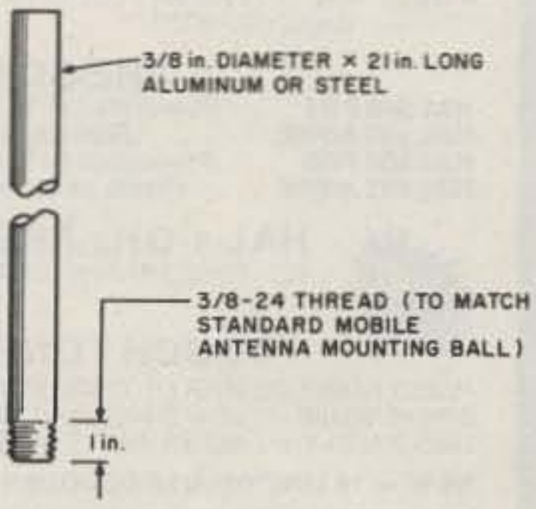

Fig. 4.

A. On a car, the metal body is used as the ground plane in place of radials. In addition, this sort of antenna system is from 2% to 15% efficient. The physical limitations of a car make us accept this loss, but you can do much better at home.

Q. Speaking of cars, I still have a standard mobile mounting ball on my car that I used to use for my CB antenna. Can I use it for a 2-meter FM rig?

A. You will have some loss and you will probably never get the swr down really low, but you have two choices. First, you can buy one of the commercial 2-meter antennas which mount in the standard mobile ball thread. These are 5/8 of a wavelength long but have a loading coil which makes them look like 3/4 of a wavelength. This is an odd number of quarter wavelengths, so the input imped-

ance is about 60 or 70 Ohms and you can use the old mount and coax feeder. You also can take an aluminum or steel rod, cut to about 20 inches, and thread the lower inch to match the thread in the ball (Fig. 4). You now have a quarter-wave vertical again using the old ball mount and coax feeder.

Q. As long as we are salvaging CB antennas, surely on 10 meters I can use the 27-MHz Loudengrabber V that I have mounted on my roof.

A. You probably can use it on 10 with an antenna tuner, but it might be less efficient than simply replacing it with a 10-meter vertical. If you want to try an experiment, connect it to your 2-meter FM rig. It might make a real nice (and quick) vertical for 2m. But don't try this unless your 2-meter rig has swr protection in case the swr turns out to be very high.

Q. One final question: I have a wire which I used to listen to the ham bands before I got my license. It runs out the window, over the roof, under the apple tree, and about 10' above the ground around the garage. If I use an antenna tuner, can I make do with this wire?

A. We would all like 90' towers and large array antennas. Most hams have to make do with what they have without structural steel work. Sure, you can use the wire, as long as it is high enough so no one can touch it while you are transmitting. Generally, you want any antenna to be as high and in the clear as possible. But if you can only run a short wire, use it. It will work and you will have many hours of good contacts. ■

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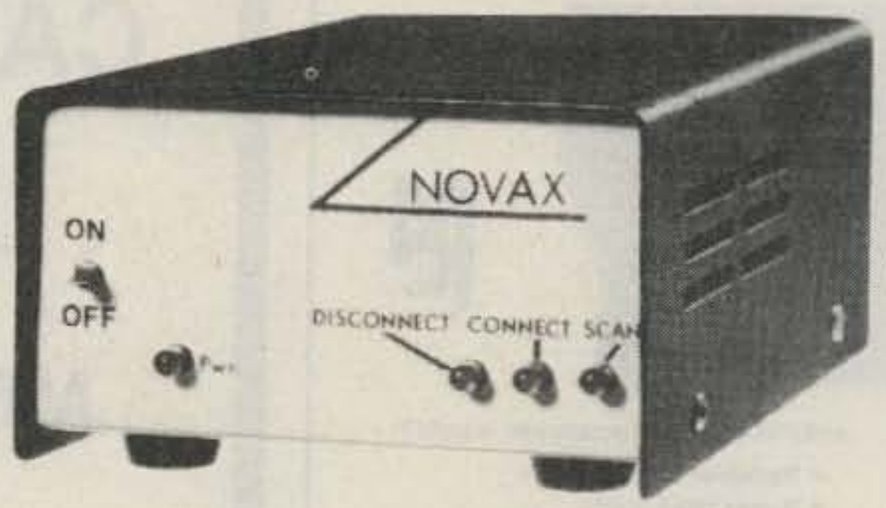

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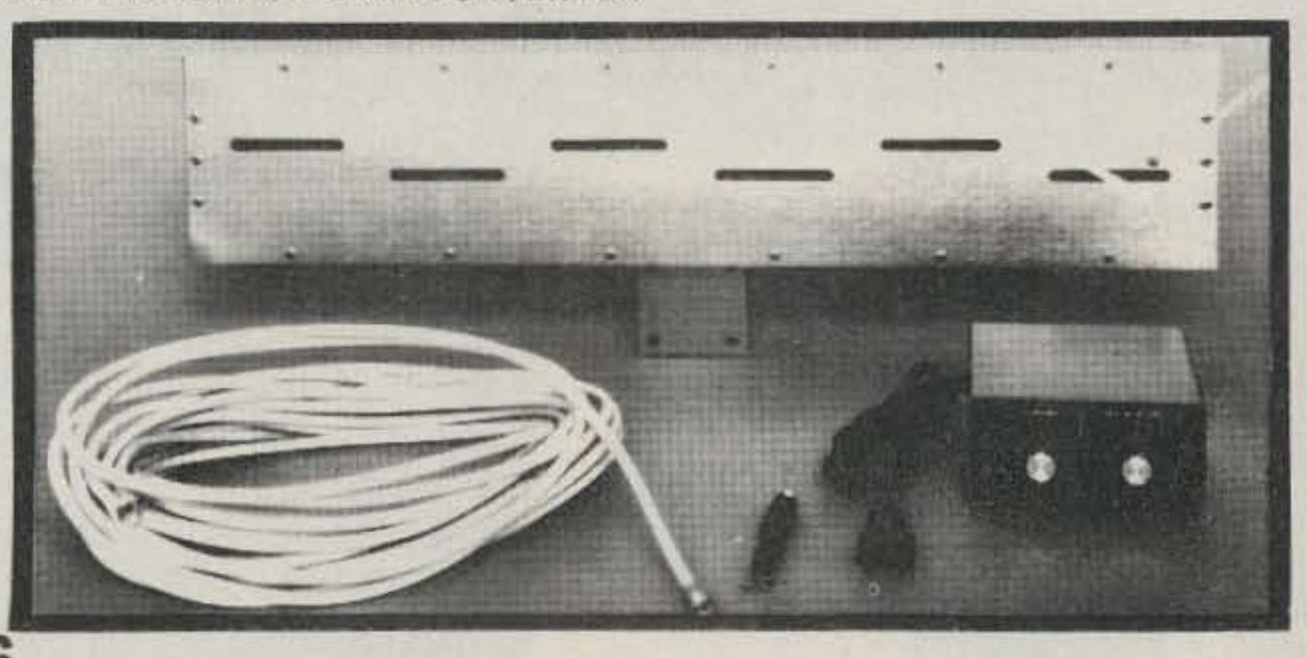

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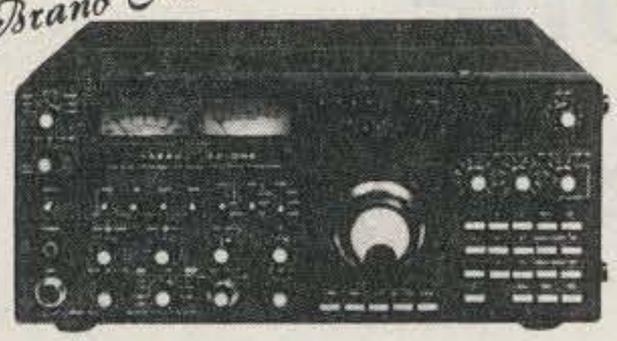

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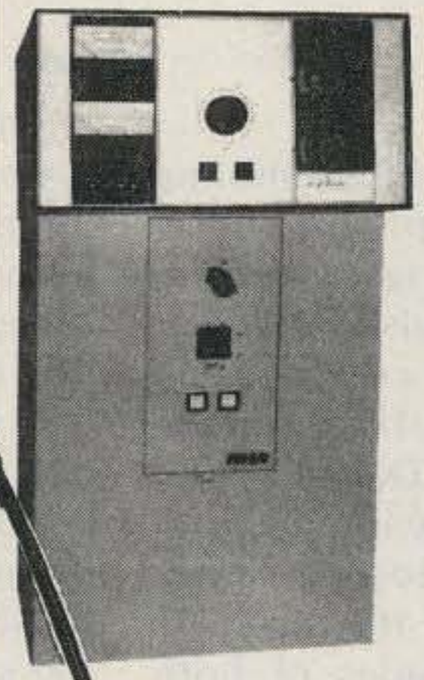

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The Daiwa Infrared Wireless Microphone — is the mike cable obsolete?

Dave Ingram K4TWJ
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If you're still fumbling with microphone cables that get entangled in auto steering wheels and gearshift levers or continuously drag papers off the home station desk, Daiwa Industries has a new item worthy of investigation—a cordless infrared microphone. Reflecting shades of both Star Trek and James Bond, the infrared mike adds a refreshing freedom to "confined" activities in both mobile and home setups (although the system is primarily designed for mobile operation). While this little gem might be considered by some to be of questionable utility, I found it one of the most logical and useful items available in many moons. The only problem I've encountered is deciding which rig should be connected to the infrared mike system. Imagine being able to move around your home desk or in your auto while using a small mike clipped to your shirt front or pocket, and you'll surely agree the mobility of a cordless mike opens many new possibilities for enjoyment of your radio equipment.

How It Works

The Daiwa infrared mike system is composed of 3 items: the microphone, the infrared beam sensor, and the control unit. Activating the microphone's push-to-talk switches on the mike's circuitry and the infrared-emitting LEDs which carry information to the small sensor unit. Output from the sensor goes to the processor unit, which connects to the rig's microphone input.

The infrared ray is not directly visible, indicating operation in the mid- to far-infrared range of approximately 2 to 15 microns (a micron is one-millionth of a meter). I suspect the sensor unit's front cover also acts as a tuned filter for the specific infrared range used, since cigarette light, match or flame flicker, flashing LED readouts, etc., are completely ignored by the sensor. Some elaborate ray-modulation tricks may also be employed, but a schematic diagram wasn't available for studying the system when my early unit was acquired.

Only three connections are required for the system, and it's ready for use. First, 12 volts dc is applied to the controller; second, the sensor is plugged into the controller; third, the controller's output is plugged into the station's transceiver. The system is shipped with a 4-pin connector wired for Kenwood rigs, but it can be quickly rewired or replaced as necessary. A drop-in charger for maintaining the mike's small internal battery is included in the controller unit's left side, while audio processing circuitry is located in the unit's right side.

The charger's operation is fully automatic with a single LED indicating functions. The LED illuminates when the mike's depleted battery is being charged. The LED begins flickering approximately one time per second when the battery approaches full charge, and it extinguishes completely when the battery reaches full charge. Since the charger then switches off, the mike can be left in its socket until the next time it's needed. This means that in a mobile installation, the mike can be left in the controller's case overnight for worry-free recharging and storage.

The infrared mike's effective working range is between 3 and 5 feet, as measured from LEDs to sensor. This distance is substantially more than necessary for mobile installations, since the sensor's suggested mounting place is above the windshield's indoor rear-view mirror. Audio quality of the infrared mike is extremely good; my unit actually sounds better than the factory mikes supplied with the rigs with which it's used (Kenwood, Yaesu, and Comtronix). Each time the infrared mike's push-to-talk switch is keyed, a piezoelectric beeper in the controller chirps softly to indicate proper operation of the system.

Using the Infrared Mike

Since this "liberated microphone" doesn't reflect the common sensation of being in direct-wired contact with its associated transceiver, we suggest initially using it with the home setup or a small audio amplifier before using it mobile. This will allow you to become familiar with mike sensitivity, maximum sensor-to-mike working range, etc. I used the transmitter

✓See List of Advertisers on page 162

monitor in my FT-901DM for this purpose. If your rig doesn't feature a speech monitor, mike operation can be monitored through the use of a stereo amplifier or transistor radio (tune radio off stations, and connect controller's mike output wires between the volume control wiper and ground; one "side" of the volume control is usually connected to ground also).

My home setup operation with the infrared mike was so enjoyable that I postponed mobile use for a couple of weeks. The infrared sensor was stuck to my wall-mounted speaker which was positioned substantially lower and approximately twice the distance of Daiwa's suggested top-of-windshield moulding strip location. The system worked great, but the mike had to be held vertically and "talked across" because of the low-mounted sensor. On-the-air comparisons reported the mike sounds as good or better than my time-proven Shure 526 or Yaesu mike. Since an in-shack television reacts wildly when my 2-kW amplifier is going full bore, I expected problems with the cordless mike. Fortunately, however, I was pleasantly surprised. The mike performed magnificently . . . and I could enjoy the flexibility of moving anywhere around the operating desk without the ties of a mike cable.

Mobiling with the Infrared Mike

The true pleasures of a cordless mike operation were realized when I mated the unit with my 2-meter mobile rig. The infrared sensor was placed above the inside rear-view mirror while the controller was mounted with adhesive pads (supplied) to the transceiver's bottom. I could move anywhere within the (full-size 1981) car's interior and conduct smooth QSOs in a very enjoyable manner. Bright sunlight, unusual reflections, and temperature variations had no effect on the system. The microphone worked as flawlessly as a wired mike. A slight amount of wind noise was noticeable when a window was open or the air conditioner was operating at maximum. Loud noises outside the auto occasionally modulated the rig, emphasizing the need for Daiwa's optional F-4 windscreen. Since the system's audio processing circuitry doesn't skimp on output level, the windscreen is definitely beneficial for mobile operations.

Summary

The Daiwa infrared mike system is one of the most enjoyable accessories I've used with an SSB or FM transceiver. The unit's versatility and relatively low cost are particularly attractive, since it allows one to enjoy a touch of class without a drastic financial outlay ($79.95; 4 optional windscreens, $7.95). My only complaint on the whole system is the somewhat flimsy push-to-talk switch on the mike (it's also a push-on/push-off, unless you have a light touch). The switch hasn't given any problems, and I'm not considering modifying it—I'm merely finicky. I'm quite impressed with the sincerity and creditability of MCM Communications, the U.S. distributor for many Daiwa products. They seem committed to caring for their customers. For more information, contact *MCM Communications, 858E Congress Park Drive, Centerville OH 45459.* Reader Service number 477.■

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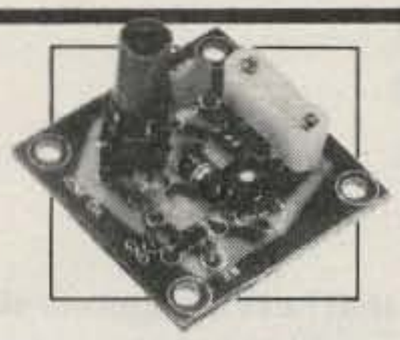

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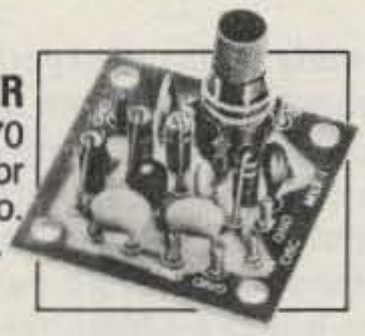

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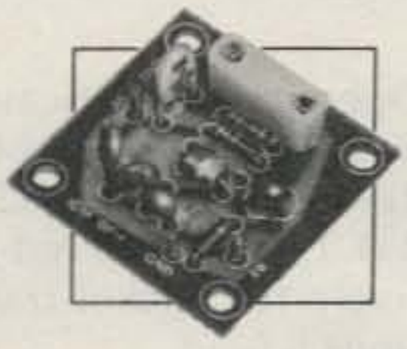

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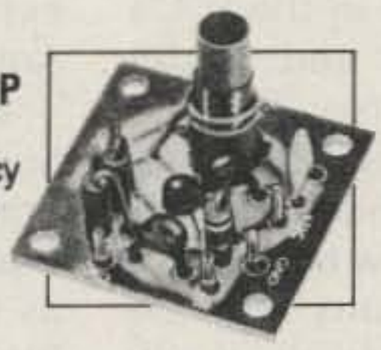

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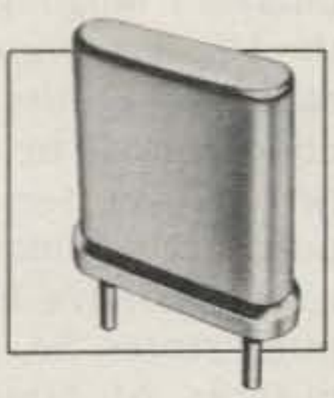

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What's It All About, ASCII?

—RTTY technology update

Authors' note: Since this article was prepared in early 1980, our experience has been that most stations that have computers also have dual-mode originate/answer modems and do not require the modem translator at the repeater. They transmit with their modem in the Answer mode and switch to Originate for receiving. This makes all data on both the input and output appear at the 2025/2225-Hz tone pair which is suitable for simplex operation. Also, since the 300-baud speed of the 103 modems is no better than we can do over the phone, our current activity is the collection of Bell 202 compatible modems that operate at up to 1200 baud. These modems are becoming available on the surplus market and require no modification for operating half-duplex over the radio. They were chosen because they use the same familiar FSK as both the 103 and RTTY modulators but at a 1200/2200-Hz rate.

On March 17, 1980, the Federal Communications Commission (FCC) permitted the use of the American Standard Code for Information Interchange (ASCII) in the Amateur Radio Service.

Specifically, the FCC permitted US radio amateurs to transmit:

- ASCII as defined in the United States of America Standards Institute (ANSI) Standard X3.4-1968.
- Speeds up to 300 baud between 3.5 and 21.25 MHz using F1 emission.
- Speeds up to 1200 baud between 28 and 225 MHz using F1, F2, and A2 emission.
- Speeds up to 19,600 baud on frequencies above 420 MHz using F1, F2, and A2 emission.

The above permission was contained in the FCC's Third Report and Order under Docket No. 20777. It represents a significant step forward and marks the beginning of a new era of data communications on the ham bands. Possibly, it will play a part in a marriage of personal computing and amateur radio. It is not as permissive as some had hoped for in order to be able to experiment with speeds higher than those permitted and to transmit other codes, including some not yet devised. We look forward to additional action by the FCC along these lines to liberalize the rules on digital transmissions in order to permit true experimentation in the Amateur Radio Service.

Outside the United States, the use of radio teleprinter codes other than Baudot (otherwise known as the Murray code or the International Telegraph Alphabet No. 2) varies from one country to another. Many have no regulatory mandate for the use of the Baudot code in the first place. Amateurs in other countries with import or monetary restrictions may have difficulty obtaining modern equipment employing ASCII. In Great Britain, amateurs can use any radioteletype (RTTY) code defined by documents of the International Radio Consultative Committee (CCIR), according to a Home Office interpretation obtained by the Radio Society of Great Britain.

In September, 1978, Canadian amateurs were given permission to transmit computer data in packet form on frequencies above 144 MHz under a new class of license called the Amateur Digital Radio Operator's Certificate. Canadians have subbands 221.0 to 223.0 and 433.0 to 434.0 MHz reserved exclusively for packet transmissions.[1, 2, 3, 4]

While ASCII was originated in the United States, it is well on its way toward becoming the world standard computer and RTTY code. It also is known as International Standard 646—ISO code (Reference 2)—and International Telegraph Alphabet No. 5. Like the Morse code, variations of ASCII exist for the alphabets of other languages including Cyrillic, Kata Kana, Arabic, Hebrew, Greek, and special letters used in Scandinavian languages.[5] As in the US, it is a sure bet that radio amateurs in other countries will be among the first to use personal computers. Many industrialized countries have home computer stores. So, it is only a matter of time before everything falls into place for the marriage of amateur radio and computers on a worldwide basis.

As soon as ASCII became "legal" in the US, a number of amateurs went on the air to try out the new mode. In the Washington DC area,

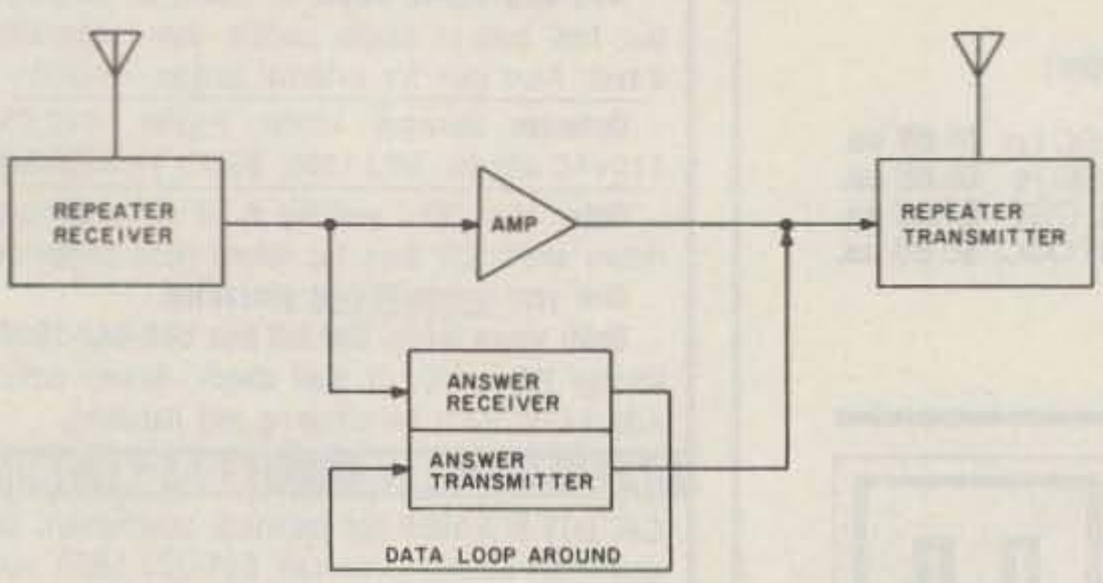

Fig. 1. Addition of an answer modem at the repeater with its received data echoed to its transmitter allows multiple users to send and receive data using only originate modems at their stations.

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most radio amateurs involved with computers had equipped themselves with modems (modulator-demodulators) for communication on the phone lines. Baudot operation on 2 meters had been dead for about a year in anticipation of the FCC's ruling. Eighteen stations were ready to go during the first hour that ASCII was allowed; 14 stations made successful two-way ASCII contacts. We have heard scattered reports of 2-meter ASCII activity from other areas of the country. On the high-frequency (HF) bands, a number of stations were on the air using 110-baud ASCII on the RTTY frequencies. Many amateurs who wanted to get on ASCII as soon as possible did not want to reconfigure their stations until the details of the FCC ruling were known. We hope to see them on the air soon.

Technical Standards

Comments on Docket 20777 on file in the FCC public reading room indicated that the writers favored three basic approaches, divided almost equally. About a third said the *bandwidth* should be limited. Another third suggested that *speed* be regulated. The remaining third took the FCC to task for trying to regulate something best left to self-policing amateurs. The FCC decided to regulate *speed*. On other particulars, the respondents suggest that the FCC forget about specifying the parity bit because home computers tend to ignore it. They recommended making both synchronous and asynchronous transmission legal to permit experimentation. Finally, they recommended that the bit order be from the least to most significant bit according to common practice.

You will note that there are no restrictions imposed by the FCC on use of the parity bit, the number of stop bits, the use of synchronous or asynchronous transmission, the bit order, the maximum frequency shift for F1 emission, or the modulating tones for F2 or A2 emissions. These matters are open to experimentation and will evolve according to the needs and preferences of amateurs.

For starters, most amateurs will completely ignore the parity bit. In many cases, stations will transmit a parity bit, but the receiving stations will not process it. However, some agreement on the use of the parity bit is desirable because this feature can help reduce transmission errors. The number of stop bits will likely be 2 for 110 baud and 1 for 300 baud and up. Two stop bits are needed by a number of ASCII printers which operate at 110 baud.

Most amateurs will use asynchronous transmission to begin with because of the availability of asynchronous equipment. Synchronous ASCII transmission is an interesting area for amateur experimentation. The bit order is likely to remain least significant bit to most significant bit. Frequency shifts and modem tones for amateur ASCII transmissions are unlikely to settle down for quite some time. Amateurs presently are using modems of the type used for Baudot RTTY and those designed for telephone line communications between computers.

On the phone lines, the data communications convention for personal computers is to use a modem which uses Bell Telephone 103/113 standards. This permits serial, asynchronous, full-duplex communication at speeds up to 300 baud on the telephone line. It uses audio frequency shift keying (AFSK) FM with frequency assignments as shown in Table 1.

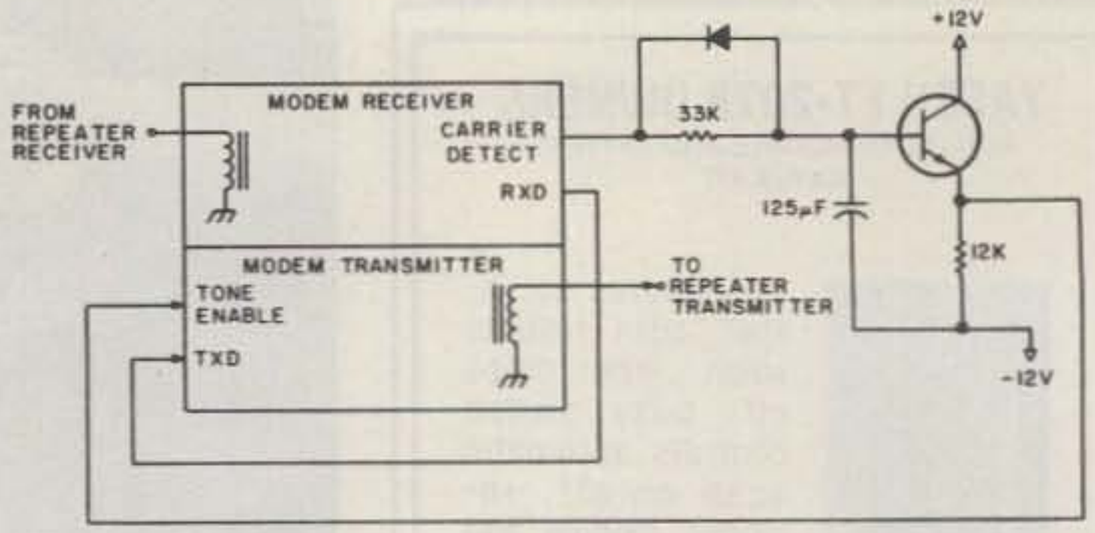

Fig. 2. An RC combination with an emitter-follower slows down the carrier-detect signal from the receiver so that at least 4 seconds of carrier are required before the modem transmitter is activated.

Bell 103/113-compatible modems are available for personal computers in several different forms. One is the originate-only modem, the cheapest type, which is all one needs to originate calls to other computers. Originate-only modems use the "Originating End" tones given in Table 1. Another is the answer-only modem for computers which never make outgoing calls. The third variety is the originate/answer modem which can handle calls either way.

Separate for the moment the modem function from that of coupling to the telephone lines. The least expensive route is to use an acoustical coupler which mechanically connects to the telephone handset. Home-brew acoustical couplers can be made from small transistor radio speakers and spray-can plastic caps. A direct connection to the telephone lines can be made by means of an FCC-approved telephone data coupler, which is considered a must for modems with answering capabilities.

These modems and data couplers are now readily available to home computerists and will, no doubt, have an impact on the standards to be employed by radio amateurs. The extent to which this will replace existing amateur radio FSK keyers and converters or tuning units (let's just call them modems) deserves some thought.

HF ASCII RTTY

It seems likely for two reasons that there will be a mixture of ASCII and Baudot on the HF bands for a while, using existing RTTY modems. One is that some of the non-US amateur RTTYers find it difficult to obtain ASCII gear initially. Another is that the average HF RTTYer has hundreds of dollars invested in a good modem designed to copy through the noise, interference, and fading encountered on HF. HF RTTY modems are far better in this respect than most Bell 103/113 modem designs. So, it would be a step backward to ditch a well-engineered HF RTTY modem in favor of one designed for use on the telephone line. Nevertheless, some 103/113-type modem operation on the HF bands is to be expected, and the 200-Hz shift employed might not be too difficult to live with.

RTTY modems such as

Function	Originating End	Answering End
Transmit	1070-Hz space	2025-Hz space
	1270-Hz mark	2225-Hz mark
Receive	2025-Hz space	1070-Hz space
	2225-Hz mark	1270-Hz mark

Table 1. Bell 103/113 modem frequencies.

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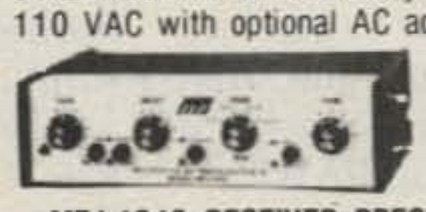

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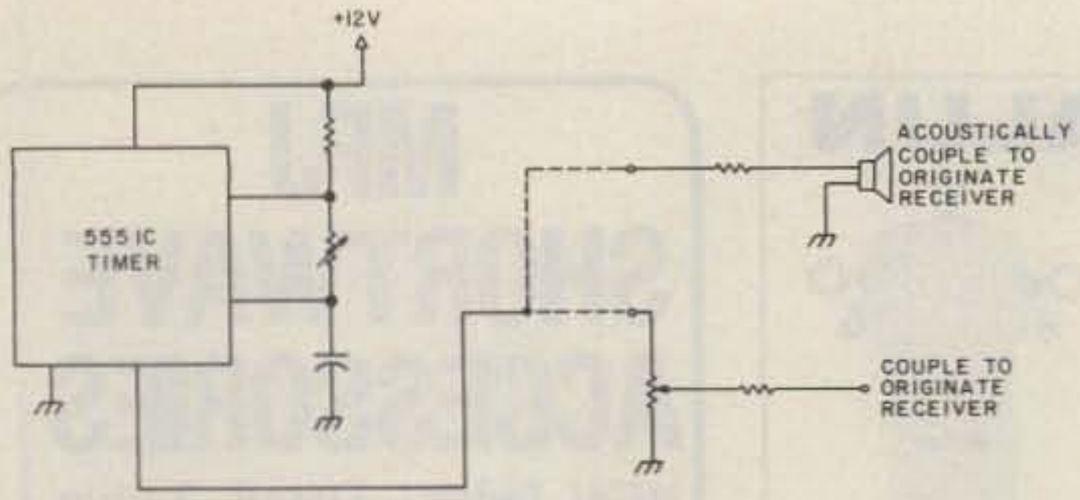

Fig. 3. A 555 oscillator at 2225 Hz can be used to fool an originate modem into thinking it is connected to an answer modem so that it will enable its transmit tones while operating half duplex. This is not required if a minor change inside your originate modem can be tolerated.

the ST-6 can be modified easily to handle both existing RTTY tones of 2125-Hz mark and 2295-Hz space and 103/113 tones by retuning audio filters. Clearly, a contest of wills and pocketbooks is in the offing before this incompatibility is resolved. Our feeling is that the old 170-Hz shift should be kept for those stations still running 60-wpm Baudot and that 200-Hz shift will be used for 110- and 300-baud ASCII.

ASCII RTTY via OSCAR Satellites

OSCAR satellites present a special problem for RTTYers for either ASCII or Baudot. The managers of the satellites do not like any type of FM (such as FSK) to be used because the signal has a 100% duty cycle. They prefer lower duty-cycle signals that are keyed on and off in order to keep overall loading on the satellite within reasonable levels. Thus, any RTTY modem for communications via OSCAR satellites should be capable of on/off keying. Because of noise characteristics, for equal results a good on/off-keying RTTY demodulator needs to be a bit more sophisticated than its FSK counterpart. For the 1980s, an on/off keying capability will be a must for RTTY modems.

VHF/UHF ASCII RTTY

In contrast to HF and OSCAR RTTY, we expect to see ASCII with Bell 103/113 tones dominate VHF/UHF RTTY. This seems fairly certain because of the decline in Baudot RTTY activity on the VHF/UHF bands in recent months.

As noted earlier, the cheapest way of communicating with a computer is to use an originate modem. Manufacturers' surplus originate modems are available for as little as $25. This works fine if the originating station connects with another station which has an answer modem. Another look at Table 1 will convince you that two originate modems cannot talk to each other. The same is true of two answer modems. Those with originate/answer modems can talk to anyone; indeed, this is the case with many computer owners.

Modem Translator Experiments

A scheme was needed to make two originate modems compatible. The solution: placing a modem translator at the WD4IWG/R 2-meter repeater which serves the Washington DC area RTTYers and amateur radio computer enthusiasts. Just as the repeater operates on two *radio* frequencies to translate incoming signals to the correct output frequency, the translator modem changes incoming *audio* tones from originate modems into answer modem tones on the repeater output. As a result, all originate modems listening to the repeater output are able to copy all signals.

The advantages of this scheme are:

- Uses exactly the same modems as used over telephone lines.
- Requires no special, unique hardware.
- Eliminates the need for the more expensive answer modems at all stations.
- Regenerates data at the repeater, realizing some improvement in signal-to-noise ratio.
- Does away with the problem of who is originating and who is answering, which normally is needed in duplex modems.

Implementation: Hardware installation was fairly simple. An answer modem initially was connected as shown in Fig. 1. The lines required to the repeater were an audio tap off the receiver and a tap into the transmitter audio line. The received data line coming out of the modem receiver was then echoed back into the modem transmitter so that an exact replication of all data present on the repeater input was reproduced on the repeater output.

The only other signal required is an *enable* signal to tell the modem when to initiate its transmit tones. This was done in the initial installation by simply taking the received data *carrier-detect* line, delaying it up to five seconds with an emitter-follower and a capacitor, and using that to drive the transmit enable line of the modem transmitter. With the resetting diode shown in the circuit of Fig. 2, any momentary loss of carrier would reinitialize the five-second turn-on delay, thereby preventing the transmit tones from coming up on anything but a valid signal. The controls as described above make the modem an autonomous device requiring nothing but power and the two audio connections.

Controls: Later, additional control circuitry was added to disable the function entirely. This is needed during periods of experimentation with other types of modulation on the repeater and to aid repeater troubleshooting. A final refinement was to use the data carrier detect to open up the repeater audio line between the receiver and transmitter. This ensures that noise on the signal received at the repeater is not added to the transmitter output.

Installation: To minimize repeater maintenance problems, the answer modem described here was packaged in modular form. A separate ac power supply was included in the module.

One Hitch: There is a minor problem with the scheme described here due to the manner in which commercial originate modems operate. Many originate modems wait for the receipt of the answer carrier before the originate-transmit tones are enabled. This is done by sampling the receive carrier-detect line in the originate modem and looping it back to the originate-transmit enable. This feature poses no problem for a station while receiving because it will hear the answer tones being transmitted by the repeater. But, on transmit, since the receiver is most likely disabled, the originate modem will not hear the answer tones. Fortunately, this is a wiring change only for those individuals who are using surplus or home-brewed gear. They can wire the modem-transmit tones to come on only when the radio transmitter is keyed on. For the casual user who has a nice expensive com-

mercial modem that should not be attacked with the soldering iron, there is another way to coax a modem into originating tones first. A simple switch inserted into the carrier-detect line to enable or disable this function is a solution. Another one is to use a 555 timer in an oscillator circuit to generate 2225-Hz tones to fool the modem into thinking it is on line. These tones may either be hard-wired or acoustically coupled into the modem during transmit to enable the originate transmitter. A possible circuit is shown in Fig. 3 and can be constructed for less than $2.

Conclusions

FCC approval of ASCII will be a boon to amateur radioteletype activity, especially on the VHF/UHF bands. It should help not only to get back some RTTYers who drifted off to play with computers, but also to stimulate some computerists to become hams.

The repeater modem translator described above has been in place since March, 1979. It is an inexpensive way to permit use of existing originate-only modems. ■

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✓See List of Advertisers on page 162

Louis A. Smith II N3BAH
RD #6, Box 479
Latrobe PA 15650

The Radio Shack Pro-2002 Scanner

—a look at the Shack's latest

When any manufacturer bills a new rig as the "ultimate scanner," naturally I'm skeptical. I've seen several of the new synthesized receivers which are promoted as being capable of receiving everything under the sun. They're usually rehashed versions of the lower-priced rf packages with some gingerbread knobs and switches added for color. These units are almost invariably full of bugs and prone to breaking down about one week after the warranty expires, so when Radio Shack announced the introduction of their new microprocessor-based scanner, I viewed it with anxious, but cautious, optimism.

The Realistic Pro-2002 is Radio Shack's latest addition to its line of scanners and is a replacement of the Pro-2001. It is cosmetically similar to its predecessor, being housed in the same-dimension case, but this is where the similarity ends. The 2002 is a totally new concept for Realistic and contains several features unique in scanner technology. The rig is microprocessor-based and all functions are accessed via the 30-key front-panel keyboard. It covers the 30-50 MHz VHF-low, 108-136 MHz aircraft, 138-174 MHz VHF-high, and 410-512 MHz UHF bands. Fifty channels may be stored in five banks of 10 each, as well as five search ranges, with individual delay, lockout, and priority options. Volume and squelch rotary controls are large and conveniently located. Logging indicators are provided for easy return to a desired setting. A 12-hour digital clock with am/pm indicator is becoming a standard feature in programmable units and is present on the 2002. Other useful functions are selectable scan/search speeds, directional search, scan and manual controls, external speaker, antenna, and tape-out jacks. A 120-V-ac cord is built in and a jack for 12 V dc is provided along with cables and mobile mounting bracket.

Due to the complexity and uniqueness of the Pro-2002, I will attempt to cover its features and functions individually rather than collectively.

Frequency Coverage

The 2002 has one of the most enviable frequency repertoires in the scanner industry. Bands covered are 30-50 MHz in 5-kHz increments, 108-136 MHz in 25-kHz increments, 138-174 MHz in 5-kHz increments, and 410-512 MHz in 12.5-kHz increments. That's a total of 4000 low-band, 1120 aircraft, 7200 high-band, and 8160 UHF channels, or 20,480 discrete frequencies! Notice that among these bands are included 138-144 and 410-420 MHz ranges, used by the US Government, which cannot be directly received by any other commercially available searching synthesized scanner.

Searching/Scanning Functions

A maximum of 50 channels may be programmed into the memory of the scanner. Channels are programmed into the unit via the 30-key color-coded front-panel keyboard and are stored in banks of 10 channels. These banks may be selectively scanned or locked out during scanner operation by using the appropriate bank-select key(s). Banks are labeled 10, 20, 30, 40, and 50. For example, bank 30 would contain channels numbered 31 through 40. In addition to storing channels to be scanned, these bank-select keys also perform double-duty as keys for selecting search ranges. Up to five ranges may be programmed into positions S1 through S5.

Both the speed and direction of the searching may be controlled. To initiate a search, the user enters the lower and upper search limits of the desired range and selects either the upward or downward direction. Direction may be changed at any time during the search. Search speeds of 3 or 8 channels/second may be selected by using a toggle-action push-button control. Once programmed, search ranges remain memorized even when the unit is turned off or unplugged, provided the 9-V-dc backup battery is installed. Ranges may be selected or locked out using the bank/search-select keys. If two or more search ranges are programmed and locked in, the microprocessor will search through all ranges sequentially. For example, if range S1 is programmed to search 154-158 MHz and range S2 is programmed to search 453-456 MHz, the unit will begin to search at 453 MHz after it has finished 154-158 MHz. If any other ranges are programmed and locked in, the searching will continue through these other ranges. Upon searching the last range in the sequence, the unit will repeat the search beginning at the first range. If only one of the five ranges is programmed, searching will repeat over this range only.

Scanning is controlled by using keys labeled scan, manual, delay, priority, and lockout. Manual channel selection may be achieved by either stepping through the channels with the manual key or by selecting a particular channel with the digital keyboard.

Lockout serves to eliminate a particular channel or channels from the scanning repertoire. Delay is used to add a three-second delay onto selected channels after a transmission is received and prior to the resumption of scanning. The priority key is used to assign priority status to one of the scanner's 50 channels. When a channel has been given priority, this frequency is sampled once every three seconds, for a period of 100 milliseconds, regardless of other scanner activity. If a signal is received during the priority sampling, the receiver immediately switches to this frequency for the duration of the message.

The scan rate is selectable at either 3 or 6 channels/second. For a rig with up to 50 channels to sample, this is too slow. Ideally, the rates should be selectable at either 15 or 20 channels/second. With the existing scan rate, however, I've found it to be practical to scan no more than 20 channels (two banks) at one time.

Miscellaneous Features

The digital readout display is comprised of seven-segment green LEDs and provides information concerning whether the unit is in the scan, manual, search, or program mode, if a channel is programmed with a delay or lockout, if the unit is in the priority mode, and which is the priority channel. Also indicated are which channel/search banks are active or locked out, channel numbers, and a seven-digit frequency readout.

The frequency display also doubles as the readout for the digital clock, indicating hours, minutes, and seconds. The clock, which operates in the 12-hour mode, requires continuous ac or dc current to operate. Should power be interrupted or cut off, the display continuously flashes "E00.00.00" until reprogrammed with the correct time. The clock cannot be programmed to automatically turn the scanner on or off at a desired time; it isn't a clock-radio.

Should the user desire to conserve power when operating the scanner from a battery, a switch is provided on the rear panel to disable the clock. The clock may be displayed anytime simply by pressing the clock key.

In order to stop the rig during the search mode, a monitor key is provided. This control also places a particular frequency from the search range into a special memory for future reference or transfer to one of the scanner's regular channels.

A mobile mounting bracket is provided in order to permit installation in a vehicle. A unique three-wire dc power cable is also included, consisting of black, brown, and red leads. The black cable is connected to negative ground and has an in-line connector for easy removal of the scanner. Red is connected to +12-V-dc continuous power source, and the brown lead is connected to +12-V-dc accessory fuse box terminal. (The purpose of the second +12-volt connection is for memory retention and clock circuits.)

A single external antenna terminal is provided, which is a decided advantage to the dual VHF/UHF inputs on previous Realistic models.

Rf Comments, Specifications

While the scanner is designed with both AM detection and FM quadrature detector, the two circuits do not function simultaneously on all bands. FM signals are received on all bands except the 108-136 MHz aircraft range, which is only received in the AM mode. The AM detector does not function on any frequency outside this band.

The Radio Shack Pro-2002 was added to its Realistic line of scanners this year and is a replacement for the excellent Pro-2001. While the 2001 covered only the conventional VHF-high/low and UHF bands (FM only) with 16 channels, it did so with overall sensitivity and audio clarity superior to the Pro-2002. On the specification sheets, both are listed as having the same sensitivity for VHF-high/low and UHF bands. In operation, however, the 2002 cannot receive and reproduce signals with the same clarity as its predecessor. Moreover, when field tested in mobile operation, the Pro-2002 had a high amount of static and ignition noise. Under the same conditions, the Pro-2001 received very little such interference. Another disturbing point is the reception of images and interference in the VHF-high band, especially in metropolitan areas with heavy signal density.

It is unfortunate that, with all the features the Pro-2002 includes, the rig doesn't have a better rf package inside. If its receiver circuitry performed as well as that of its predecessor, the Pro-2002 would be superb. Nevertheless, the unit's frequency coverage alone places it in a category by itself, and VHF-high band sensitivity is very good.

Should Radio Shack choose to re-manufacture the Pro-2002 and improve the VHF-high image rejection, UHF sensitivity, and scanning/searching rates, the results would be truly appreciated by serious monitor enthusiasts. Such a revamping was done by Radio Shack under similar circumstances with the DX-300 communications receiver.

The Pro-2002 programmable AM/FM scanning receiver is available from *Radio Shack, One Tandy Center, Fort Worth, TX 76102.* Reader Service number 479.■

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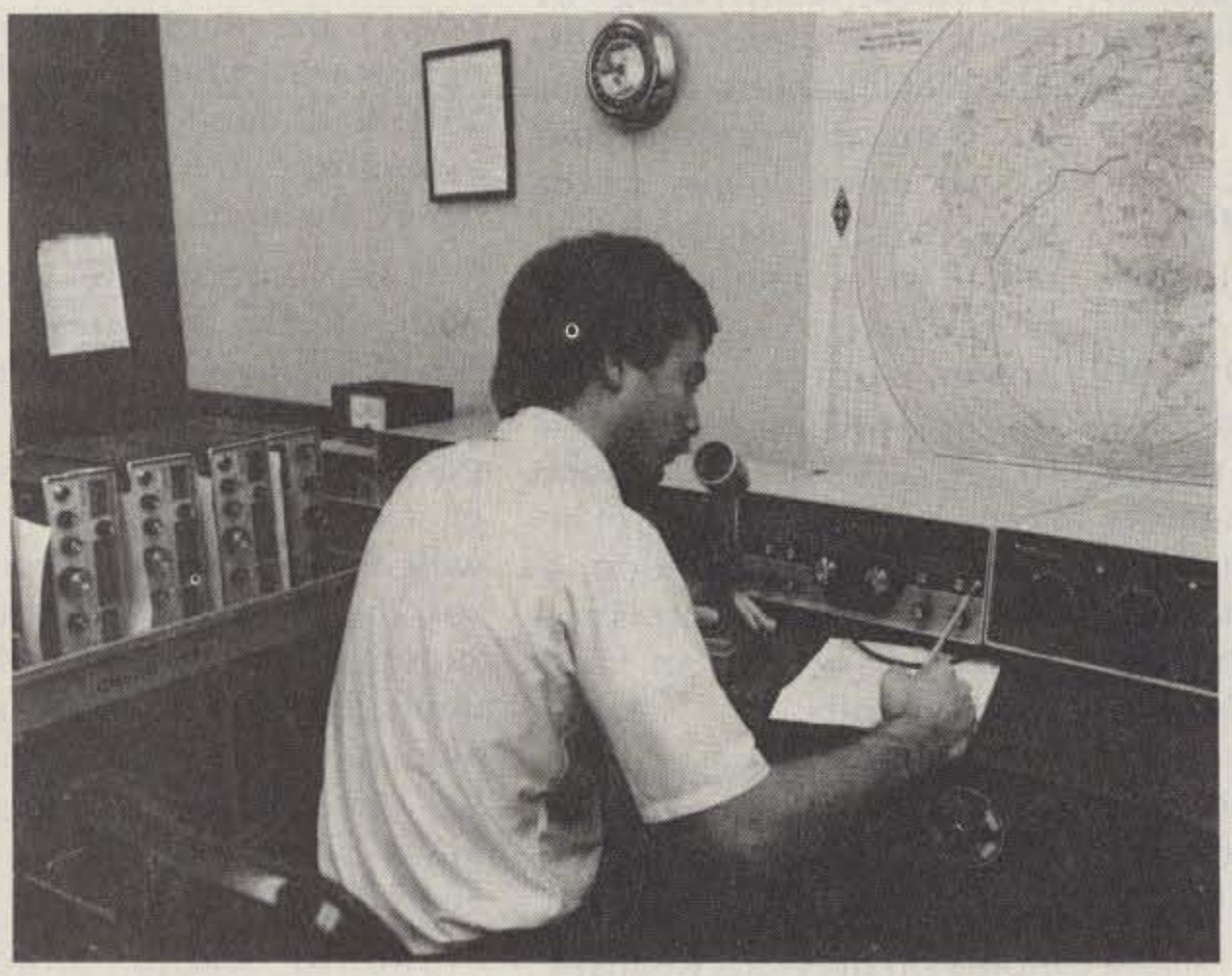

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The measurement of small values of inductance often is difficult without specialized (and expensive) equipment. If, though, you have a frequency counter, a handful of commonly-available parts, and a bit of ambition, the undertaking is much simplified. If you have a simple calculator, the math takes only seconds.

The idea is not mine. It came from William Huffman N5CC, who asked me to prepare an article on the subject. Bill built the ancillary device to be used with a counter. The design is straightforward and its construction should present no problem. A glance at Fig. 1, which shows the schematic wiring diagram, will reveal a simple Colpitts oscillator.

This oscillator, which should have excellent short-term stability and good long-term stability, needs only the usual care in construction. The two fixed capacitors, constituting the combination reactance-dividing network and capacitance portion of the LC circuit, should be silver-mica or, preferably, polystyrene, for best stability.

As built by N5CC, the oscillator sits in a 12.5 cm × 8.75 cm × 7 cm (5" × 3" × 2.75") cabinet. The Radio Shack 270-251 will give you room to spare. Internally, the 9-V battery shares space with oscillator components. Externally, the front panel holds a push-to-make momentary-contact switch and a pin jack for bringing out the rf signal. On top is a pair of binding posts for attaching the inductor to be measured.

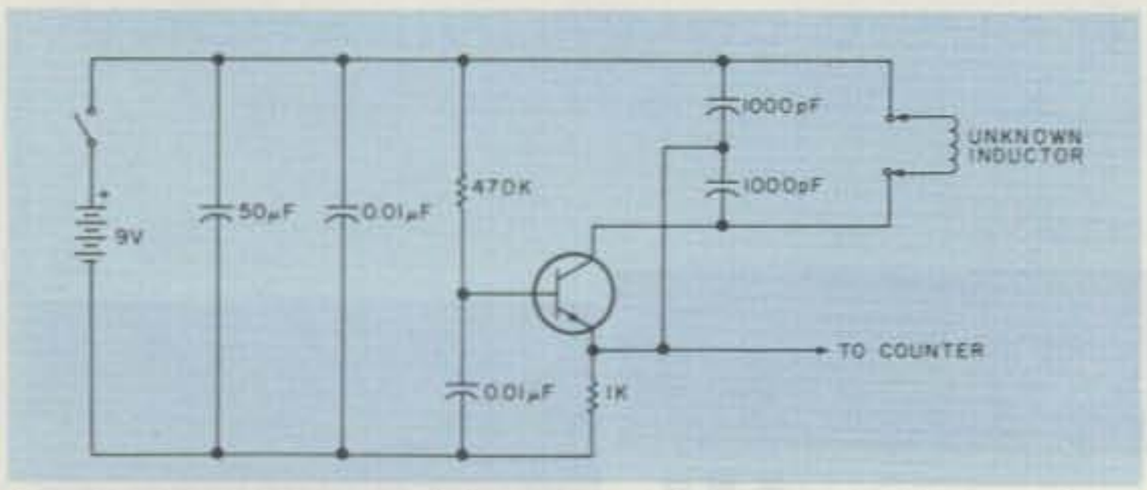

Fig. 1. Colpitts oscillator. Any high-beta NPN transistor should prove to be a reliable oscillator over a wide frequency range.

To use it, connect a counter to the rf output pin jack. Then calibrate the oscillator.

If you have an inductor of known value, this is a one-shot action. However, if you don't (and most of us don't), you can do a fairly accurate job by averaging a number of marked inductors. That's what I did. My hellbox delivered up a number of rf chokes marked 47 μH and 56 μH. In turn, each of these was attached to the inductor terminals and the resultant oscillator frequency was measured by the frequency counter. By presuming an accurately marked inductor, one can compute a presumed value for the internal capacitance of the oscillator circuit.

Average a stack of these and you have a figure that quite probably is reasonably accurate.

Here are the simple mathematical steps to follow in the computation of internal capacitance:

$4\pi^2 f^2 LC = 1$

$C = 1/4\pi^2 f^2 L$

$C = 1/39.478 f^2 L$

Let an inductor marked 47 μH be attached to the oscillator and the resultant frequency be recorded (in MHz). Presume it to have been 1.032 MHz. Then, to have capacitance ascertained in picofarads, CpF =

$1/39.478 \times (1.032)^2 \times 47 \times 10^{-6}$

$= (1 \times 10^6)/39.478 \times 1.065 \times 47$

$= (1 \times 10^6)/1976$

$= 0.000506 \times 10^6 = 506.$

Repeat this operation for a number of marked inductors and then average the results. In my case, the average was very close to 500 pF, which seemed to be a

reasonable value considering the components in the oscillator circuit.

Going back to our original formula and using f in MHz, L in Henrys, and C in picofarads, we see that:

$L_H = 1/4\pi f^2 C$
$L_H = 1/39.478 f^2 500$
$L_H = 1/19739 f^2$
$L_H = 0.0000506/f^2$.

Now let's put an inductor marked 56 μH, 5%, in the oscillator. Its frequency measured 0.9648 MHz. Dropped into the formula:

$L_H = 0.0000506/(0.9648)^2$
$L_H = 0.0000506/0.9308$
$L_H = 0.0000543$
$L_{\mu H} = 54.3$

If we presume the inductor was correctly marked, the accuracy of the formula is confirmed. All you need to remember for future measurements is one concise formula:

$$L_{\mu H} = 50.6/f^2_{MHz}.$$

There are a few precautions to be observed. The lead from counter to oscillator affects frequency, so it should be precisely the same from calibration to use.

The developer, N5CC, recommends that several oscillators be used for enlarging the range of inductors to be measured. His prototype, which has 1000-pF capacitors in the LC circuit, works best in measuring low-value inductors. He suggests the use of 10,000-pF capacitors for inductors in the 1-mH to 1-H range.

Note that the accuracy of inductor measurement hinges upon two factors: the accuracy of the frequency counter and the precise knowledge of the calibrating inductor. The former should present no problem, but finding an inductor of an exactly-known value is not easy! Take consolation in the fact that its use is required only once! ■

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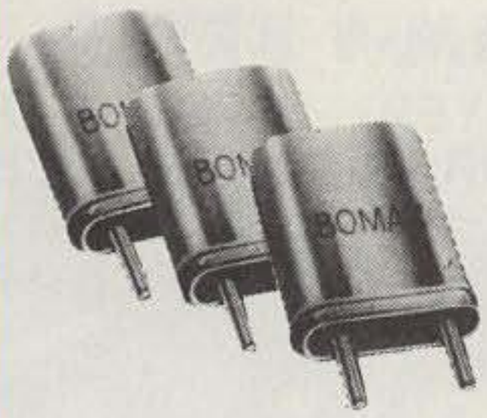

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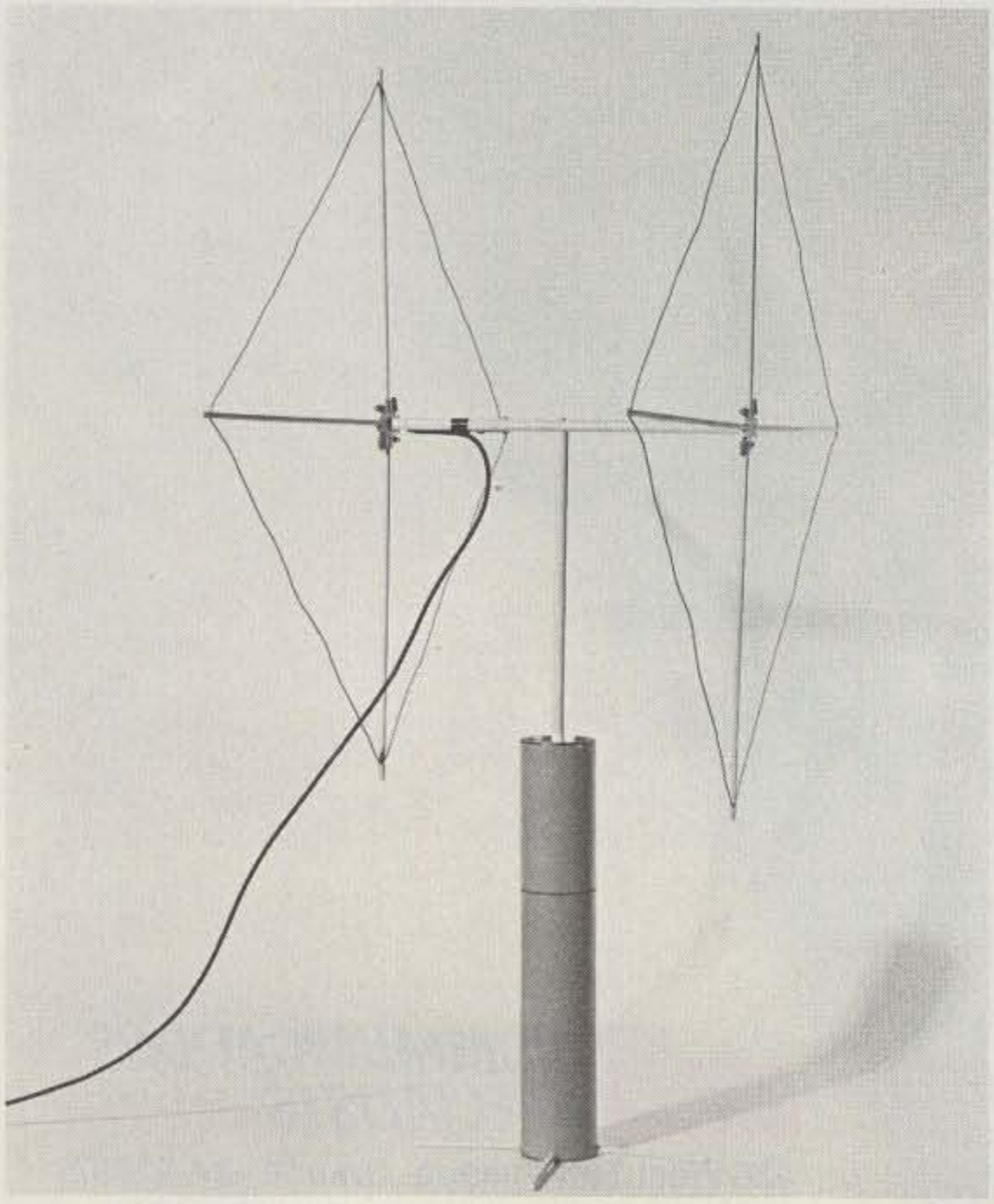
For the most part, we take the ease and convenience of two-meter FM operation for granted. Since it's possible to access a repeater in many areas with almost no antenna, there's a tendency to let the repeater do *all* the work, just getting by with an absolute minimum for a portable or mobile antenna—rubber duck, quarter-wave whip, or the like. This approach works most of the time, allowing casual operation through repeaters, but often falls far short of providing really good performance when working simplex and when used under demanding conditions of rough terrain, contest competition, and poor propagation paths.

If your fancy turns to backpacking, mountaintopping, and similar ham pursuits, the added forward gain and physical selectivity offered by a small beam will reap handsome dividends. Most apparent will be the improvement in transmitted and received signal levels, but—very important to whose who regularly operate from the higher elevations—the "physical selectivity" (front-to-back and front-to-side discrimination) offered by a beam will make such operation a great deal more orderly, reducing the tendency to key up several repeaters simultaneously and sorting out signals on the popular simplex frequencies. One of the most suitable antennas to do these things is the quad.



Portable two-meter quad from Palomar Engineers.

The quad is primarily considered an antenna for the HF bands, with its asserted element-for-element superiority over the yagi and its potential for use of low-cost construction materials. But the quad is a good performer on any frequency, and in recent years has received increasing attention as an effective and efficient VHF and UHF antenna.

There are a number of reasons for looking at the quad for VHF/UHF use. The antenna can be built of inexpensive and easily-obtained materials, and its performance can be equal to or better than other arrays of comparable size. Adjustments for resonance and feedpoint impedance matching are easily made, and the antenna readily lends itself to stacking either side by side, or one above the other, as with yagi arrays. Too, the quad is a relatively broadband antenna, making it particularly useful on the wider VHF/UHF bands.

The basic quad consists of a full-wavelength driven loop and a reflector, which is cut about 5% longer than the driven element and spaced between 0.15 and 0.25 wavelength. Closed loops can also be used for the directors, in which case they are made 5% shorter than the driven element. Any reasonable number of directors can be added, until the antenna becomes too bulky and unwieldly and a point of diminishing returns is reached.[1]

As a rough guideline, when compared with the half-wave dipole, the two-element quad shows a gain of 6-7 dB, as opposed to a 5-dB gain for a two-element yagi. The three-element quad (reflector, driven element, and one director) is capable of about a 10-dB gain, while a five-element quad—generally considered impractical at HF frequencies except by the hardiest "antenna farmers"—checks in with a gain of 13 dB.

---

[1]For a specialized discussion of the quad on the higher bands, refer to the RSGB *VHF/UFH Manual*, by D.S. Evans G3RPE and G.R. Jessup G6JP. A British publication, the book is readily available in the United States.

Besides the plain-vanilla quad, there are several specialized configurations popular on VHF and UHF. The so-called Swiss Quad, pioneered by HB9CV, is an all-metal, mechanically-excellent, all-driven array having a radian pattern comparable to that of the ordinary quad. The expanded or bi-square quad is a takeoff on the basic configuration, in which dimensions are expanded to two wavelengths for each loop (for added gain); dimensions are still practical even on the lowest VHF band, 6 meters. The Super Quad describes virtually any combination of standard (one-wavelength) or expanded (two-wavelength) quads stacked in various arrangements to yield very high gain figures. Finally, the Quagi, which is a hybrid antenna blending features of both the quad and yagi into a single design, uses a standard one-wavelength quad driven element and reflector in combination with dipole (yagi) director elements. The result is an antenna boasting high gain, simplified construction, and easy feedpoint matching.

Regardless of type, simple quads scaled to VHF and UHF dimensions are increasingly popular in mountaintopping, Field Day, backpacking, and portable operation for reasons of economy, bandwidth, high gain, portability, and relative ease of construction. An interesting commercial two-meter portable unit—perhaps the first commercially produced—is the Palomar Engineers collapsible quad. Designed particularly to extend the range of low-power two-meter transceivers by providing the gain and front-to-back discrimination of the two-element quad, it is a good candidate for serious in-the-field work when one would like to have the effective gain of a linear amplifier but without being saddled with additional battery power and weight requirements.

The Palomar design is based on one of the several portable quads described by R.J. Decesari WA9GDZ/6 in the September, 1980, issue of *QST*.[2] The Palomar antenna, presented as a good alternative to a standard 4-element yagi, is capable of up to 6 dB forward gain with an excellent front-to-back ratio.

The original WA9GDZ/6 designs were the results of a quest to construct a highly portable (non-yagi) antenna that packed a substantial gain into a small package; efforts to design a collapsible yagi had proved overly large and cumbersome. Several alternative designs were built, some with 45-degree diagonal polarization for good compatibility with both FM (vertically-polarized) and SSB/CW (horizontally-polarized) modes, and some with straight vertical polarization. Other models were built that used different methods of keeping the quad spacers erect. The Decesari antennas can be made from any of several hardwood, plastic, and Plexiglas™ material; the loops are constructed of copper wire.

Palomar Engineers are the exclusive manufacturers of the patented 2-meter version, which is based on the Fig. 7 design in the *QST* article.

The antenna uses quad driven-element, reflector, and spacing dimensions optimized for 146-MHz operation, with the feedpoint at one side of the driven element to yield a vertical polarization characteristic for FM work. These figures work out to a driven element about 1.72′ on a side, a reflector 1.80′ on a side, and an element spacing of about 16″. In this design, the elements are made of #18 PVC hookup wire, the quad "spider" is lucite, while the spacers, boom, and mast are of wooden dowel construction. The storage container/support is fabricated from cardboard and has a varnish coating. The antenna uses knurled brace thumbscrews to hold the spacers in place. Four wooden spokes at the bottom of the storage container form a stand to provide support for the antenna, both to keep it steady and to prevent its blowing over (mountaintopping, you know!). To aid in 50-Ohm feedline matching, a matching stub and trimmer capacitor are provided.

At present, the antenna is sold fully assembled. According to Jack Althouse K6NY of Palomar Engineers, they plan to furnish them unassembled in the future. Also expected are some changes in mechanical details to lower the cost.

We found the antenna to be an ingenious one, certainly worth consideration by the serious backpacker, to whom *portable* means just that. When collapsed, the antenna folds completely into the storage container/support tube, with the spacers folding along the longitudinal axis of the boom. Overall weight is but 1-1/4 pounds. We did consider the antenna stand to be a bit on the fragile side, so one must take care in carrying it, in its installation, and in its use.

Although rigorous antenna pattern and gain tests were not performed, the portable antenna exhibited a marked forward gain and front-to-back ratio. These characteristics were clearly evidenced when working through repeaters outside the local area, where rotating the antenna produced the anticipated signal strength changes. The quad antenna's superior performance was quickly noticed when making comparison checks between it and a 5/8-wave whip, when driven by a two-Watt handie-talkie (HT). When using several repeaters 25-35 miles distant, the HT-mounted 5/8-wave resulted in marginal performance on both transmit and receive, while use of the quad made operation into several of these repeaters almost full quieting. When the quad was compared with the HT's stock rubber duck, there was hardly any comparison at all: Some repeaters that were marginally readable on the rubber duck were very nearly full quieting, and it was often possible to access machines that were unusable before because of inadequate signal strength from the HT.

What about swr? We found that the standing wave ratio was quite acceptable across the entire frequency range covered by the antenna. Swr at the design center frequency of 146 MHz ran about 1.1:1 and changed almost imperceptibly over the 144-148 MHz range. These measurements were made without any pruning of the antenna or adjustment of the matching stub. Being very broadbanded, it's unlikely that any adjustments would have to be made.

We found the little quad to represent a novel idea as far as VHF antennas go. It's a highly compact but practical package especially suited for on-the-go operation. Perhaps a bit dear at $87.50, but with the price subject to downward revision when the antenna becomes available as a kit, it's a very nice range-extending accessory to have and use.

Who says hiking can't be fun?

For more information, contact *Palomar Engineers, Box 455, Escondido CA 92025.* ■

[2]Decesari, R.J. WA9GDZ/6, "A Portable Quad for 2 Meters," *QST*, September, 1980.

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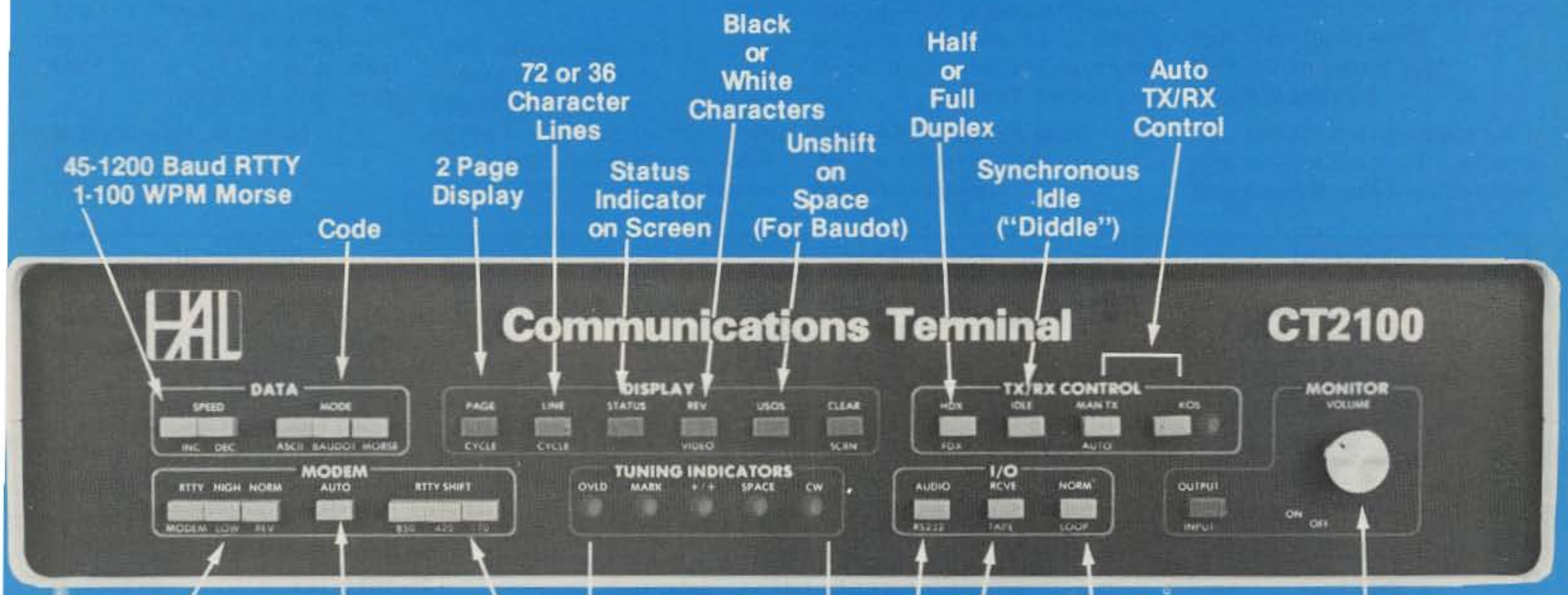

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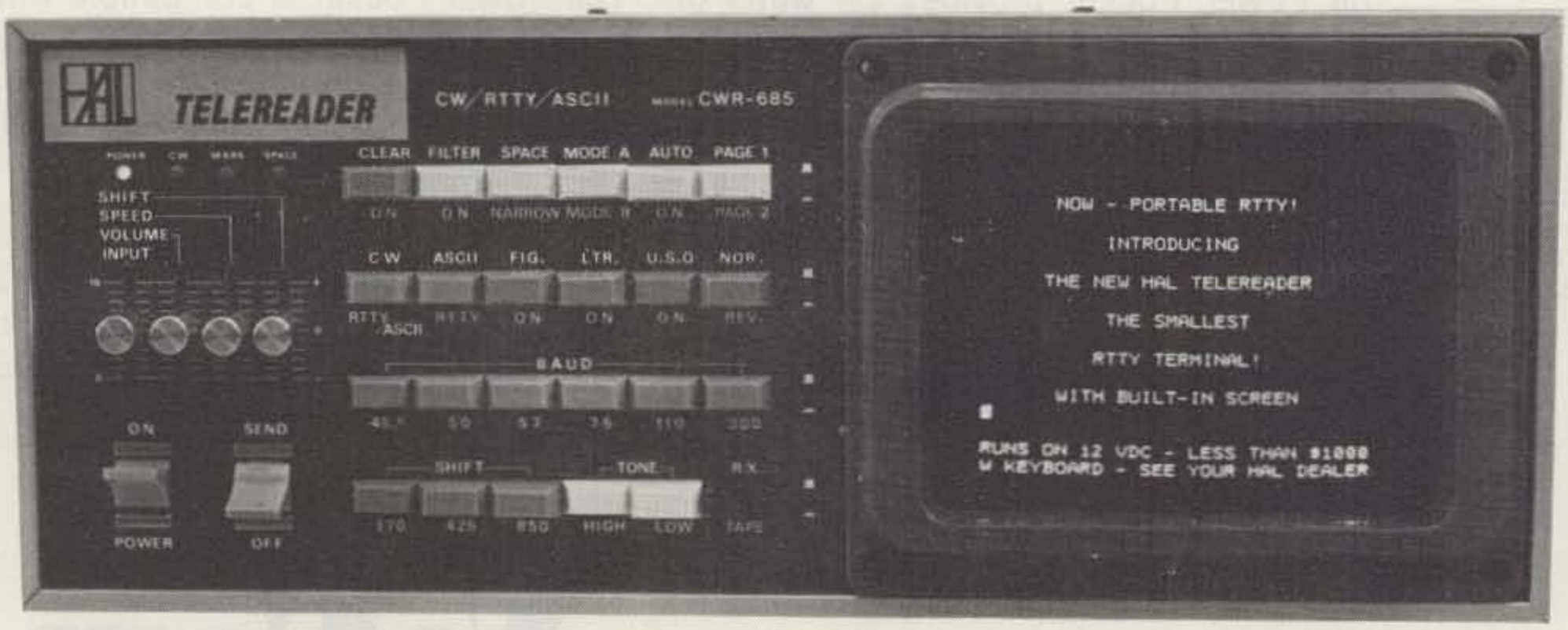

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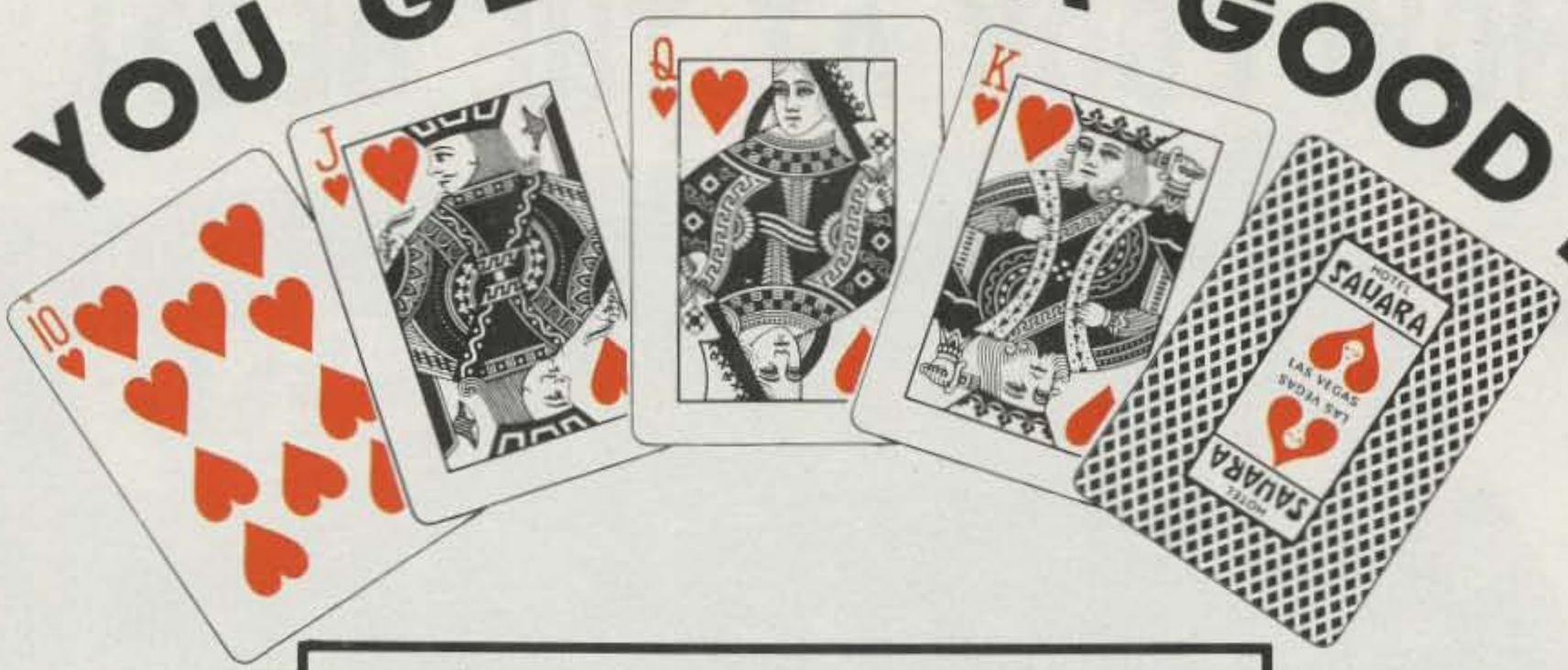

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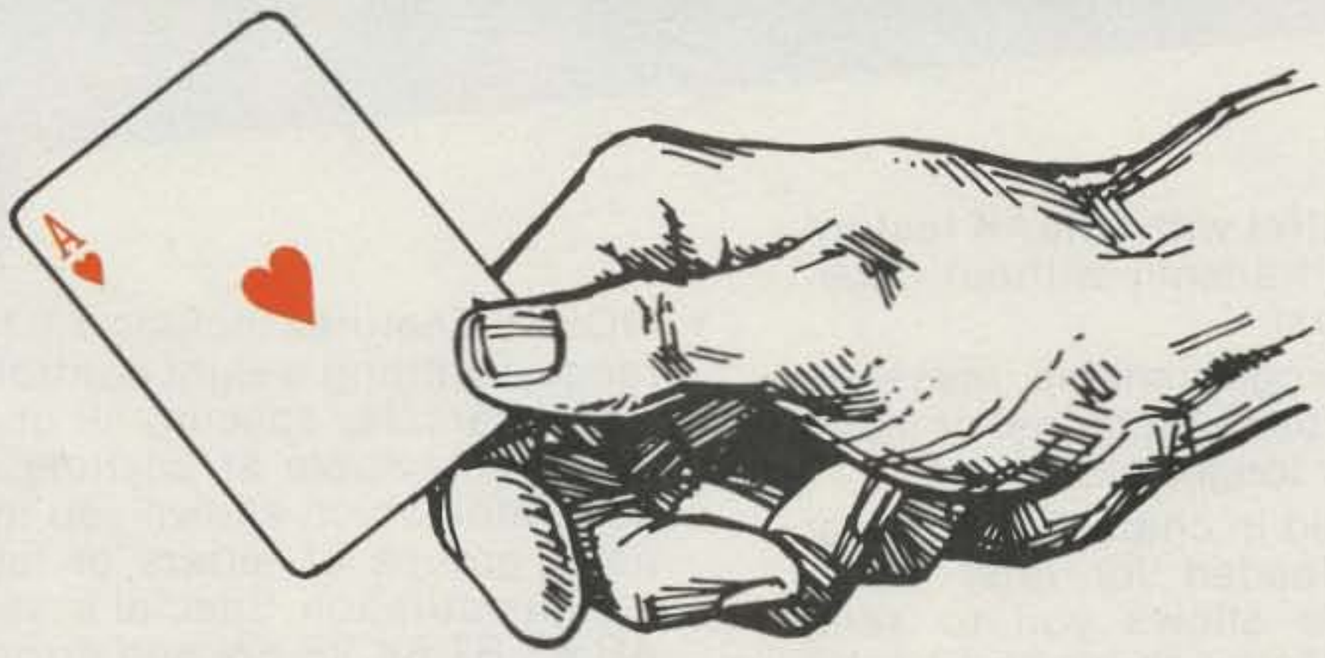

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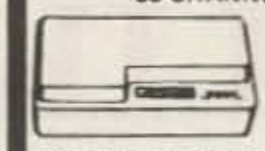

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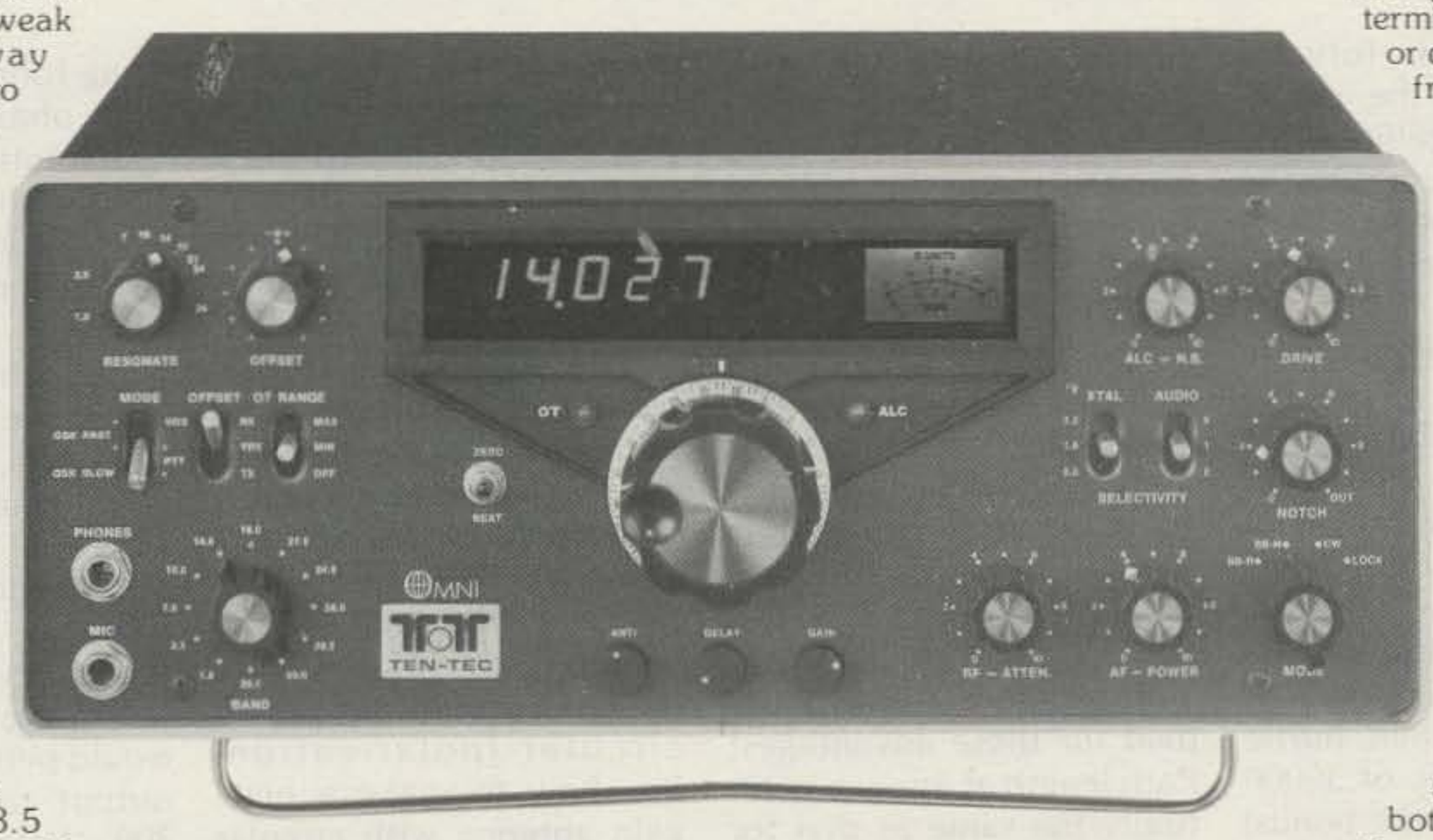

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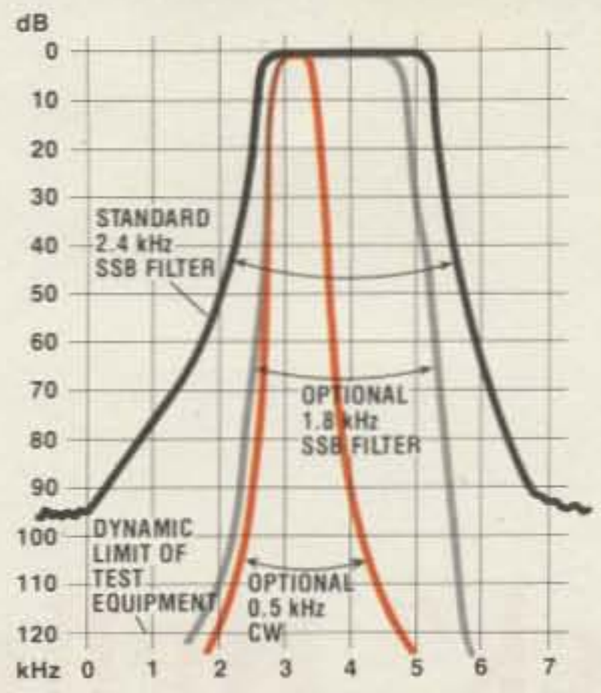
Tailored i-f response. OMNI is equipped with the potential for ***seven*** response curves to handle any listening situation.

Standard filters include an excellent 8-pole 2.4 kHz crystal ladder filter and, in addition, a 150 Hz active audio cw filter with three ranges (450, 300, 150 Hz).

Optional filters include 1.8 kHz 8-pole crystal ladder ssb filter, 500 Hz 8-pole cw filter, and 250 Hz 6-pole cw filter.

Front panel switches put any optional filter in series with the standard filter for up to ***16 poles of filtering*** for near ultimate skirt selectivity.

Four i-f response curves for ssb and three for cw. That's response tailoring, that's crowd control.



OMNI/SERIES C I-F RESPONSES WITH STANDARD AND OPTIONAL FILTERS.

Optimized sensitivity and dynamic range. The OMNI sensitivity range of 0.3 μV typical (slightly less on 160 & 80M) combines with a 90 dB dynamic range to provide an ideal balance that will handle any situation from copying a weak signal half way 'round the world to keeping the next-door kilowatt from muscling in. And a PIN diode switched 18 dB attenuator is included for extra insurance against overload.

More crowd-handling features—and all standard equipment.

Built-in notch filter. To drop out unwanted signals or carriers. Tunable from 200 Hz to 3.5 kHz, with a 50 dB notch depth.

3-mode, 2-range offset tuning. To put you where the others aren't and where the elusive DX is. Move just the OMNI receiver, or just the transmitter section, or the entire transceiver, ±500 Hz or ±4 kHz. For complete freedom of frequency movement to get away from the crowds.

Built-in noise blanker for those times when your noise-generating neighbor is crowding your receiver. Filtered to handle the big signals easily.

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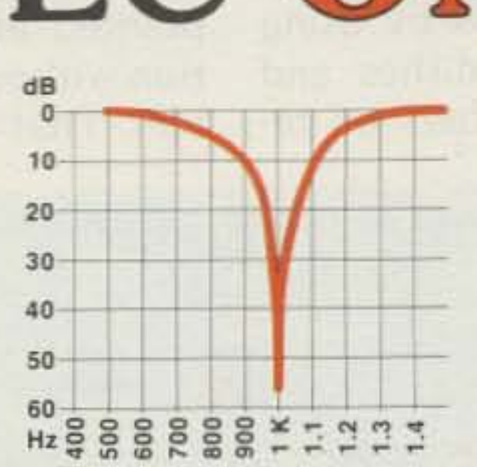

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Model 546 OMNI-C transceiver $1289

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Colin Richards 9M2CR
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"Chopstick" Helical for 432 —satisfies your Phase III appetite

Forward gain, forward gain: that's the ceaseless search in satellite work. It's a task that jumps to the forefront with the approach of a new breed of satellite—Phase IIIB.

The Phase IIIB satellite will be put into a "pseudo-synchronous" orbit—which means that it will offer many of the advantages of commercial synchronous satellites. It will swing around the bottom of the globe at a low perigee of 1500 km and then hurtle out to an apogee of 36000 km—and (here's the bonus)—its movement relative to an earth station for the 4 hours spanning this apogee will be small. For four hours there will be an almost-stationary satellite up there, covering half the globe.

For the first time, radio amateurs will be able to communicate on a worldwide basis using VHF+UHF, thus skipping many of the baneful problems of HF propagation. What's more, Doppler shift at the apogee will be very slight—so that the skillful searching and re-tuning so essential with low-orbit satellites will no longer be required.

But there is a price to be paid for these advantages! Path length at apogee is virtually the same as that for commercial synchronous satellites. While they counter this path loss by using giant 30-metre dishes and low-noise amplifiers on receive, cooled in liquid helium, no amateur can compete with this! But latest estimates for Phase IIIB suggest that we can get by with an erp of 500 Watts—a tolerably modest figure. Of course, a 500-Watt final is out of the question for most amateurs—so we have to get our gain elsewhere—notably from the antenna system.

Phase IIIB uplink will be centered on 435.215 MHz and will require clockwise circular polarization. So—how to make a high-gain antenna with circular polarization which can be hoisted into the air and pointed in the right direction without too much trouble? That is the question. Long-John yagis—crossed and phased—could offer one solution, but at 435 that phasing harness could present problems, while impedance matching is also a chore.

So, why not a helical? Here we have neatness, high gain, wide bandwidth and circular polarization—all in one. Scanning the handbooks for design info on helicals showed that a ten-turn helix looked promising: a gain of 15 dB would persuade my 10-Watt output to masquerade as 300 Watts, and a beamwidth of 36 degrees ought not to be too finicky to point. The boom length at 435 MHz would be about 6 feet, with a reflector 28 inches square—these seemed manageable dimensions. But what to use for the helix, how to form it, how to keep it in shape? All pertinent questions at this particular QTH—with the nearest parts or material stores some 70 miles away.

The boom was no problem. A 6'4" length of 1"×1/2" meranti timber, good and straight, looked just about right—with the 1" edge vertical to avoid

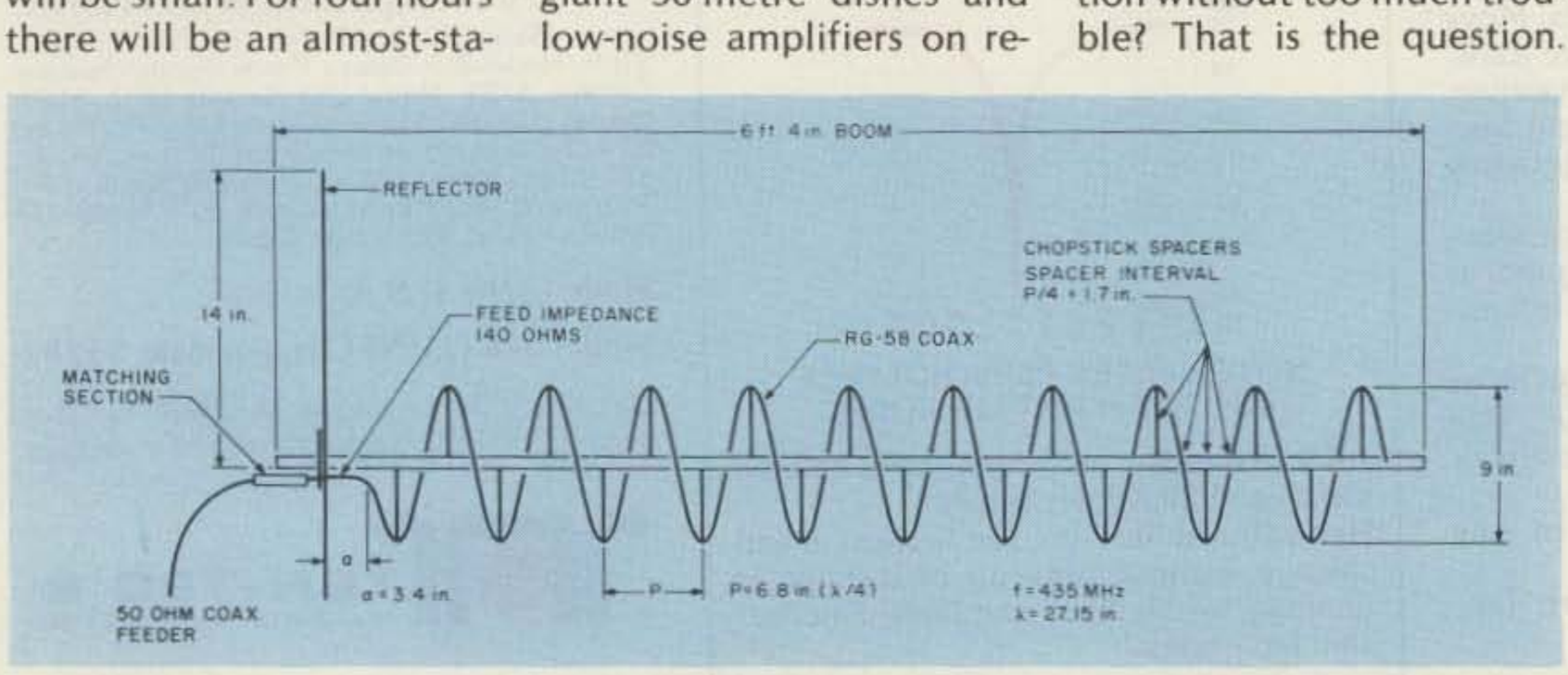

Fig. 1. Ten-turn "chopstick" helical: gain 15 dB, beamwidth 36 degrees.

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Theta 7000E Microprocessor-Controlled Communications Terminal

New versatility for the old bear in your station . . .

The perfect addition to any amateur radio installation! Complete, automatic send/receive of Morse code (cw) Baudot code (RTTY) and ASCII code (RTTY). Works with any video monitor.

Suggested List:

Model 7000 **Drake Theta 7000E Terminal $1095.00**

Model 7009 **Drake TR-930 Video Monitor $ 185.00**

7-Channel Battery Back-Up Memory, the Theta 7000E has seven keyboard-selectable, non-volatile, random access memory channels each of which can hold 64 characters. Data in these memories is alterable at any time and is retained when power is removed. Messages in these memory channels can be repeated 1 to 9 times via keyboard command. All channels may be daisy-chained for continuous read-out. Channel number in use is indicated on display.

Wide Range of Transmitting and Receiving Speeds, 5 to 50 wpm in Cw with autotrack on receive. Standard RTTY speeds of 60, 67, 75, and 100 wpm Baudot code and 110, 150, 200, and 300 Baud ASCII code.

Self Contained Demodulator, three-step shift selects either 170 Hz, 425 Hz or 850 Hz shift with manual fine tune control of space channel for odd shifts. High/low tone pair select. Mark only or space only copy capability for selective fading.

CONVENIENT KEYBOARD FEATURES, automatic keyboard-operated transmit, (KOX) or manual keyboard transmit. **Unshift on space,** reverts to LETTERS case after reception of each space character in Baudot code. **CR/LF is automatically inserted** every 60, 72 or 80 characters while transmitting. **Cw identification,** in RTTY mode. **Echo function,** prerecorded cassette tapes can be read and transmitted. **Test messages,** "RY" and "QBF". **Transmit word mode,** characters can be transmitted in word groupings.

Crystal Controlled AFSK Modulator:

High Tone Pairs	Shift	170 Hz	425 Hz	850 Hz
	Mark	2125	2125	2125
	Space	2295	2550	2975
Low Tone Pairs	Shift	170 Hz	425 Hz	850 Hz
	Mark	1275	1275	1275
	Space	1445	1700	2125

• **Printer Interface for Hard Copy,** all modes for parallel ASCII printers. Loop keyer for conventional teleprinters. • **Composite Video Output,** for any standard video monitor. •**Kansas City Standard AFSK Output,** KCS tone pair for ASCII. • **Large Capacity Display Memory,** two page display memory contains 32 X 16 lines per page. • **Split-Screen,** with a keyboard command, the display can be divided in two; the upper half for transmit and the lower half for receive. Messages can be composed while receiving. • **Buffer Memory,** 53 character type-ahead keyboard buffer. • **Word Wrap-Around,** in receive mode, word wrap-around prevents the last word on a line from becoming split in two. Moves whole word to next line. • **Automatic Letters Code Insertion,** if desired, LETTERS (diddle) code can be transmitted continuously in a pause of transmitting from the keyboard. • **Audio Monitor,** a built-in audio monitor circuit with automatic transmit/receive switching enables checking of the transmit/receive tones. • **Transmitter Keying Circuitry,** keys either grid block, cathode keyed, or solid-state transmitters. • **Power Requirement,** The Theta 7000E requires only 13.6 Vdc @ 1 amp. Plugs into 13.6 Vdc accessory jack on PS7 or PS75 power supplies. • **Effective Packaging for RFI Protection,** well designed metal cabinet and protective circuits prevent RFI. • **Terminal Size:** 15.8"W x 11.8"D x 4.7"H (40 x 30 x 12 cm) • **Weight:** 11 lbs (5 kg) • **Monitor Size:** 8.7"W x 9.8"D x 8.9"H (22.1 x 24.1 x 22.6 cm) • **Weight:** 11 lbs (5 kg)

Model 1230 **LA7 Line Amplifier $49.95** Suggested List

Line output, input levels as low as 15 mV rms (47 kilohm) will result in an output of 1 mW nominal into a 600 ohm balanced line. Output level adjustable by internal pre-set level control. Interfaces low level audio to RTTY terminal unit or phone line that requires a 600 ohm balanced/unbalanced input. One 36" phono to phono cable supplied. • **Size:** 4.5"L x 1.3"H x 2.5"W (11.4 x 3.3 x 6.4 cm). **Weight:** .3 lbs. (.14 kg).

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any bending (as it happened, the antenna itself turned out to be featherlight and easily supported by the 1″×1/2″). But what about the helix, and what about the spacers?

Copper tubing was unobtainable; in any case, it would have been expensive, heavy, and difficult to shape. Someone, somewhere had mentioned using coaxial cable: so why not RG-58? The outer screen would simulate a tubular conductor; the inner conductor is not needed but could be soldered to the screen at each end. Good grade coax has a tinned, close-mesh screen with an excellent weatherproof sheath. What could be better? I promptly hunted out a 25-foot length.

Spacers were now the problem. Most handbooks showed 3 spacers per complete turn of the helix, each spacer being set at a 120° angle to the last. Since the boom was rectangular, it seemed more sensible to opt for 4 spacers per turn, and to put them at 90° settings. The original plan was to use 1/4″-diameter plastic rod or wood dowel for the spacers, but nothing remotely resembling such material was available locally. Pondering the problem over a tasty meal of Fuyong egg, crispy chicken, and Cantonese bean curd, I suddenly saw the answer there in my right hand: chopsticks! Why not?

Chopsticks are available in a wide variety of designs and materials in Malaysia. I chose simple, wooden, everyday chopsticks (not bamboo)—undecorated—sold in bundles of 20 for 25 US cents a bundle. As with most chopsticks, the lower half has a circular, tapered cross-section, merging into a rectangular shape for the upper half. It couldn't be better! I marked the boom at 1.7″ intervals and drilled holes 3/16″ in diameter—consecutively at right angles for its entire length. The boom was long enough to allow 3 to 4 inches to stick through the reflector, for clamping purposes. A 3.4″ piece of the same boom material was fixed to the boom at the reflector end, and the 1.7″ intervals were measured from this. All this can be seen clearly from Fig. 1.

A drop of glue was put into each drilled hole, and the chopsticks were pushed in one by one until they wedged tight. A double-check made sure that they were put in with a clockwise spiral, as viewed from the reflector forward (that is, from the back of the beam). When giving the final push, each chopstick was twisted so that the square sides were roughly in line with the path that the RG-58 helix would take. This made it easier to file a small U-shaped depression in the top to allow the RG-58 to sit in neatly.

Chopsticks are generally about 10 inches long, and when pushed through the boom about 4 inches protruded on the other side. These bits were carefully sawn off. The helix diameter is 9 inches, so a mark was made on the last 4 spacers at each end of the boom, at a point 4-1/2 inches from the center line of the boom. A fine hole was drilled at these marker points and thread strung along from first to last spacer in each of the 4 rows. This enabled the other spacers to be marked to show where they should be cut off.

After trimming, the tops were filed into a U-shaped depression in line with the helix path. A small hole was then drilled, an eighth of an inch below the tip, so that a piece of waxed thread could be used to bind the RG-58 helix in place.

One end of the 25-foot length of RG-58 was bared for half an inch, the sheath and dielectric removed, and the screen and center conductor twisted together and soldered. Starting with this end, the RG-58 was bound to the short, straight, end section (3.4 inches) next to the reflector position. The soldered tip was placed so that it would mate with the center terminal of an SO-239 socket which would be mounted on the back of the reflector. The RG-58 helix was then wound carefully around the spacers, one at a time, binding in each spacer before moving to the next. In this way it was possible to ensure that an even, circular spiral was created—with no bulges or flat sections. As we neared the tenth turn, there was about 8 inches of surplus RG-58. This was cut off, the end trimmed, and the outer screen and inner conductor were soldered together as at the start of the helix. The thread bindings were touched with glue, and the boom and chopsticks given a coat of clear varnish and set aside to dry.

Colin Richards 9M2CR with the completed project.

The helical at work—note that the reflector frame is now a lightweight bicycle wheel rim, which is "neater, lighter, and better looking."

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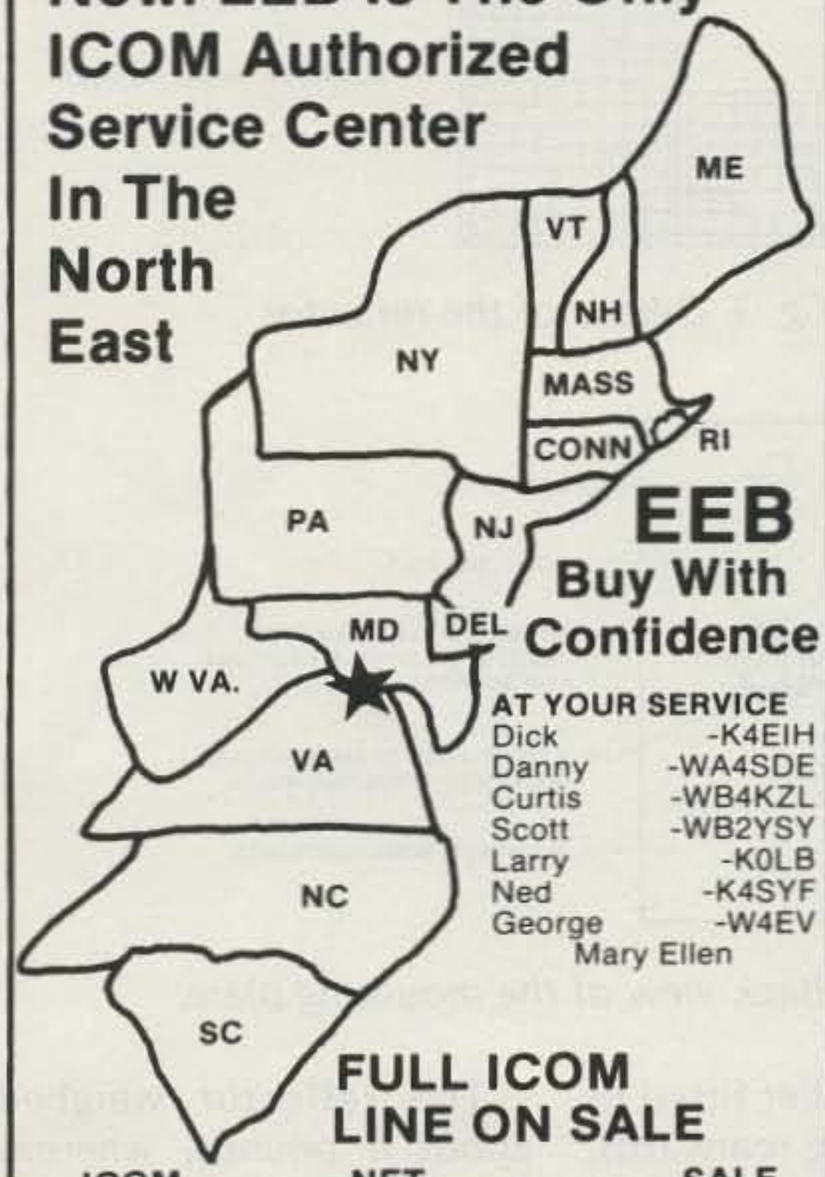

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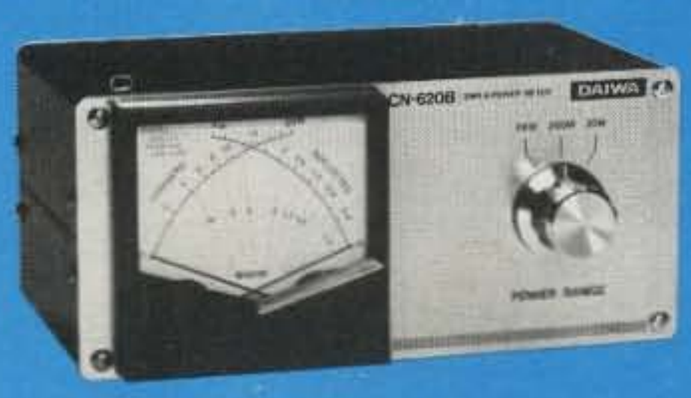
Connectors: SO-239

Model CN-620B (New 2 Kw Scale)



Frequency Range: 1.8—150 MHz
SWR Detection Sensitivity: 5 Watts min.
Power: 3 Ranges (Forward, 20/200/2000 Watts)
(Reflected, 4/40/400 Watts)
Dimensions: 165 x 75 x 97 mm;
6.5 x 3 x 4 in.

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Frequency Range: 1.8—150 MHz
SWR Detection Sensitivity: 5 Watts min.
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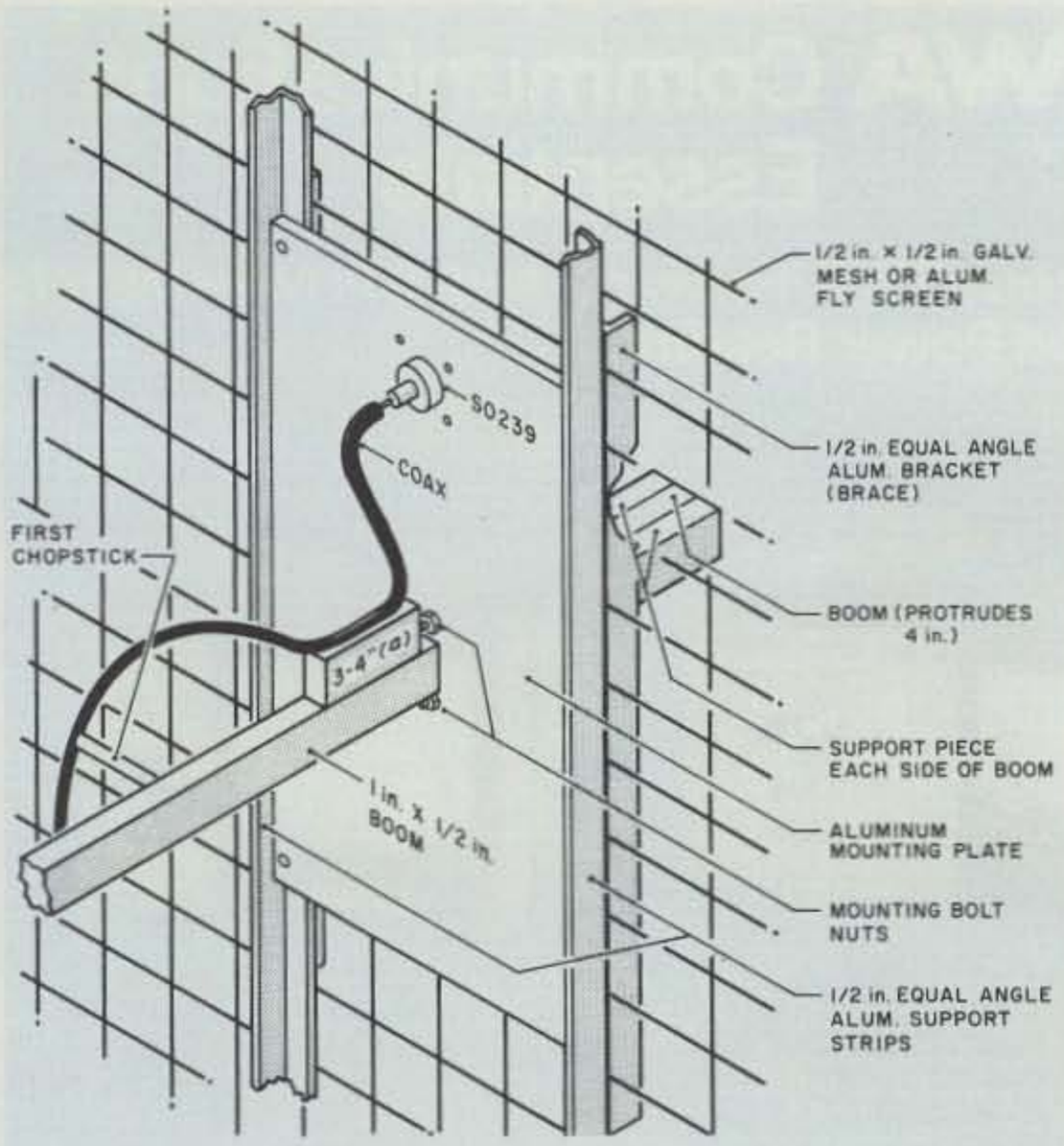


Fig. 2. Front-view details of mounting the bracket on the reflector.

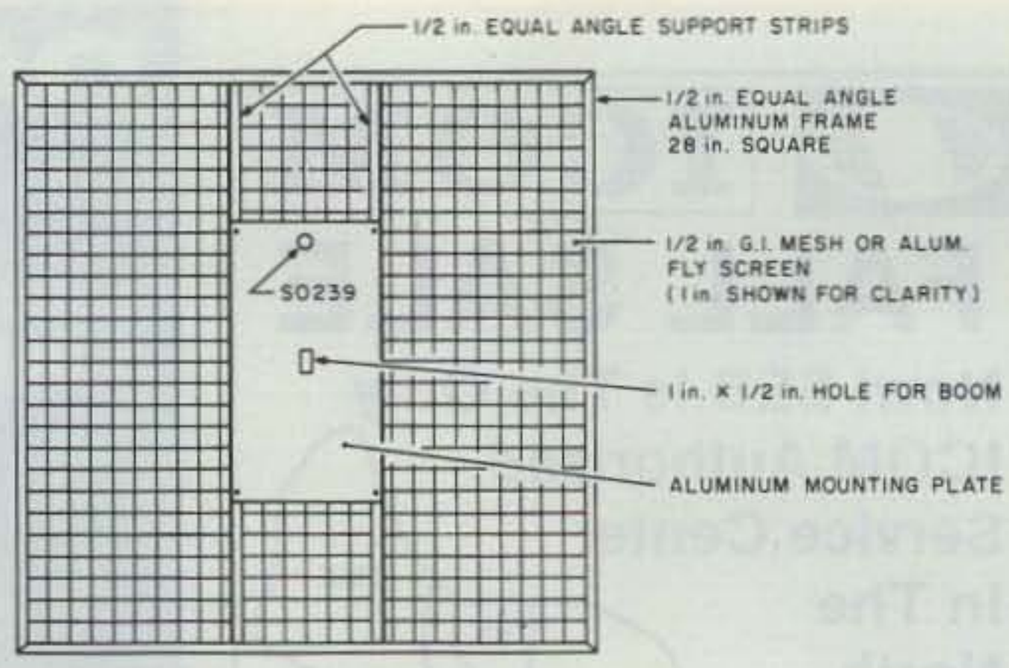


Fig. 3. Details of the reflector.

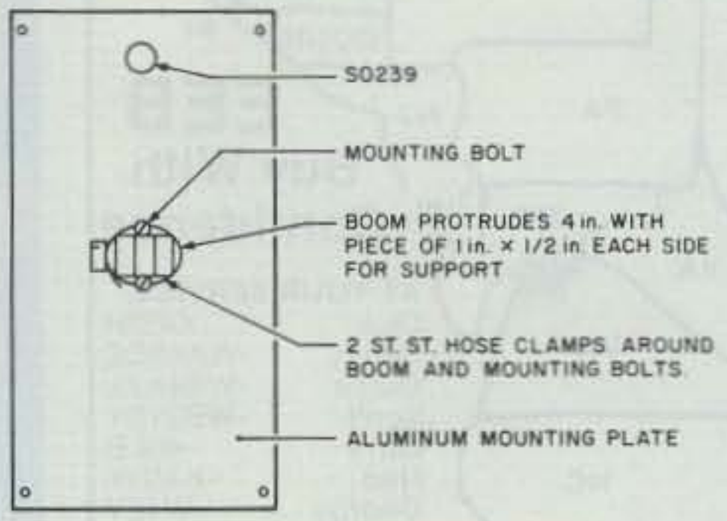


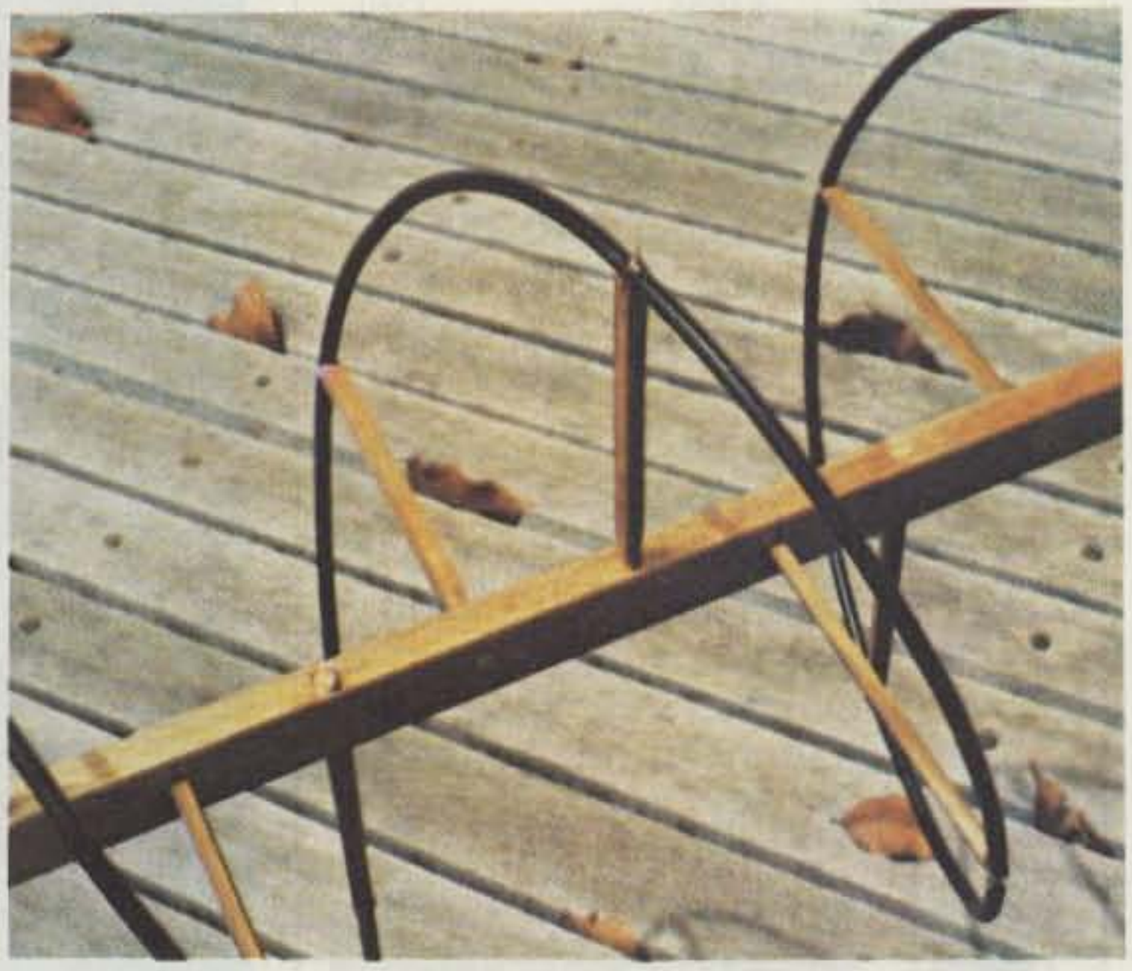
Fig. 4. Back view of the mounting plate.

The reflector came next. (Note the later improvement in the photo of the helical at work.) Half-inch-squared mesh GI screen was used, and a 28-inch square cut out and edged with 1/2" × 1/2" aluminum angle. A small, sturdy aluminum plate was used as a center mount for the reflector (it was, in fact, an old door-lock plate!). An aperture 1" × 1/2" was cut in the center to allow the boom end to fit through and protrude 4 inches on the other side of the reflector. Above and below this aperture a hole was drilled for a 3" × 1/4" carriage bolt. The bolts were firmly screwed to the plate, with most of their length also protruding to the rear of the reflector.

Two more lengths of aluminum angle (1/2" × 1/2") were screwed across the plate in a vertical direction, to make the reflector rigid. The SO-239 socket fitted to the plate, facing rearwards, with its center terminal lined up with the end of the helix at section A in Fig. 1. The antenna boom was then pushed through the reflector mounting plate, carefully squared up, and fixed firmly in place with two stainless-steel hose clips around bolts and boom.

The reflector weighed about 8 pounds, whereas the antenna-plus-boom was only 2 pounds. A plywood bracket was therefore fitted at the balance point, just a few inches from the reflector. Minor dents in the RG-58 helix were pushed gently into shape, and the ten-turn "Chopstick" helical was ready for hoisting aloft! Almost ready, that is.

Securing the boom to the reflector.



The helix attached to the "chopstick" spacers.

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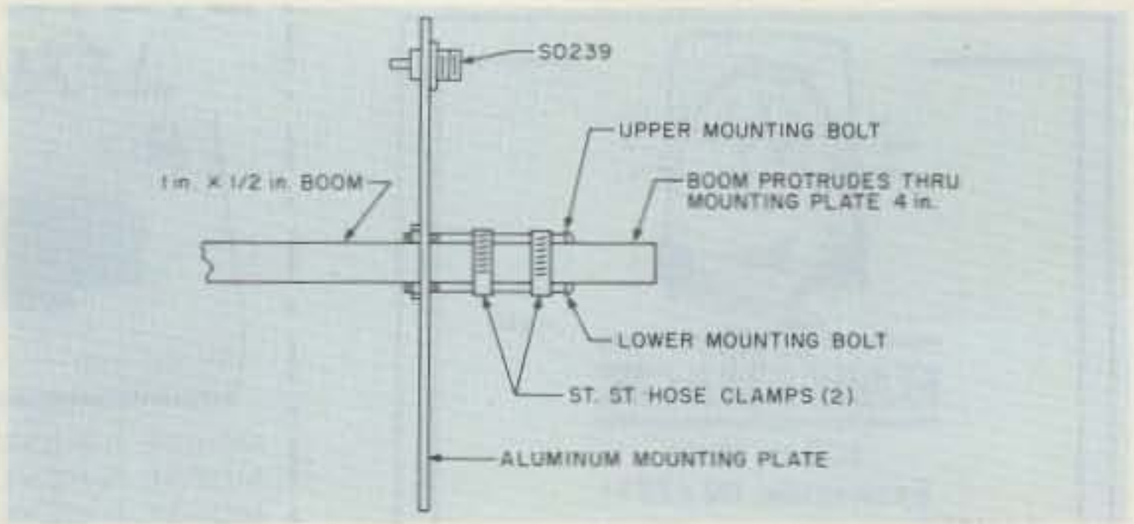

Fig. 5. Side view of the mounting plate.

There still remained the question of matching to a 50-Ohm feeder. The feed impedance of a helical antenna of this design is near enough 140 Ohms (this stays the same, by the way, regardless of the number of turns in the helix). A quarter-wave matching section should therefore have an impedance of about 84 Ohms. The nearest coax is RG-62, which has an impedance of 93 Ohms. A quarter wavelength at 435 MHz is 6.8", and the velocity factor brings this down to 5.7" (there's a trap here: solid dielectric coax like RG-8 or RG-58 has a velocity factor of 0.66, but is partly air-spaced and the factor is 0.84). After many "cuts and tries," the swr was brought down to 1:1.1. So this time the antenna was really hoisted in the air and put to work. Results? When used as an uplink antenna on OSCAR 7, Mode B, signal reports have been encouraging; downlink on Mode J, I can copy stations right down to the horizon. I think it works! ■

Reprinted from the December, 1980, *Amateur Radio* (Australia).

TERMINALL

The communications terminal that does it all!

TERMINALL is a hardware and software system which converts your TRS-80* (Model I or Model III) into a state of the art communications terminal. TERMINALL is simple to use. TERMINALL gives you more for your money. TERMINALL works with a general purpose computer and is expandable. TERMINALL has it all!

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TERMINALL was designed from the outset to be easy to connect to your radio and easy to use. Plug into your receiver headphone jack and copy Morse code or radioteletype (RTTY). Plug into your CW key jack and send Morse code. Attach a microphone connector and send Baudot or ASCII RTTY using audio tones (AFSK). That's all there is to hooking it up.

The software may be loaded into your computer from cassette or disk. Enter your callsign and the time and you will start receiving immediately. No settings or adjustments are necessary to receive Morse code -it's fully automatic - and it works! You may type your message while receiving or transmitting.

You will be on the air, receiving and transmitting any mode in minutes. As we said, TERMINALL is simple.

More for your money

■ TERMINALL has the RTTY terminal unit - demod and AFSK - built in. This results in a lower total cost because separate terminal units usually cost at least $225 assembled, and most do not even have a crystal controlled AFSK. TERMINALL eliminates not only the higher cost of an external terminal unit, but also eliminates the hassle of interfacing to another piece of equipment.

■ **Outstanding documentation.** Professionally written, 90 page user manual - contains: step-by-step instructions - explicit examples - numerous photographs and illustrations - theory of operation -parts layouts - schematic diagrams - trouble shooting guide.

■ **Built in software backup** - set up the program parameters and messages the way you like to operate - then have the program save a new copy of itself -on either cassette or disk!

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The Code Pet

—a Morse tutorial for Commodore's computer

Alden Lansdowne AAØG
335 North Vassar
Wichita KS 67208

You're practically a shoo-in for that upgrade license if you can copy the code from this program written for the Commodore Pet™. You pick the speed from five to twenty words per minute and it sends perfect code in groups of five characters. Since this is a sound program, you will need an addition to the Pet such as can be found in *Kilobaud Microcomputing*, March, 1979. The article by Gregory Yob on page 71 explains several ways to connect sound. I strongly recommend the method in Fig. 4(b). By the time I isolated an amplifier with capacitors, I had distortion. The transistor seems to be best and also is easy to construct.

After you enter the speed, the screen is blanked and you copy the code with pencil and paper as you would if you were performing for the FCC. After 100 groups of five characters (or five minutes), the screen will show the text sent. A completely random text of letters, numbers, and common punctuation will assure you of receiving all characters equally.

Should you wish to stop before the computer is finished, type S and the computer will respond. Code is sent as near the input speed as possible for me to program. (If you make improvements, please let me know.) The basis for the time was reached by running the program, timing for five minutes, and then counting the groups of five characters. Speeds under 13 words per minute are sent at 13 words per minute with additional

Program for Morse code.

```
100 PRINT"▼  MORSE CODE PROMPTER PROGRAM"
110 PRINT "QQI WILL SEND MORSE CODE AT RANDOM.IN"
120 PRINT "QGROUPS OF FIVE CHARACTERS AT THE"
130 PRINT "QSPEED YOU DESIRE.  AFTER 100 GROUPS OF"
140 PRINT "QFIVE, A COPY OF THE SENT TEXT WILL"
150 PRINT "QAPPEAR.  IF YOU WISH TO STOP BEFORE"
160 PRINT"QI'M FINISHED, TYPE 'S'."
170 PRINT "QQWHAT SPEED WOULD YOU LIKE ME TO SEND?"
190 CLR
200 INPUT "Q(5 TO 20 WPM)";P
210 IF P<5 OR P>20 THEN 200
220 IF P>12 THEN K=1: GOTO 240
230 K=ABS(P*150-1900): P=13
240 P=ABS(P*3-80)
250 POKE 59409,52: REM TURN OFF VIDEO
260 PRINT "▼"
270 PRINT "LETTERS.  HERE IS THE LIST TO CHECK"
280 PRINT "YOUR ACCURACY:Q"
290 POKE 59464,0: POKE 59467,16:REM SOUND
300 POKE 59466,51
310 A=INT(RND(1)*47)+44
320 IF (A=64) OR (A>57 AND A<63) THEN 310
330 PRINT CHR$(A);
340 FOR I=44 TO A
350 READ A$
360 NEXT
370 FOR J=1 TO P: NEXT
380 FOR I=1 TO LEN(A$)
390 D$=MID$(A$,I,1)
400 IF D$="L" THEN L=3*P: REM DAH LENGTH
410 IF D$="S" THEN L=P: REM DIT LENGTH
420 POKE 59464,211: REM TONE
430 FOR J=1 TO L: NEXT J
440 POKE 59464,0
```

spacing between characters. The timing for this is accomplished in lines 220 through 240. Line 270 is incomplete, but before the screen is turned on, line 610 will finish the sentence and tell you how many groups you have copied. Line 290 includes an extra POKE statement; however, without it, you would hear a false tone the first time you ran the program.

This program uses the inherent ASCII code in the Pet to reference a number to the corresponding ASCII character for display. Line 320 removes the holes in the ASCII code. Line 300 follows guidelines for sound pitch as in *Kilobaud Microcomputing*, February, 1979, page 9. If the tone is not right for you, change the 211 in line 420 to any number between 1 and 255.

Line 600 turns the sound off. If you have inadvertently pressed STOP, just type RUN 600. You won't see it on the screen until you have pressed RETURN. The program as shown will run until 100 groups have been sent. If you want to copy for only five minutes, add line 205 and change line 560 as in Version II.

Learning code isn't always that much fun, so anything to ease us through this period helps! Good luck on the upgrade.■

```
450 NEXT I
460 REM END OF LETTER. CHECK 5 GROUP
470 RESTORE
480 GET E$: IF E$="S" THEN 590
490 C=C+1
500 IF C=5 THEN C=0: GOTO 530
510 FOR J=1 TO K: NEXT: REM WORD SPACE
520 GOTO 310
530 FOR I=1 TO P*6+2*K: NEXT
540 G=G+1: H=H+1
550 IF G=6 THEN G=0: GOTO 580
560 IF H=100 THEN 590
570 PRINT "  ";
580 GOTO 310
590 REM END
600 POKE 59464,0: POKE 59466,0: POKE 59467,0
610 PRINT "[S]YOU HAVE COPPIED";H;"GROUPS OF FIVE"
620 POKE 59409,60
630 PRINT "SQQQQQQQQQQQQQQQQQQQ"
640 END
1000 DATA LLSSLL,LSSSL,SLSLSL,LSSLS
1010 DATA LLLLL,SLLLL,SSLLL,SSSLL,SSSSL,SSSSS,LSSSS,LLSSS,LLLSS,LLLLS
1020 DATA B,B,B,B,B,SSLLSS,B
1030 DATA SL,LSSS,LSLS,LSS,S,SSLS,LLS,SSSS,SS,SLLL,LSL,SLSS,LL,LS,LLL,SLLS,LLSL
1040 DATA SLS,SSS,L,SSL,SSSL,SLL,LSSL,LSLL,LLSS
```

VERSION II ADDITION

```
205 T=TI+18000
560 IF TI>T THEN 590
```

CURSOR NOTATION

[▼] CLEAR SCREEN

[S] HOME CURSOR

[Q] CURSOR DOWN

✓See List of Advertisers on page 162

Paul Grupp KA1LR
73 Magazine Staff

No More Two-Tone Sidetone

—modify your AEA keyer

The AEA CK-1 and MM-1 are spectacularly versatile keyers, and after many months of using both of them I have only one complaint, a complaint that many others have voiced. The problem involves the sidetone.

Let's face it—there aren't many keyers with a nice smooth sine-wave oscillator for the sidetone. On the other hand, most transceivers offer excellent sidetone characteristics. Moreover, when using the transceiver's sidetone, you can avoid the embarrassment of having the keying cable go bad while you are sending, or (heaven forbid!) forgetting to flip the "transmit" switch. In both cases the sidetone on your keyer would percolate along happily, giving no indication of the fault.

So what's the problem? If you want to use the sidetone in your rig rather than the one on the keyer, you can simply turn down the volume control on the keyer, right? Wrong! If you turn down the volume control on the keyer, you won't hear the audible confirmation of each entry you make on the AEA's keypad. This can lead to errors in message loading and speed selection if you don't depress the keys firmly, or there is keybounce.

The solution is ridiculously simple. Unlimber your soldering iron, and in less than five minutes you'll have your AEA keyer giving you audible confirmation of entry, but no sidetone. We'll start with the CK-1, since that keyer is nearest and dearest to my heart.

Remove the two screws on the sides of the keyer and carefully separate the two halves of the keyer. On the circuit board, locate diode D1, which can be found next to U3, just south of the 7805 regulator. Check the pictorial in the manual if you are not sure that you have the right one. Now here comes the hard part. Brandish your soldering iron threateningly before the keyer, and then unsolder one end of the diode. That's it! Tape the diode so it doesn't short out anything, and close up the keyer.

The MM-1 is equally simple to modify. The diode of interest in the MM-1 is the D1, located near the crystal. There are two diodes and a resistor in a row; the diode you're after is the second one from the resistor. Unsolder one end of the diode, and you'll have verification of key closure, but sidetone only from the rig.

If you wish to use the keyer's sidetone from time to time, you can simply install a miniature SPST toggle switch to switch the diode in when you want to hear sidetone from the keyer. In the MM-1, the switch can fit in one of the holes drilled for the Aux jacks. Space in the CK-1 is a little tighter, so you'll have to drill your own hole, but there is still plenty of room. ■

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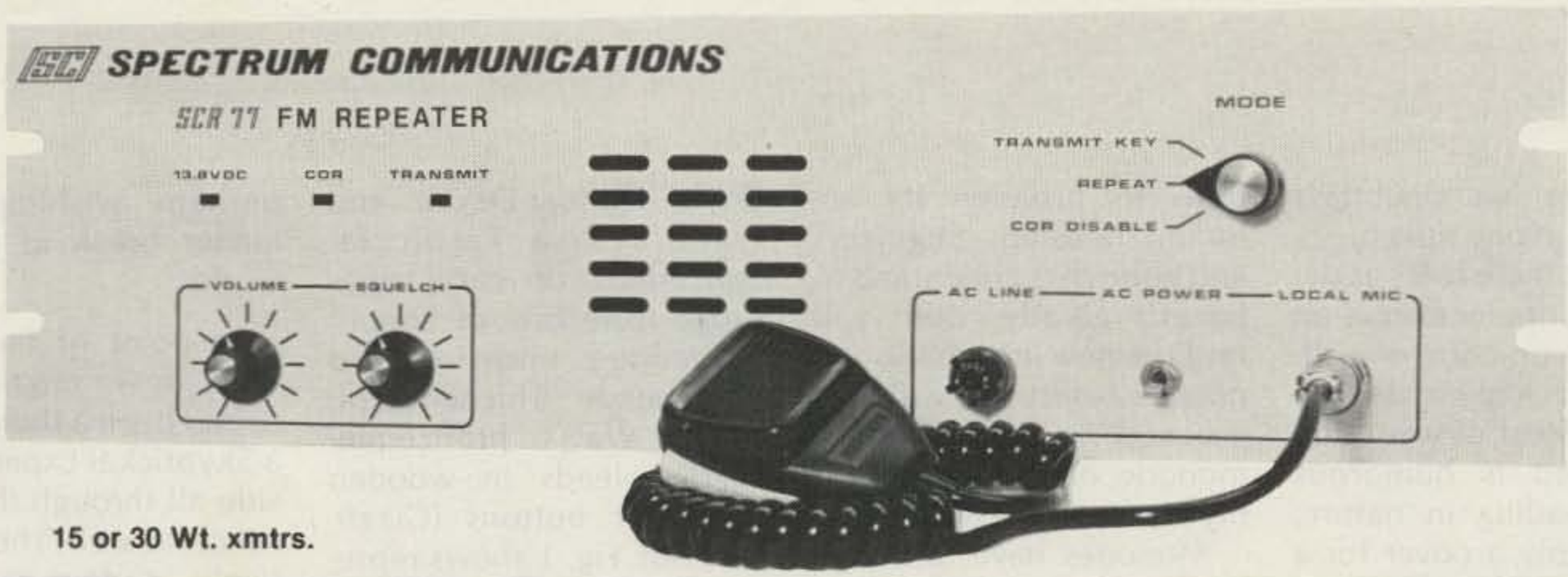

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Monodes
—harbinger of a new age

Everyone has doubtless heard, at one time or another, that there lurks at the far fringes of electronics an engineer's unicorn or will-o'-the-wisp known as the monode. Most of what you have heard is humorous and misleading in nature; this is simply a cover for a lack of hard facts.

But with recent developments promising to catapult it squarely into the limelight of the next wave of innovation, it has come time to broaden its acquaintanceship. Engineers and hobbyists alike stand to benefit greatly. Both will find the new information of prime interest. We will now proceed to unburden the monode of its undeserved myth of uselessness.

Monodes have left their mark through much of early history. This fact is now clearly seen from the new perspectives given to us by contemporary historians of technology; notably Y. Coyle Dunbar-Dexter and Isadora Pisa Ferniccia. Specimens of early ones range from bits of copper embedded endwise into clay beads (Chichen Itza, Angkor Wat) to bronze pin-shaped leads in wooden beads or buttons (Gizeh, Jericho). Fig. 1 shows representative pieces from these sites, circa 2240 BC to 1680 BC.

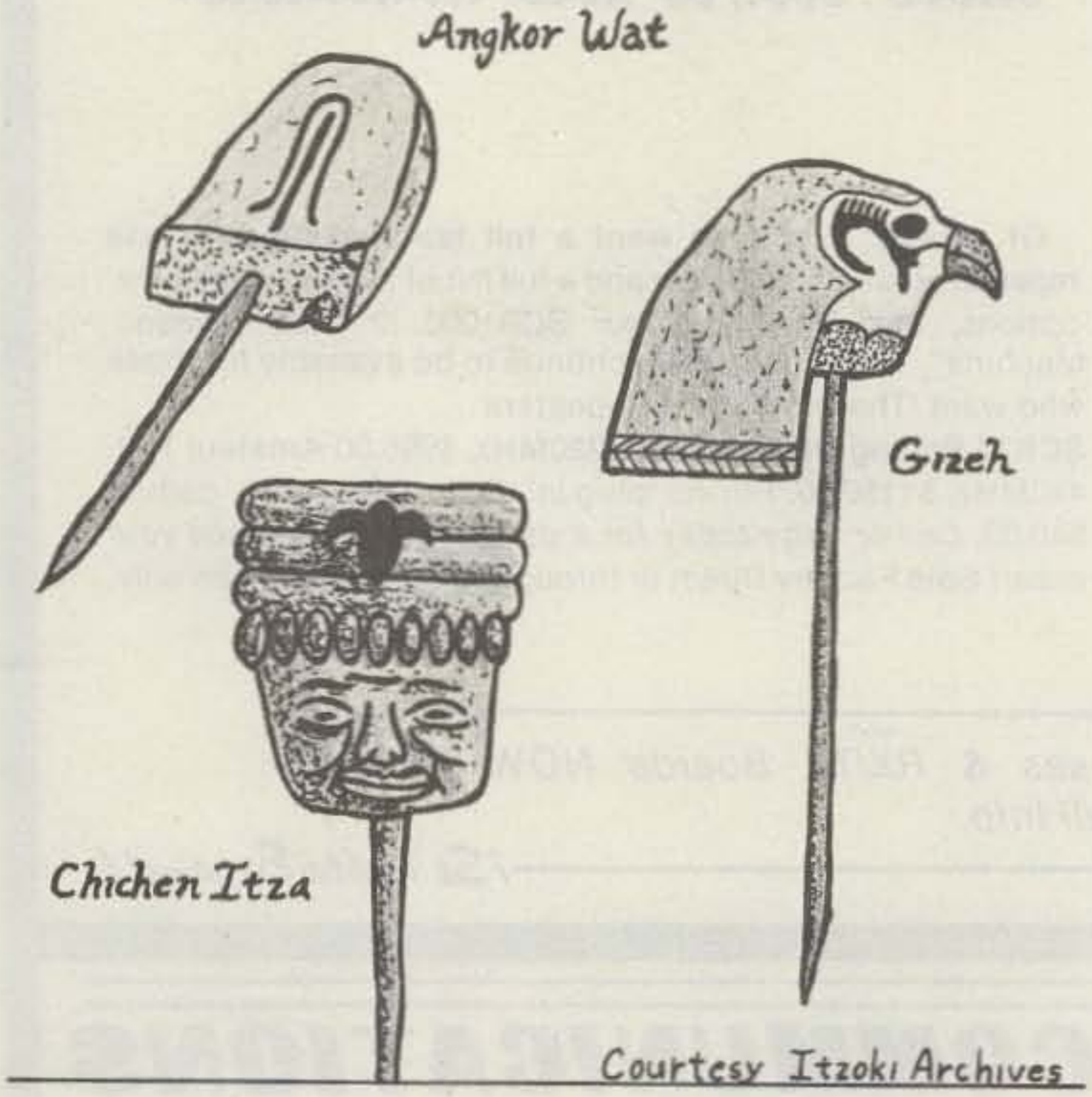

Fig. 1. Representative ancient monodes.

This graphic argument needs no further justification. The ancients' failure to extract a usable performance from them, however, led to their continual burial and rediscovery in widely scattered places and times.

There are historians who scoff at the ancient monodes theory, nonetheless. Most often, these are not technically oriented people, and so they put forth the rather tepid counter that the so-called monodes are often found in proximity to such commonplace articles as combs and brushes (who among the present readership has not built a Wimhurst or Van de Graff machine?); some are even found right in a mummified corpse's hair!

We can scarcely blame the ancients for burying these defiant devices with their frustrated and no doubt defamed inventors, perhaps wishing both a kinder break in the afterworld.

In point of fact, Puck's Staff, as we might well call it, had been a thorn in many a Skyptickal Experimenter's side all through the Renaissance, as well. The first relatively modern mention of them is found in a rough draft of a never-finished monograph, as it identified itself, by Evangelista Torricelli, in 1642. Fig. 2 shows this work. He had a vague notion that the strange forces found in amber, animal fur, and the like had an affinity for metals and proceeded to tackle electrode theory one electrode at a time.

Since an electrode's principal characteristic seemed to be its length, he assembled one by putting mercury in a glass tube and inverting it into a shallow dish of more mercury. This was to provide an easy means of varying its length, but he became so engrossed in the tricks the atmosphere played on it that he dropped further dead-end research in favor of the easier quarry. He invented the barometer the following year as a result.

Benjamin Franklin also delved into the matter for a

See List of Advertisers on page 162

time. This has been determined by piecing together scattered interviews biographers held with younger contemporaries after his death. Franklin mounted ball-capped rods atop Leyden jars (the now-familiar ball and stem most static electricity devices sport), but found that, when capped with wooden or gutta-percha insulators as monode theory calls for, they became quite refractory to further experimentation. He, too, gave up in despair. Fig. 3 shows this relic of the lackluster side of science.

Many nineteenth century luminaries also wrestled with the "wicked one-legged beastie," as Samuel Morse referred to it. But, with so many highly successful endeavors proceeding forth, this was scarcely a time for championing the lame ducks of technology.

Michael Faraday attempted to derive the form of the Tubes of Force he would find around a monode. His subsequent nervous breakdown forever sealed off any chance of knowing just how close he may have come to the truth of the matter. He became so distracted that he could only talk about irrelevant trivia for years, never touching on the subject for a moment. Research is also in progress on the so-called heavy metal poisoning that afflicted Isaac Newton.

Heinrich Hertz came much closer than anyone to seeing the monode in its own right. He attempted to ascribe to most common arrangements of matter a "monopolar character" to account for the apparent lack of omnipresent electromagnetic activity as observable in his day. He was right, in that monodes do *not* make antennas, and vice versa. We will go into this in more detail.

As twentieth century physics unfolded, portraying a world in defiance of common sensibility, the monode began to fall into line as a viable entity in its own right. Engineers and scientists here at Bull Laboratories have detailed its operating principles, and applications research is in progress at a rapid pace, aided by the sophisticated support technologies available today.

The basic stumbling block all along has been in the current mode assumed. Both monodes and superconductors, therefore, exhibit essentially surprising behavior in the macroscopic realm.

Rather than burden the reader with quillets of theory, we will here take the more pragmatic and intuitive approach and describe the appearance and measurement of basic monode circuit parameters:

Voltage—Voltage is a measure of electromotive potential difference between two points. The voltage of a monode with respect to any other point in a circuit can be measured readily enough, but the one-lead device cannot have a voltage drop as such. Monodes do not *drop* voltage, so much as they *never pick it up*.

Current—Current does not flow in monodes in the conventional sense. Kirchoff's Law still applies, however. The monode's voltage with respect to any other point in the circuit remains constant as long as currents flowing into the monode are equal in magnitude to the currents flowing out. The fact that both flow over the same lead simply means that conventional current meters register nothing.

Resistance—Since this is defined as voltage drop per unit current, we have a double dilemma, as witnessed above. Is the monode's behavior independent of the resistivity of its conductor? Does it display a temperature coefficient of some sort? And what about heterojunction effects? One might well ask.

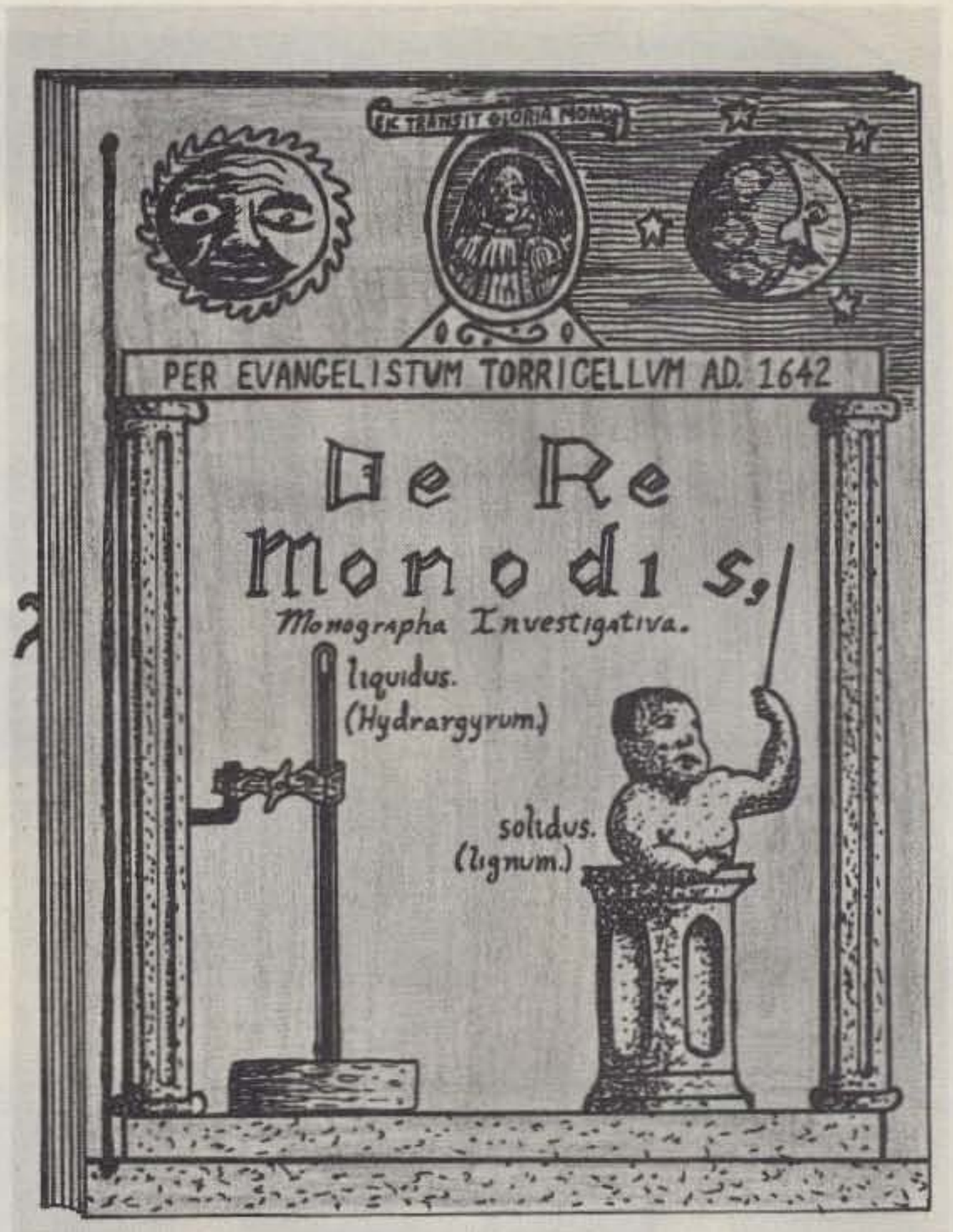

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Fig. 2. Torricelli's investigation.

Ac measurements are also difficult. Since there is no externally definable current, how can it alternate? Ac monodics seemed a doomed cause until the invention of the alternating source in 1936 by Bull Laboratories founder General E. Fuller Bull. See Fig. 4 for operating details. Shown in the inset is a modern equivalent—an array of series connected photovoltaic cells is illuminated by an LED and mounted on a quartz crystal which is made to oscillate by a conventional oscillator circuit.

You might now see why Hertz' original notion about ac and monodes is true. If we try to make a monode antenna, say, by topping an automobile radio antenna with a decorative foam ball, we are in reality going to be receiving signals from the lower segments of the antenna, which act as unshielded conductors from the radio's coax connector to the top segment. It is this top segment which, together with the foam ball, forms the monode. Hoping to force the top segment to become a monode/antenna by removing the lower segments is of no use. Now, the lower half of this segment is needed to connect the upper half (the new monode) to the coax connector. It is this new unshielded conductor, of course, which picks up signals. Chopping away until only the foam ball remains, we at last see how poorly monodes func-

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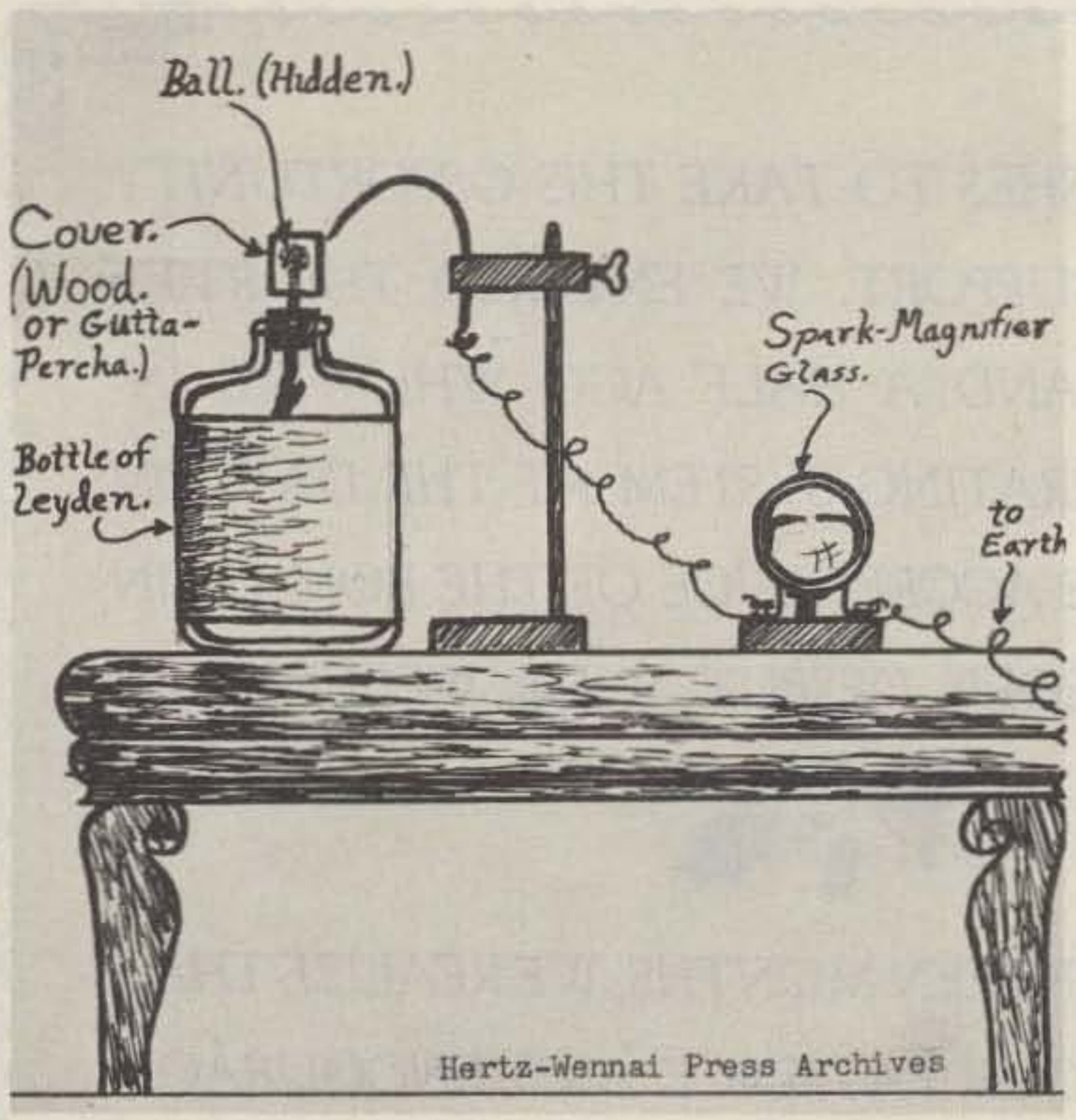

Fig. 3. Franklin's monodick apparatus.

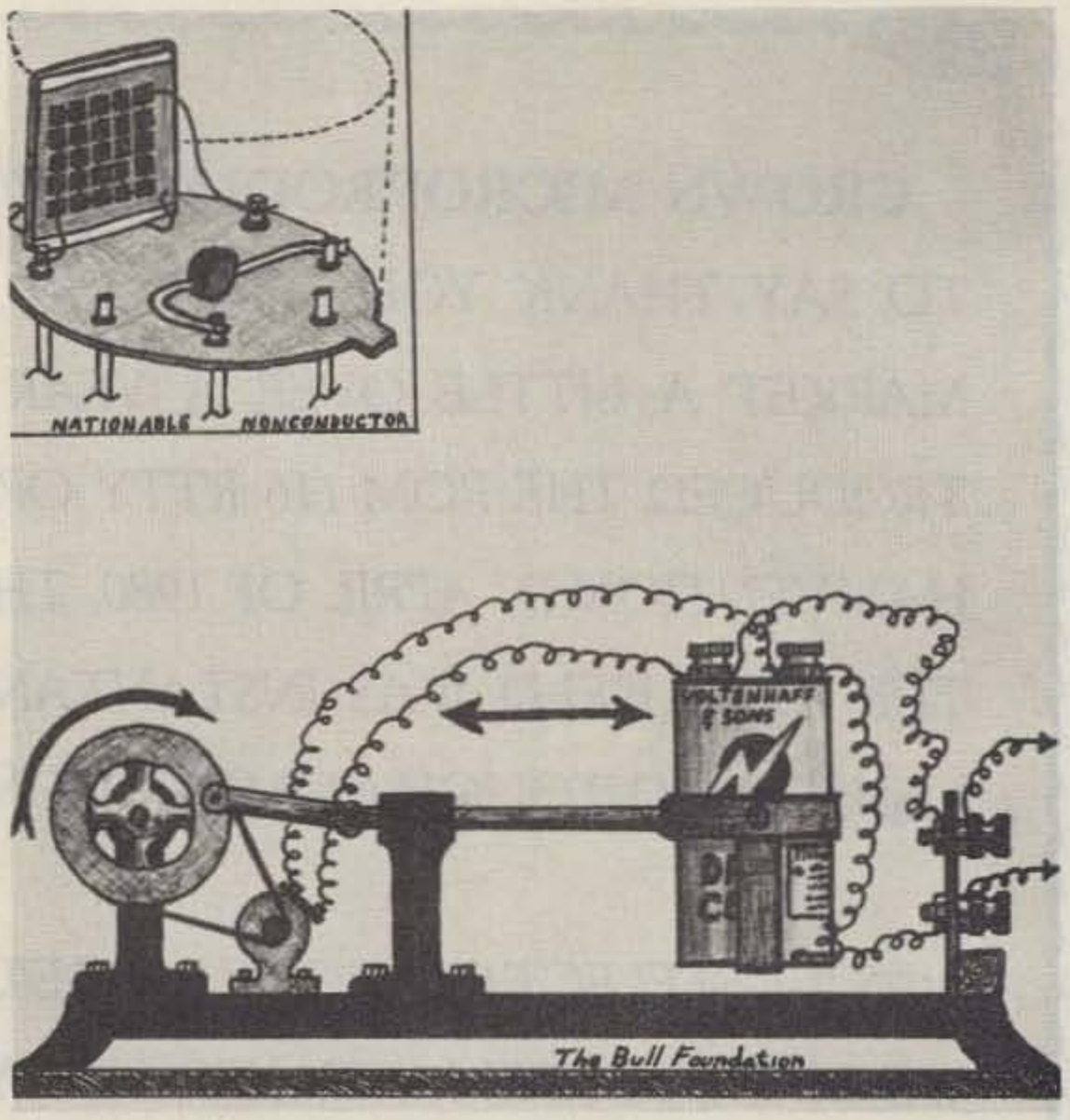

Fig. 4. Early and modern alternating sources.

tion as antennas.

The monode will see its first gamut of applications in the digital field, owing to its highly unary truth table and singularly consistent characteristics. Indeed, Buckminister Fuller has dubbed the monode "the unit of electrical behavior."

As an example of its almost trick logic, note Fig. 5, the data bandwidth doubler. This feedthrough device is crimped onto stranded hookup wire to increase its pulse bandwidth and functions as follows:

Logic ones are conventionally communicated as current pulses. (Complementary codes exist, too; we will stick to this one for simplicity.) These pulses obviously must flow over the low-resistance path offered by the wire. Logic zeroes, on the other hand, are represented by an absence of current and thus obviously prefer the *high*-resistance path formed by the two 100-megohm resistors in series, which prevent their being swamped by ones. Since negligible current flows over this path, the two monodes terminate the path at source and destination for a healthy cost and weight savings over twisted pairs or coax.

Monodes now largely use standard integrated circuit technologies owing to their availability. However, new and more appropriate variants are appearing, notably SEAMOSS (Superinsulating Epoxy And Metal Or Substantial Substitute), based on the valence-filled NC (no connection) junction.

Since monodes do not use conventional current, it must be bypassed. This was done at first in the power supply, using a hefty shunt resistor and an air gap or glass rod in series with the output.

The development of the powerless monode did away with this, however. This three-terminal device, in addition to dissipating heat from the bypassed current, also dissipates "peat," or powerless heat, the zero-energy equivalent of heat dissipated by conventional current. Thus, in addition to being mounted on an aluminum heat sink with silicone grease, the device must also be attached to a transite pad with asbestos grease, for peat's sake.

An even more recent development, allowing monode ICs to be used in conventional circuits, is the incorporation of bypass resistors into the IC case. These damp supply line ripple as an added benefit, since often they have values on the order of .03 Ohms or less.

The first digital monodics research was done in 1967. A team of Bull Laboratories scientists theoretically predicted the properties of a monode gate which they proposed to call a "dislatch." Upon fabrication and testing of the first unit, however, it was deemed a flop.

There are two kinds of flop, J and K, which are identical, which is simply to add variety to texts on monode theory and practice. Much of this would be stodgy pottage, indeed, without such details; the phenomenon is known as "monotony."

The flop possesses a unique ability to keep circuit complexity to a minimum. This is due to the fact that the output is independent of the input, folding its truth table down to a mere speck of ink on the printed page and making it highly noise-immune as well. The distinction between ripple-through and synchronous logic becomes superfluous.

Some digital functions served exclusively by the monode and its MSI derivatives include the Gunn Effect No-Shot Schmitt Trigger; its output is a blank when it is not loaded.

The flop is also the ideal matrix element for the WOM or Write-Only Memory. Far from being the white elephant many wags have painted it to be, it finds many useful applications. It is usually functionally organized as a set of interpenetrating spirals to form a circular file or data sink.

One use, which may have far-reaching consequences, is in the capacity of a data terminator. Not knowing the inherent capacity of the Bit Bucket, which we must assume on thermodynamic grounds to be finite, it is wise to provide for the dis-

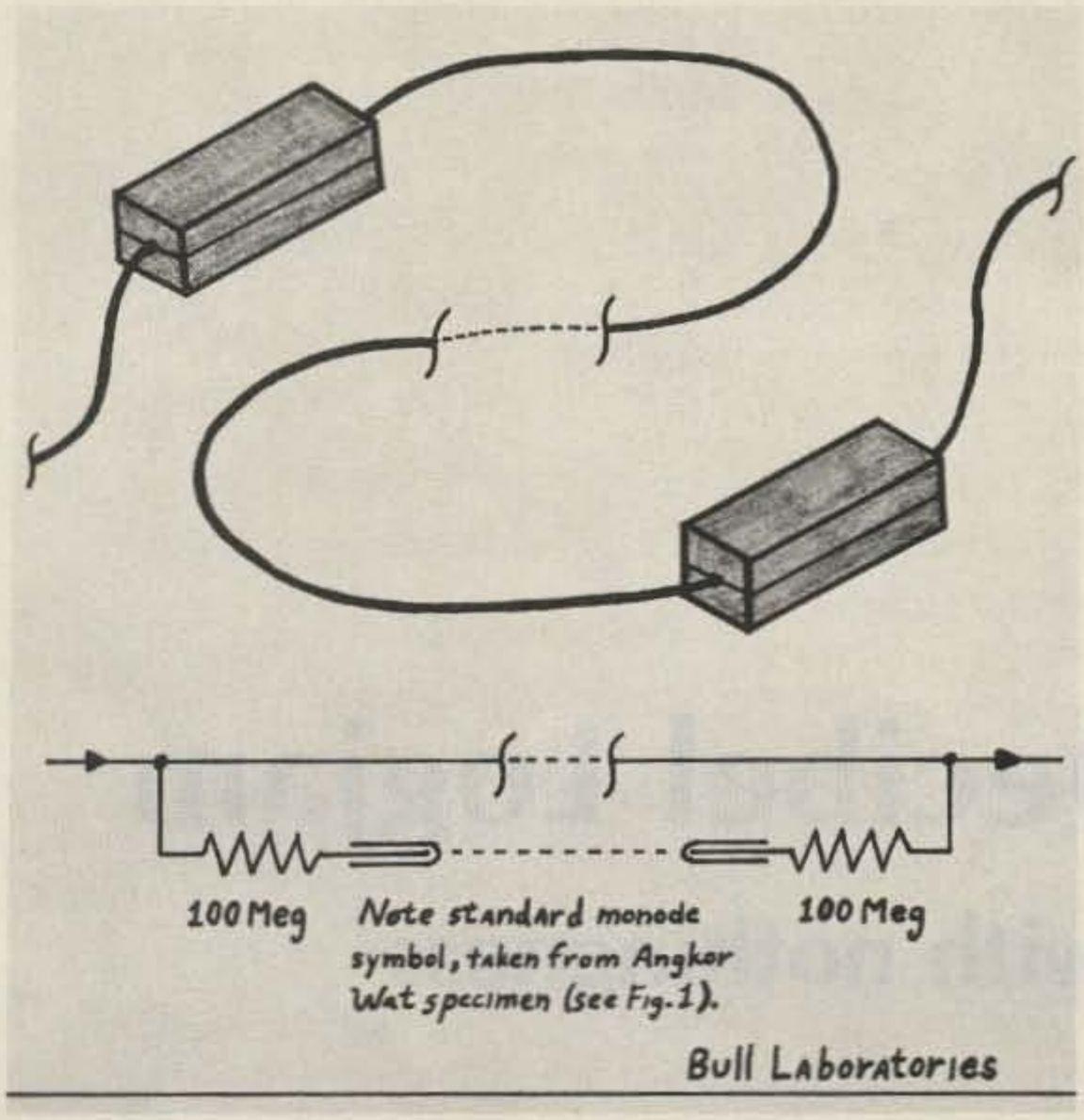

Fig. 5. Data bandwidth doublers.

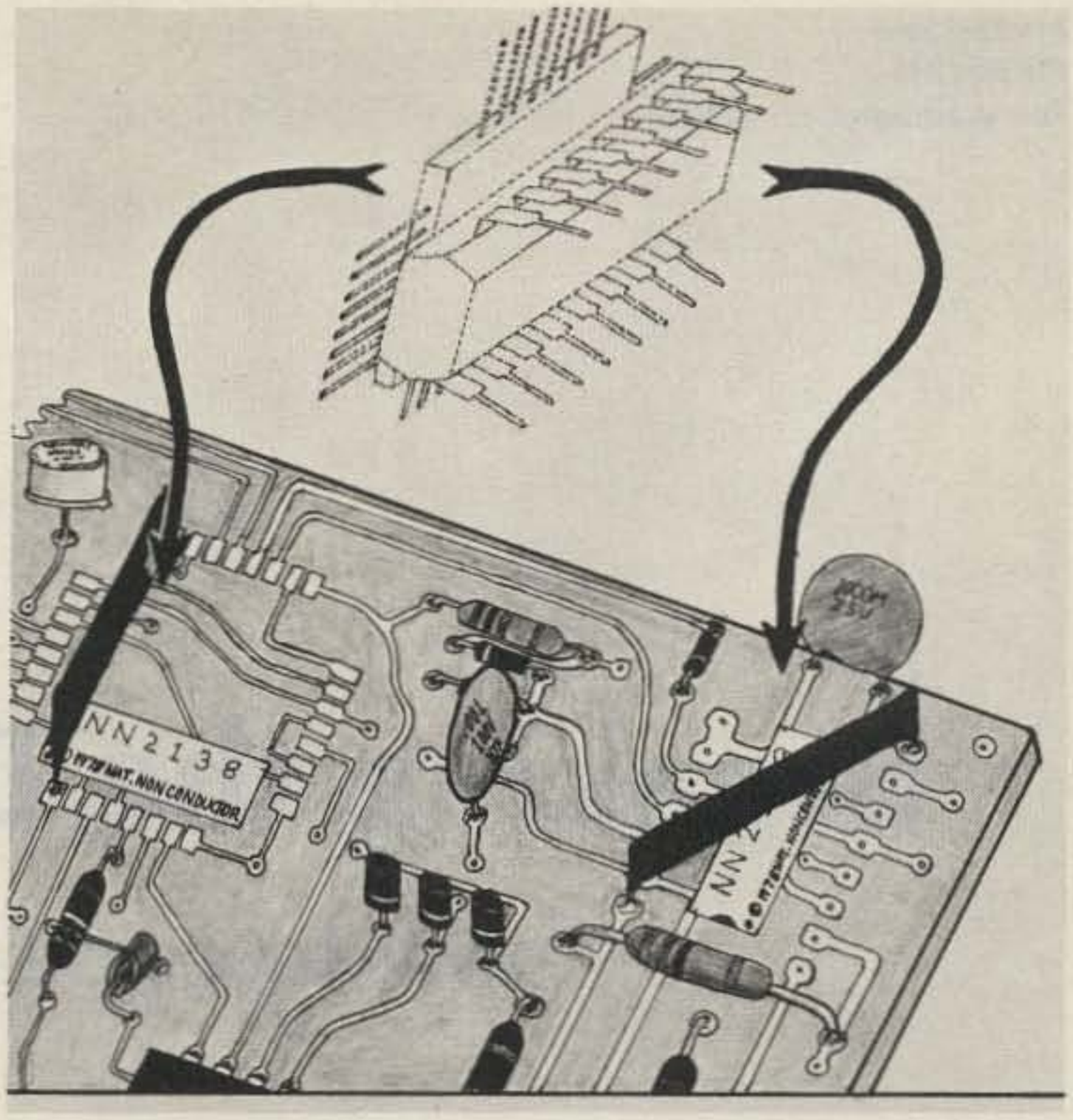

Fig. 6. Vanished "flop-flip" case WOM. Case design would be unwieldy if chip existed.

posal of spent data, rather than simply spraying it into the environment as noise. Future generations of computers will very likely be planet-sized, if not larger, and we are presented with the horrifying spectre of civilizations fighting over caches of transition-free space. Of course, this does not even take into consideration the cost of transporting it to work sites once it is staked out.

In the early days of computer technology, a programmer was as often as not a jumper jockey, wiring by hand the controller boards used to program line printers and the like. The distinction between program and data was painfully clear. This separation is referred to as Harvard Architecture. Those who toiled at these tasks may at least console themselves that the knowledge so gained has been of great benefit in present-day technology. Many MSI integrated circuits are in reality not logic circuits at all; like the controller boards, they are Read-Only Memories. The chip engineer's job in many cases is reduced from tedious design-from-scratch to literally writing functions onto standardized ROM formats.

With flop-based ICs, this is destined to become an even greater boon. Since flop outputs do not follow their inputs, many functions to be written into WOMs can be deleted without any functional impairment. This has been dubbed Dropout Architecture.

It is not difficult to prove that, using Dropout Architecture and conventional ROM table-folding techniques, WOMs can be progressively simplified to the point that they will vanish, making them extremely compact and versatile. Of course, *There Ain't No Such Thing As A Free Lunch*, as they say in the vernacular. In most cases, the IC's supply bypass resistors will not share in these logic-derived benefits. Hefty power supplies will thus remain the rule, given the degree of supply bypassing previously mentioned. Also, good design practice will still call for at least a label to indicate the choice of WOM not to be used. Fig. 6 shows a vanished WOM as it may appear and demonstrates an unusual benefit of the concept. Proposed case outline MO-223 is a "flop-flip" case which can be not used in either a dual-inline or quad-inline circuit board location.

Monodes entered the linear realm in 1972 with the invention of the Zero-Current Source. It is realized in chip form as two powerless monodes in a totem-pole arrangement, providing a 100% offset with respect to both supply and ground simultaneously.

This makes possible the infinite-output-impedance NOP-amp, which is ideally suited for unity gain applications since the output impedance matches the input impedance. As long as no disturbing input signal is present, distortion is extremely low.

Other unique devices are exemplified in designs now on the drawing board at Nationable Nonconductor, a Bull Laboratories subsidiary. For example, the NN3160 and NN3161 are, respectively, a suppressed-leading-zero-to-analog converter and its trailing-zero sister. The NN31246 is an Indefinitely Long Delay Line or "Collander Brigade." It is actually a 1xN analog shift WOM, of course. It is used to shunt signal quiescent periods away from sensing circuit inputs.

A German research group has recently achieved a combination theory/practice coup with the development of the G999. This Gottdeschaft device is a triple negator and is used to cast out nines in decimal arithmetic units.

We can expect the monode to flood the marketplace soon, one-upping many current two-lead devices. With the prospect in sight of a complete engineering revolution, as Dropout Architecture's characteristic philosophy of material economy is applied to many other disciplines, physical technology itself will become a thing to be avoided. We will be ushered into a new Eden and rejoice in Eternal Oneness. ■

Michael Sara
PO Box 245
Port Washington NY 11050

Breaking the Decibel Logjam

—how to cope with nothingness

The purpose of this article is to clarify what a decibel is and to explain why it acts the way it does. The average amateur seems to encounter difficulty when studying the subject. It is sometimes difficult to grasp the decibel because of its "nothingness." It has no weight, it cannot be seen, and its taste and smell are nonexistent.

Before going any further, it might be well to state that the decibel is a *ratio*, nothing more and nothing less. It merely represents the relationship between two quantities of energy. Unlike the meter, the pound, or the quart, it has no counterpart in wood or metal in the Bureau of Standards. It is an arbitrary standard originally set up by telephone engineers for their convenience in making measurements and calculations.

The decibel is similar to the old "transmission unit" used for measuring the efficiency of telephone circuits. The original unit was equal to the loss in a mile of standard telephone cable. This mile of cable was used to compare the losses or gains in a circuit.

The mile of standard cable was too bulky to keep around so it was replaced by its electrical equivalent: an artificial line with a resistance of 88 Ohms and a capacitance of 0.054 uF. For measuring purposes, the combination of these units was equal to a mile of standard cable. If the input to a circuit was increased, the amount of increase could be measured by the number of mile-units which had to be inserted to bring the output back to the original level.

The greatest defect of the mile of cable is that the cable, having a certain amount of inductance and capacitance, does not have a flat frequency response, and transmission efficiency depends upon frequency as well as power. In working with new types of circuits, there was a great need for a new unit of transmission which was *independent of frequency*. One was needed which was based on power alone, since the gain or loss in power is the true index of efficiency.

Another measurement scale was devised and the basic unit of transmission, by agreement among the engineers, was the *bel*. It was given this name in honor of Alexander Graham Bell, the inventor of the telephone. In common practice, one tenth of this fundamental unit is used; it is called the decibel and goes by the abbreviation dB.

The decibel is a natural unit based on the way our ears respond to various sound levels. We rate the efficiency and power output of apparatus in Watts, but our ears do not respond to sound energy the same way a meter does. Instead of responding in direct proportion to the wattage, our ears respond *logarithmically* with respect to the power.

For those who may have become a bit doubtful about their algebra, a little review may be in order before continuing with the discussion.

Use of Logarithms

The common system of logarithms uses ten as a base. The logarithm of a number is the power to which ten, the base, must be raised to equal the number. For example, ten squared, or ten raised to the second power (10^2), equals 100. Thus, the logarithm of 100 is 2. If we raise ten to the third power, we have 1000 ($10^3 = 1000$); so the logarithm of 1000 is 3.

The number which we have just found is called the characteristic of the logarithm and always has a value of one less than the number of digits in the given number. 1000 has four digits and so the characteristic of its logarithm is 3. Unless

the given number is a direct power of 10, its logarithm consists of the characteristic followed by a decimal number known as a *mantissa*, which must be found by use of a table of logarithms. If we want to find the logarithm of 775, we know that the characteristic is one less than the number of digits so that makes it 2. By referring to a log table we find the mantissa to be .8893 so the log of 775 is 2.8893. This means that if 10 were raised to the 2.8893 power, the result would be 775. Numbers may be multiplied by adding their logarithms or they may be divided by subtracting their logarithms.

Returning to the discussion of the decibel, suppose we had an amplifier with an even 1000 milliwatts output. If the output were reduced the least amount detectable by a sensitive ear, we would find that it had been reduced to about 794 milliwatts, or to 0.794 of the original power. If once again the power were reduced the slightest amount detectable by the ear (a *good* ear) and the output measured again, we would find that the power had been reduced to 0.794 of the 794 milliwatts, or to 0.630 of the original power. If we go so far as to reduce power another step, we find that the power has been reduced to 500 milliwatts, or to one-half of the original amount. It took three steps (reductions of power) to reduce the original power to one-half its value.

The decibel, which is the new unit of transmission or power ratio, is supposed to be the smallest change in power that is audible to the trained ear. The formula for finding the decibel of a ratio between two power levels is: $dB = 10 \log_{10} (power_1/power_2)$.

Power 1 and power 2 represent power before and after it has been reduced or increased. When substituting, if the larger of the two is always placed on top, it will simplify solution. If we substitute 1000 milliwatts for p_1 and 794 milliwatts for p_2, we will have the following:

$$dB = 10 \log_{10} 1000/794$$
$$= 10 \log_{10} 1.259.$$

The log of 1.259 is 0.100, so $dB = 10 \times 0.1$, or, $dB = 1$.

In substituting for the second and third reductions, we find that we have reductions of 2 and 3 dB, respectively. This then gives us an approximate scale that is easy to remember: One dB reduces the power to 4/5ths of the original, two dB reduces it to 2/3rds of the original, and a reduction of three dB brings the power down to one-half of the original.

Practical Examples

If these power ratios are memorized, almost any dB loss or gain can be figured quickly. For example, what power ratio would be represented by a loss of 9 dB? A 9-dB loss would be the same as three 3-dB losses. Remembering that a 3-dB loss equals a power ratio of 1/2 and also remembering that when the logarithms of a number are added the numbers are multiplied, we find the following:

$$3\ dB + 3\ dB + 3\ dB$$
$$= 1/2 \times 1/2 \times 1/2 = 9\ dB$$
$$= \text{power ratio of } 1/8.$$

To find the power ratio of a 7-dB loss we have the same as a 3-dB, 3-dB, and 1-dB loss, so:

$$3\ dB + 3\ dB + 1\ dB$$
$$= 1/2 \times 1/2 \times 4/5 = 7\ dB$$
$$= \text{power ratio of } 1/5.$$

When solving for gain, the problem is figured for an equivalent loss and the resulting power ratio is inverted. For example, to find the power ratio of a gain of ten dB, we have to find a change of 3 dB, 3 dB, 3 dB, and 1 dB, so it follows that

$$3\ dB + 3\ dB + 3\ dB + 1\ dB$$
$$= 1/2 \times 1/2 \times 1/2 \times 4/5$$
$$= 10\ dB = 1/10.$$

Inverting: 10 dB gain = power ratio of 10.

This is another common ratio that should be committed to memory, and it is easy to remember: 10 dB equals a power ratio of 10.

Voltage or Current Ratios

The formula so far has been for finding the decibel direct from the power measurements. When voltage or current readings are to be used in place of power, the formula must be changed to read:

$$dB = 20 \log_{10} (V_1/V_2).$$

The power in a circuit is proportional to the square of the voltage or current. As stated before, adding of the logarithm of a number to that of another multiplies the numbers, so two times the logarithm of the voltage or current ratio squares it and gives us the power ratio. Current values may be substituted for V_1 and V_2. When using voltage or current values in the formula it is considered that the *input and output impedances are the same.*

By substituting in the formula for power, we can work out the following table.

Decibels Gain	Power Ratio
0	1
1	1.25
10	10
20	100
30	1000
40	10000

By this we find that each time the level in decibels is increased by ten, the power is multiplied by ten. To increase the audio output of a piece of equipment by 40 audible steps, or by 40 dB, the power output must be increased 10,000 times. ■

HAM HELP

I recently purchased an old Hallicrafters linear amplifier, Model HT 41. I need to get a copy of the schematics and, if possible, operating instructions. If anyone can furnish these, I will gladly pay costs. Thank you.

Glenn Churchill KA2IOI
1 Meadow Rd.
Hudson Falls NY 12839

I need a schematic for a Navy RBH-2 general-coverage system CNA46188 receiver manufactured by National under its own model number NC156-1. I am willing to pay a reasonable amount for the schematic and manual. Thank you.

Terron
9301 SW 4th St., 219
Miami FL 33174

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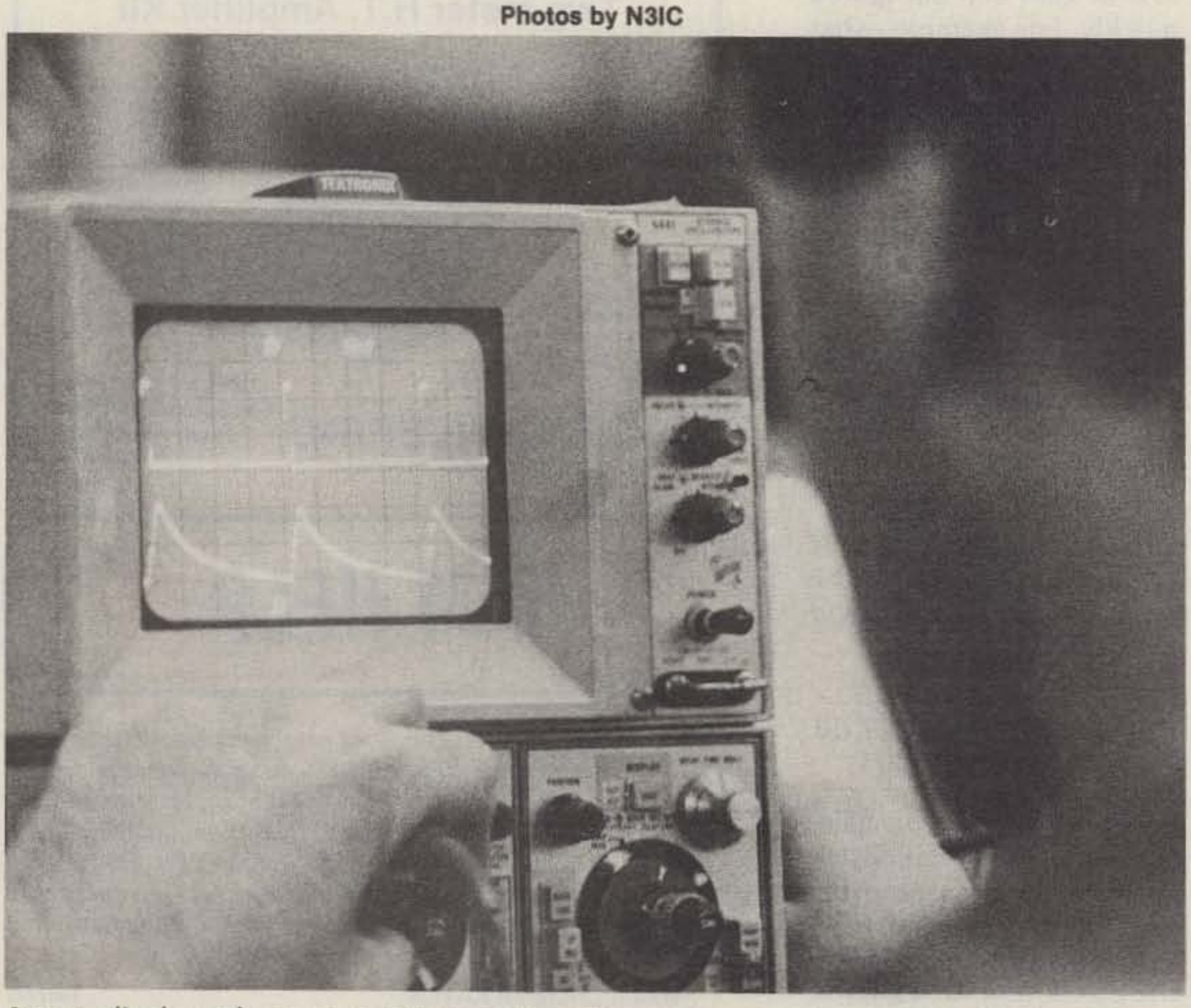
Less Drain Is Your Gain!

—power-saving mods for the Wilson II and IV

Photos by N3IC

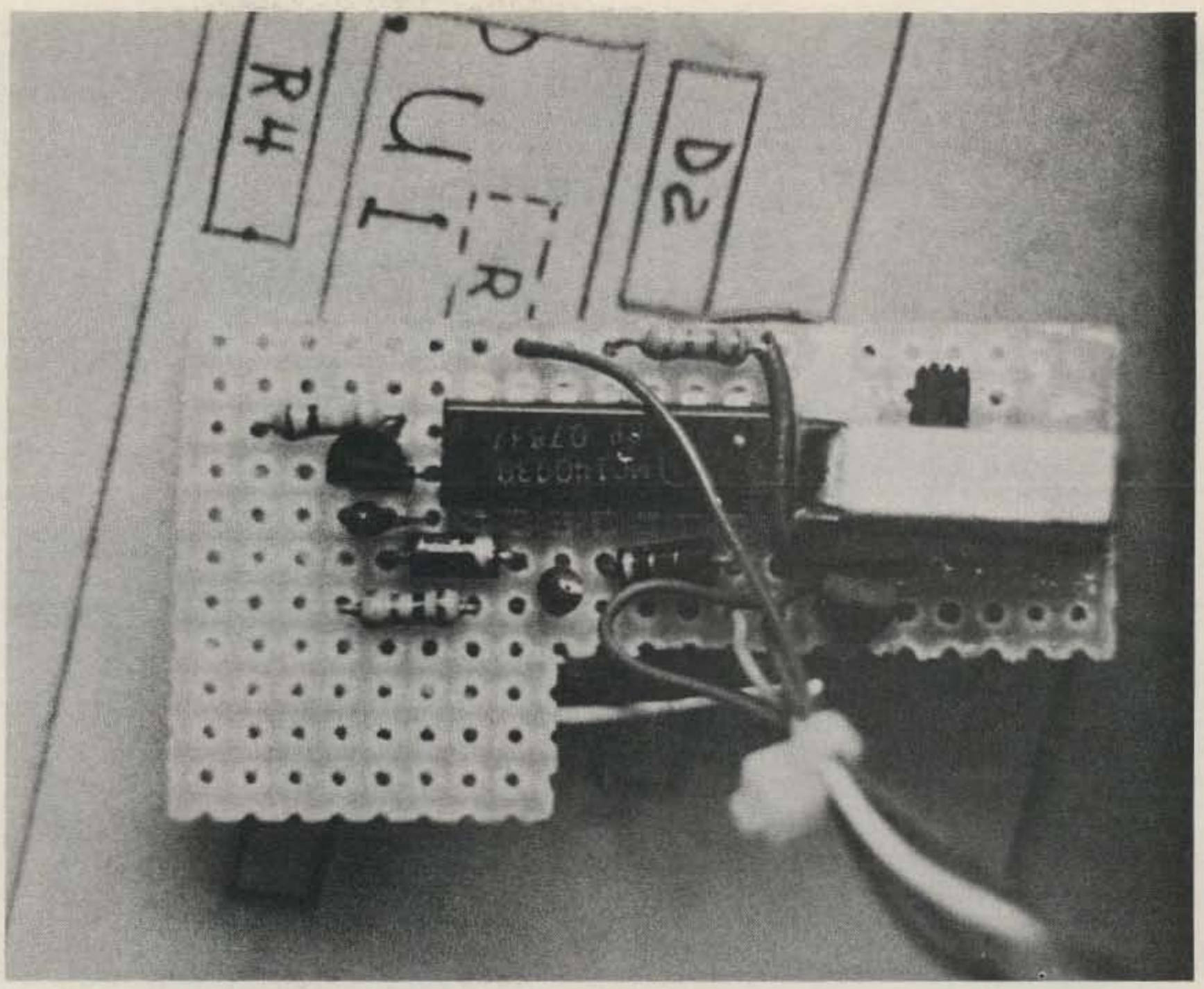


Scope display of power saver in action. Top trace—receiver power. Bottom trace—squelch voltage.

Robin Becker KA3W
2912 N. Calvert Street
Baltimore MD 21218

Wilson Mark II and Mark IV hand-helds are excellent performers. In many ways, they rival the premier Motorola HT-220s. One way in which the Wilson units come up short is on standby current. Wilson specifies the standby current at 15 mA; mine draws about 22 mA normally. A call to the factory confirmed that this is par. While respectable, 22 mA, or 15 mA for that matter, just doesn't compare to the HT-220's standby current of 3.5 mA. Recently, while making a modification suggested by Wilson to reduce distortion in the audio stages, I decided to do

something about this. The result was a reduction of the standby current to the outstanding level of 4 mA. Perhaps even more incredible, the modification requires only about $2 worth of parts and just a slight wiring change to the circuit board! The details of the modification are described below, along with two other changes which conserve power on receive and transmit.



Top view of completed board.

The basic idea behind the modification is to switch off the power to most of the receiver as much of the time as possible, switching it on periodically for a brief instant to check for a received signal. When the receiver is powered up, the presence of a quieted signal keeps it on and the absence of a signal turns it off again. Once turned off, the receiver is powered up again after a delay and the process repeats. If the turn-off occurs quickly compared to the time between successive turn-ons, substantial power savings result.

To implement this idea, logically it would seem that checking the squelch voltage of the receiver would be sufficient to determine if a signal is present. In fact, this is the scheme that most scanners use to check for busy channels. However, to prevent noise bursts from coming through, squelch circuits open only after the presence of a continuous quieted signal for some fixed time period. Wilson set this time period to be from 40 to 120 ms, depending on the squelch control setting. The squelch action of the Wilson HT is depicted in Fig. 1, which shows the voltage at the collector of Q14 for various signal conditions. If the squelch control is set as tight as possible, the receiver would have to be powered for 120 ms before the squelch voltage would indicate the presence of a signal. Thus the minimum power-on time would be about 120 ms.

To realize significant power savings, the receiver must be off for much longer periods than it is on. If the receiver power-on period is set to 120 ms, the power-off period must be set to 1 second or longer. This is not acceptable, since it results, on average, in the loss of the first 500 ms of any transmission. If the power-on period could be shortened, however, the power-off period could also be shortened, and hence the amount of any transmission that is missed would be reduced. A power-on period of 10 ms followed by a power-off period of 200 ms, for example, would result in the loss of only 100 ms of signal on average, while still reducing power consumption considerably. A loss of 100 ms corresponds to about one-half of a syllable and is not significant. In fact, this is comparable to the amount of signal lost in normal operation due to the response time of the squelch circuit (see Fig. 1 and note the time delay from signal onset to squelch opening).

Thus, to design a successful power-saving circuit, a method of reducing the required power-on time must be found. Although the squelch circuit of the receiver takes up to 120 ms to open, it closes in at most 15 ms (the squelch circuit closes in about 5 ms if the squelch control is set as tight as possible). Therefore, if instead of waiting for the squelch to open when the receiver is powered, we instead somehow start with the squelch open and only wait for it to close, the power-on periods could be reduced to 15 ms or less. This coupled with power-off periods of 200 ms would yield fairly fast response and dramatic power savings. Unfortunately, the Wilson's squelch circuit always closes after the receiver is powered. However, if the squelch circuit itself is always powered during receive and the rest of the receiver is powered up at intervals of more than 120 ms (the maximum time it takes for the squelch to open), then the squelch would

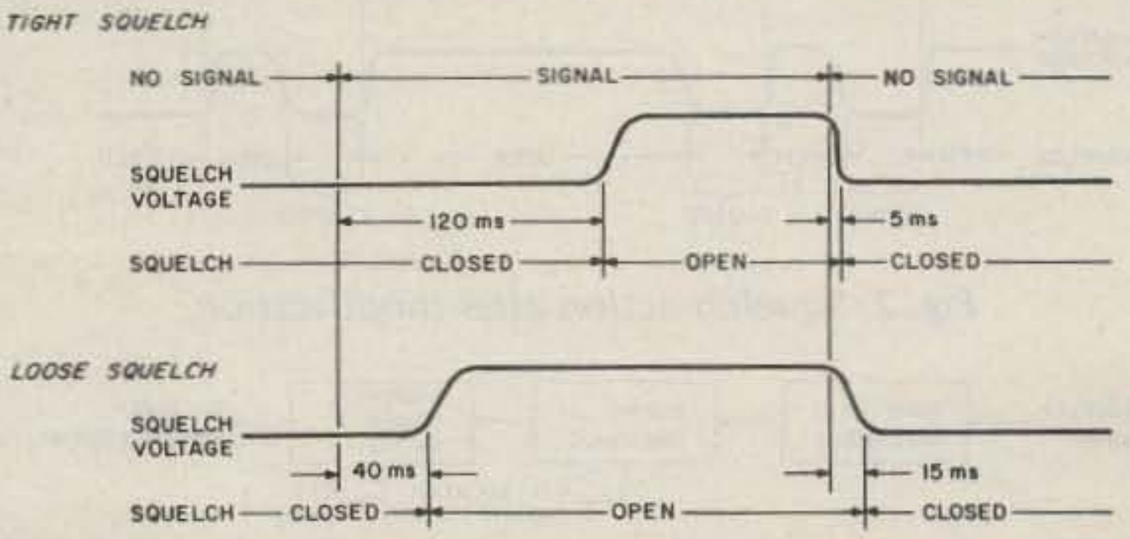
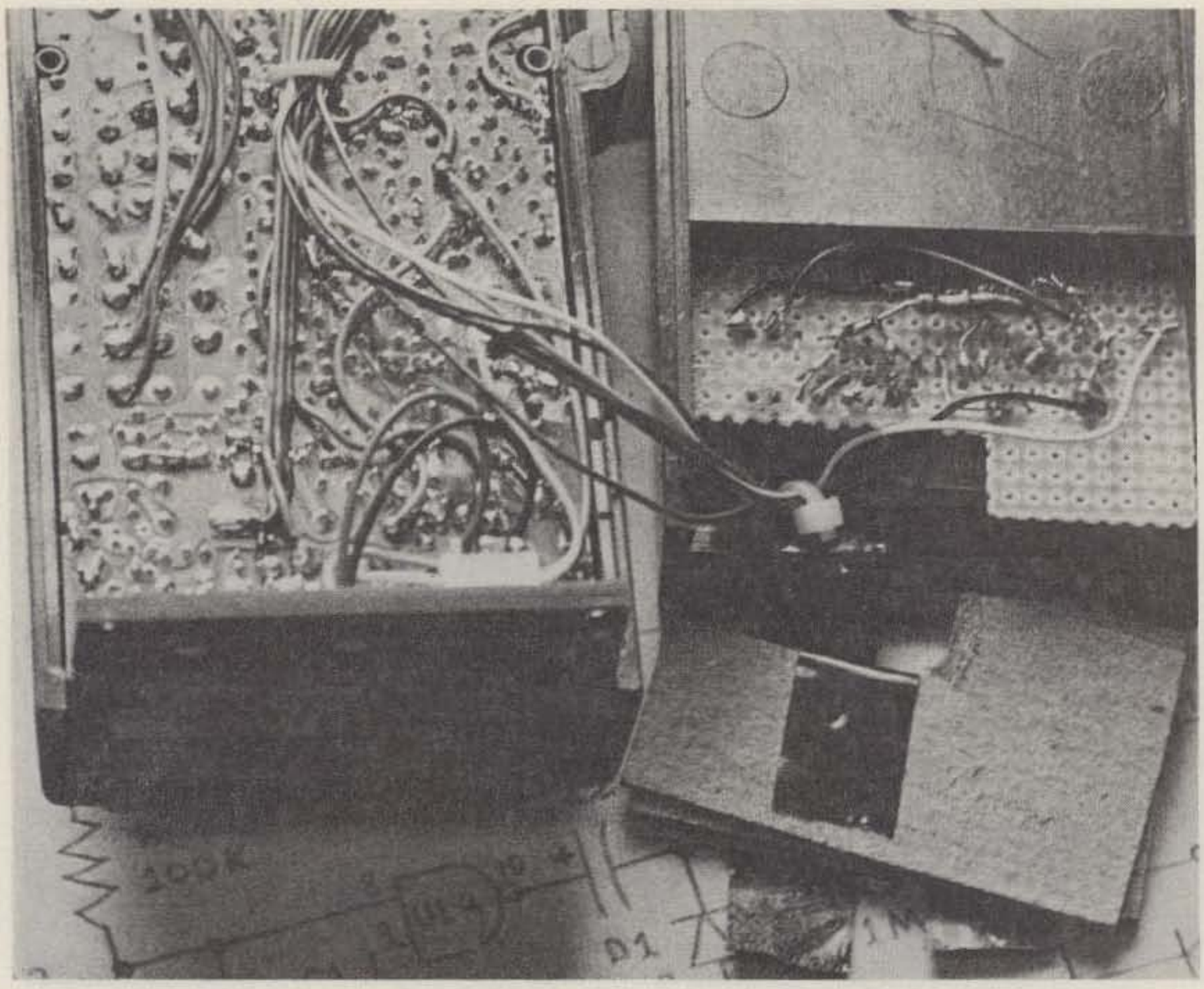


Fig. 1. Squelch action before modification.



Bottom view of completed board showing method of installation in HT.

always be open at the instant that the receiver is powered. The operation of such a system is shown in Fig. 2.

Although the system now seems complete, another problem has been introduced. Since the audio stages are turned on and draw power whenever the squelch is open, some additional method must be used to keep the audio stages turned off during the time when the squelch is open and the receiver is not powered. This problem turns out to be easily overcome by allowing the receiver power control signal to act as an auxiliary squelch control signal. In this way, the squelch control signal is kept closed when the receiver is not powered. When the receiver is powered, normal squelch action controls the audio stages.

A block diagram of the circuit is shown in Fig. 3.

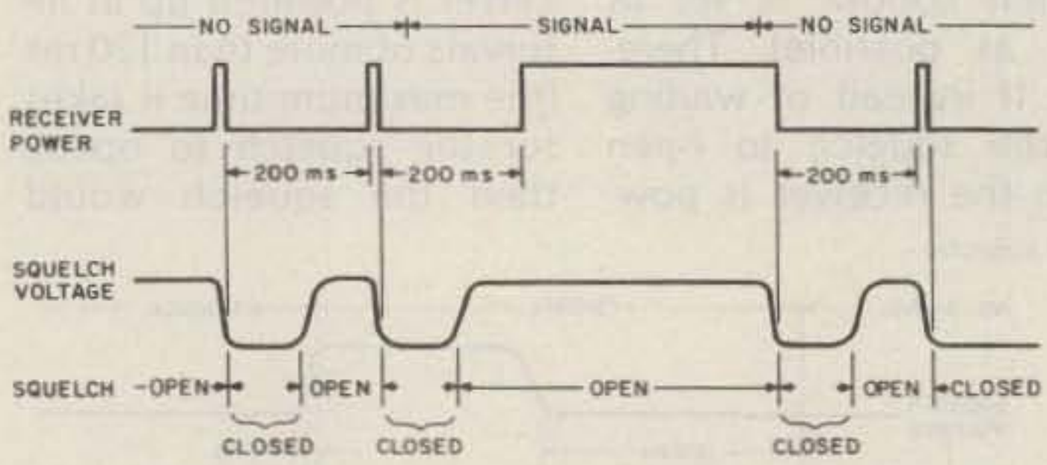


Fig. 2. Squelch action after modification.

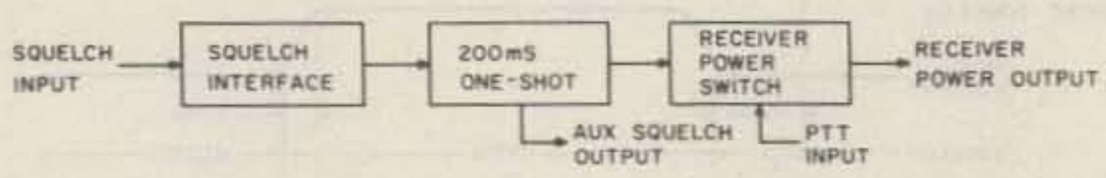


Fig. 3. System block diagram.

The squelch interface converts the squelch signal to logic levels and to some extent duplicates the squelch control stage of the HT. This is necessary because the solution to the problem mentioned above keeps the receiver squelch control stage clamped while the receiver is not powered. The squelch interface circuit triggers the one-shot when the squelch closes. The one-shot sets the length of the power-off period. It also is used to keep the audio stages off during power-off periods via the auxiliary squelch output. When the one-shot is inactive and the HT is in receive mode (PTT is high), the receiver power switch is closed and B+ is applied to the receiver. When the one-shot fires or when the HT goes into transmit mode (PTT is low), the power switch opens and the receiver is turned off.

The complete circuit is shown in Fig. 4. Transistor Q1 converts the squelch voltage to 0 - 12 volts. The one-shot is made from two Schmitt-trigger NAND gates, U1A and U1B. These gates are very useful for fashioning one-shots and oscillators, and the spare gate can be used in some future project. When the output of U1B is low, it shuts off the audio stages through diode D2. U1C controls the receiver power via transistor Q2. The power pulsing action can be disabled by closing switch S1. This keeps Q1 off, preventing the one-shot from firing.

The entire circuit easily fits into the area reserved for a tone encoder. Construction is quick using a perfboard, and a suggested parts layout is shown in Fig. 5. I soldered the IC directly into the circuit, although the board might still fit if a molex™ or a low-profile socket is used. Both unused gate inputs on U1 (pins 1 and 2) must be tied high or grounded. I used 1/4-Watt resistors and tantalum capacitors because of their small size. All parts are readily available from many suppliers. One supplier is Digi-Key, PO Box 677, Thief River Falls MN 56701.

The wiring is as follows: Disconnect the wire from the emitter of Q29 (upper right of the circuit board) to the junction of R5, R6, R9, R11, R13, R14, and C46 (middle of the circuit board). Connect +V on the new board to the collector of Q29. Connect the collector of Q2 on the new board to the junction of the components listed above. Connect the PTT input on the new board to the emitter of Q29. Connect the squelch input on the new board to the collector of Q13 (near the top of the circuit board). Connect the auxiliary squelch output of the new board to the collector of Q14 (upper left of the circuit board). Finally, connect the ground on the new board to the circuit board

ground somewhere near Q14 (the exact location is not critical).

If the disable function is desired, a small slide switch can be mounted on the perfboard. The switch should be bonded to the board (epoxy works fine). By cutting a notch in the case within the battery compartment, the switch can be conveniently reached without disassembling the case.

Circuit operation can be checked by observing the one-shot output (pin 11 on U1) on an oscilloscope. With the HT turned on and the squelch control fully clockwise, a pulse train should be observed. The pulse should be high for about 5 ms and low for about 200 ms. Next, rotate the squelch control to its fully counterclockwise position. The one-shot output should stay high and the receiver squelch should open.

If all is well, install the perfboard in the HT. The board may be glued in place if desired, although I have not found this to be necessary. Insulate the perfboard from the circuit board using cardboard, foam, etc.

The completed unit draws around 3.5 mA during power-off periods and normal receiver current (22 mA in my case) during power-on periods. With the squelch control pegged, the duty cycle is 5 percent or so, and as a result the average current should be approximately 4.5 mA. Measurement in the lab confirmed this figure. The HT was also tested on a Cushman, and no change in receiver sensitivity was observed when switching between pulse mode and normal mode.

Once installed, the operation of the circuit can be verified by rotating the squelch control until the squelch threshold is just reached. Periodic noise pulses should be heard from the speaker if the squelch control is set right on the edge between open and closed. Otherwise, you'll never know it's working unless you keep track of how often your batteries run down!

Now on to some changes on the circuit board. These changes are not that easy and are only recommended for those persons experienced with tight circuitboard work. Although the changes only involve substitution of components, access is difficult due to the cramped quarters. With a little care they may be performed successfully.

The first change further reduces receiver standby current drain, although only by a little more than .5 mA (from 4.5 to 4 mA). Change R48 from 18k to 100k. R50 should now be adjusted so that the audio output clips symmetrically. A value of 270k worked for me. A side effect of this modification is that the time it takes the squelch to open is increased by about 20 ms. C57 could be reduced to compensate for this, but then the squelch would close on shorter noise pulses than it did originally. I suggest leaving C57 at 1 uF, since the added time is not significant. Although this modification can be made without installing the power pulsing circuitry, the benefit would be marginal in that case.

The second change reduces transmit current by about 20 mA. Change R93 from 470 to 4.7k. This change cannot be made unless the power pulsing circuitry has been installed. A similar savings in transmit current can be achieved without installing the power pulser, however, at the cost of about .7 V lower receiver voltage, by changing Q29 to a Darlington (such as an MPS A13) and increasing R93 to 10k.

In conclusion, I see no reason why the receiver power pulsing idea could not be adapted to other HTs. For synthesized HTs, power would have to be maintained to the synthesizer, since the lock-up times are probably on the order of 100 ms. Give it a try!

Finally, I'd like to acknowledge the help of N3IC in kicking ideas around, designing circuits, and taking the photos, and also thank N3TE for sparking the whole process. ■

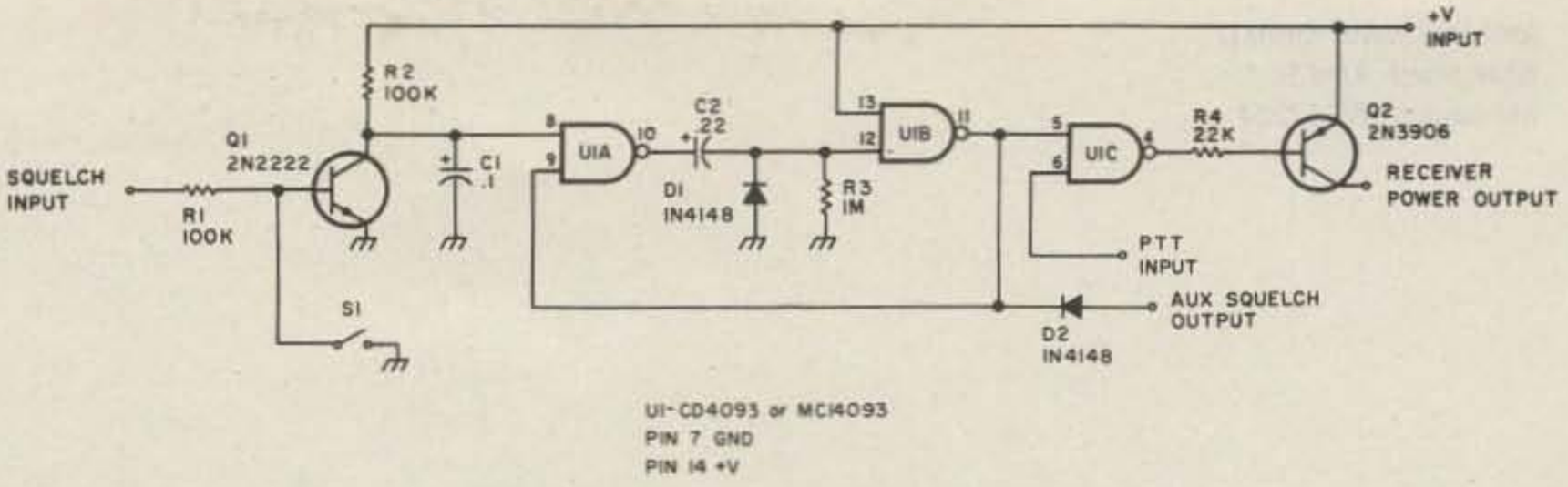


Fig. 4. Power pulser schematic.

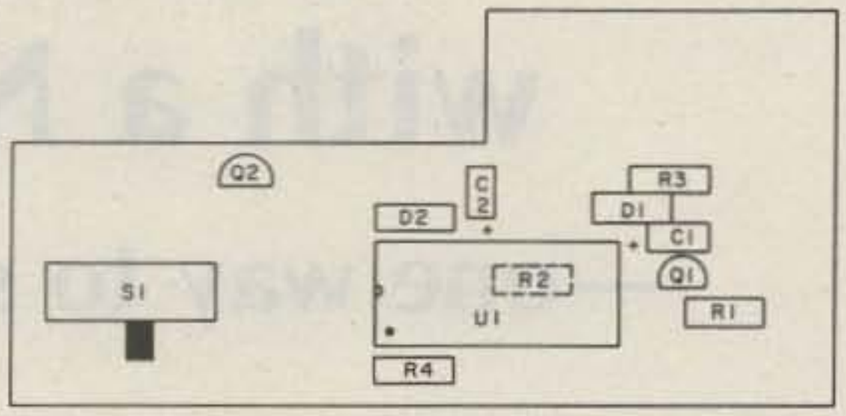
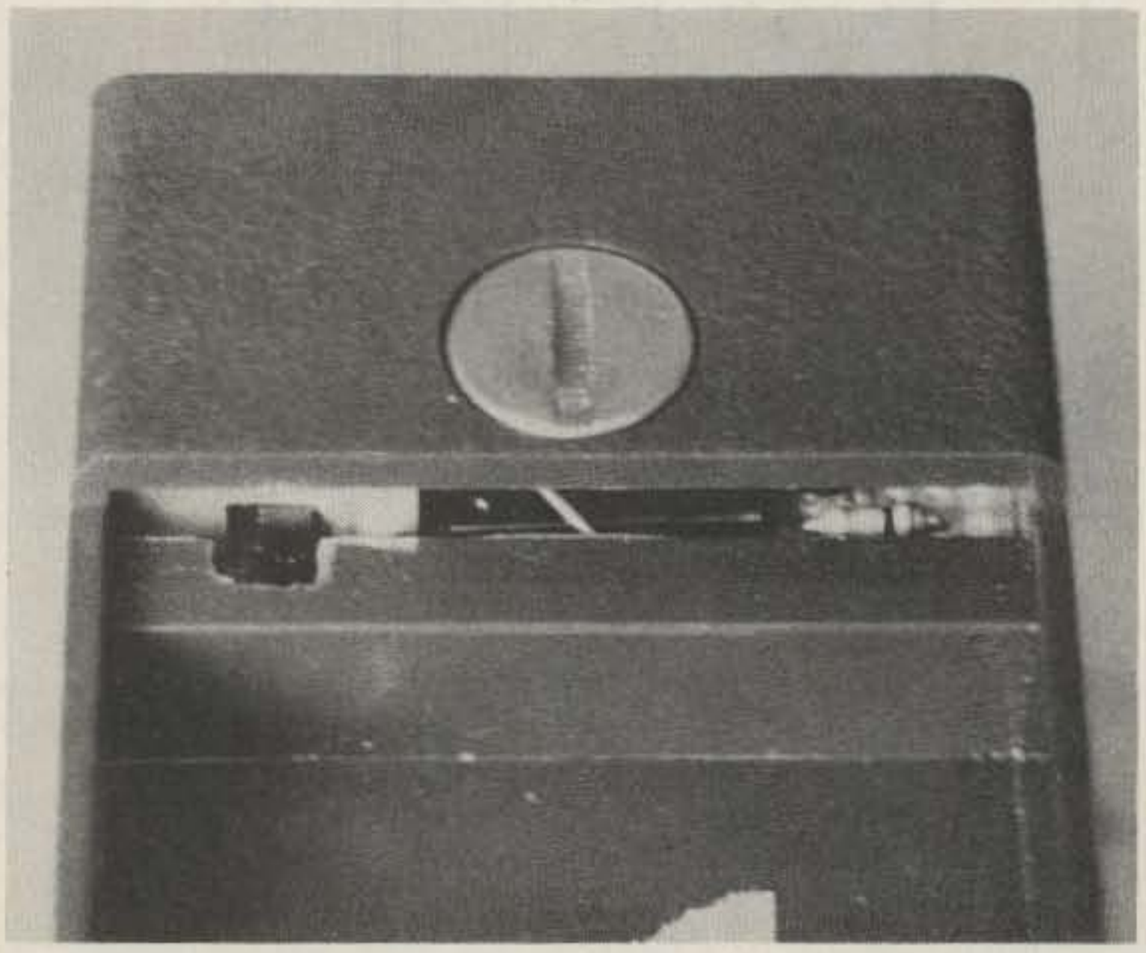


Fig. 5. Parts layout, top view.

Reference

Wilson Mark II and Mark IV Operation and Service Manual, Wilson Electronics Corp., 1978.



View of switch cut-out in battery compartment.

Joel Eschmann K9MLD
8204 North 93rd St.
Milwaukee WI 53224

A Positive Supply with a Negative Chip

—one way to solve the parts problem

From time to time you, like myself, have gotten into a situation where your junk box just did not have the right parts needed to build a project. You found yourself needing some critical components not immediately available from the parts store—or maybe it's 9:00 pm, Sunday night.

Well, this is a story about such a situation which I wish to share with you.

One evening, while working on a new ATV transmitter, I had a requirement for a good regulated power supply. A look into my junk box revealed a shortage of positive-reference regulators.

Again, one of Edsel Murphy's laws prevailed: "If working on a new design, the most critical part will be missing." (Well, if that isn't one of Murphy's laws, it sure is one of mine.) Staring into the junk box, I recognized some LM-337 regulators. This regulator is a negative-reference voltage device, but did this matter?

I walked over to the blackboard and quickly drew a schematic of a negative-regulated supply (Fig. 1). It became obvious that there was no reason not to use it. I located the other components needed for this power supply—which I was planning to make adjustable to 13.5 volts—and laid out a breadboard.

While working on the breadboard, certain benefits of this type of design suddenly became evident. Notice in the schematic that I have utilized collector feedback for good regulation. (Of course, this required a more available NPN transistor, as least as far as my junk box is concerned.) Now that is the first plus. The second plus in this design is the fact that we can ground to the chassis the collector of the pass transistor (Fig. 2). Plus number three: using a TO-3 package allowed me to eliminate any need for isolating the case of the pass transistor as is required by every other supply.

Wouldn't you think, with all these pluses, that although this supply uses a negative regulator it should come out plus? Hi!

In previous designs (see "More Power to You," *73*, August, 1979), I discussed details of regulated supplies, current limit, regulators, crowbar circuits, etc. I wish to keep this design simple and very basic. With that in mind, let's examine it briefly.

The transformer is an 18-V, 4-Amp unit purchased at Radio Shack (PN 273-1514). Referring to Fig. 3, we can see the calculations to the rectifier assembly. This rectifier bridge is from Radio Shack (PN 276-1171) and has a rating of 100 piv at 4 Amps.

A good rule of thumb for the filter capacitor is approximately 3000 uF per Amp. With this 4-Amp supply, I paralleled four 3300-uF units from my junk box.

Referring to Fig. 4, we can calculate the dissipation of the pass transistor to determine the proper heatsink rating. Starting with a dc level of 25 volts from the unregulated supply and a regulated output of 13.5 V,

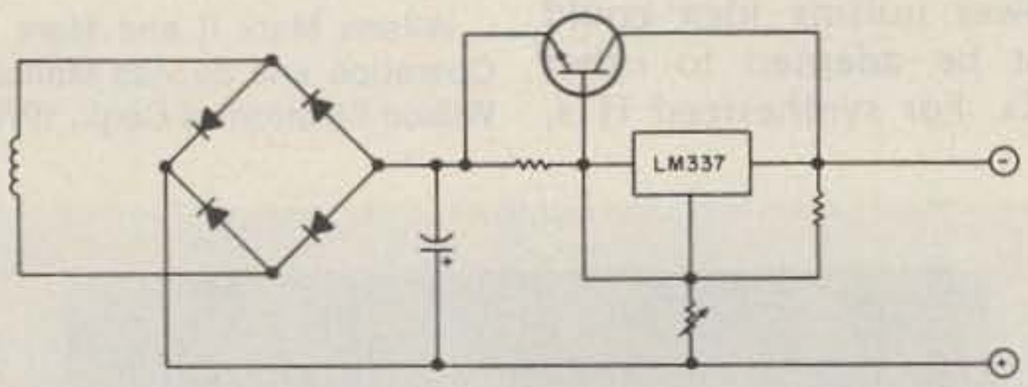


Fig. 1.

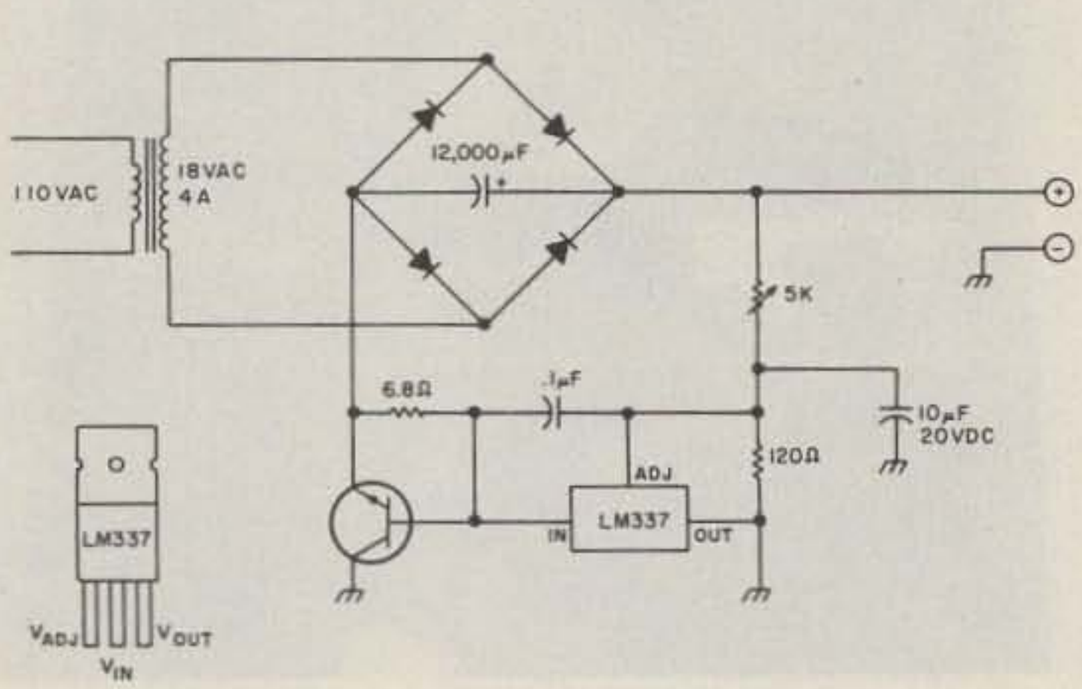


Fig. 2.

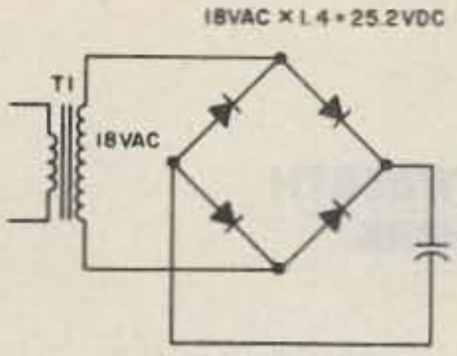


Fig. 3. Full-wave bridge, filtered and unregulated.

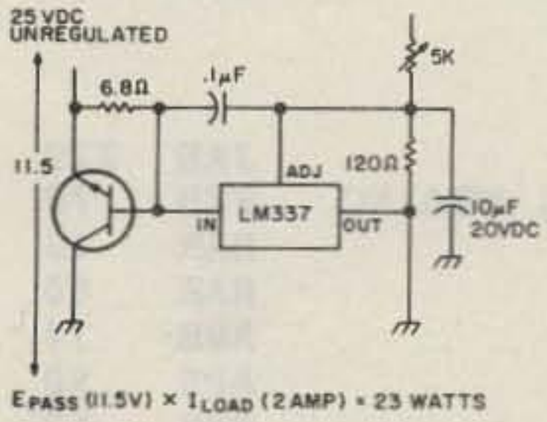


Fig. 4.

the difference voltage across the pass transistor will be 11.5 V. The product of the difference voltage and the load current will be the power dissipation, in Watts, by the power transistor. For example, 11.5 V × 2 Amps (load current) equals 23 Watts of heat in the transistor. With this in mind, I would recommend a 100-Watt power transistor like Radio Shack's PN 276-2039. A companion heat sink could be the Radio Shack Universal (PN 276-1361).

The remaining parts are not magic. Any ½-Watt resistor can be used for the regulator bias. Due to the fact that the supply was designed for 4 Amps, the LM-337 requires a heat sink to handle about 3 Watts (Radio Shack PN 276-1363).

The only cautions to be exercised to keep the 3-lead regulator stable are lead length, wire routing, and grounding. Ground loops and stray current paths can cause stability problems resulting in the regulator not functioning under load, so lay out your package carefully.

Edsel Murphy may have the corner on the unusual-situation market, but I have the first on a negative coming out positive! ■

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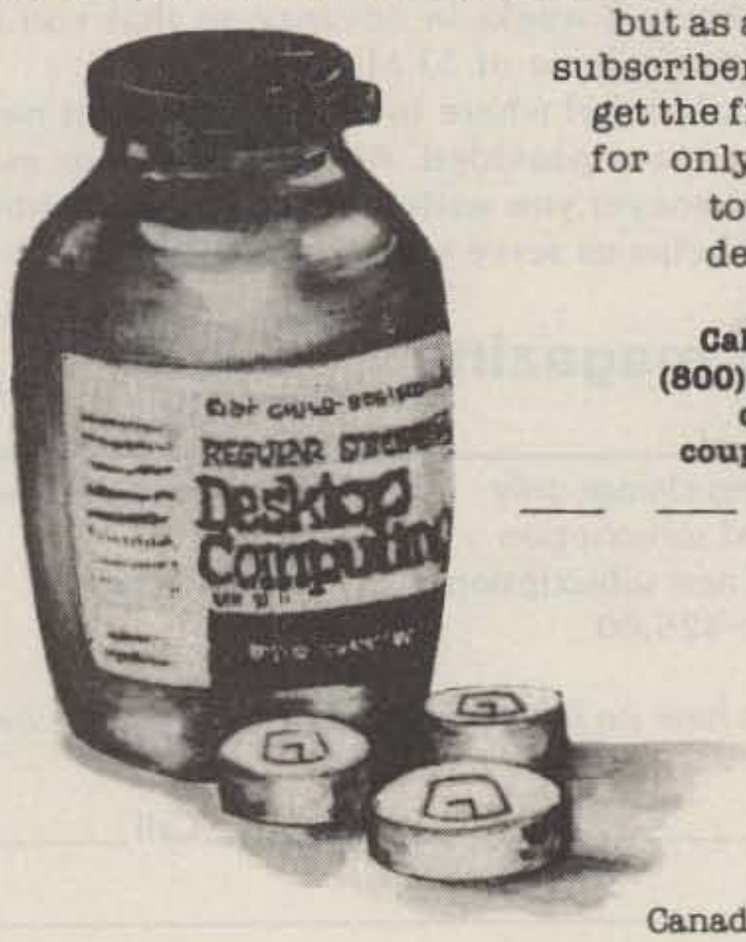

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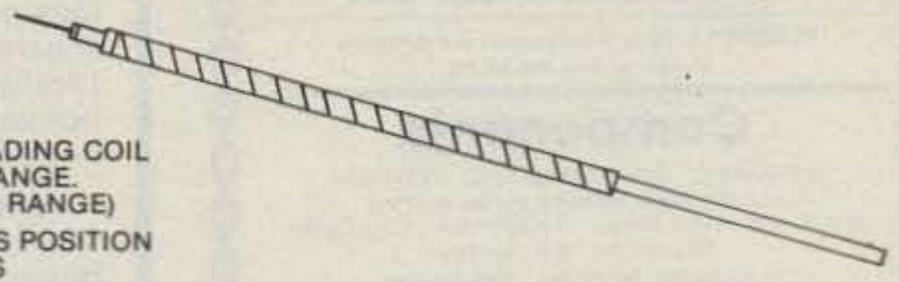

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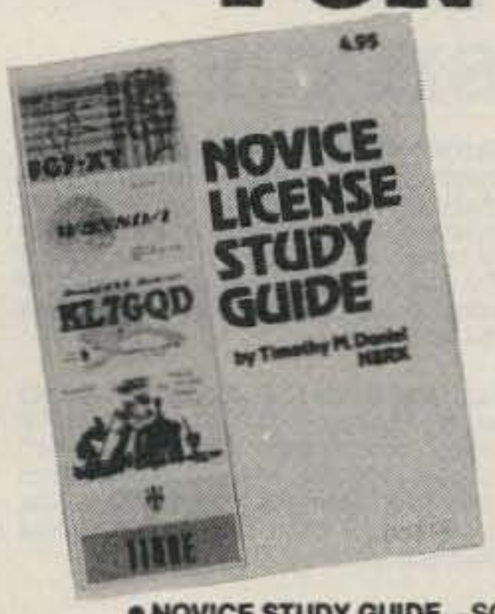

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*Sale of the ST-7/T is subject to FCC Certification.

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YOU MAY SEND A DUPLICATE OF THIS FORM.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

As the year draws to a close, our thoughts return home. The holiday season arrives, and one longs to be with family.

Well, it may not be family in the traditional sense, but "home" for the FUN! column is *73 Magazine*. This month, we take an affectionate look at the old homestead and contemplate, with some curiosity, what our hobby would be like without it.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1 *73*'s QTH
8 Pakistan prefix
9 Norway prefix
10 RTY: _____cal
11 *73*'s digital section
12 KP4-land (abbr.)
13 Morse or ASCII
14 Contest columnist
15 Sweden prefix
16 *73*'s is 21
17 Test letters
18 A clear band space
19 Deface
21 An ARRL section (abbr.)
22 Cover artist: issues #1 and 250
24 Cell type
25 A *73* article, before published (abbr.)
26 K2AGZ
27 Mr. FUN! (abbr.)
29 Bolivia prefix
31 Poland prefix
33 Monthly feature (2 words)

Down

1 Belonging to "Looking West" columnist
2 When W2NSD/1 _____, hams listen
3 Iran prefix
4 *73*'s original QTH
5 *73* helped pioneer these machines
6 *Bonne chance*, on CW
7 *73* used to track him
11 Component
14 Former column (3 words)
20 Costa Rica prefix
22 Every pot has one—most repeaters, too
23 Say die?
28 Mexico prefix
29 Civil defense (abbr.)
30 Popular bootleg prefix
32 Postscript

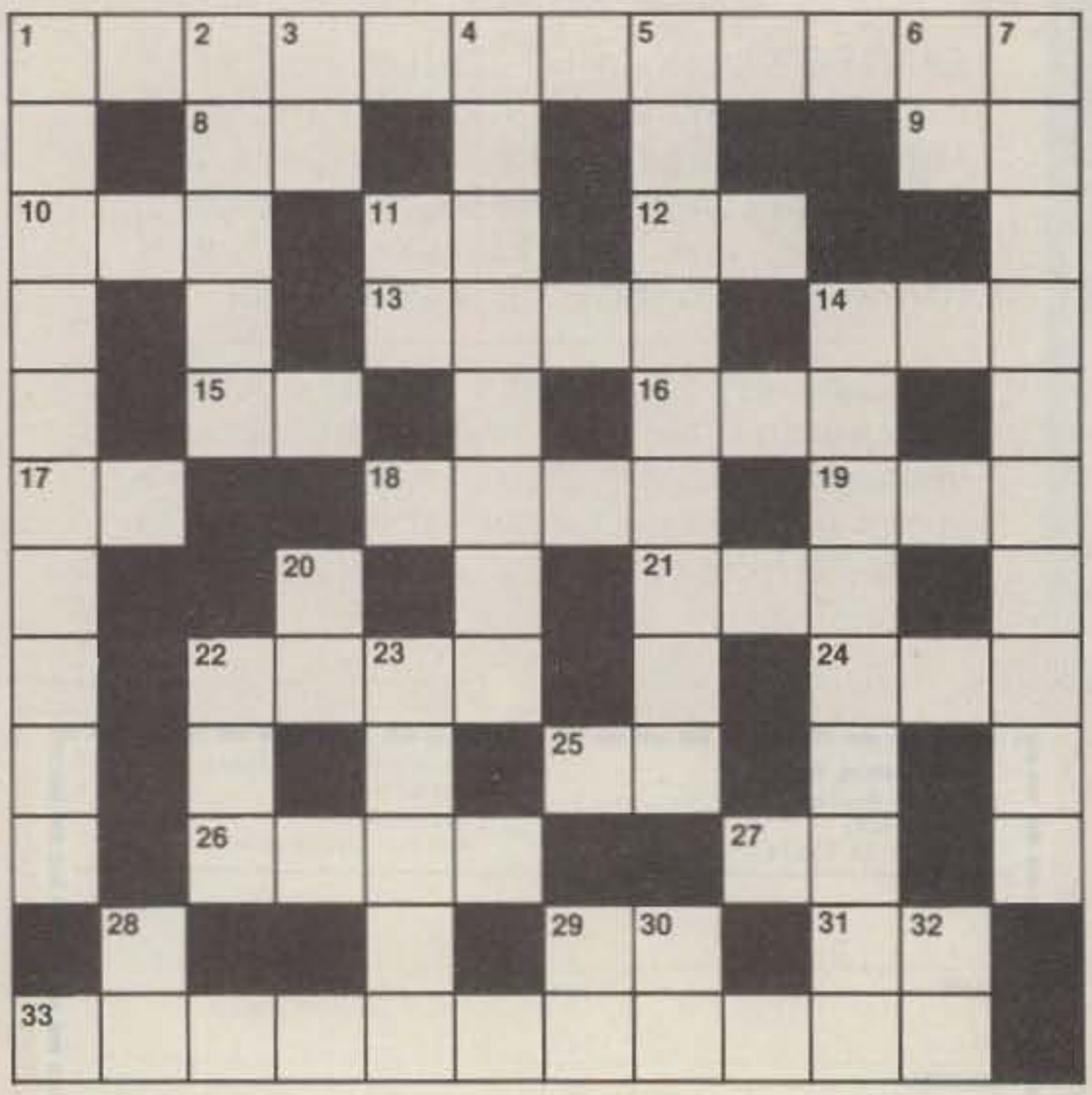

Illustration 1.

ELEMENT 2—MULTIPLE CHOICE

1) During this publication's early days, Wayne Green would often extol the virtues of his favorite car. It was:
   1. a 1912 Buick
   2. a Porsche
   3. a Volvo
   4. a Fiat

2) When this column first appeared, in October, 1980, it was written by WB2IBE. Whatever happened to him?
   1. He quit to write a similar column for *Creative Computing*
   2. He died
   3. He retired
   4. He upgraded and changed his call to KI2U

3) What was *73*'s original cover price?
   1. 37¢
   2. 73¢
   3. 75¢
   4. 88¢

4) How much did a life subscription cost in December, 1961?
   1. $30
   2. $50
   3. $75
   4. $100

5) Which person listed below has *not* been a DX columnist for *73*?
   1. James Cain K1TN
   2. Floyd Vivino WA2DCS
   3. Chuck Stuart N5KC
   4. Yuri Blanarovich VE3BMV

ELEMENT 3—TRUE-FALSE

	True	False
1) During this magazine's first two years, it was printed on green paper to differentiate it from the competition.	_____	_____

A	A	P	R	O	P	A	G	A	T	I	O	N	H	A
S	M	T	T	O	F	F	C	O	R	U	S	H	E	L
S	V	S	K	R	E	H	L	L	H	I	N	G	B	E
O	I	H	A	T	A	F	S	U	T	T	H	E	W	T
C	N	S	I	T	I	G	D	O	R	I	D	S	B	T
I	O	D	S	Y	S	S	R	O	V	L	L	I	K	E
A	C	F	E	L	J	E	A	I	G	G	F	A	T	R
L	F	C	W	O	B	T	W	E	S	T	G	G	O	S
E	E	W	O	O	I	B	A	G	E	Y	W	B	T	W
V	T	R	O	P	E	R	R	E	N	A	H	A	K	O
E	R	B	H	I	D	L	W	J	A	I	W	P	T	M
N	Y	J	P	L	E	H	M	A	H	W	K	O	M	J
T	A	Z	K	A	D	F	T	W	O	M	H	O	O	W
S	A	A	I	J	E	M	T	R	O	P	E	R	O	I
B	S	U	C	X	M	N	K	I	N	G	M	Y	D	L

Illustration 2.

2) From 1965 to 1971, the *Cigar Smoker's Journal* was a *73* publication. _____ _____
3) Wayne Green once edited *CQ Magazine*. _____ _____
4) The ARRL had a full-page ad in *73*'s first issue. _____ _____
5) A *73* FUN! editor once campaigned for ARRL office by handing out promotional rolling paper. _____ _____
6) *73* is available in microfilm from University Microfilm, Ann Arbor, Michigan. _____ _____
7) While this year's "FUN! Poll" counted 612 ballots, the actual response was closer to 1,000. _____ _____
8) "RTTY Loop" made its *73* debut in the June, 1977, issue. _____ _____
9) The first item ever described in *73*'s "New Products" section was an Allied catalog. _____ _____
10) Wayne Green, in addition to his many other responsibilities, is also the mayor of Peterborough, New Hampshire. _____ _____
11) YA1NSD was Wayne's callsign in Afghanistan. _____ _____
12) *73* also publishes *HR Report*. _____ _____
13) The ARRL subscribes to *73*. _____ _____
14) Mickey Mouse once appeared on *73*'s cover. _____ _____
15) In 1976, *73* published 13 issues. _____ _____
16) Someone once wrote to "Ham Help" asking for assistance in building a particle beam. _____ _____
17) A 1980 *73* profile of Dick Bash opened with the quote, "Morality? Man, who am I to judge morality?" _____ _____
18) Before this *73*, there were others. _____ _____
19) "*73* ON-THE-AIR" is the name of *73*'s monthly cable TV program. _____ _____
20) A *73* columnist was once interviewed by Johnny Carson on the "Tonight Show." _____ _____

ELEMENT 4—FILL IN THE BLANKS

1) You are reading issue #____ (no peeking).
2) Along with "Never Say Die," the other three original *73* features still being run are _____, _____, and _____.
3) "Well . . . I Can _____, Can't I?"
4) "ARRL: Love it, Hate it, _____ _____."
5) As editor of *Astounding Science Fiction*, he gave sci fi writers such as Isaac Asimov and Robert Heinlein their first national exposure. Later, he wrote an article for the first issue of *73* and was listed as a contributing editor. His name was _____ _____.

ELEMENT 5—HIDDEN WORDS
(Illustration 2)

Hidden in this puzzle are the name of ten past and present *73* features. The words are formed in any direction—horizontally, vertically, or diagonally, forwards or backwards. As you find each word, circle it.

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1)—2. Fun, if you can afford it.
2)—4. A truly remarkable fellow.
3)—1. Imagine a time when 73¢ was too much to charge for a magazine!
4)—1. Wayne told you it was a great deal.
5)—2. But he's available.

Element 3:

1)—False	Come on!
2)—False	Hardly.
3)—True	And it hasn't been the same publication since.
4)—False	Would you believe a classified?
5)—True	It seemed like a good idea at the time—but I lost.
6)—True	Yeah, but I have to squint to read it.
7)—True	Next time, I'll wait longer before counting.
8)—True	And it's still going strong.
9)—True	To the delight of amateurs everywhere.
10)—False	At least I think not.
11)—True	Not recently.
12)—False	Right state, wrong company.
13)—True	Of course. My *73* issue #1, by the way, is stamped: "Received: ARRL HQ." I got it this year at a local flea market. A real collector's item, no?
14)—True	September, 1977, being printed on a Teletype.
15)—True	The usual 12, plus a special year-end "Holiday" issue.
16)—False	If this one were true, OSCAR might be in trouble.

P	E	T	E	R	B	O	R	O	U	G	H
A	■	A	P	■	R	■	E	■	■	L	A
S	E	L	■	I	O	■	P	R	■	■	M
T	■	K	■	C	O	D	E	■	B	O	B
E	■	S	M	■	K	■	A	G	E	■	U
R	Y	■	■	S	L	O	T	■	M	A	R
N	■	■	T	■	Y	■	E	N	Y	■	G
A	■	L	I	N	N	■	R	■	G	E	L
K	■	I	■	E	■	M	S	■	U	■	A
S	■	D	A	V	E	■	■	J	E	■	R
■	X	■	■	E	■	C	P	■	S	P	■
N	E	W	P	R	O	D	U	C	T	S	■

Illustration 1A.

A	A	P	R	O	P	A	G	A	T	I	O	N	H	A				
S	M	T	T	O	F	F	C	O	R	U	S	H	E	L				
S	V	S	K	R	E	H	L	L	H	I	N	G	B	E				
O	I	H	A	T	A	F	S	U	T	T	H	E	W	T				
C	N	S	I	T	I	G	D	O	R	I	D	S	B	T				
I	O	D	S	Y	S	S	R	O	V	L	L	I	K	E				
A	C	F	E	L	J	E	A	I	G	G	F	A	T	R				
L	F	C	W	O	B	T	W	E	S	T	G	G	O	S				
E	E	W	O	O	I	B	A	G	E	Y	W	B	T	W				
V	T	R	O	P	E	R	R	E	N	A	H	A	K	O				
E	R	B	H	I	D	L	W	J	A	I	W	P	T	M				
N	Y	J	P	L	E	H	M	A	H	W	K	O	M	J				
T	A	Z	K	A	D	F	T	W	O	M	H	O	O	W				
S	A	A	I	J	E	M	T	R	O	P	E	R	O	I				
B	S	U	C	X	M	N	K	I	N	G	M	Y	D	L				

Illustration 2A.

17)—True Morality? Man, I just take the cash and run.
18)—True As you may have guessed, *73* was a popular title for various club newsletters and other ham publications. The 1960 *73* stuck.
19)—False *73*'s Tuesday night skeds.
20)—True Johnny and I chatted back in 1969.

Element 4:
1)—255; 2)—Propagation, Letters, New Products; 3)—Dream; 4)—Don't care; 5)—John Campbell.

Element 5:
See Illustration 2A.

SCORING

Element 1:
Twenty points for the completed puzzle, or 1/2 point for each question correctly answered.

Element 2:
Four points for each correct answer.

Element 3:
One point for each correct answer.

Element 4:
Four points for each blank filled.

Element 5:
Two points for each word found.

Think you know this magazine?
1-20 points "*73 Magazine*? Oh, is that what I'm reading?"
21-40 points Once wrote a letter to Wayne complaining about a misleading question in the FUN! column.
41-60 points Bums issues off of friends.
61-80 points Is an ardent subscriber.
81-100+ points Has memorized the yearly indices.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

KOREAN AMATEUR RADIO LEAGUE AWARDS

This week I was the happy recipient of a very nice letter from the Korean Amateur Radio League. Two very attractive awards were among the material received and it's my honor to share the KARL AWARDS with you now.

AKA, the Worked All Korean Prefix Award, is issued to amateurs and shortwave listening stations worldwide on payment of a fee of 5 IRCs and an award application.

Each claim must be accompanied by a list of Korean prefixes worked in prefix order. Each list must be accompanied by a signed verification of two amateurs that the applicant has confirmation of each contact in his or her possession at the time of application. Please *do not* send QSL cards; the verified list will suffice.

Cards dated on or after January 1, 1959, will qualify. Contacts made from any location within your call area are eligible. Contacts with HL9 stations will be graciously accepted.

All correspondence should be sent to Awards Manager, Korean Amateur Radio League, CPO Box 162, Seoul Central, Korea.

The HM Award, formerly known as HMA, has identical application requirements, with the exception that the award is issued for total HM/HL QSOs worked in any one of five Award Classes. The following classes apply: Class K, O, R, E, and A. Spelling out the country's name, the classes require 5, 10, 20, 30, and 50 QSOs respectively to qualify.

When applying for either of these classic Asian awards, tell our friends in the "land of morning calm" that you read about it in *73 Magazine!*

BULGARIAN 1300 AWARD

The Bulgarian Federation of Radio Amateurs introduces the award, Bulgaria—1300, to commemorate the 1300th anniversary of the foundation of the Bulgarian State, in 681 AD.

This award will be issued to licensed radio amateurs throughout the world having the necessary score for established two-way radio contacts with Bulgarian amateurs. To be eligible, all contacts must be made in the period January 1, 1980, through December 31, 1981. This gives our readers only a month, so you'd better hurry and work a few contests before the deadline!

The award is available in three categories: Class 1—requires 1300 QSO points; Class 2—requires 1000 QSO points; Class 3—requires 500 QSO points.

QSO points are earned as follows: 30 points for QSOs with any Bulgarian amateur located in the capitals of Bulgaria working with the prefixes LZ13. These are LZ13C (Sofia, The Central Radio Club); LZ13CSF (Sofia); LZ13CPL (Pliska); LZ13CPR (Preslav), and LZ13CWT (Veliko Tirnovo). Five (5) QSO points are earned for contact with any other LZ station irrespective of his or her callsign.

Regardless of operating mode, contacts may be made once per hand. The award is issued free of charge and the only requirements of major concern are that your contacts should be listed in prefix order, and the list be verified by at least two fellow amateurs.

Applicants may apply for this award any time up to December 31, 1982. Remember, however, that all contacts must be made *before December 31, 1981*, to be valid. Send your application to: P.R. of Bulgaria, Sofia 1000, PO Box 830, Bulgaria.

WORKED LA3FL/MM AWARD

The three radio officers aboard the *Royal Viking Sea*, a Norwegian ship which cruises

LA3FL/MM

all over the world, are offering free the Worked LA3FL/MM Award.

Applicants must work the station on CW in four different bands, minimum of 539 RST. A QSL card must be sent for each band to the LA bureau or to Per A. Mikalsen, Chief Radio Officer, *Royal Viking Sea*, Ruseløkkveien 14, Oslo, Norway.

ROYAL VIKING SEA
ROYAL VIKING LINE
P.O. Box 1612 Vika Oslo 1 Norway

WORKED **LA3FL/MM** AWARD

ISSUED FOR 4-BAND QSO

CERTIFICATE NR.——

THIS CERTIFIES THAT: _____

_____OF_____

HAS MANAGED THE EXTRAORDINARY AND OUTSTANDING ACHIEVEMENT OF ESTABLISHING TWO-WAY CW CONTACT ON 4 AMATEUR RADIO BANDS WITH THE NORWEGIAN LUXURY CRUISE LINER

M/S ROYAL VIKING SEA

SAILING THE SEVEN SEAS

THE CONTACTS WERE MADE AS FOLLOWS:

	DATE	BAND	QTH	LOCATION
1.	_____	____ MHZ	_____	_____
2.	_____	____ MHZ	_____	_____
3.	_____	____ MHZ	_____	_____
4.	_____	____ MHZ	_____	_____

VERIFIED AND DATED AT SEA: _____

73, _____ AWARD CUSTODIAN

PER A. MIKALSEN, LA3FL
CHIEF R/O
M/S ROYAL VIKING SEA

Office address: Ruselokkveien 14 Oslo Norway

FESSENDEN'S 75TH

During the week of Christmas, 1981, AA1A will be operating most HF SSB phone bands to commemorate the 75th anniversary of the experiments by Reginald Fessenden, who made two-way contacts with Scotland as well as the famous Christmas Eve voice broadcasts. Fessenden also was responsible for many radio firsts as well as many innovations such as the heterodyne principle and high frequency alternators. He later was the developer of sonar.

Special QSLs will be sent out with more information to those who work us. We will be operating near the lower edge of the General class bands.

Two books are available for those interested in a famous early radio experimenter: *Fessenden, Builder of Tomorrows*, by Helen M. Fessenden, and *Radio's First Voice*, by Ormond Raby.

BETHLEHEM, INDIANA, CHRISTMAS EXPEDITION

The Clark County ARC, Jeffersonville, Indiana, will operate from Bethlehem, Indiana, from 1700 UTC, December 12 to 1700 UTC, December 13. Operating frequencies for W9WWI/9 will be 3.905, 7.240, 14.290, 21.365 MHz on SSB as propagation permits. The N9RM 146.25/.85 repeater will be used for local contacts.

A special 8½" × 11" Christmas season certificate imprinted with the unique Bethlehem postal hand stamps will be sent to all stations who QSL. Please QSL with a large SASE to Clark County ARC, PO Box 532, Jeffersonville IN 47130.

BETHLEHEM, WEST VIRGINIA, EXPEDITIONS

The Triple States Radio Amateur Club will operate from Bethlehem, West Virginia, from December 17 to December 21, from 1400 to 2300 UTC daily. Operating frequencies for WD8DDL/8 will be 7.275, 14.325, 21.425, and 28.550 MHz on SSB, and 7.110, 14.075, 21.110, and 28.110 MHz on CW.

A special holiday-season card will be sent to all contacts. Send an SASE to TSRAC, 26 Maple Lane, Bethlehem, Wheeling WV 26003.

BIG SKY WORKED ALL COUNTIES AWARD

Recently, the Lower Yellowstone Amateur Radio Club of the Sidney/Glendive area of Montana decided to sponsor a Montana Counties Award. The certificate was the idea of WB7UTJ and N7BMR.

To qualify for this award, any licensed amateur must contact and have received a QSL for all 56 counties in Montana on any band or mode of operation. Repeater contacts will not be acceptable, and all QSOs to be valid must have taken place on or after January 1, 1980.

To apply for the award, have your list verified by two other amateurs and send an award fee of one dollar (US funds) and two first-class stamps to either WB7UTJ or N7BMR.

The Kauai Amateur Radio Club is pleased to announce the establishment of five awards which are now available to amateurs worldwide.

WORKED KAUAI AWARD

The WK Award requires all contacts be made January 1, 1980, or later on any band or mode of operation. For applicants in all 50 states and Canada, five KARC member stations must be worked. DX stations need only three contacts with KARC members. General certification rules apply.

WORKED HAWAII AWARD

The WH Award has the same requirements of the WK Award

except that for US and Canadian amateurs 50 Hawaiian contacts must be logged, five of which must be KARC members. For DX stations, 15 Hawaiian stations must be worked and one must be a KARC member.

WORKED HAWAIIAN ISLANDS AWARD

To qualify for the WHI Award, five Hawaiian stations must be worked on the following Hawaiian Islands: Hawaii, Kauai, Maui, and Oahu.

WORKED ALL HAWAIIAN ISLANDS

The WAHI Award requires the applicant to work a minimum of one station on each of the following islands: Hawaii, Kahoolawe, Kauai, Lanai, Molokai, Maui, Niihau, and Oahu.

WORKED ALL HAWAIIAN COUNTIES AWARD

There are a total of five (5) counties in the state of Hawaii. To qualify for the WAHC Award, one Hawaiian station must be worked in the counties of Hawaii, Honolulu, Kalawao, Kauai, and Maui.

Be sure to enclose $1.00 for each award being applied for the help defray costs incurred in maintaining this program series. All correspondence should be directed to the Awards Manager, KARC, PO Box 548, Kalaheo HI 96741.

SANTA CLAUS, INDIANA

The Pike County Amateur Radio Club of Winslow, Indiana, and the Old Post Amateur Radio Society of Vincennes, Indiana, will operate a special events station from Santa Claus, Indiana.

The callsign will be W9CZH, and the dates, December 4, 5, and 6. Starting time is 0000Z on the 4th, continuing on through to 2300Z on the 6th. Frequencies (plus or minus QRM): 21.410, 14.305, 7.270, and 3.925 SSB, 14.090-14.100 RTTY, and 146.52 FM.

A special QSL/Xmas card postmarked from the Santa Claus post office will be sent upon receipt of an SASE. Send to Santa Claus, PO Box 111, Ireland IN 47545.

MOUNT SAINT HELENS AWARD

Down the road a mere 180 miles sits majestic Mount St. Helens. We here in Washington remember the historic Sunday morning very well. Supported in the community by a Naval Air Station, we thought for sure bombing maneuvers were underway here on Whidbey Island. Instead, what we were hearing was the explosion and the awesome eruption of Mount St. Helens, a devastating act of nature which had happened some 14 minutes earlier (took this long for us to hear it at the speed of sound). By this time, radio announcers had already received the unfortunate news over the wire services, and aftershocks were being experienced which were to continue for weeks and months to come.

The amateurs throughout the area performed marvelously in the hours of desperation. It behooves all of us, sometime in our amateur careers, to contact amateurs from the region and listen to the story they have to tell!

A unique photographic award of the Mt. St. Helens eruption on May 18, 1980, is now available. Two opportunities, with no mode or band restrictions, are provided to qualify for this very popular award:

1) Contact 8 or more stations within the counties of Washington that surround Mount St. Helens (Clark, Cowlitz, Skamania, and Lewis counties). All contacts must be made on or after March 27, 1980, which was the actual first eruption of the mountain in over 123 years.

2) Report one contact with W7AIA (Clark County Amateur Radio Club) during its operation from 0200 UTC May 16 to 0200 May 18, 1981. That marked the first anniversary of the disastrous eruption that took the life of Reid Blackburn KA7AMF, who was a member of this sponsoring organization.

To apply for this award, send appropriate log information and $2.00 or more as a donation to the Reid Blackburn Scholarship Fund which has been established in memory of our dedicated friend and fellow amateur. Forward your application to Awards Manager, PO Box 1424, Vancouver WA 98668.

SOUTHERN CALIFORNIA DX CLUB AWARD

This week I received a very nice letter from Norm Friedman W6ORD, representing the Southern California DX Club, Incorporated. In his letter, Norm announced a Certificate of Recognition which is issued to amateurs throughout the world who can qualify.

Each applicant must work and confirm contact with 35 current members of the DX Club on any frequency from 1.8 to 30 MHz. This will qualify the applicant for the basic award. A bronze seal will be issued for 75 contacts, a silver seal for 100 contacts, and a gold seal will be presented for 125 contacts with Southern California DX Club members.

Verification of these contacts can be administered by any ARRL or IARU affiliated club. All contacts must be made on or after January 1, 1980, to be valid.

Send your list of contacts and $2.00 US funds or 10 IRCs to Norm Friedman W6ORD. For a current membership roster of the DX Club members, send an SASE and 2 IRCs to Norm and he will be sure a copy is rushed to your door.

CORRECTIONS

Figure 8 in "Folded Unipole for 160," on page 32 of the October issue, refers to an swr of "0". Such a value is impossible to obtain. The graph should have a low point of 1.0.

Also, the review of Kenwood's TR-9000, beginning on page 30 of the August issue, refers to measuring power over a range of 143.3 to 148.7 MHz. This should read: 143.9 to 148.7 MHz.

Tim Daniel N8RK
***73 Magazine* Staff**

ege, inc.

453

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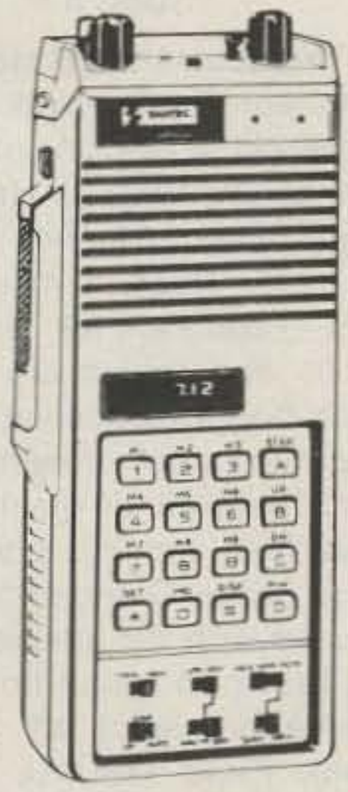

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1040 HF Preselector for XCVR	82.95

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CNA-2002 Auto tuner 2.5 KW	399.95
CNW-418 Antenna tuner 200W	169.95
CN-520 SWR/Power Meter 1.8-60MHz	59.95
CN-540 SWR/Power Meter 50-148 MHz	69.95

Some items in limited quantity and subject to prior sale.

MFJ PRODUCTS

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962 1.5KW Tuner mtr/switch	189.95
949B 300 watt deluxe tuner	115.95
941C 300 watt tuner switch/mtr	74.95
940B 300 watt tuner switch/mtr	65.95
820 SWR/watt meter & sensor	57.95
825 Deluxe SWR/water meter & sensor	99.95
814 HF SWR/water meter	41.95
721 CW/SSB filter	49.95
722 CW/SSB filter w/notch	57.95
732 DX SSB filter	57.95
752B Dual Tunable filter	74.95
624 Phone patch	53.95
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401 Econo Keyer	41.95
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422 Pacesetter Keyer w/Bencher BY-1	87.15
481 Memory Keyer 2 msg	74.95
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312 Police/Fire/Weather converter	49.95
202 Noise bridge	45.95
250 1 kw Dummy Load w/oil	29.95
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420-450 14 14-element UHF Beam	37.54
420-450-27 27-element UHF Beam	55.95
420-450 18C 18-element UHF for oscar	58.70
432 16LB 430-434 MHz beam/balun	60.70

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See List of Advertisers on page 162

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

FAIRBAULT MN
DEC 5

The Courage Center Handi-Ham System will hold its annual winter hamfest on Saturday, December 5, 1981, at the Eagles Club, Fairbault MN. There will be a flea market, a dinner at noon, a program, and prizes. For more information, contact Don Franz W0FIT, 1114 Frank Avenue, Albert Lea MN 56007.

HAZEL PARK MI
DEC 6

The 16th annual Hazel Park Amateur Radio Club Swap & Shop will be held on Sunday, December 6, 1981, at Hazel Park High School, Hughes Street at 9½ Mile Road, 1 mile east of I-75, Hazel Park MI. Tickets are $2.00 and tables are 75¢ per foot. Doors will open at 8:00 with the main prize drawing at 2:00 pm. There will be plenty of food and free parking, plus hourly door prizes. Grand prizes are included with the admission ticket. Talk-in on 146.52. For more information, send an SASE to Jack Field W8UPU, 1444 E. Evelyn, Hazel Park MI 48030.

SOUTH BEND IN
JAN 3

A hamfest swap and shop will be held on Sunday, January 3, 1982, at Century Center, downtown on US 33 one way north between the St. Joseph Bank Building and the river, South Bend IN. Tables are $3.00 each. There is a half acre of carpeted room in the same building as the industrial history museum. Talk-in on .52/.52, .99/.39, .93/.33, .78/.18, .69/.09, and 144.83/145.43. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-5307.

WEST ALLIS WI
JAN 9

The West Allis RAC will hold its 10th annual all-indoor Midwinter Swapfest on Saturday, January 9, 1982, beginning at 8:00 am at the Waukesha County Exposition Center. Advance tickets are $2.00 and tickets at the door are $3.00. Reserved 4-foot tables are $3.00, at the door, $2.00, and on the balcony, free. Included with the ticket will

be a 50¢ coupon toward a sandwich purchase. Prizes will be awarded. For more information, write 1982 Swapfest, PO Box 1072, Milwaukee WI 53201.

RICHMOND VA
JAN 10

The Richmond Amateur Telecommunications Society will hold its annual Frostfest on Sunday, January 10, 1982, from 8:00 am to 4:00 pm at the Virginia State Fairgrounds, Richmond VA. Admission is $3.00 plus a table charge for exhibitors and flea-market displays. Overnight trailer parking with complete hookups will be available at $7.00 per night. Various prizes will be given away during the day with three main prizes to be awarded at 3:00 pm. There will be approximately one acre of indoor heated and well-lighted space. Talk-in on 146.34/.94, 146.28/.88, and 146.52. For additional information, call Joe Stern W4LD at (804)-737-0333.

ARLINGTON HEIGHTS IL
FEB 7

The Wheaton Community Radio Amateurs will hold their annual hamfest on February 7, 1982, beginning at 8:00 am at the Arlington Park Race Track EXPO Center, Arlington Heights IL. Tickets are $3.00 at the entrance and $2.50 in advance. There will be free flea-market tables, expanded floor space, parking, awards, and a large commercial area, including the new computer section. Talk-in on 146.01/.61 and 146.94. For commercial info, call WB9TTE at (312)-766-1684; for general info, call WB9PWM at (312)-629-1427. For tickets, send an SASE to WCRA, PO Box QSL, Wheaton IL 60187.

LIVONIA MI
FEB 28

The Livonia Amateur Radio Club will hold its 12th annual LARC Swap 'n Shop on Sunday, February 28, 1982, from 8:00 am to 4:00 pm at Churchill High School, Livonia MI. There will be plenty of tables, door prizes, refreshments, and free parking. Talk-in on 146.52. Reserved table space of 12-foot minimum is available. For further information, send an SASE (4 × 9) to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

See List of Advertisers on page 162

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350PS AC supply	149	f
DMK-XL Mobile mt	29	mw
210X 80-10m Xcvr	359	f
210X/LE 80-10m Xcvr	399	m
215X/NB 160-15m Xcvr	369	m
AR-200 Power supply	59	w
200PS Power supply	69	w
110L Xcvr (RX+TX)	199	mf
PS-110H 12v ps	69	m
CLEGG/SQUIRES-SANDERS		
Interceptor Receiver	$ 99	m
22'er FM series 25	69	m
FM-27B 2m FM Xcvr	129	e
011 Power supply	29	w
Desk cgr for HT-146	9	w
COLLINS		
75S-1 Ham Rcvr	$275	mwf
75S-3 Ham Rcvr	375	mf
75S-3B Ham Rcvr	450	wf
75S-3B Rcvr (round)	499	f
F455FA08 800 Hz filter	99	w
F455FA31 3.1 KHz filter	79	w
51S-1 Rcvr (round)	1195	w
32S-1 Transmitter	275	f
32S-3 Transmitter	425	mwf
32S-3 Xmtr (round)	475	m
516E-1 KWM-1 DC ps	69	f
351D-1 KWM-1 mount	49	w
KWM-2 Xcvr	499	mwv
516F-2 AC supply	175	mfv
CC-3 Carrying case	49	m
351D-2 KWM-2 mount	45	f
DENTRON		
160-10AT-3kw Tuner	$ 99	w
Jr. Monitor Tuner	39	w
DTR-3KA Ant tuner	279	e
DTR-1200L Linear	349	e
DTR-2000L Linear (air)	799	m
W-2 Wattmeter	69	w
WVP-2A VHF PEP meter	49	m
AF-1A Rcv audio proc	69	wf
DRAKE		
SW-4A SWL Rcvr	$169	f
2A Ham Rcvr	129	f
2B Ham Rcvr	149	e
2C Ham Rcvr	169	we
2AQ Spkr/Q-mult	29	e
2BQ Spkr/Q-mult	29	f
R-4 Ham Rcvr	229	mfe
R-4A Ham Rcvr	249	mwf
R-4B Ham Rcvr	289	mwfc
R-4C Ham Rcvr	389	cve
MS-4 Speaker	19	we
4NB Blanker	49	e
FL-250 Filter	35	e
FL-500 Filter	35	e
FL-1500 Filter	35	e
2NT CW Transmitter	79	w
T-4X Transmitter	249	mwc
T-4XB Transmitter	349	w
T-4XC Transmitter	399	all
TR-3 Xcvr	229	m
TR-4 Xcvr	299	mwfe
TR-4/NB Xcvr	349	mve
TR-4C Xcvr	379	mwc
RV-4C Remote VFO	89	m
FF-1 Xtal adaptor	19	f
TR-6 6m Xcvr	469	w
TR-6/NB 6m Xcvr	499	e
AC-3 AC supply	59	mwfc
AC-4 AC supply	89	all
DC-3 DC supply	49	me
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TR-22 2m FM Xcvr	99	e
TR-22C 2m FM Xcvr	119	m
AA-22 2m amp/preamp	49	w
UV-3 (2m/450) Xcvr	499	w
UV-3 (3-band) Xcvr	699	c
ETO		
Vomax Processor	$129	m
ENCOMM		
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FT-301 DIG Xcvr	469	m
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FP-301 AC supply	99	mw
FT-301D Deluxe ps	149	mw
FV-301 Remote VFO	89	m
LL-301 Phone patch	35	m
FT-7 20w Xcvr	329	mc
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FV-901DM Remote VFO	289	m
SP-107P Spkr/patch	49	v
FV-107 Remote VFO	99	me
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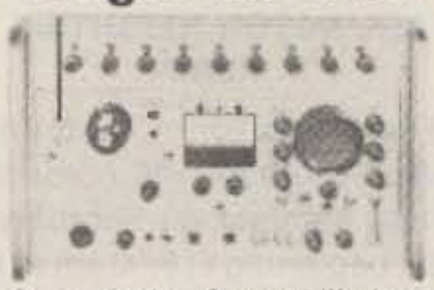

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DX BULLETIN OF THE MONTH

As we have mentioned in the past, it is extremely helpful to subscribe to one of the bulletins in order to be in touch with what is happening out there in the DX jungle. To show what one of the better DX bulletins looks like, let's take a look at *The DX Bulletin*.

It's a weekly publication edited and published by Jim Cain K1TN, a well-known DXer, contester, and "well-cooked" ham. *TDXB* provides fresh and up-to-date information about DX activity, happenings that relate to DXing and contests, notes on equipment and conventions, records of stuff worked on the bands, QSL information, and notes on propagation. All in all, it's a very well-written publication. The subscription rates are $26 per year for W, VE, and XE (others: $35). The address is 306 Vernon Ave, Vernon CT 06066.

Well, Merry Christmas and Happy New Year! May you work all the new ones you still need!

WELL-COOKED OR INSTANT HAM?

During my summer vacations, thanks to the lousy rainy weather, I had the pleasure to visit a bunch of really nice hams on Long Island (NY). Among other things, I also had an opportunity to lay my hands on a Signal One CX11. What a machine! It's very tempting and makes you feel like mortgaging your house to get one.

The main thing I would like to highlight is the people—true hams—whom I had the pleasure to meet. What is the big deal about this?

What we are witnessing today is an influx of new "instant" hams who are the products of ham colleges which have all kinds of instant miraculous ways to get you legally on the ham bands and talking as soon as you can. Let's have a look at this group. Typically, they are an outgrowth of the CB generation in which, to get on the radio, all you had to do was pay your bucks and get the best (most expensive) radio, big "shoes," and a tower. Typically, too, they got fed up with all the regulations and quickly found that there were more frequencies around than those they were "forced" to be on. So here comes the vfo and 1- or even 10-kW amplifier. They start using their "freedom of speech" all over the bands, including commercial and amateur. They usually talk about nothing—and they can do that for quite a while.

Then comes the discovery that there are hams who can use vfo's and kilowatts legally and that things are more decent on the ham bands. You don't hear so many carriers. They get interested and some of them simply retune their rigs down there, pick a callsign, and you know the rest. Some go and take courses, "suffer" through the "nonsense," and finally manage to get their tickets. You can tell them from the crowd if you listen in the pileups: they usually call for five minutes without stopping.

Our compliments to those CBers who are basically law-abiding, got fed up with the mess around 27 MHz and then got genuinely interested in ham radio. They got their licenses and tried to learn as much as they could. They discovered a whole new world and enjoy learning more about all the aspects of radio communication: equipment, antennas, propagation, etc. They are a welcome contribution to the hobby.

If we look back a few years, when CB wasn't around, the situation was different. You usually started as an SWL or by seeing another ham's station. The process involved not only talking on the bands, but also a great amount of interest and activity in designing, building, and experimenting with equipment.

The DX Bulletin

ISSUE 108 SEPTEMBER 19, 1981

PROPAGATION: Sep 19, Below Normal; Sep 20, Low Normal; Sep 21, High/Low Normal; Sep 22, High/Above Normal; Sep 23, High/Low Normal; Sep 24, High Normal; Sep 25, High/Low Normal; Sep 26, 27, High Normal; Sep 28, High/Above Normal; Sep 29, High/Low Normal; Sep 30, High/Above Normal; Oct 1, High Normal; Oct 2, High/Low Normal; Oct 3, High Normal; Oct 4, 5, Above Normal. TNX N4XX.

A PIN DROPPED...

And you could hear it on 14225 last Saturday (Sep 12), even though it seemed the whole world was listening. "W7PHO, this is K7LAY/BY Shanghai, you're five by nine."

K7LAY/BY was a demonstration station in Shanghai by Bob Hudson and other members of the Boeing radio club; they were set up mainly to work a Chinese station in Bejing, which was signing "CIE." That contact lasted ten minutes, followed by the pre-arranged schedule with W7PHO and two other stations, including a club station in Washington state and a station on a Marianas chain island. It seemed that hundreds of DXers had heard of the planned schedule over the air and awaited the call from Hudson and his loaned TR-7 from Drake.

While some informal authorization for the transmissions had been obtained, it was realized that these contacts would not be counting for anybody's DXCC; that was not the idea. The idea was to make a further breakthrough toward real Chinese amateur operations in the future. Apparently in that respect the operation was a success. The station could be heard all over the U.S.

K1CC in POLAND

Nich Assarabowski, just back from Poland, reports the convention he attended near the SP9KRT club site in southern Poland was a success, with several hundred hams in attendence despite the increasingly desperate situation there. At the same time, the convention of the Solidarity Union was being held at the other end of the country, on the Baltic Sea coast.

Rich made about 2,000 contacts himself as SO3CC, from the home of SP3DOI, and operated a little fm on 2 Meters (simplex only, no SP repeaters yet). Despite mostly homebrew radios and severeTVI problems, among Poland's 7,000 hams (out of some 35 million citizens) amateur radio is alive and well. Rich's slide presentation dispelled a notion common in Europe that U.S. DXers are very loud due to running "big power." After seeing some of the tall towers and multi-element arrays several of the local DXers were heard planning new towers and quad antennas. Poles are also now getting interested in using their new privileges on RTTY and SSTV.

W9DXCC CONVENTION

Convention chairman K9KM reports about 150 attendees last weekend for this long-running event, down about ten percent from previous years. Special mention was made of the presentations by Dick Ehrhorn, W6KTO, of Alpha amplifiers, and by Dana Atchley, W1CF, who spoke on antennas for 80 and 160 Meters.

The DX HOG OF THE YEAR crown was placed on the deserving head of Al De Marre, K9RF, who was also awarded a special trophy dubbed the "Repeater Usage Award." The HOG is a fun award going back to the very beginning of the W9DXCC Convention.

ARRL was represented ably by Don Search, W3AZD. While the meeting was marred by having only four representatives from Indiana (none from Indianapolis), Milwaukee looks like a growing DX hotspot, with many in attendance from that metropolitan area.

The DX Bulletin (ISSN 0279-8077) is published weekly for $26 per year in the U.S., Canada and Mexico; all others $35 per year. *The DX Bulletin* is published at 306 Vernon Ave., Vernon, CT 06066. Second-class postage paid at Vernon, CT. POSTMASTER: Send address changes to *The DX Bulletin*, 306 Vernon Ave., Vernon, CT 06066

----------THE DX BULLETIN SEPTEMBER 19, 1981----------

OE2VEL and OE1ETA have been very active on their Pacific operations, first /KH8 American Samoa, last week as ZK2TA Niue. They were slated to finish up there about Sep 15 and then operate from Tonga A35 or Tokelau ZM7 until the 21st. After that the last legs of the trip will include the Kiribatis and possibly Nauru. Their activity seems to have concentrated on CW and they have been workable easily on both 40 and 80 Meters.

DJ6SI started his African work on schedule from 5V7HL Sep 12 and was expected to appear from Volta as XT2AW Sep 16-18, then from the Camerouns TJ and finally his last two days Sep 21 and 22 from Gabon. He returns to Germany Sep 24. QSL to DK9KD for all.

Vince Thompson, K5VT, back in the States, says his 3V8VT operating was 20 Meters only due to antenna limitations, but he is hinting another stop in Tunisia may not be far off, and if so he will be prepared for all bands at that time.

Rumors concerning Albania now seem to center around KA8AK, who claims to have a license for ZA2HAM valid Dec 4-14 of this year. Other Spanish hams continue to be mentioned in connection with the effort.

Following their successful Juan de Nova operation, FR8FLO and FR7BP made a surprise appearance from Mayotte on their way home, signing FH8FLO; the operation seems to have run only a day or so.

A commemorative operation is planned from Hawaii's Pearl Harbor, to sign KH6SP Dec 4, 5, and 6.

2D8TC is up to his ears in alligators on 160 Meters...Tom, whose technique is to call stations he hears on their frequency on Top Band, finds that although East Coast U.S. stations are putting big signals into Ascension, they don't seem to hear him. Yet, when he does work someone he gets a good report. Perhaps those alligators have migrated down from 50 MHz; Tom also sez some big signals are coming out of the States on 6 Meters, and he has been able to work a few of them.

Re DXCC...it has been announced that ARRL's Headquarters Awards Committee will be setting a date (apparently a future rather than retroactive one) after which credit for single-mode awards will be given only for QSLs which clearly state "2-way QSO." As it takes several months for a formal announcement to appear in QST, a guess might be January 1, 1982 for the new rule.

That Bangladesh rumored for early this month may actually happen, but the dates are October 13-18, according to JA8CRE of the "JA8 DXGroup." They don't have a callsign yet. JH2NDK is the group leader, and will be accompanied by JA8MWU and several others, who will share operating chores on 80-10 Meters and possibly 50 MHz, CW and SSB.

Terry Baxter, N6CW, and friends will operate from Tortola, British Virgin Is, again this year for the CQ Phone Contest. This will be Terry's sixth straight effort from there (he is VP2VDH).

And St. Pierre will again be the destination of W8AH Oct 10-18, in the company of K8CJQ, W8NR, and WB8ZJY. They will be on 80-10 Meters, no lists.

In Issue 107 mention was made of the ARRL Roanoke Convention later this month, and of a slide show on the 1980 PJ2CC CQ WW Phone Contest operation. That multi-multi operation was the 1980 top score but not an all-time record. That honor still belongs to the 1979 VP2KC multi-multi. Sorry.

What has happened to YI1BGD and LU3ZY on South Sandwich? Anyone know? No reports of either of these stations in some time. Many still need.

160 Meters is already getting very good in anticipation of the Winter DX season; VK and ZL stations have been coming through to the East Coast U.S. around 0600Z. At the same time, 10 Meters, at the other end of the spectrum, continues its stumbling act toward autumn propagation. For example, last weekend in the Worked All Europe 'test, 10 was excellent the first day but on Sunday only USSR stations had decent signals.

And as K5RC observed in a recent issue of the National Contest Journal, 160 is going to be very interesting this year with KWs allowed; now we will see who was playing fair in the past and who wasn't!

A number of inventions were made and hams contributed greatly to the art of communications. Quite often seemingly impossible things were done. This is the true nature of amateur radio—experimenting. These people appreciate the privilege of being able to communicate around the world and want to preserve and not to destroy it. They are self-policing and stick to the rules, regulations, and ethics. They are always gentlemen. They are not afraid to experiment.

This spirit is still alive and I had the pleasure to experience it during my visits while I was down in W-land. The "Old Ham" has some sort of home-brewed antenna, a scrounged tower, and good equipment which is quite often modified commercial or home-brewed. He is keeping up to date with technology and that gives him the edge in the pileup: His receiver has better selectivity and his antenna gives him an extra dB or two. This is what makes the Old Ham: experience and equipment. He hates lists because they are degrading the whole idea of the DX sport—chasing and nailing the DX.

It is a pleasure to meet such a bunch, because you can talk about all the aspects of ham radio and share your experiences. Among others, my hosts included Bob K2US, who is experimenting with antennas and decided to try one of the VE3BMV razor beams; Gary K2UU, who enjoys working on antennas, working DX and contests, and is involved with the big multi-multi station of K2GL (better known as N2AA); Ovie N2AJ, who is more technically-oriented; and Jack W2LZX, president of the LIDX Club and an old DX tiger. You can see that they can get excellent stations going by using their skills and experience when there is a lack of funds. In DXing, you can make up for the deficiencies in finances either by spending a little more time or by building and modifying equipment. A number of remarkable installations are around which rival some commercial radio stations. People such as K2GL, W2HCW, W2PV, K0RF, AB0I, and N5AU, to name a few, have stations which show a lot of work, love, and persistence. It is a sheer pleasure to talk to people like them. Because they love their hobby, these "well-cooked" hams work at it and enjoy it.

CHINA BREAKTHROUGH

The Boeing Employees Amateur Radio Society (BEARS) delegation arrived in the People's Republic of China on September 4, 1981, and departed on September 12. We were the first official international amateur radio delegation to visit China in more than 32 years. Our host was the Chinese Institute of Electronics, a branch of the 4th Ministry of Machine Building. The delegation members consisted of Pat West W7EA, Henry Oman K7HO, Bob Hudson K7LAY, and Bill Showers KC7CF.

Sponsors included Boeing and the Western Washington DX Club. Contributors to our expedition included the R.L. Drake Company, which supplied two complete TR7 stations, Telex/Hy-Gain, which supplied two dipole antennas, and the ARRL, which supplied a copy of the film "Wide World of Amateur Radio" and a few books.

Our delegation prepared and presented a four-hour slide presentation covering amateur radio in the USA. This presentation was made in each of the cities that we visited.

Although we did not expect to operate, we were permitted to set up a demonstration station in Beijing and communicate with our home city, Seattle. This historic event occurred at about ten pm, Beijing time, on September 6th. Our contact in Seattle, representing our two clubs, was W7PHO and our callsign in Beijing, also representing our two clubs, was K7LAY. We are very sorry that we could not talk to more stations.

The Chinese advised us that our transmissions were the first authorized amateur radio communication demonstration in more than 32 years—truly an historic event. This contact signifies the increasing friendship between our two nations.

A second historic event occurred on September 9th. With the assistance of our delegation in Shanghai, the Chinese in Beijing installed a Drake TR7 station and the Chinese in Shanghai also installed a Drake TR7 station. Successful communications were established between Beijing and Shanghai by Chinese operators, again for the first time in more than 32 years.

The operator in Beijing was Chen Ren-Mo, and the operator in Shanghai was Hsu Y.C. Mr.

----------THE DX BULLETIN SEPTEMBER 19, 1981----------

BANDPASS

AP2HB 14212 01E 11
A22GW 28530 16E 7
A22BX 28534 16E 7
A35JL 14285 07E 13
A71AA 14220 14C 7
A71AD 21280 18E 9
A71AD 28620 12E 13
A9XDO 28535 16E 12
BV2B 14215 11E 9
BV2A 14012 12W 9

CN2AQ 14040 06W 9
CN8EA 21313 23E 10
CO5DM 14022 02E 9
CR9AN 28576 14E 8
CT2AR 3790 07W 6
D4CBC 28608 16E 7
D4CBC 14210 02E 12
EA9JV 21015 22E 10
EI7CB 7005 07W 6
EL2F 14011 23E 10

EP2TY 28590 13E 10
FR0CO 14015 12C 6
FK8CE 14045 11C 7
FK8DR 14210 10E 11
FO8DF 14026 13C 6
FR0AD 14003 11E 11
FR0GGL 21035 20C 11
FW0BE 7010 10E 15
HF0POL 14010 03E 10
HK0BKX 28010 15C 7

HK0BKX 14010 12W 9
HK0BKX 3505 03E 10
HL1CX 7010 11W 7
HL9IJ 21026 23C 8
HL1IJ 21027 01E 9
VK3SJ 21300 18C 8
HZ1AB 21025 21C 10
HZ1AB 14215 04E 10
JX5VAA 14245 03C 7
JX5VAA 21295 20E 9

JY9RV 28537 18C 7
J28CI 21035 18C 9
AH2L 7007 10W 5
AH2L 28720 22C 6
AH2L 14015 12E 7
AH3AA 21040 06W 8
AH8AA 14240 10E 12
KH3AB 28015 00E 8
KH0AC 21345 00E 7
KS4DV 14220 09E 9

N6NR/KX6 28530 22E 10
OD5QR 21286 22C 6
OD5LX 14030 02E 9
EI4EJ/OD5 14224 23E 10
OD5LX 14003 02E 11
OY9R 21315 20E 9
P29EJ 14007 12E 7
P29DI 14212 09E 8
DF9FM/ST3 28016 19E 5
SV0BP 14210 04E 10

KA1NZS/SV9 21275 19E 10
S79MC 21285 18E 6
TA1MD 14206 00E 7
TA2KS 14235 22E 8
TA1MB 14010 00E 10
TF3YH 21025 16C 7
TF3YH 21300 17E 10
TL8WH 28560 21C 7
TL8JM 28557 00C 8
TU2JJ 14202 05W 6

TU2DP 28600 15C 6
TU2HJ 14210 03E 7
TU2HJ 28600 10E 10
T30AT 14020 06W 9
T30DB 14265 07E 11
T5TI 21300 20E 5
T5TI 21290 19E 6
T5TI 21290 20E 9
UM8MAX 14020 01C 10
UK1PGO 21018 13C 7

UK1PGO 21290 15E 7
UA1PAM 14030 06W 9
UK1PGO 14025 05W 9
VK2AGT 14217 13C 5
VK2AGT 14220 13E 8
VK2AGT 14210 12E 13
VK9XG 14270 12E 13
VP8AEN 14202 09C 6
(S. Georgia)
VP8AEN 14255 10E 11

VP8QP 21327 00E 7
(Falklands)
VR6TC 21350 01E 9
VS6CT 21340 01C 6
ZK9A 14225 15C 7
XZ9A 21275 17C 7
XZ5A 14222 12E 8
YC3BEX 21270 16E 10
YJ8BG 14235 10E 10
YJ8BG 14225 07E 13

HB9ASJ/ZB2 7013 04C 7
ZE1BG 21290 20E 11
ZK1CG 14225 10E 5
ZK1CG 28530 23C 6
ZK1CG 14210 10E 14
ZK2TA 7005 10E 15
3A2GL 21325 22C 7
3B8DB 14025 12C 7
3B9DA 14020 12C 10
3B8AE/3B9 14204 03E 11

3D6BE 14211 14C 7
3D6AX 14008 13E 7
4S7MX 14220 12E 8
4S7EC 14010 12E 11
4U1UN 28650 14E 13
4Z4DX 3501 03E 10
4Z4DX 7005 02E 10
5N0KUY 21280 22C 7
5V7HL 14025 02C 12
5W1DO 21295 04E 9

5Z4KL 21272 11E 11
KA1CFQ/6W8 28570 18E 7
7Q7LW 21290 19C 8
7Q7LW 21280 20E 10
7X5AB 28594 13E 7
8Q7AV 14215 11E 8
KA3BUJ/8R1 7068 04C 7
KA3BUJ/8R1 21025 11C 11
9J2BO 14030 13E 11
9K2DR 28530 11E 13

9L1CA 28540 15E 7
9M2GD 14215 14E 7
9M2CW 14208 11E 9
9M2MN 14250 11E 10
9M2DGD 14215 11E 13
9M2DGD 21276 12E 13
9M8PW 7003 12W 11
9Q5FL 28620 15E 5
9Q5FL 28620 17C 7
9V1TL 28027 11C 4

9V1QQ 14220 11E 5
9V1TL 14034 10E 10
9V1OY 14225 11E 13
9X5WP 21405 19C 7
9X5DR 14210 23E 10

W1, W2, W3: mail your reports by Saturday.

All others: mail your reports by Friday.

TUNE: 203-871-6251

----------THE DX BULLETIN SEPTEMBER 19, 1981----------

Convention	DXPO 81	Atlanta, Sep 19/20; I 103, 104, 107	CONTRIBUTORS
Tonga or Niue		Sep 15-21 by OE ops; I 107, 108	
Kiribati or Nauru		Sep 22-30 by OE ops; I 107, 108	W1DQH, K1RM, W0VX, KA1KD,
Belize	VP1	Pfx change Sep 21; I 107	W4VQ, KE1F, KA1LY, KA3R,
Jersey	GJ5	Sep 19-25 by German ops	WB3CC, WA1TPR, W3ODJ,
			K9MM, K9KM, K6IR, WA4YZF,
Cayman Is	ZF2CZ/DQ	Thru Sep 25 by WA3e UFI, IZH	W5DV, NG4E, WD5AAM, W7YF,
Bermuda	K1EFI/VP9	Sep 24-Oct 5, 80-10 CW/SSB	W1VV, KB1F, W0YBV, NE8KB,
Convention	ARRL	Roanoke, Sep 26/27; I 107	KF4BQF, WB0QQV, VE1BNN,
Juan Fernandez	WB1GDQ/CE0	End of Sep; I 105, 107	WA7OBH, WA2FHA, AD8J,
Deadline	DXCC	For annual list, Sept 30	W0BW, WB8ZRL, WA1JGK,
			W8GZX, W5ODD, W2HAZ, KE1NI,
San Felix	CE0X	By WB1GDQ group first of Oct	W8AH, N6CW, KH6BZF, JA5CRE,
Kiribati	T3	Again possible by OE ops; I 107, 108	KA3CHS, KF8K, KB2CV, K1CC,
Laccadives	VU7	Rumors fading for an October op'n	N4XY, K1BV, KH6BZF, N4NW,
Convention	Houston	Oct 2-4; I 103	W3FU, Maleb Snorkle.
Convention	ARRL	Midwest, Salina, KS, Oct 3/4; I 107	
			THANK YOU!
Bangladesh	S2	By JAs, Oct 13-18; I 108	
St Pierre	FP0	By WB4H group Oct 10-18	
Crozet	FB8WG	Rumored for Nov; I 106	

QSL ROUTES (CALL/MANAGER)

A22YV/JA2KLT	FR7BP/J/FR0FLO	KM6BI/W5RU	TR8GDG/W5RU	ZD8IC/N2CW
A22ZM/ZS6CU	FR7CE/DF2OU	KP2A/AF2C	TU4BA/W2TK	ZD8VO/K4VO
A6XJA/PA0LP	FW0BE/DJ9ZB	KP4A/DJ9ZB	TYA11/W4FRU	ZF2AV/WB0ISW
A71AD/A7XD	HB0ALO/HB9ALO	KP4AM/W7PHO	T30AT/G3XZF	ZF2DZ/WB3GPR
A9XDO/KA4S	HB0AQW/HB9AQW	KP4ID/KP4AM	T30DB/G8LGB	ZF2FF/WB3JWJ
CE0AA/CE3AA	HC8KA/HC5KA	KR6AY/K0VXU	T5TI/10SSW	ZK1BD/ZL1SZ
CE0AC/CE3YY	HF0POL/SP5EKZ	KX6LO/KX6BU	UK1PGO/UK3SAB	ZK2TA/OE2DYL
CK9JA/JA1UT	HH0N/WD4JNS	KP4A/W3HNK	VE1AWS/W3HNK	ZP5KJA/JA1ODP
CS0CJC/CT4SU	HL9FR/WB9RGA	W1DV/WA2RKK	VE6SI/VE3PET	ZS5SP/WD4IHV
C31LM/EA3BDW	HM1FW/W3GNM	W4MAT/DJ0UN	VP2LGR/W5RU	3B8AE/3B8CF
C31NM/PA0GIN	HP1XEK/DL1HH	WD4CEM/W5RU	VP2MIX/W0IJN	3C1NM/EA1QF
C31TE/EA3VM	H5AK/WB2ULI	WH4AAA/W5RU	VP2M00U/AA7O	3V8VT/K5VT
C31UM/EA3BUM	JW6MY/LA6MY	WD5FTP/WB5ZAM	VP2M0K/KL7IHP	3X1Z/W4FRU
C5ACC/W4MGN	JW7XB/LA7XB	WB0ICS/WB6FBN	VP2VJ/VE3MJ	4N1R/YU1DZ
C5ACO/W2TK	JW0BS/LA0BS	OD5RZ/VE5QY	VP5FF/WB4OSN	4S7MX/SM3CXS
C5AR/G3LQP	JX5VAA/LA7JO	OE1ETA/OE2DYL	VP8AJL/GM3ITN	424AB/K3STM
DL2VK/DF9FM	JY9RV/GW3RVG	OE2VEL/OE2DYL	VQ9JJ/W5RU	5B4KU/SM5ASE
EA8RV/K5MHZ	J3AH/W2GHK	OH0AM/OH2BH	VQ9PD/W1HSP	5R8AL/JA2KLT
EL2F/WD9DUF	J6LCV/WD4NBX	OH0BA/OH2BAZ	VQ9QA/N3QA	5T5DX/W2TK
EL5G/K3RB	J87BK/WBPSD	OY8KH/W5RU	VS5MF/N2OO	5T5ZZ/W4FRU
F0AHY/FC/DL4FF	J87BT/WBPSD	SM2ALH/SM2DLZ	VS6CT/KB9N	5W1DG/VK9NS
FB8YH/F3KH	J87RS/8BBKF	SO3CC/K1CC	VU2DDE/W5RU	5W1DK/VK9NS
FC0GQQ/DJ6ZB	J87WW/WBWW	ST0AS/DK2OC	VU2KM/N7UT	5W1DO/OE2DYL
FG7TD/W5RU	J88AG/N0AFW	SV0AA/5/DJ0UN	XE2GDD/KN5H	5Z4NQ/WD9CIV
FK8CE/K2ROR	J88AQ/W2MIQ	S79MC/AK3F	YB8AEG/WA2JOC	6W8JO/W2TK
FK8CL/DJ9ZB	AH4AA/W5RU	S9VCT/K5VT	YB9AAT/W7KQH	7P8BZ/K5VT
FK8DH/DJ9ZB	AH8AA/W4FGX	TA7MM/TA1KD	YB9VA/W5GZI	8P6OR/K5MHZ
FK8DJ/DJ9ZB	KA2MZS/WB5WLH	TJ1BB/AF4B	YB0ACP/K6DLV	9J2JN/KB2ZP
FM0EOM/F2VT	KA3BUJ/WB4ABK	TL8CN/W5RU	YC1GJ/W2GBX	9N1BMK/JH3LPT
FO8HH/KA3A	K5VKX/W3YY	TL8JM/W5RU	YJ8VV/ZL1VV	9Q5FL/K4AEB
FO0FB/WB6GFJ	KH3AB/KB7MO	TL8WH/W5RU	YO0WUG/YO3AC	9Q5L/K3FN
FO0NP/OH2NP	KH6LW/KH6JEB	TR8AC/W5RU	YV1DQU/WA1RDI	9U5WR/SP6FEH
				9V1UZ/N2JA

Hsu was licensed many years ago as XU8CH and C1CH.

Although propagation was not good between the cities, communications were established about 10:45 pm on September 9th. The station in Beijing used the callsign CIE and the one in Shanghai used K7LAY. Both stations were heard in many countries with strong signals. The Chinese asked us to tell the world that their top government leaders are solidly behind amateur radio, and that before too long, China expects to establish many friends throughout the world through the medium of amateur radio.

Our delegation was overwhelmed by the reception we received in China and very honored to be the first official amateur radio delegation to China and to demonstrate amateur radio. In China, we met many old-timers and our meetings with them were precious events in all our lives.

We are very appreciative of our host in China, The China Institute of Electronics, and also the China National Radio Sport Commission and the Shanghai Institute of Electronics.

Editor's Note: This report is based on a press release from the US delegation, filed on September 12 in Hong Kong. *73* hopes to be able to report more details on the China breakthrough in the months to come.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

I've lost track of the number of times we've asked everyone to send in their information as early as possible, but I thought I'd better do it one more time. At least three or four contest announcements were received too late for the last issue. Some came as late as four weeks past deadline. Just to show you what kind of lead time is involved, the material for this issue had to be in my hands no later than September 20th. To be safe, it should be sent directly to my home address and not through the magazine as that only tends to slow things up. It might be several weeks before mail is forwarded to me from Peterborough. If material is coming from overseas, send it as early as possible and use air mail to avoid delays. In all cases, try to get the information in as early as possible.

In the results department... W1CCN finished third while K2SX finished fifth on CW during the 1981 RSGB 7-MHz Contest. They were the only USA amateurs listed in the official results. Maybe we can do a little better in '82.

QSL OF THE MONTH

Bright, eye-catching color and humorous graphics made K5ZOO's card this month's winner.

If you would like to enter the contest, put your QSL in an envelope and mail it along with your choice of a book from *73's* Radio Bookshop to *73 Magazine*, Pine Street, Peterborough NH 03458. Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does occasionally damage cards) and do not specify book choice will not be considered. Each month we consider a new set of entries, so you may want to resubmit your card in another month.

CONNECTICUT QSO PARTY

Starts: 2000 GMT December 5
Ends: 0200 GMT December 7
Rest period: 0500 to 1200 GMT December 6

Sponsored by the Candlewood Amateur Radio Association (CARA). Phone and CW are considered to be the same contest. Stations may be worked once on each band and each mode.

EXCHANGE:

Send QSO number, RS(T), and ARRL section or Connecticut county.

SCORING:

Out-of-state stations multiply total QSOs by the number of Connecticut counties worked (8 maximum). Connecticut stations multiply total QSOs by the sum of ARRL stations and provinces. Additional DX contacts count for QSO points, but only one DX multiplier overall is allowed. W1QI, the club station, will be operating CW on the odd hours and SSB on the even hours and counts as 5 points on each band and mode. Novice contacts count as 2 points each and OSCAR contacts count 3 points each.

FREQUENCIES:

CW—40 kHz up from the bottom of each band; SSB—3927, 7250, 14295, 21370, 28540; Novice—3725, 7125, 21125, 28125.

ENTRIES & AWARDS:

A Worked All Connecticut Counties certificate will be awarded to each station working all Connecticut counties. Other awards given as usual, minimum of 5 QSO points! Logs must show category, date/time (GMT), stations, numbers,

The Scuttlebutt

yankee clipper contest club

NEWSLETTER CONTEST WINNER

This month, we salute the Yankee Clipper Contest Club (YCCC) and its publication, *The Scuttlebutt.* Despite the limitations of a small budget, editor K1GQ produces a good-looking, information-packed, 10-page newsletter each month. What's the secret of this low-cost success?

For starters, the editor leaves no stone unturned in his quest for club members with connections necessary to get *The Scuttlebutt* printed at the lowest possible cost . . . sometimes for free! Occasionally, he cajoles a local firm involved in the ham business to pick up the tab, in exchange for a page of advertising.

Typesetting for *The Scuttlebutt* is a volunteer effort, contributed by club members with access to the required equipment. Mailing labels are similarly handled by a member who keeps the YCCC membership list on the computer in his office.

The editorial content of the newsletter is a cooperative effort, too, with many club members helping out. The editor doesn't try to write the whole thing.

The lesson to be drawn from *The Scuttlebutt* is that there are numerous untapped resources both within your club and within your community. Editors on a budget (aren't we all?) must seek out these hidden assets. Quality on a shoestring—it *can* be done!

Proud of your club's newsletter? Send it to: Newsletter Contest, *73 Magazine*, Peterborough NH 03458.—WB8BTH.

bands, QSO points, and claimed scores. Enclose a large SASE for results. Logs must be postmarked by January 2nd and sent to: Steve Grouse KA1ECL, 3 Queens Court, Danbury CT 06810.

G-QRP-CLUB WINTER SPORTS

Daily from 0900 to 2300 GMT December 26 to December 31

All amateur radio operators interested in QRP are invited to take part in the club's activity. No special exchange information was mentioned in the information provided by the club. The operating schedule for each day is as follows:

- 3560 kHz—1200-1300, 1400-1500, 2100-2200 GMT.
- 7030 kHz—1100-1200, 1300-1400, 2000-2100 GMT.
- 14060 kHz—0900-1000, 1730-2000, 2200-2300 GMT.
- 21060/28060 kHz—1000-1100, 1500-1730 GMT.

Reports on the Winter Sports Activity should be sent to Gus Taylor G8PG, 37 Pickerill Road, Greasby, Wirral, Merseyside L49 3ND, England.

CANADA CONTEST

Starts: 0000 GMT December 27
Ends: 2359 GMT December 27

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs. Use all bands from 160 to 2 meters, CW and phone combined, and everybody works everybody. Classes of entry include: single operator, all band; single operator, single band; and multi-operator, single transmitter, all band. All contacts with amateur stations are valid. The same station may be worked twice on each band, once on CW and once on phone. No crossmode contacts and no CW contacts in the phone bands allowed.

EXCHANGE:

Signal report and consecutive serial number starting with 001. VE1 stations will also send their province (NS, NB, PEI).

SCORING:

Ten points for each contact with Canada, 1 point for each

CALENDAR

Dec 5-7	Connecticut QSO Party
Dec 26-31	G-QRP-Club Winter Sports
Dec 27	CARF Canada Contest
Jan 1	ARRL Straight Key Night
Jan 2-4	Zero District QSO Party
Jan 9-10	*73*'s 40- and 80-Meter Phone Contest
Jan 16-17	*73*'s International 160-Meter Phone Contest
Jan 16-17	International SSTV Contest
Jan 30-Feb 7	ARRL Novice Roundup
Feb 6-7	RSGB 7-MHz Contest—Phone
Feb 20-21	ARRL DX Contest—CW
Feb 27-28	RSGB 7-MHz Contest—CW
Mar 6-7	ARRL DX Contest—Phone
Jun 12-13	ARRL VHF QSO Party
Jun 26-27	ARRL Field Day
Jul 10-11	IARU Radiosport
Aug 7-8	ARRL UHF Contest
Sep 11-12	ARRL VHF QSO Party

RESULTS

RESULTS OF THE 1980 CANADA CONTEST

Class	Call	Score	QSOs	Points	Mult.
A	VE5DX	773,740	1194	7034	110
A	VE3GCO	299,390	549	3290	91
A	VE7SK	263,283	360	2831	93
A	VE2DZE	203,662	351	2578	79
A	VE7CMK	172,317	436	2427	71
MS	VE7WJ	600,516	602	4716	126
MS	VE7CNY	341,972	691	3638	94
MS	VE6ANC	251,251	397	3263	77
MS	DA2CF	31,220	185	1561	20
50	JR3SQZ	0	7	7	0
28	VE6CKW	39,160	294	1780	22
28	VE7CXC	35,000	463	1750	20
28	VE4VV	26,576	351	1208	22
28	WA5QBO	23,380	183	1670	14
28	VE6BFN	20,010	280	1334	15
21	DF1EI	1,000	20	200	5
21	JA6OKB	654	28	109	6
21	VE3KOY	705	42	141	5
21	JH0CXS	20	2	20	1
14	VE3DIJ	8,100	79	540	15
14	VE4YF	3,720	38	372	10
14	KL7JHD	3,240	360	540	6
14	KA2EPS	3,152	79	394	8
14	EA7AKQ	512	20	128	4
7	VE7BS	8,932	107	638	14
7	JL1CGL	64	14	32	2
3.5	VE2JV	8,000	78	800	10
3.5	KA8FAL	2,317	51	331	7
3.5	WA0DEL	1,872	35	234	8
3.5	VE3LXL	212	15	106	2

contact with others. Ten bonus points for each contact with any CARF official station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band and mode (12 provinces/territories × 8 bands × 2 modes for a maximum of 192 possible multipliers).

FREQUENCIES (as applicable):

Phone—1810, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50100, 146520; CW—1810, 3525, 7025, 14025, 21025, 28025, 50100, 144100. Suggest phone on the even hours (GMT), CW on the odd hours (GMT).

AWARDS:

The CARF Canada Contest Trophy will be awarded to the highest scoring single operator entry. Certificates will be awarded to the highest score in each entry class in each province/territory, USA call area, and DX country, and to the highest score from those who have only their amateur certificates.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, and a summary sheet showing a chart of multipliers per band/mode and score calculation. Send your entry with comments to: Canadian Amateur Radio Federation, PO Box 2172, Station D, Ottawa, Ontario, Canada K1P 5W4, postmarked within one month of the end of the contest. Results will be published in *TCA*, the Canadian amateur magazine. Nonmembers may include an SASE for a copy of the results.

ZERO DISTRICT QSO PARTY

Starts: 2000 GMT January 2
Ends: 0200 GMT January 4

Organized by the Mississippi Valley Radio Club. Stations outside of Zero District will work Zero stations only. Zeros may work any station. The same station may be worked once on each band and each mode. However, stations in the special mobile class may be worked each time they change counties.

EXCHANGE:

RS(T) and ARRL section. Zero District stations must also send county.

FREQUENCIES:

3560, 3900, 3725, 7060, 7270, 7125, 14060, 14300, 21125, 21060, 21370, 28125, 28060, 28570.

SCORING:

Add the number of Zero District ARRL sections worked plus the number of Zero District counties, then multiply by the number of contacts. Zeros score by adding ARRL sections, Zero District counties, and DXCC countries worked and then multiplying by total contacts.

ENTRIES & AWARDS:

Certificates will be issued to all entrants who submit a log and SASE. Endorsements will be given for high score in each ARRL section, DX country, Novice/Technician class, and Special Mobile class. Mail logs by February 15th to W0SI, 3518 W. Columbia, Davenport IA 52804. Include an SASE for log forms or results.

HAM HELP

I need an i-f transformer for a Hammarlund HQ-170 receiver. It is designated T1 on the schematic, and is Hammarlund part #K26402-1. It is a combination 455-kHz and 3035-kHz transformer that needs an exact replacement. I will gladly pay a reasonable price for a suitable transformer.

David Hansen KB6FI
7484 Tustin Road
Salinas CA 93907

Information and/or schematics wanted for conversion of Drake L-75 linear to 10 meters. Will defray all costs involved.

E.V. Schoonmaker N5CGE
792-A Fairview Avenue
Annapolis MD 21403

Wanted: work in Knoxville or Chattanooga, Tennessee, area. First class radiotelephone and Extra class license.

H.F. Schnur
115 Intercept Ave.
North Charleston SC 29405

I am in need of the following items: (1) manual/schematic for Hallicrafters HT32B; (2) a main power transformer for the HT32B (please state price), and (3) a manual or schematic for the Globe Electronics Hi-Bander VHF-62 transmitter.

I will pay for postage and copying costs.

Richard E. Duell W9LSD
4415 N. Florence Dr.
McHenry IL 60050

I am trying to locate an instruction manual and schematic diagram for a Model Memo 512 keyer made by K. E. Electronics.

I will pay for copy or copy and return original.

William Hartley K2RDS
1201 Paul Ave.
Schenectady NY 12306

I am in need of a Centralab switch, #PA-076. I'll be glad to pay for it.

Don Ramey WA4FQC
Box 217
Meridianville AL 35759

I need an antenna relay for the Hammarlund HX-50 transmitter. Also, information about any source for Hammarlund parts will be appreciated.

Arnold Irvine KA0ELN
5 Drumcliffe Drive
Warren PA 16365

Please: I need the manual for a Peirson KE-93 receiver and an Elmac AF-67 transmitter. I will copy and return and pay mailing costs.

Robert F. Voelker WA2PCL
101-23 Lefferts Blvd.
Richmond Hill NY 11419

I am looking for a UA1LO QSL card from before 1968 for my astronaut autograph collection. (UA1LO was Yuri Gagarin, the first man in space.) Thank you.

Mike Smithwick AA6XI
25215 La Loma Drive
Los Altos Hills CA 94022

I am looking for a book or information on a 2-meter rig, the Setec-Elect FRT-203. It's an 8-channel rig and I have no idea who made it.

F. Whittier WB1CXX
RFD #1, Box 390
Madison ME 04950

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

development. In the past I've found older amateurs are generally resistant to new ideas and really hate to have to read about them. But after a while, though I lose readers in the process, interest does come and finally the other amateur publications reluctantly join me in publishing information on the new technology. It worked this way with sideband, with transistors, with ICs, and with FM, so we'll probably see the same pattern.

There are, obviously, far more benefits than just a wonderful emergency communications system which can come from this step ahead. If we are successful in establishing a system for getting the growth of amateur radio that we really need...and that will be on the order of 33% per year, not 3%...we are going to have to develop much more efficient communications modes. Anyone listening to the high end of twenty-meter phone any evening has to realize that new techniques are already needed... seriously needed. With high-speed ASCII communications, we could easily accommodate a thousand stations where we now have one and we could have room for the two million hams we should have right now and the three million we want to have by 1990.

This is a reasonable answer, too, for using the narrow bands available on our ham satellites.

If we develop the encoding techniques I discussed at the last NIAC meeting, our information exchange would immediately go from 8500 words per minute to about 26,000! All this would be done via a simple integrated circuit chip which would encode the 32,000 most used words before sending them...and then decode them upon reception. Further, the output could be in *any* language, allowing amateurs anywhere in the world to communicate with each other, regardless of their spoken language. Again, nothing has to be invented. We just have to write the computer programs to accomplish this and perfect our equipment, techniques, and protocols.

A word of warning, if I may. If we are going to turn around the disaster which has brought us to technological defeat at the hands of the Japanese, we are going to have to do more than nod our heads and adjourn until the next scheduled NIAC meeting. If we are going to be able to provide anything of any great value in the way of emergency communications ...if we are going to develop the systems which I have outlined...we need to really activate NIAC, using its communications with the FCC to bring this situation to the attention of the White House.

By the way, speaking of satellite communications: If we were to dedicate one channel of a satellite to a calling frequency, it would, using 9600 baud, be able to handle 216,000 different calls per hour for us, with each call consisting of the callsign of the station called and the calling station.

In terms of emergencies, tests have already been made which show that we can use relatively low-powered emergency transmitters, and by measuring the signals received through a ham satellite, it is possible to determine the location of the transmitter to a surprising degree. Digitizing and automating this service would provide an emergency locating system which would be simple and inexpensive and work anywhere in the world...whether it be used to locate a raft floating in the Pacific Ocean or someone lost in the jungles of Sumatra. It is the digitizing and automation which bring this emergency service to anyone who needs it.

So here we are, on the brink of yet another revolution in communications. Will this be brought about by amateurs or must we wait for commercial and military systems to do what we could develop? A good part of the answer for that lies, in my estimation, in whether we as a group will be able to start some action with the FCC and with our government which will result in a sudden and spectacular growth of amateur radio.

Most of you who are here today have made long trips and have to leave your businesses. You've carried the expense of this yourselves. Now, while it is obviously an honor to be a member of a government advisory committee, it is an empty honor...worthy of no more than a line in a *Who's Who* biography which will be read by few...unless we are able to actually accomplish something.

As the *only* official interface between the amateur radio community and the FCC, we have a responsibility to our fellow amateurs to speak up for them. As the group which I feel must shoulder most of the responsibility for the loss of our country's technological leadership of the world, we should speak up for radio amateurs and do our best to see that the FCC provides the incentive for amateur radio to grow again. We have to remember that even if we are able to spark a combination of events which gets amateur radio into a growth pattern which is three times our past highest growth, it will still take us at least ten years to catch up with the catastrophic losses we have suffered over the last 18 years.

I believe that the FCC commissioners will be interested in this situation and be responsive to our leadership, if we can provide it...and that, at the root of it, is the real purpose of this committee.

I suggest that we need more than an occasional meeting and minutes, more even than a report and recommendation. I suggest that we appoint an action committee to work with the FCC to develop both White House interest and the rules changes which might contribute to the goals we have in mind.

Since my business is growing at an ever-increasing rate, now numbering eight monthly publications plus a software publishing division, and with five more monthly publications in prospect, plus the opening of at least three more major divisions of the company, my own time is severely limited. I would be happy to serve as a member of an action committee, but I would not be able to provide the leadership and time that a chairman should devote to such a committee. Between my ham interests and my computer interests, I spend a good deal of time traveling. Last month I managed to get on the air for a short while as W2NSD/3D6, W2NSD/ZS, and as 7P8CA, all while setting up South American and South African editions of one of my computer magazines.

I did manage, just before leaving for Africa...and just after a trip to California setting up three prospective new publications...to visit with FCC Chairman Fowler and discuss briefly some of the ideas which I have just covered. I found him most enthusiastic and cooperative...so I believe that if NIAC will appoint a subcommittee, an action subcommittee, we will be able to more than be rewarded for our time and money spent as members of NIAC.

The job of such a committee and of the FCC is not an easy one. The polls of amateurs have shown clearly the strong feelings for maintaining the Morse-code requirement. Yet when one talks to people interested in becoming radio amateurs, this is always the major obstacle. Indeed, between the wealth of destructive code teaching systems now available and the ability of even the best of us to put off an unpleasant job if at all possible, it is a wonder that we have even maintained our present membership.

As I have mentioned in the past before this committee, I think I have heard every argument, both pro and con, on the subject of the code requirement for our amateur licenses. It is my belief, after giving consideration to all of these arguments, that we should have a technical license exam, not one measuring a skill. I see not even the remotest connection between a skill of copying code and being a good amateur. Despite the attempts of the plain language proposals, I tend to define a good amateur as one who is pursuing any or all of the four major reasons set out in our rules, 97.1, for the existence of the service.

It is increasingly difficult to remain blind to the success of the Japanese amateur radio system and I think we should put aside our "not invented here" emotions and take advantage of an innovation which has obviously worked. Just as American industry is taking the Japanese Type-Z management system seriously and finding that this brings about remarkable increases in productivity for their firms ...and a sudden drop in people changing jobs...we should look pragmatically at the Japanese no-code license system as a possible solution to our problems.

There will, I am sure, be resistance from older amateurs. I would be surprised if one or more of the ham magazines did not rush to take political advantage of the situation. But if we insist on trying to follow the system of doing only what the majority wants, we will have a technology as innovative as our television programs. This is a time for leaders... leaders with confidence. We have a good example of this in our Administration, which has not been afraid to push against the tide toward goals it sees as important in the long run. I am hoping that NIAC will form an action committee which can do likewise for the benefit of amateur radio and our country.

Despite my plea not to be made chairman of a committee to tackle the problem, the new chairman of NIAC, Charlie Dunn K7RMG, immediately established an Action Committee and made me chairman. I was serious about already having enough to do and was not pulling the old briarpatch tears. Well, okay, I'm chairman of a committee, and I'll do the best I can to get it organized and into action.

The goal of the Action Committee is to work with the FCC to establish a growth of amateur radio such as we have never seen before. I feel, as I said in my report, that we should aim at no less than a 33% growth per year and keep that up for a least ten years.

Another task of the committee is to work with the FCC to set up some system whereby amateurs can experiment and develop new modes of communications such as digital high-speed interactive networks as cited in my report.

Obviously, we have our hands full, so it is going to take a lot of work and cooperation with this committee...which consists of Dorhoffer of *CQ*, Imlay of *QST*, Curtis (who publishes books in the computer field), Harold Todd W7ZXM from Seattle, and me as chairman.

If you have spent any time mixing with would-be hams, you know as well as I that our Morse-code requirement is probably the major single obstacle which has been keeping down our growth. Yes, I know that most old-time amateurs are fiercely adamant about keeping the code test. But as I mentioned in my report, it has been years since I have heard a new argument on the subject and the balance, as far as I can see, is to-

wards making this a technical hobby instead of a skill hobby.

Some of the wheezes which come to mind are as follows:

1. *Code is a ham heritage.* So is QRM, but that's no reason to keep it. I am convinced that we will have more CW operators than ever if we make it a fun part of hamming instead of obligatory. Besides, with more and more operators using Morse keyboards, what do you mean by heritage? Those keyboards and Morse code readers are selling like crazy...if that tells you anything.

2. *Without the code test we'll be swamped with lousy operators.* Oh my goodness, since when did learning the code make anyone a good operator? If you want to hear really good operating, not the jamming and pileups we indulge in here, listen to the Japanese operators. They were taught how to operate by their clubs but had no code test.

3. *In emergencies, code can get through when phone can't, so everyone should know the code.* Well, that may have been true 50 years ago, but today most of your emergency traffic is on phone...and sideband gets through as well as CW almost anytime. In the future, we will be running most emergency traffic over high-speed digital networks, not on code or phone, anyway.

4. *CW rigs cost less than phone equipment, so by emphasizing code we are enabling even the poor amateur to participate.* In the pre-war years we could buy this baggage. When Heath brought out the HW rigs, that argument went out the window...where it still lies...and that was about 20 years ago. Let's try to get out of the past.

5. *With the current exams made stupidly simple by cheat books such as the ARRL* Q & A Manual *and the Bash books, we have to have SOMETHING to keep everyone out.* I partially agree...but let's make it something better than the Morse-code test. Perhaps we could change to a licensing system whereby new amateurs would have to qualify before a club board, showing that they know the rules and are able to operate a ham station. We might make the technical exam less vulnerable to circumvention by League and Bash Q & A books.

6. *If we don't keep the code in the ham test, code will just die out.* As I said, I think that once it is made fun instead of punishment, we will find a new enthusiasm for the skill. Our clubs and publications can intensify this with contests, certificates, and articles on the subject.

7. *Just because the Japanese have had such incredible success merely by removing the code requirement is no reason why we have to imitate them.* Well, I believe in learning. When someone does something new and it is a success and what I'm doing is an obvious failure, it is time to re-evaluate and not let *Not Invented Here* stop me.

8. *I had to go through all that misery, so why should I want anyone to have it easier than I did?* Golly, I don't have any real answer to that bit of garbage.

9. *Suppose you are stuck in a life-and-death situation where all you have is a CW transmitter for communications?* Having been in just such a situation, and having used CW to save 85 lives, my answer is that the likelihood of such a situation occurring is so remote that I really wonder if it is worth sacrificing the technology of America on such a remote circumstance.

Yes, I know that there will be crowds of old-timers at Dayton looking for me with ropes, tar, and feathers. Well, I've leveled with you down through the years, never taking the easy way out. In this case, I think it is time...way past time, actually ...to get serious about revamping our ham exams and making our hobby a technical one rather than one limited mostly by an easily learned skill.

Think of it like this. Sure, you and I know that it is not difficult to learn the code. Piece of cake, really. But you also have to admit that when you talk with non-hams, you probably make a big deal of it. If you put yourself in the shoes of someone considering being a ham, you will see, as they do, that the Morse code is a terrifying new language...one which they are not at all sure they can master. This fear is in itself enough to turn tens of thousands away from amateur radio each year.

Then, when someone decides that he or she is going to try anyway, the fear is enough to put off practice. Remember that nowhere in our magazines or in talking with amateurs is any reference made to code being fun. It is the major hurdle for newcomers and we make a big deal of it as such. So our talking generates terror in the hearts of newcomers and makes practice all the more difficult...even impossible. They *know* they are going to fail...and they find this self-fulfilling.

I've talked with thousands of people who wanted to be hams, but who were unable to surmount the code requirement. Most of them seriously tried but were conned into using a terrible code course and found themselves failing at it no matter how hard they tried. Indeed, many of the code courses are ridiculous...including the best-selling one of all. This single code course probably has lost us more hams that we've gained in the last twenty years.

In speaking out against the code requirement, perhaps I am sowing the seeds of my own losses. The *73 Magazine* code course, while it sells far fewer than does the ARRL series, has sold about 25,000 cassettes a year. Will I be out of the code cassette business if we get rid of that element of the license? I think not...in fact I'm betting that I'll be able to sell more than ever...as fun.

The recent *QST* polls showed that *QST* readers overwhelmingly are in favor of keeping the code requirement, so it's Wayne Green against the world again. *QST* has been pushing code for as long as I've been hamming—over 40 years. This got them into trouble in the late 40s when a large percentage of the amateurs deserted the League to go with the National Amateur Radio Council...a phone-oriented group which got us expanded phone frequencies on 75m, the 40m phone band, and more frequencies on 20m...over a lot of dead bodies. NARC, achieving its goals, went away.

So, if anyone has any other arguments which I have not enumerated, I'll be glad to publish them, along with my ripostes. Let's get this out in the open and fight fair on it...not let prejudices left over from 50 years ago continue to stop our growth. When I first got into amateur radio, there was still a lot of smoldering anger over being forced off spark. Then I watched the same thing happen with AM phone. I believe in being conservative, but there is such a thing as carrying it too far. If you disagree with me, I ask you to fight fair. If you agree with me, fight with me for the growth and health of the very best hobby ever invented.

FCC CASH-FLOW PROBLEMS

With the Reagan administration shaking every federal agency to reduce expenses and lay off people, the FCC...which has been underfunded for years ...is in particular trouble. Indeed, if they had not been so prudent in the past, they would be far better able to weather the current storms.

There has been some talk of getting government agencies to charge for services so they can get into the black. If this talk persists, we may again see a charge for ham licenses. Since amateur radio takes up a miniscule amount of the Commission's time, our charges should be minimal, as they were the last try. But I think I have some ideas which might cut the cost of the amateur service even further for the Commission.

A large percentage of the Commission time and money is spent on commercial broadcasters, so there is adequate reason to pass along this cost to them. After all, *they* are making a living out of the FCC work. I'd also like to see the common-carrier chaps pick up their end. It's about time...the television broadcasters using this service kind of snuck in through the back door. Indeed, I haven't seen any legal justification for them being allowed to use common-carrier channels for television. That service was not designed for that use and, as far as I know, it was never authorized for that. Well, let's see that go through the legalities and be made official...with the common-carrier boys picking up the full tab.

Perhaps I'm being a bit vindictive because this bunch of crumbs cost *73* tens of thousands of dollars in legal fees to fight their suit against us. A suit found without merit, which I feel was brought merely as an intimidation to try to prevent *73* from publishing 2300-GHz articles. I suspect that more is accomplished in our country via the threat of court cases than through the cases themselves. I know that few firms are large enough to absorb the costs the CCAT people put us through, and most would have shut up and blown away. I

happen to think that freedom of the press for amateurs to learn about these things is worthy of such an investment, so we put up the money needed to fight these stinkers.

Getting back to the FCC problems. During the Carter administration, the FCC commissioners were so upset over amateur radio as a result of the hearing over linear amplifiers that they virtually eliminated the division. Now what's left of the amateur division has to face across-the-board budget cuts. For those readers who are forgetful or inattentive, let me remind you that this alienation of the Commission came about entirely needlessly. It was the testimony of one amateur which did it... and he was representing a well-known group. He stood up there and insulted the new commissioners, putting us all in the doghouse for four years.

We have a new chairman of the Commission and several new commissioners, so we have a chance for a fresh start.

There are three ways in which amateur radio is costing the FCC money these days. One is the cost of giving license exams and issuing licenses. A second has to do with monitoring our bands. A third is the cost of handling our requested rule changes.

On the first item, I think we could set up a system which would cut their expenses enormously. I've written about this before, but not recently. What I would like to see is a system whereby qualifying radio clubs would be permitted to give license exams. In order to get around hokey pokey, I would suggest that there would have to be three licensed amateurs present during any test administration.

This could be almost completely computerized as far as the Commission is concerned, with machine-readable cards being sent in by clubs for the issuance of the licenses. This would enable field offices to cut back substantially on personnel no longer needed to give and monitor these tests on a regular basis.

This would enable almost every hamfest to have a licensing session, run by a local qualified ham club. It would further cut the cost for people wanting ham tickets since they no longer would have to make the long trip (for many) to a city having an exam center and lose a day or two of pay in the process. Most exams could be given at night or on weekends, at the convenience of the examinees and the club.

By automating the process, the FCC wouldn't even have to have data entry people at Gettysburg to enter the names and addresses of the licensees. This would be a further savings for them. And this move ahead toward automation would set the stage for almost instant licensing. The next step would be sending in the information over the telephone via a data terminal (or any microcomputer with a modem...which just about every club has at its disposal). The exams could be given, the data typed in at the club, sent by modem to Gettysburg, and instantly confirmed, along with the new call of the licensee. Gettysburg would forward the data to Washington, where the actual license would be printed out and mailed, much as is done at present.

If we get into a charge for our licenses, each club could set up an account with the FCC which could be debited each time a new license was issued by them. This would give the FCC a nice float with which to work. If we had, say, 5,000 clubs participating, with each depositing $500 (towards licenses at $10 each), this would give the FCC a two and a half million dollar float. That would earn them about $30,000 a month in interest at 15%. That in itself would pay the salaries of about 15 people at the FCC.

With membership to the League costing $25 per year, perhaps that is a more reasonable price for us to pay for our licenses. Certainly the benefits of our licenses are more than a club membership. That would put a price tag on a five-year license at $125, which might seem a bit steep for youngsters. Of course, we have very few youngsters coming in at the present cost (nothing), so it is difficult to get emotional over any drop that $125 might entail.

The fee would hit retired people hard...even though they seem able to come up with the money for the ARRL with no problem. It might come down to a choice between a license and a *QST* subscription.

So what would be reasonable for a ham license, considering where we are with inflation these days? If $25 a year is too much, how much isn't too much?

One way to look at this is from the other side. What is it actually costing the government to provide us with the license? Perhaps this makes more sense than going by how much it is worth to us...which is a lot in some cases...and not much in others. If we are able to help the Commission cut their expenses, we can rationalize paying less for the service we are getting... and that is the key, to my way of thinking. I don't mind paying *my* share. I don't want to pay the share for someone too lazy or cheap to pay, someone who wants to ride on my coattails.

If we are able to take the license examination administration off their hands, that will save them money. And, considering the usual government efficiency, cutting that expense at one end should save several times the cost by the time the whole organization is considered.

Then there is the matter of monitoring. Here we could certainly help and would benefit in several ways as a result. The benefits would be fantastic. First, we would stop hearing from the Commission that amateurs are not permitted to experiment with new modes of communications just because the FCC monitoring stations are unable to decipher our transmissions. That beauty of a rule...a rule, by the way, which was never written into any of our regulations, but was just decided unilaterally for us...has kept amateurs from developing any significant new modes of communications for the last twenty years or so. That has been one of the most destructive unwritten rules in the history of amateur radio, as well as a direct violation of 97.1c of our written rules.

Secondly, with a thousand amateurs available for monitoring for every present FCC employee, we could do a job of monitoring which would be almost infinitely better than is being done at present. I know there are thousands of amateurs who would jump at the chance to participate in such an operation. Indeed, amateurs could set it up, establish the computer communications which would make it work, develop automatic scanning equipment to monitor the entire spectrum, and so on. Between our retired hams, our handicapped hams, and the cooperation of several thousand ham clubs, we'd have a ball...and do a splendid job.

We also could save the FCC a bundle...passing along only those reports which were of importance to the few FCC monitoring stations still needed. You know as well as I that clubs would love to set up direction-finding systems to track down mysterious stations...to listen for emergency air or marine traffic...and so on. It would give us much more to do which would be both fun and beneficial to the country.

On the matter of cutting down on legislative expenses, let me bring up an idea which I have written about every now and then down through the last thirty years. This has to do with amateurs taking the responsibility for coming up with proposed rule changes...and working them out via a symposium similar to that run by the ITU in Geneva every few years. We could have as a responsibility for our ham clubs the generation and forwarding of proposed rule changes. Then we would have a meeting every two years where club delegates could discuss and decide what actual changes we really want.

We could, like the ITU, set up subcommittees to discuss and recommend action on each of the proposed changes. These committees would pass along their recommendations to a meeting of all club delegates for final voting and action. This process could save the Commission hundreds of thousands of dollars presently spent on trying to cope with proposed ham rule changes. It also would get us our rule changes while they are needed, not years later when they are a nuisance and long unneeded.

In these ways, we could get amateur radio off the back of the Commission, saving them most of their present amateur radio expenses. In return, our service would be much more flexible and able to grow and develop, keeping up with... and preceding...technology. I think we would start seeing inventions and pioneering of new ideas returning to amateur ra-

dio. . . with benefits to our country and the world.

It is a shame that in these days of digital communications amateur radio is held back by the FCC with the technology of twenty years ago.

CLUB RESPONSIBILITY

Just a few years ago, I ran a poll of ham clubs and found that only about 1% were spending time and effort to run ham classes to develop new Novices. Perhaps I got overly abusive about this in my editorials, but the response was good and we got to a point where over 50% of the ham clubs were running ham classes.

That seems to have dropped in recent months. . . probably due to the difficulty of finding candidates as interest in CB has diminished. Well, CB or no CB, we need massive numbers of new hams. You read about that in more detail in my piece about NIAC and its recent meeting.

Now, I can see where a small ham club, with perhaps a half dozen members, might have difficulty in developing the resources needed to teach new hams. But if there are any larger clubs which are not holding up their end of this, let's get going immediately. Get those classes started. There are plenty of teaching materials. . . and you have members who will help out. . . if you will get moving. I want to see our next poll show that over 90% of the ham clubs are generating new licensees.

What is a reasonable number of new hams to bring into the world? Well, since your club probably represents only about 25% of the available local amateurs in your area, at best, you should aim for at least matching the number of your present club members each year. We need an overall 33% growth per year in amateur licensees. If we are able to get 4,000 of our clubs to run classes, we need to generate 33 new hams per club this year. . . and 45 per club next year. Obviously it can be done. . . if your club will start doing it. . . and see that every other club in your area is working just as hard as you are.

FAKE QSL CARDS

The world of the DX Honor Roll is shaking as a result of the expose by W6NZX. In what appears to be a classic case of shooting the messenger, Bob has been singled out to be pilloried, thus making sure that no one else rocks the boat.

Since there is no known way to prevent cheating, either on the side of the Honor Roll amateurs or the DXpeditioners, perhaps it is time we gave some consideration to taking the heat off the whole situation by either getting rid of the lists in ham magazines. . . or making it purely a matter of "claimed" countries contacted. I hate to be the one mentioning this, but the whole matter is one of no importance whatever.

By attaching some importance to the number of countries contacted, we set up several undesirable effects. First, we have seen the development of a cult in amateur radio dedicated at almost any cost to staying on top of the list. This has gotten to unbelievable proportions, with the pursuit taking precedence over families and even over work.

As the importance has been magnified in the minds of the cultists, *any* stratagem has become accepted toward the goal of staying on top of the list. These chaps are well aware that many of the cards they have are fakes in one sense or another. Indeed, the awards committees know this too, but have played along with the cultists (whom *they* have generated), accepting fakes at face value when there was no question in their minds about the invalidity of the cards.

I've mentioned recently that I have a bunch of cards which I know to be fakes, but which I could submit for awards. . . and get them. I'm not talking about cards from almost unknown stations, but cards from some of the best-known DXpeditioners.

Now what is a "fake" card? As minds crazed with getting ahead of others on The List churn, more and more fakes appear. Some are transparent forgeries, where the cards have been turned out in a local print shop with not even an effort to copy the original. I used to get those in abundance when they were submitted for our Worked The World award. Fortunately, being active in working DX, I had the real cards on hand for comparison.

Others are copies of the real cards. Now how is a person checking through a stack of cards going to be able to tell the difference between the real card and an exact imitation? According to inside sources, the awards people have not figured this one out and so they have been accepting the cards at face value.

With QSL managers all over the place, there is no way for a QSL printer to know that an order for 500 cards is from a chap (or group) about to put them out as counterfeit cards. Most people who handle our QSL orders (and *73* turns out around a hundred orders a week) know nothing about amateur radio. They just set the type, proofread it against the order, make up the printing plates, print the cards, package them, address them, and ship them out. I'm sure that most of the QSL printers work pretty much the same way. It's mass production.

QSL managers, with thousands of blank cards, have often been known to hand out samples to friends. It isn't difficult to fill in a card and end up with something which is exactly like the real thing. With many cards coming in envelopes, even the lack of a postmark or QSL bureau stamp doesn't mean much. For the perfectionist, there are fake bureau stamps, brief notes from the real DX operator in answer to some question to provide the envelope. . . and so on.

It does appear that for many DXers there is more fun and work involved in fooling the awards people than in the chase of the DX. That has become a subset of the cult.

DXpeditioners who do their own QSLing have given little thought to the counterfeit problem and have often handed out souvenir cards to anyone asking. Many of these have been filled out later and passed through the awards people for full credit. I've visited a number of rare spots and often have handed my cards out as souvenirs at hamfests.

Some of the rarer spots from which I've operated are 3D6, 7P8, 5Z4, 0D5, JY, YA, EP, YK, 9N, VS6, HL, 3D2, FO8, FK8, 5W1, KS6, KC4, 4U, etc., so picking up a collection of my old cards could be of some help. You don't hear a lot of YA and EP stations these days.

Another type of fake card is the one from the DXpeditioner who isn't where he says he is. This type of cheating has been going on as long as I can remember. The first really wholesale case where I was shown proof of the cheating happened around twenty years ago and had to do with a chap operating out of a hotel in North Africa, signing the calls of one country after another as he went around on his imaginary DXpedition. He was saved the problem of getting licenses, travel expenses, sand in the rigs, and other unpleasantnesses of West African travel through the expedient of not bothering to move. This was an inexpensive and creative solution to what otherwise would have been considerable aggravation. The cards are still acceptable for awards.

The ruse was so transparent that it took no time at all before other hams were using it and expanding upon it. This was a far simpler and cheaper way of getting to those out-of-the-way islands. . . of operating from unfriendly countries. During the 60s, all of us DX hunters built up our collection of fake cards. The awards managers were well aware of what was going on, but didn't want to upset things by refusing to accept the cards, so a conspiracy of silence developed. The rules were tightened a bit to make blatant cheating more difficult.

Miller and his cohorts pushed things too far for even the conspiracy of silence to swallow. Of course he went a step further, not only faking his operating locations, but also charging the hell out of members of the cult, who by now would pay *anything* to stay on top. My understanding is that he charged $50 per new country for cultists and that this was bringing him a very nice income. . . on the order of over $50,000 a year. . . completely tax free.

I still run into hams in rare spots who remember Miller opening his mail, taking out the money and throwing away everything else. . . piles upon piles of mail. I know that when I wrote my editorial and exposed some of the things he was doing, he sued me for $650,000 for cutting down his income. He sued the League for only $500,000 for besmirching him. . . and lost when it was proven that he had been operating from places other than he claimed. Despite all that, I believe that my cards from Miller are still valid

for awards...and I have a lot of them.

Just as an example, I got a card from him from Burma. Hmmm, I thought that no amateur radio was permitted in Burma. So I went to Burma personally and looked into it. I asked the government about hamming..."no way." I asked the hotel where he said he had stayed and operated from... "impossible." I asked the local amateurs (who had been put off the air and their equipment confiscated)..."totally impossible." When I challenged Miller with this, he changed his story and said that actually he had operated from a hospital instead of the hotel, as he had claimed. Since the hospitals were under army control, not the control of doctors, that obviously was a lie, too. But I wrote back and had that checked out... "false."

If it were a matter of any significance about how many countries any of us has contacted, we might look into ways of trying to stem the cheating. But the importance of this as a goal in life is about on the order of that of the Trobriand Islanders and their fetish of growing pigs with reentrant tusks.

My own experience has shown me that an amateur with a decent station and some operating experience can whack off one hundred countries in one weekend (with the help of a contest). It takes about a month to get 200 worked...and perhaps a year for 300, with some diligence. That's what it took me. Beyond 300 you get into cheatsville and the DXpeditions. That's why I got my 300 and then stopped counting. Now and then I work a new one, but I don't know within 20 countries how many I've really worked...and I don't care.

If the DX awards would stop at 300, it would kill this whole cult and free up a few hundred people around the world to contemplate living more productive lives. We might be able to leave the world of counterfeiting to those who arrange for fake passports and wills.

Speaking of fake papers, I was in Asia one time and found that I had to have an authenticated shot which was not on my health record. A ham in the country fixed that easily. He scribbled in the shot information and stamped it with a checker and stamp pad. Looked great and got me through. I managed not to contract the disease during the visit... perhaps the checker did it.

There are 300 legitimate countries on the air and they are easy enough to contact, so the tendency to cheat might be avoided. It's the last few that bring out the worst in people. Remember that if any one of the Honor Roll chaps misses one new country which comes on the air, he is moved back one rung on the ladder...usually permanently. And that means falling way, way back.

If we could take the pressure off, we might find more DX stations on the air. I've mentioned frequently that when I visit rare spots I invariably find that the operators feel harassed and are not very enthusiastic about hamming. You can't blame them; they are never permitted to get on and rag-chew. They are always haunted by ferocious pileups and demanding DXers who feel it is their right to make a contact of at least ten seconds...and never mind what the operator in the rare country wants to do.

I've heard DXers cursing out ops in rare spots who had given up to go to bed or to work. Well, if you are going to take it all this seriously, then *you* have a problem, not the DX. You are the one who has to decide whether it is worth several days of your time to get a new country. I'll invest up to ten minutes trying for a new one, but that's about the limit for me.

At any rate, getting back to fake cards, it turns out that some of the West Coast gang have gone overboard and have been printing up rare cards wholesale and passing them around. Complaints to the awards people have gone unheeded. There is no question about whether they really care or not. So when one chap brought it to a head by submitting a pile of faked cards all in the same handwriting, *he* was given the shaft and everything else was quickly covered over. At least that is the story going around and, considering the history, it's difficult to find a serious flaw in it.

Even the change to computerized operating isn't going to make a significant difference as far as I can see. I can envision the day when a DXpedition will come on the air from Gherkin Atoll and make contacts automatically at the rate of several thousand a minute, with the logs being transmitted on a second channel as generated to the awards committees of several amateur radio societies. At 9,600 baud, we can pass information through at an effective rate of about 7,500 words per minute without special encoding, so we will be able to get DXpeditions over in a few hours instead of weeks. The QSL manager would also be tuned into the log channel and his computer would print out and send along the QSLs to the QSL bureaus.

But what is to prevent any ham from programming his station to make contacts for everyone in his DX club? Or even to have them check in over a two-meter link and make their contacts? And, if you want to be nasty about it, what is the difference? Any good station anywhere in the world can make contact with a similar station, so all we are measuring with our awards is the amount of time someone is willing to spend for the desired award. There is no real measure of the station, of the ability of the operator, or even of propagation conditions. The awards are, essentially, without any real merit.

So, if you won't get rid of the Honor Roll and its pernicious undermining of our hobby, I'll be pushing forward toward computerized contacts and the day when we can work 350 to 400 countries in a minute or so. Perhaps we will then set up awards for working 400 or 500 countries every day for a year.

Five hundred countries? Sure. That's part of the whole game. The awards groups set up their definitions of countries to suit themselves. No one likes it when he loses a country. The fun is in working ever more of them, so awards committees have to come up with new rationalizations to provide us with more and more. They can whet our appetites by temporarily refusing to accept this or that, generating great and enthusiastic controversy.

Years and years ago, I got together with Bill Orr in Nice and discussed the subject. He came up with a humor article on Countries Galore in '64. Well, most of those enclaves he joked about at the time are now accepted countries. With the SARL accepting Transkei and Bophuthatswana as countries, how long will it take for more of the IARU societies to accept them? Bophuthatswana is a great one, being spread out into a lot of enclaves. We could make that into twenty or more separate countries without even trying. South Africa, in an effort to wiggle its way out of segregation problems, has a lot more similar "homelands" which are being contemplated...each a solid-gold possibility for a new country for us.

Indeed, as I've hinted before, I have my eye on one such territory. As soon as it becomes a separate country politically, I'm planning to rush down there and set up a station and drive you crazy for a few days. I even have a call in mind for it...if this does not give anything away. Of course, we'll have to run it by the ITU first, but I think it is a winner. I've already asked for Q5R9 for my call. Laugh, I hope, but remember that I said it, when you hear me.

Though I am perhaps critical of the DX awards committees for accepting known fraudulent cards, I can understand their problem. With so many of the DXers submitting them, and with it being almost impossible to really know for sure which are the real and which the fakes, it is a no-win situation. But a simple returning of Bob's cards might have been more prudent, rather than making a martyr of him by trying to pillory him for forcing the issue and blowing the whistle.

Keep on accepting the fake cards and shut up. Most of us don't really care.

ZAP! YOU'RE IT!

The September editorial piece about police radar brought in quite a reader response. A lot of you have been zonked by the police, not for actual speeding, but because your transmitter indicated speed on their radar units. You really are going to have to learn from the misery of others and either cut out talking from your car or get a detector so that you know when to shut up.

In case you think that being right cuts any mustard with our court system, forget it. I even have a case of a ham judge who refuses to pay heed to the ham interference defense. Some of us get so wrapped up in our rosy

altruistic imaginations that we forget that the purpose of police radar is not to stop speeding but to make money for towns... and it is a fantastic money-maker. If they say you are guilty, you *are* guilty, and your best bet is to pay up and chalk another one up to our American judicial tax collection system.

Getting down to radar detectors, I've been testing a few more. The newest one is by Fox. It's the smallest one yet and is unobtrusive on the shelf where it can look out of your front window. It's as sensitive as any yet...even matching the famed Escort, which I mentioned in September.

The Super Fox Vixen is about 5" x 3-1/2" x 1-1/4" and comes with a plug for your cigarette lighter socket. Since you have no business smoking any more, this is a fine use for that otherwise wasted socket. On our new Datsun Maxima, where most of the Vixen tests have been run, the power socket is turned on and off by the ignition key, so I don't even have to remember to turn it off when I get out of the car. Most of the radar detectors draw enough current (300 mA) so you will find a dead car battery if you leave 'em on while not using your car for a few days...like at the airport during a trip.

The Vixen, in addition to being small, has the benefit of being distributed through car accessory stores and many electronic stores, so it should be simple to find. The cost is $250, right in there with the Escort ($245).

The only real difference between the Super Fox Vixen and the Escort is that the Vixen has a buzzer and light indicator of radar, while the Escort has those plus an S-meter. Perhaps it is the ham in me that likes to watch the S-meter and see when I am getting close enough to a radar unit to know that it can pick up my ham rig. The Vixen will keep you out of trouble, which is what you want. Be sure that you specify a Super Fox Vixen...the superhet model... as the firm also puts out a Fox, which is a passive detector unit and about 1/100th as sensitive. I have one of those in our RX7 and it generally goes off just as I am passing a radar unit, right at the last minute. Since I have both 2m and CB rigs in the car, if I waited for the passive unit to alert me I would be off the road by now with too many tickets to drive.

I've found that a small square of Velcro™ stuck to the bottom of the unit...and another on my dash shelf...allow it to be whisked off the shelf when I park the car in Boston or at the airport. There's no use dangling a $250 goodie right out there in front of thieves when you can flip it under the seat while parked in high-crime areas. Of course, in New Hampshire this just isn't a problem.

Small world department: The people who handle the promotion and advertising for Fox are the same people who handled DenTron...and are handling OSI, the computer firm. OSI, by the way, was bought by Macom, the firm which makes most of the Gunn oscillators for the superhet radar detectors...and which makes the 10-GHz gear I used for my DXing a year or so ago. Macom, formerly Microwave Associates, is where Sam Harris W1FZJ, the microwave genius, used to work before he moved to Arecibo. The president of Macom is an old-time ham, Dana Atchley.

LETTERS

DAY IN COURT

Thanks very much.

Your September issue of *73* arrived the day after I got an unjustified speeding ticket backed up by police radar. Armed with the information in your editorial, I immediately ordered the legal index and bought an Escort. The delivery of both was very fast and arrived in time to assist my court preparation.

You are too pessimistic. The court is an adversary relationship and the person with the best preparation (among other things) wins. A previously good driving record is also a must. In my case I was stopped for "37 in a 25 mph zone" based on radar. I was sure I was not speeding and so informed the arresting officer. His comment was "tell it to the judge." After obtaining the name of type of radar in use, noting the other traffic immediately before me, etc., and fuming, I read *73*. After obtaining and reading the Fuzzbuster legal index and spending a few more hours in the local law library and in technical reading, I called the Commonwealth's attorney. His initial view was: "Radar is infallible. Some states will listen to technical arguments but not VA."

After the roll was called in court (1½ hours of calling the roll, listening to shoplifter cases, etc.), the court got started on the docket. In a lull, I reminded the Commonwealth's attorney that I intended to plead not guilty and of the technical basis for my defense (RFI from the ham gear causing spurious readings as adequately documented in the manufacturer's handbook, Bureau of Standards tests, etc.). I also mentioned the other traffic in the pattern which was pulling away from me but not stopped. I was supported by diagrams, texts, etc., in a large bundle under my arms. When the case came before the judge, the Commonwealth's attorney recommended dropping the charges.

It took a few hours, but justice is worth the effort. The Escort works like a charm—I won't be surprised again. I may even not key the rig passing the radar next time.

J.D. Peters K1ER
Manassas VA

JD, you're not doing your homework completely. The Car & Driver *article on American justice is necessary reading to dispel your euphoria. Being totally and demonstrably right did not help when the editor of* Car & Driver *lost a clear-cut case . . . including two very expensive appeals. When I get complaints from hams in African countries about the sad shape of the courts there, I refer them to the article to show that our courts are not any better. . . the occasional lucky chap like you notwithstanding.—Wayne.*

SURVIVAL

Your editorial statements and talks concerning the relationship between amateur radio and a productive electronic engineering industry such as that of Japan have intrigued me. I couldn't agree with you more! But I think that there is more to it than is indicated by the numbers of amateurs in a country, or the licensing structure encouraging or discouraging the growth of the hobby. In recent times, the professional literature in science and education has bemoaned what has been happening in our American society and its effect on school curriculum and the courses students take, both in the high schools and in the colleges. (One of the more recent articles for the general public appeared in the *Washington Post* on May 31, 1981, and was written by David G. Savage.) For some years now, many high schools have dropped math and science requirements for graduation. This is also true for many colleges. This is not true in Japan.

The Japanese educational system is rigorous, with mathematics instruction being given in a more concentrated form and with more students taking the advanced courses. By the ninth grade, the Japanese student has had three years of geometry and one year of trigonometry. High school courses include calculus, probability, and statistics. Is it any wonder that (as pointed out in the article by Savage) Japanese leaders often point to the rigor of their educational system as a key to their economic success?

In the United States, about 5% of all bachelors and masters degrees are in engineering. In Japan, about 20% of the bachelors and about 40% of the masters degrees go to engineers. Between 1963 and 1977, productivity in the US grew 39% and 1.6% of our students became engineers. Productivity in Great Britain during this period grew 51% and 1.7% of the British students became engineers. In West Germany, productivity was 114% and about 2.3% of West German students became engineers. In Japan, 4.2% of the students became engineers and

productivity went up 197%. Make what you will of these figures!!

As amateur radio operators, we look to the Japanese for much of our equipment and we are thus familiar with their engineering products and their quality. We hold long and friendly conversations with Japanese amateurs. Russian equipment, on the other hand and for the most part, is unfamiliar to us. The vast bulk of the QSOs between American and Russian hams appears to be a mere exchange of technical information. And nothing could be more deadly to a friendly QSL exchange than PO Box 88, Moscow! Yet their educational system and its productivity is almost awesome to an American educator.

In 1957, the Russians threw a piece of iron called "Sputnik" up into the heavens. America became frightened and began a frantic beefing up of its math and science programs. This lasted until the middle 60s. At that time, while our intense efforts began to go downhill, the Russians decided to go uphill. A recent study by the National Science Foundation indicates that the math and science program required for all Soviet students is far stronger than that of any other nation. Not only do a considerably greater number of Soviet students finish high school (our 75% to their 98%), but their requirements are quite a bit tougher. For example, a high school graduate has had five years of algebra, ten years of geometry, two years of calculus, five years of geography, five years each of biology and physics, and four of chemistry. By contrast in the United States, of the high school graduates, 9% have had one year of physics, 16% one year of chemistry, and 45% one year of biology. Savage points out that each year about five million Soviet high school students graduate with two years of calculus and, in contrast, about 105,000 American students have had one year of calculus.

One might argue that the forced curriculum of the Soviet Union does lead to a resentment of sorts among certain parents and educators, and ought to be tempered. But it might also be argued that lack of a rigorous math and science program in the United States may be at a price much more expensive than the diminution of the hobby of amateur radio. The price being survival.

Marvin D. Solomon WB8VNP
Okemos MI

Thanks, Marvin, for the statistics, which are interesting. Perhaps the lack of interest in science on the part of our students stems from a lack of motivation. If such is the case, if we could spark an interest in amateur radio within our high schools, then we might find our schools more pressed to teach math and science courses. And consider that, if amateur radio had continued its growth pattern from the 50s into the 60s and 70s, that alone would have changed our percentages of students becoming engineers. We're talking about a loss of around 60,000 technicians and engineers per year over the last generation. That magnitude of interest could have had a significant impact on our whole educational system.

If we had continued our growth, I'm sure that amateur radio would be vastly different...more advanced... than it is today. Much of amateur radio is stuck in the 30s, fifty years behind the times. The rest of it is hung up in the 50s, only thirty years behind technically. The amount of progress and experimentation with modern communications techniques is negligible. If I am to judge by ARRL surveys and my mail, most amateurs will fight hard to keep amateur radio from changing. Heck, I still hear AMers on 75m holding forth. Will we continue to be left behind as digital and high-speed communications systems are developed?—Wayne.

TRICKED OUT

We noted with interest the article in the September issue on "Tricking-Out the FT-901/902." It refers to a bandpass tuning feature developed by Bill Orr.

We believe this to be an error, as this feature was first developed by Buddy Alvernaz W6DMA when he was employed by Jennings Radio (now a division of ITT).

There was an article in the May, 1958, issue of *QST* (page 18) which described this feature and listed Buddy Alvernaz as the originator.

ITT Jennings
San Jose CA

WACRAL NETS

WACRAL (the World Association of Christian Radio Amateurs & Listeners—G3NJB) runs the following nets:

- Sunday at 0830 on approximately 3775 kHz, and at 1400 on 7075 kHz;
- Monday at 2100 on 3550 kHz (the CW net);
- Wednesday at 1030 on approximately 3665 kHz;
- Monday and Friday at 1900 on 21,350 kHz (the overseas net).

The purpose of all the nets is to encourage and spread Christian friendship and fellowship—the main aim and purpose of WACRAL itself.

Just as a point of interest, apart from the overseas net, the other nets have been in continuous weekly operation now for over seven years. There is always someone on, and most nets are controlled by me.

L.D. Colley G3AGX
Micasa, 13 Ferry Road
Wawne, Nr Hull
HU7 5XU England

ITALIAN LICENSES

We have the pleasure to inform you that on August 28, 1981, a reciprocal operating agreement between Italy and the USA regarding amateur operators was reached.

This department is ready to assist your military or civilian personnel holding a US amateur license to apply for a permit in case of a short visit in Italy or an amateur station license with allocation of an Italian callsign if resident.

Please write for further information.

Manuel F. Calero I4CMR
ARI (Associazione Radioamatori Italiani)
Reciprocal Licensing Department
Via Giorgione, 16
I-40133 Bologna
Italy

ROASTED FANNIES

For some time now, Radio Systems Technology has been designing hidden antennas for home-built plastic aircraft using the nonconductive structure of the aircraft to enclose the antenna radiating rod(s).

It has come to our attention that certain builders have been concealing the transponder or DME antennas in close proximity to the pilot or passengers. The usual location of choice has been directly under the passenger or pilot seat structure.

RST would like to point out that this places, in effect, high-powered microwave energy in very close proximity to a rather sensitive part of the pilot/passenger's anatomy. Bluntly, it may be a little like sticking your fanny into a microwave oven.

We are not clinical radiologists, nor do we have the equipment necessary to determine the backscattered field strength of these antennas. We do know, though, that there will be some leakage around any ground plane. Until a competent professional with the necessary training and equipment will volunteer to make the measurements for the rest of the home-building brethren, RST is suggesting that builders who wish to install transponder/DME antennas under the seats also laminate a sheet of plain old aluminum foil into the seat structure to shield the pilot from possible harm. (Microwave energy will not penetrate the thinnest of metallic foils.)

Radio Systems Technology
Grass Valley Ca

HAM HELP

I'm looking for information on an Ameco TX62 6-meter/2-meter AM/CW transmitter. I will pay any copying and mailing costs. Also, I am interested in any clubs in the Orange/E. Santa Ana, California, area. Thank you.

Dennis P. Breeden WB3KUM
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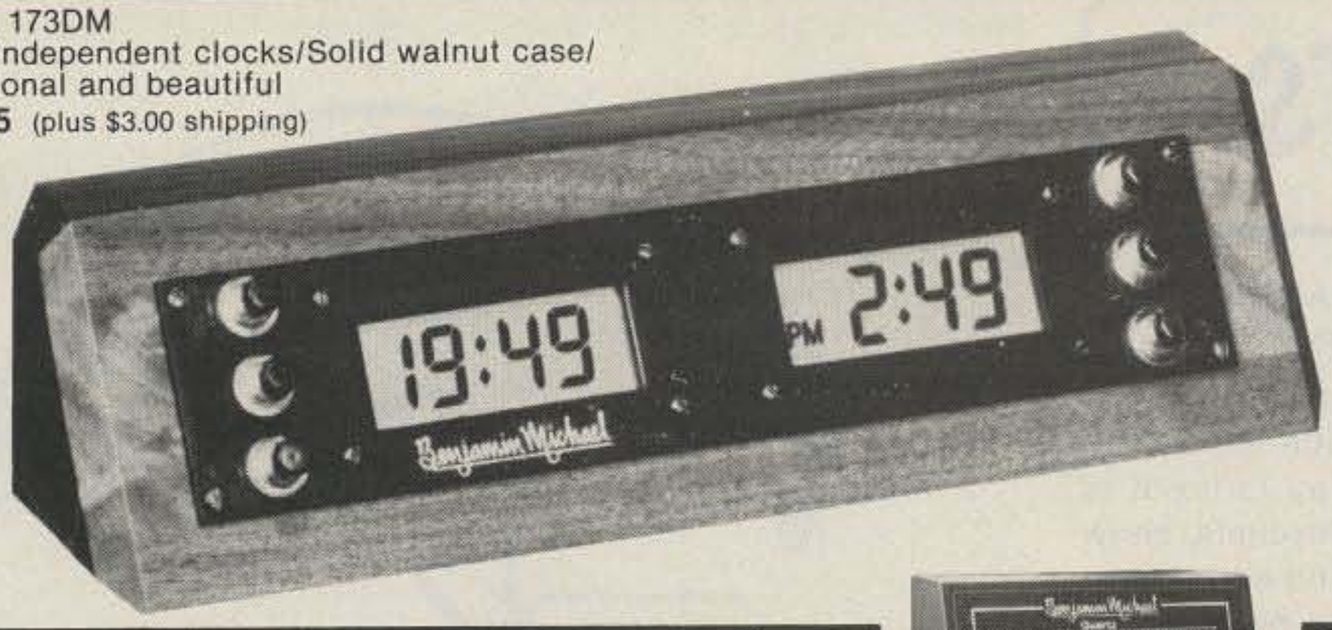

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✓See List of Advertisers on page 162

NEW PRODUCTS

LULY POLARIZER

Robert Luly Associates has introduced a new product for the satellite industry, the Luly Polarizer. The Polarizer is an electronic rotator (no moving parts) that replaces the mechanical rotator which was burdened with freezing or burning up, twisting cables, and weight problems.

The Polarizer enables polarity shift from horizontal to vertical automatically. The insertion loss is equal to an N connector, a mere .15 dB. Operating current is 12 to 15 volts at 50 milliamps (available from standard receivers). The polarity can also be varied 0-180°, allowing for dual polarization realignment after moving the antenna from one satellite to the next.

For more information, contact *Robert Luly Associates, PO Box 2311, San Bernardino CA 92405.* Reader Service number 481.

STANDARD COMMUNICATIONS TALKMAN

Talkman is a miniature, lightweight, voice-actuated, hands-free two-way radio; it is ideal for active bicyclists, snow skiers, hunters, and even those engaged in such pursuits as tower rigging and construction. Measuring only 2½" wide, 4½" high, and 3/4" deep, Talkman weighs less than one pound. It is available in any one of five channels in the FM 49-MHz band and will transmit up to a quarter mile. Power is provided with an easily obtainable 9-volt battery. The headset features a stowable whip antenna and an adjustable boom-mounted miniature voice-activated microphone.

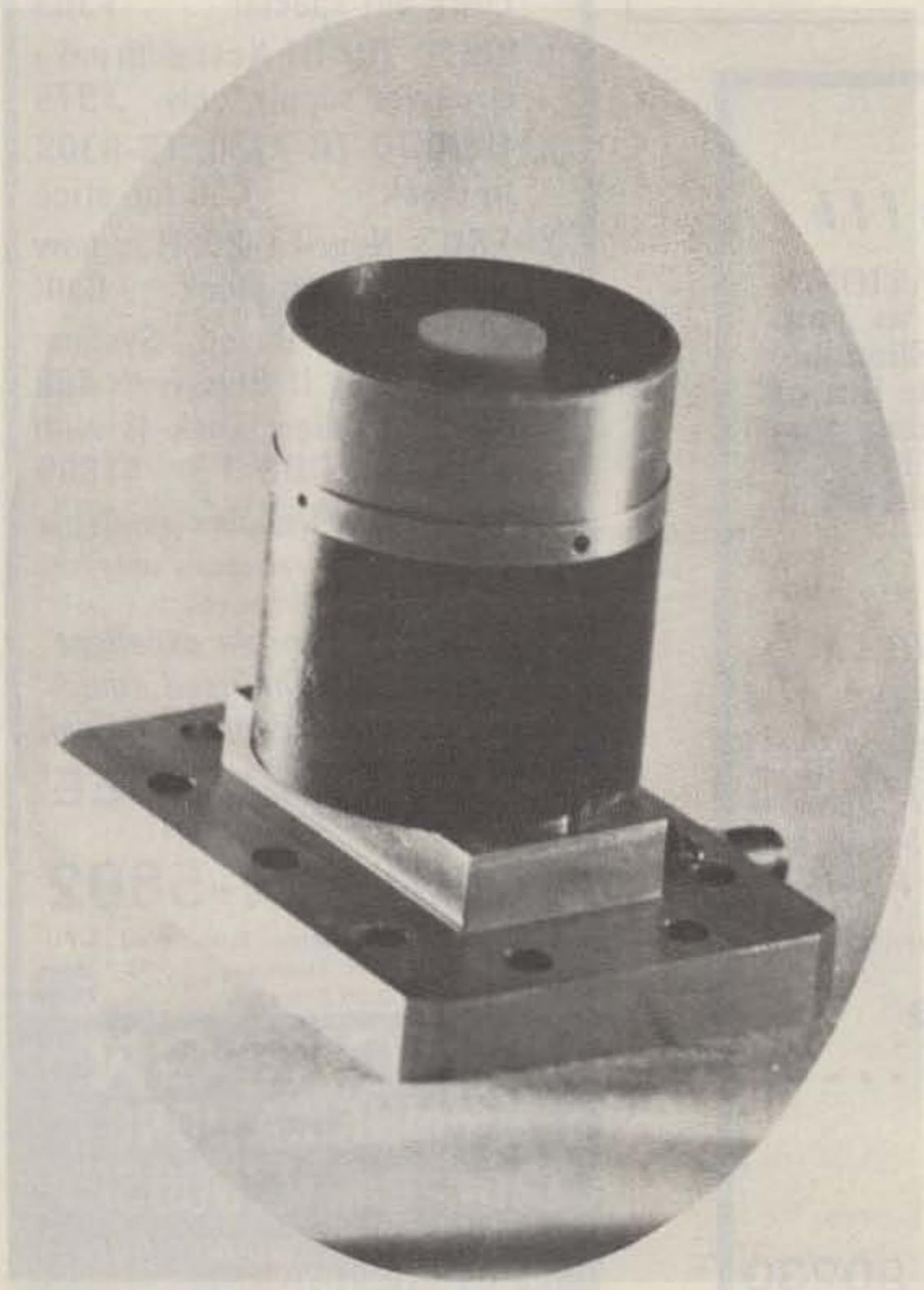
For more information, contact *Standard Communications Corp., PO Box 92151, Los Angeles CA 90009.* Reader Service number 486.

The Talkman from Standard Communications.

FLEA-SIZE KEYER FROM CURTIS

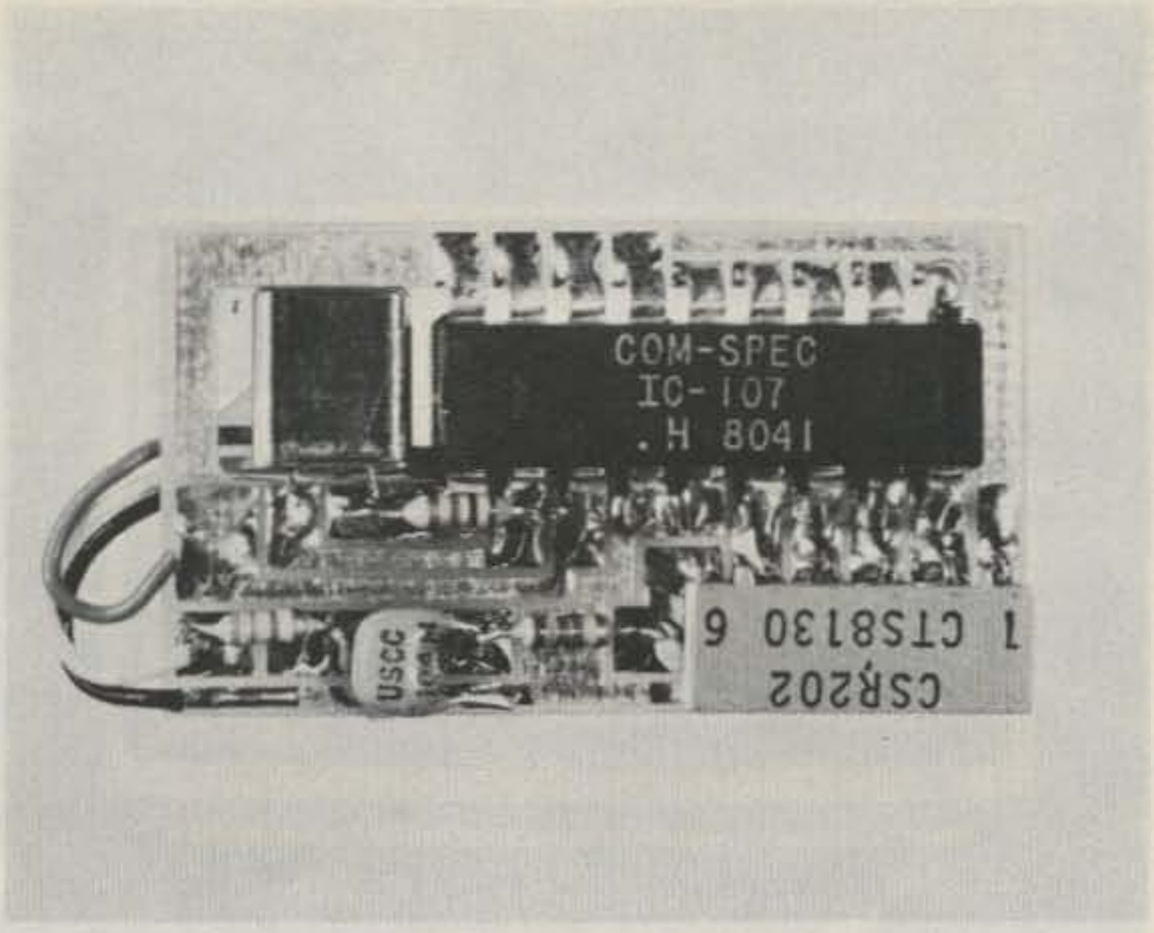
A rugged, low-priced keyer from Curtis Electro Devices promises to be the tiny, no-frills unit CW buffs have been waiting for. Although only 1.5" square, 3" deep, and 3.5 ounces in weight, the "Lil' Bugger," as it's called, offers many of the features found on full-sized keyers, plus a few of its own. The front panel contains only a thumbwheel speed control. Weighting, sidetone pitch, and volume are adjustable internally via small trimmers. The tungsten output relay will easily key any amateur transmitter, including really tough cases such as old shipboard transmitters. Jacks are provided for the keyline, sidetone output, and an external ac adaptor. The case also contains a compartment for an ordinary 9-V transistor radio battery.

The standard model K5 is equipped with the Curtis 8044 chip. A second version of the unit (model K5B) uses the new Curtis 8044B IC which provides the squeeze-keying characteristics of the Ten-Tec, Heath, Nye, and Accukeyer. In these models, a squeeze released during a dot will automatically produce a following dash. Similarly, a squeeze released during a dash



The Polarizer from Luly.

The Lil' Bugger from Curtis Electro Devices.



Model SS-32M from Communications Specialists.

will produce a following dot. The standard 8044 produces nothing after a squeeze release. Squeeze-key operators are divided into two groups depending on how they learned, so the K5 series accommodates both. Non-squeeze operators can easily use either version.

The small size of the K5 plus the three-lugged leads provided for paddle connection allow the unit to be attached to the side of any standard paddle set with double-sided mounting tape. It is ideal for QRP, Field Day, DX-peditions, or regular station use. Provision for a straight key is also made.

For more information, contact *Curtis Electro Devices, Inc., Box 4090, Mountain View CA 94040.* Reader Service number 489.

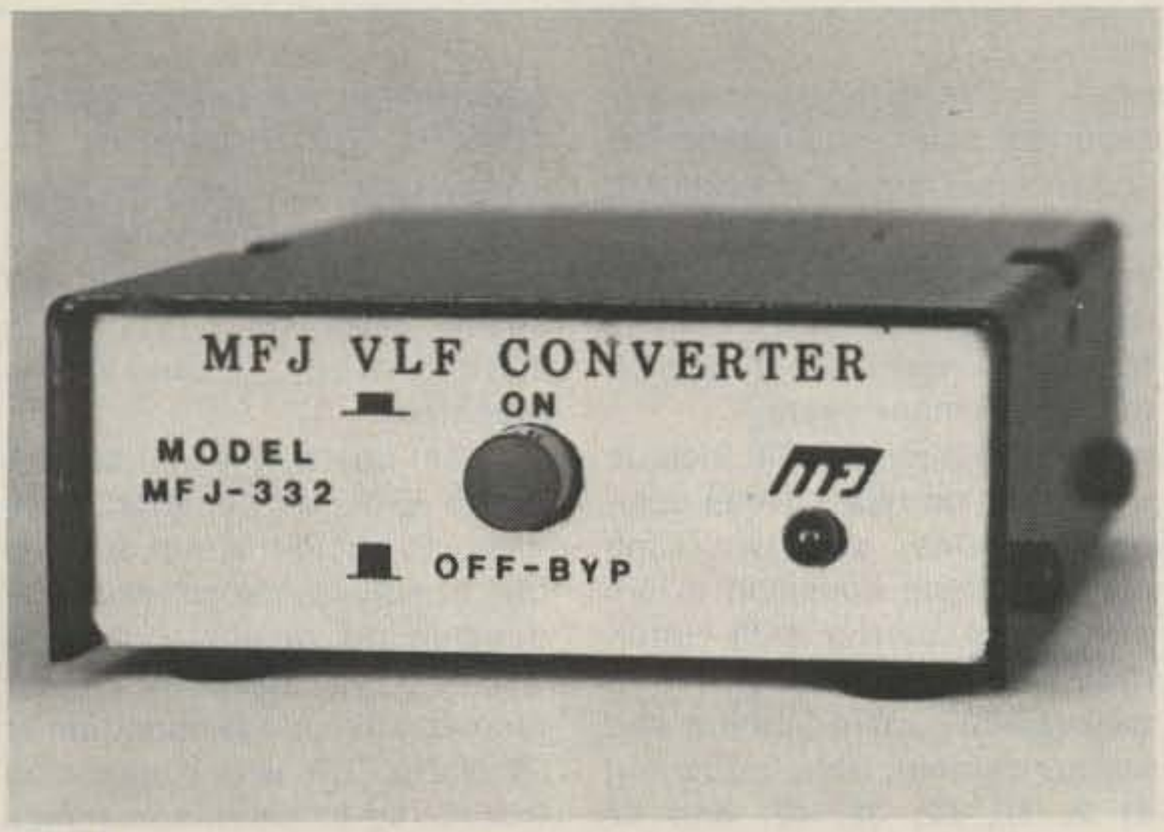
TWO NEW VLF CONVERTERS FROM MFJ

The MFJ-332 VLF converts an HF transceiver into a sensitive Very Low Frequency receiver. It converts 10 to 500 kHz to 28.010 to 28.500 MHz. The MFJ-331 SWL version converts 10 to 500 kHz to 4.010 to 4.500 MHz. Both give direct frequency readout on your receiver.

With a VLF converter, you can hear WWVB, ship-to-shore communication, navigation radio beacons, weather broadcasts, and even the standard AM broadcast band (with reduced sensitivity).

Both units easily connect between your transceiver/SWL receiver and antenna. Tuning between 28.010 and 28.500 MHz (4.010 to 4.500 MHz on the MFJ-331 version) lets you receive the longwave band from 10 kHz to 500 kHz. This gives direct frequency readout by ignoring MHz numbers. For example, 28.050 (4.050 MHz) is 50 kHz and 28.375 MHz (4.375 MHz) is 375 kHz.

There is a red LED that indicates "on." The unit is bypassed in the off position for normal operation. The MJF-332/331 VLF converters are housed in black and eggshell-white aluminum cabinets and require 9-18 V dc or 110 V ac with the optional ac adapter.



MFJ-332 VLF converter.

The MFJ-332 and MFJ-331 are available from *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 482.

CTCSS ENCODER FOR ICOM IC-2AT HAND-HELD

Communications Specialists introduces their new SS-32M micro-miniature programmable CTCSS encoder for use in the Icom IC-2AT hand-held. The unit is based on the popular SS-32 encoder and is programmable using jumpers. Measuring just 1.45" × .8" × .13", the SS-32M may also be used in other applications where size is critical.

For more information, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92667.* Reader Service number 488.

600 SERIES CES/MICROPAD

Communications Electronics Specialties introduces its new 600 series encoding micropad with DTMF ANI and numerous other features ideal for mobile amateur operations.

"The series 600 micropad," according to CES President Ron Hankins, "is compatible with any transceiver and offers a reliable and convenient design for the mobile radio operator, automatic PTT for 'one-handed' dialing, and ruggedized components."

The micropad incorporates a single-contact tactile keyboard for highest reliability. The series 600 is crystal-controlled and features a quality dynamic cartridge, adjustable tone level, and built-in tone monitor speaker. Noise-free dialing is made possible by a design element which mutes the microphone when the tone pad is in use.

600 series specifications include: 10-15 V dc; 13 mA operating current; −25° to 70° C temperature range; ANI speed of 5 tones/second, and an ANI capacity of 2 codes up to 15 digits each.

For more information on CES encoders and other quality CES products, contact *CES, PO Box 507, Winter Park FL 32790.* Reader Service number 487.

ICOM IC-3A/IC-3AT 220-MHZ HAND-HELD

Icom is very excited to announce a second cousin to the popular IC-2A series—the IC-3AT for coverage of the 220-MHz band. The IC-3AT is essentially identical in appearance, size, and operational features to the popular IC-2A series.

Most importantly, all accessories, including battery packs, chargers, microphone, etc., are completely compatible for the IC-2AT and IC-3A series, so a ham who has already invested in an IC-2A system with accessories can use those same accessories on the IC-3AT.

The IC-3AT also includes a 16-button DTMF pad. It covers the entire 220-MHz band from 220 MHz to 224.99 MHz and is set up for both repeater and simplex operation. The power output is nominally 1.5 W with the standard IC-BP3. The IC-3A system comes complete with IC-BP3 nicad battery pack wall charger, belt clip, rubber duckie, and wrist strap.

For more information, contact *Icom America, Inc., Suite 307, 3331 Towerwood, Dallas TX 75234.*

COMMSOFT CODEM

The COMMSOFT CODEM, a universal CW interface for personal computers, is now available for radio amateurs. The CODEM provides an easy way to get your Morse code software on the air. Converting received CW audio to RS-232 or TTL signal levels and RS-232 or TTL signal levels to transmitter keying, the CODEM doubles as a code practice oscillator and CW regenerator.

A sharp 800-Hz bandpass filter, AM detector, and low-pass filter are designed into the CODEM to provide outstanding noise and QRM rejection. CW can be monitored using an internal 2" speaker or an external high impedance earphone. Front-panel sensitivity, tone, and volume controls are provided. The CODEM comes with a comprehensive manual which includes operating details and connection instructions. The CODEM requires an external 9 V dc power supply.

For more information, contact *COMMSOFT, 665 Maybell Avenue, Palo Alto CA 94306.* Reader Service number 483.

CW Interface from COMMSOFT.

CODE SOFTWARE PACKAGE FROM COMMSOFT

Hams who own Heath computers can send and receive Morse code with the new CW89 software package from COMMSOFT. The program includes a split screen display, 4-99 wpm operation, receive autotrack, a 1000-character pretype buffer, 10 user-definable messages, unique break-in mode, on-screen system status, disk I/O, hard copy, and a versatile code practice section.

The CW89 program runs on the Heath H-8/H-19, H-89, or Zenith Z-89 computers under HDOS. One disk drive and 32K RAM are required. A hardware interface, such as the COMMSOFT CODEM, is also required. A complete package consisting of CW89, the CODEM, a computer interconnect cable, power supply, complete documentation, and shipping is available. For more information, contact *COMMSOFT, 665 Maybell Avenue, Palo Alto CA 94306.* Reader Service number 480.

REPAIR KITS FOR EIMAC TUBE SOCKETS

Varian Eimac announces PartsKits—emergency repair kits for popular power grid tube sockets used in many broadcast and communications HF/VHF transmitters worldwide.

PartsKits provide replacement items so the user can repair a damaged socket quickly and at a fraction of the cost of a new socket.

Presently available through franchised Varian Eimac distributors are PartsKit-300 for the SK-300/300A sockets, PartsKit-840 for the SK-840 socket, PartsKit-1300 for the SK-1300/1320 sockets, and PartsKit-1500 for the SK-1500/1510 sockets.

For more information, contact Bill Orr, *Varian Eimac, 310 Industrial Way, San Carlos CA 94070.* Reader Service number 485.

DMM FOR MICROPROCESSOR INTERFACING

Sabtronics announces their new model 2020 digital multimeter with microprocessor interfaces to adapt to all the popular home/personal computers.

Combining a high-quality multimeter with a microprocessor interface expands the Sabtronics product line to provide new, cost-effective solutions to data acquisition problems.

Model 2020 DMM from Sabtronics.

The model 2020 DMMM has an impressive 0.1% basic dc accuracy with 3½ digit large LED display for normal bench use. The new DMM is capable of directly measuring ac and dc volts up to 1000 V, Ohms to 20 megohms, and ac and dc current to 10 Amps.

Optical coupling between the DMM and the computer protects the computer from damage and also serves to isolate ground noises that can affect sensitive measurements. The model 2020 DMM will mate with most popular computers.

For more information, contact *Sabtronics International, Inc., 5709 N. 50th St., Tampa FL 33610.* Reader Service number 484.

FCC

BEACON EXPERIMENT AUTHORIZED FOR 10, 18, AND 24 MHz

The Federal Communications Commission has authorized the establishment of an experimental radio beacon on the bands 10.100-10.150, 18.068-18.168, and 24.890-24.990 MHz, these being the bands allocated for amateur radio use by the World Administrative Radio Conference, Geneva, 1979. The experiment is intended to permit amateurs to become familiar with the characteristics of these bands, simplifying the scheduled future changeover to amateur use, to improve amateur use of these new parts of the spectrum, and to provide data on sharing between different services. An important element is securing data on propagation under weak signal conditions, typical of natural disaster situations. It will be recalled that this use is one of the major reasons for these new authorizations, the first in many years.

The experiments will include two emission types, three operating modes, and two time phases. Basic emission is unmodulated carrier (A0), interrupted each ten minutes for an SSB (2.8A3J) identification and announcement, this occurring at 2, 12, 22, 32, 42, and 52 minutes past the hour. Announcement will be of the form: "This is FCC authorized experimental station KK2XJM, Daytona Beach, Florida. QSL via W4MB. Next operation will be repeated on _____ MHz starting on _____," and will be repeated.

Initial operations will be at 3 Watts ERP, on 10 MHz, commencing about the first of October. In stages, the schedule depending on results, operation will include 18 and 24 MHz. Later phases will include operation at 30 Watts ERP, with sequencing from band to band, sometimes weekly, sometimes daily, as

needed to make optimum use of the bands for propagation experiments, worldwide and to specific areas.

Licensee for the experiment is Robert P. Haviland, amateur call W4MB. The success of the experiment depends on participation by amateurs and SW listeners, and on their reports. Information needed is date, time, and location of reception, strength of signal and of other signals on the band, and nature of the receiving installation. All reports will be acknowledged by QSL.

In addition to reception reports, proposals for special tests will be welcomed, subject to the limitations imposed by the license and by regulations for experimental stations. At this time, there is no authorization for communication with amateur stations.

Reports, requests for schedules, and proposals for experiments may be sent to W4MB at the *Callbook* address, or to R.P. Haviland, 2100 South Nova Road, Box 45, Daytona Beach FL 32019.

ID RULE CHANGES

On October 1, the FCC announced a change to 97.84, the rule dealing with identification of an amateur station. Section (a) of 97.84 has been changed to read:

"Each amateur radio station shall give its callsign at the end of each communication, and every ten minutes during a communication."

The change deletes the requirement for giving the callsign of the other station at the end of the contact. However, *both callsigns must be given at the close of any communication involving international third-party traffic.*

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

The original Wahl cordless clipper.

Let me take a look outside, at December in Maryland. Hmm... "The weather outside is freezing, and the RTTY machine is teasing. So since you've got nothing to do, call CQ, call CQ, call CQ!" Here we are again, with the holiday season fast approaching. Last year, I described several gift suggestions designed to gladden the heart of any RTTYer. By your response, I see that this outing was well appreciated. Let's do it again right now.

I'm going to start by telling a story. Once upon a time, oh, say about 1968, a company out in Sterling, Illinois, introduced a cordless hair trimmer to the barbers and beauticians. Featuring a nifty little case which housed a nickel-cadmium battery, it dropped into a stand into which a charger was built. Convenient, portable, and well designed, the clipper was an immediate success in the industry.

The company then decided to look around to see what other uses this little dynamo could be put to. Not having any preconceived notions, the engineers added a resistive element across the battery and came up with a cordless rechargeable soldering iron. Not only the company's own marketing people, but also many others greeted this new device with less than total enthusiasm.

Nonetheless, in late 1971, the Wahl Iso-Tip cordless soldering iron was introduced. By mid-1972, the product began to trickle down to consumers and we hams became the biggest boosters. For working on printed circuit boards, especially with static-sensitive components, the Iso-Tip is hard to beat. Because it is not connecting to the line, the possibility of passing through a charge is minimized. Sitting in its charger, the iron is always ready, reaching soldering heat within seconds. My iron quickly became one of the most used tools in the shack, whether for revising a circuit board, fixing a plug, or using the built-in light to illuminate the recesses of a piece of equipment.

Since that time, the R & D boys at Wahl have not stood still. The original iron took 12 to 16 hours to fully charge. This is fine if all you are going to do is an occasional job or two. The capacity of the iron, fully charged, is about 125 solder joints. So, if you have to hot-wire a board or fix a chip, all is well and good. But there is no way to build something complex, without stopping after an hour or so for recharging. A "quick-charge" model was then introduced, which charged to capacity in three to four and one-half hours. By dropping the iron into the recharger between joints, larger jobs became more practical. The latest development along these lines came in 1977, when the "Iso-Tip 60" was introduced. This one will charge in only one hour, enough to keep anyone happy.

Continuing the search for innovative uses for that nickel-cadmium battery, other items have been added to the line. A nifty little drill is available that slips over the top of any of the soldering irons. The drill holds a fine bit ideal for drilling out holes in printed circuit boards. Automobile battery charger cords and various soldering tips and bits round out the portable line.

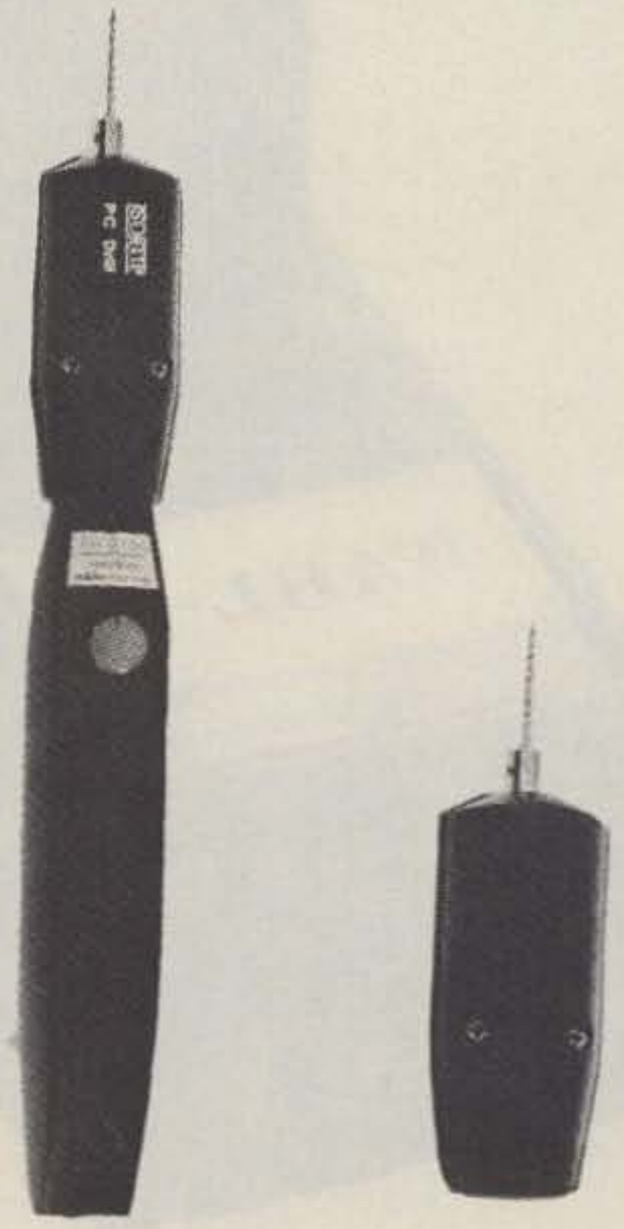
That nice little drill, by the way, is also produced in a self-contained version, powered either by a transformer from the ac mains or an automobile battery. Another fine addition to the line.

When looking for a gift idea to satisfy the ham involved in RTTY

The Wahl Iso-Tip line.

or computers, this line may just turn the trick. Prices range from a few dollars for a soldering tip to under thirty dollars for the basic iron with drop-in charger. The quick-charge iron is about five dollars more, and the drill attachment about twelve. Look for them at your local dealer, or write to the Wahl Clipper Corporation, 2902 Locust Street, Sterling IL 61081. Be sure to tell them you read about the Iso-Tip here, in *73 Magazine*'s RTTY Loop.

In the market for something a bit more, shall we say, meaty? How does this strike you: a hard-limiting FSK demodulator, capable of handling 170-, 425-, and 850-Hz shifts; of interfacing with 20-mA or 60-mA loops *or* RS-232 *or* TTL-level logic; with autostart and built-in tone keying; all in a case two-thirds the size of this page and costing under $250? Well, it strikes me just fine, and I call it (or more properly iRL calls it) the FSK-500. This demodulator looks like the way to go for the ham looking for a compact but effective unit for a modern RTTY station. Next month I will



The Wahl printed circuit drill.

go over this beasty in detail, but if you want to pick one up now, I am sure that the folks at iRL would be happy to oblige. Drop them a note at iRL, 700 Taylor Road, Columbus OH 43230. Don't forget to plug RTTY Loop, OK?

Now, let's look at a new RTTY activity. The Chicago Area RTTY Repeater Society (CARRS) has announced its first RTTY Art Contest. Running from November 1, 1981, through February 28, 1982, the contest seeks new RTTY art. All entries must be original to licensed radio amateurs and their immediate families and must not have been transmitted before November 1, 1981. Entrants must supply one unspliced five-level tape and three prints for each entry submitted. Format specifics include no limit on running time and a maximum of 72 characters per line. Entries must be compatible with machines running "downshift-on-space." Each line should be terminated with a minimum of three functions: CR-LF-LTRS sequence. Entrants agree that the submitted picture(s) may be used, duplicated, and published for any purpose by CARRS.

Judging will be by the CARRS Board of Directors and will be based on originality and technique. The winning entry will earn the winner a reconditioned Teletype® ASR-33 complete with modem, FOB Chicago. Send entries to Howie WA9KEK, 1752 North Austin Avenue, Chicago IL 60639.

As I mentioned a few paragraphs ago, the FSK-500 will be on tap for next month. Never one for organization, I might just scrape up another item or two—you'll have to wait and see. You never know what might turn up here, in RTTY Loop.

CORRECTIONS

Several readers have pointed out a potential problem using my program for transmitting and receiving Morse code with the TRS-80 Level I, appearing in the September issue ("TRS-80: Your Electronic Brasspounder").

If the program is to be used only for transmitting code from the keyboard without first connecting the 1NS8255 interface represented in Fig. 10 (page 94), the program will lock up within the downtime loop between memory locations 4607h and 4614h of Fig. 3 (page 91). This problem may be solved by substituting a JP TX statement for the CALL SKEY statement appearing at memory location 4583H. The resulting line would then appear as:

```
4583  C34047  JP TX
;Jump around SKEY
```

If at a later date you wish to utilize the receive program, the statement may be reinserted without any difficulty.

I have failed to provide the pin connection of pin 6 of the 1NS8255. This pin is the chip select, and for my purpose I have tied it to pin 7, making the chip always selected.

There have been inquiries as to whether I have modified the program for Level II. The modified program has the following improvements made to it:

- The buffer space is cleared to prevent a garbage, end of buffer, flag from being inserted.
- The video screen is cleared on program entry.
- Return to BASIC is allowed from the program.
- The operator is given a prompt for message entry.
- Program is written in Assembly language using Radio Shack's Editor/Assembler.

Anyone interested in obtaining a source listing may write to me.

Donald C. Downs N0AGX
1705 S. 5 Street
Marshalltown IA 50158

✓See List of Advertisers on page 162

OSCAR ORBITS

SATELLITE NEWS

UoSAT-OSCAR 9 Launched

Satellite enthusiasts now have another "amateur" bird to chase. UoSAT, a British satellite that combines research and amateur applications, was successfully launched early on the morning of October 6. Listeners were able to copy a signal from UoSAT's two-meter beacon, starting with the first orbit. Once aloft, the satellite was dubbed the "UoSAT-OSCAR 9 spacecraft."

UoSAT is not a communications satellite but it will be transmitting on a variety of amateur frequencies. For a more complete description of the satellite's capabilities, which include slow-scan television, see "Phase III and Beyond" on page 96 of the September, 1981, issue of *73*.

OSCAR 8 Still Flying High

Despite the demise of OSCAR 7, hams are still communicating via satellite. Recent accomplishments made via the OSCAR 8 satellite include the first mode J Worked All States Award which is credited to WA6GVS. Following on his heels, W7UFE completed mode J W.A.S. In doing so, he has become the first person to accomplish W.A.S. on each of the satellite modes, A, B, and J.

The DX scene was busy, too, with a record-setting mode J QSO between W4AUZ and GM4IHJ. Details about tracking OSCAR 8 can be found in the November issue of *73*.

Phase III Looking Good

Plans are being made for the launch of Phase IIIB, a replacement for the ill-fated original Phase III satellite. The third test of the Ariane rocket was a success, representing a tremendous breakthrough after Ariane's failure on May 23, 1980. AMSAT officials are preparing for a Phase IIIB launch in the fall of 1982. For more details about the Phase III program and other aspects of the amateur satellite service, contact AMSAT, PO Box 27, Washington DC 20044.

An error crept into the calculation of the OSCAR orbits published in the October and November issues of *73*. As a result, the equatorial crossing times are incorrect. Hopefully, the December predictions represent a great improvement in accuracy.

ORBITAL INFORMATION

OSCAR 8 ORBITAL INFORMATION FOR DECEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
19063	1	0113:10	84.2
19077	2	0117:44	85.3
19091	3	0122:18	86.5
19105	4	0126:53	87.7
19119	5	0131:27	88.9
19133	6	0136:01	90.0
19147	7	0140:35	91.2
19160	8	0001:58	66.6
19174	9	0006:32	67.7
19188	10	0011:06	68.9
19202	11	0015:40	70.1
19216	12	0020:14	71.2
19230	13	0024:48	72.4
19244	14	0029:22	73.6
19258	15	0033:56	74.7
19272	16	0038:30	75.9
19286	17	0043:04	77.1
19300	18	0047:37	78.3
19314	19	0052:11	79.4
19328	20	0056:45	80.6
19342	21	0101:18	81.8
19356	22	0105:52	82.9
19370	23	0110:26	84.1
19384	24	0114:59	85.3
19398	25	0119:33	86.4
19412	26	0124:06	87.6
19426	27	0128:40	88.8
19440	28	0133:13	89.9
19454	29	0137:46	91.1
19468	30	0142:20	92.3
19481	31	0003:42	67.6

OSCAR 8 ORBITAL INFORMATION FOR JANUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
19495	1	0008:15	68.8
19509	2	0012:49	70.0
19523	3	0017:22	71.1
19537	4	0021:55	72.3
19551	5	0026:28	73.5
19565	6	0031:01	74.6
19579	7	0035:34	75.8
19593	8	0040:07	77.0
19607	9	0044:40	78.1
19621	10	0049:13	79.3
19635	11	0053:46	80.5
19649	12	0058:19	81.6
19663	13	0102:52	82.8
19677	14	0107:25	84.0
19691	15	0111:57	85.1
19705	16	0116:30	86.3
19719	17	0121:03	87.4
19733	18	0125:36	88.6
19747	19	0130:08	89.8
19761	20	0134:41	90.9
19775	21	0139:13	92.1
19788	22	0000:35	67.5
19802	23	0005:08	68.6
19816	24	0009:40	69.8
19830	25	0014:13	71.0
19844	26	0018:45	72.1
19858	27	0023:17	73.3
19872	28	0027:50	74.4
19886	29	0032:22	75.6
19900	30	0036:54	76.8
19914	31	0041:26	77.9

HAM HELP

I would greatly appreciate any information (schematics, service manuals, performance improvement, etc.) on the following equipment:
a) Clegg Thor 6 transceiver;
b) Simpson Model T marine transceiver;
c) Konel Gemini III marine transceiver;
d) Johnson Ultracom 30-50-MHz FM transceiver;
e) Lafayette PB-50 30-50-MHz FM receiver.

I will copy and return manuals and refund postage costs. Thank you.

Gary B. Trustle WB8SPV
424 Franklin Ave.
Waverly OH 45690

Help, help! We have a Telrex beam, Model TBS-308, and need any information available on assembly details to permit correct operation on certain frequencies. It is a tri-band beam, traps and all, apparently two elements on each band. Any data would certainly be appreciated. Telrex Labs does not have data on this old a beam. I will cover any duplication costs if required and postage. Thanks for any help.

Paul Wiegert W8TH
1205 E. Franklin Street
Centerville OH 45459

I need manuals/schematics for the following units: EICO 752 dc power supply, Standard Communications SR-C803L VHF FM transceiver, Triplett 3434 TV-FM sweep/marker generator, and Clegg HT-146 2-meter handie-talkie.

I would prefer to buy, or copy and return your original, especially on the HT-146 as Clegg does not have an original. And does anyone have a battery for the Clegg?

John E. Carter WB4HLZ
2622 Rolling View Drive
Smyrna GA 30080

✓See List of Advertisers on page 162

TR-7730 *from page 27*

doesn't help matters much, but under most daylight conditions, the display is pretty hard to read. The other two problems I encountered involve the scanning circuit. There are an awful lot of 5-kHz split repeaters out there now, and it would be useful if the band-scanning circuitry stopped with the discriminator centered. There are currently only two rigs available that offer this feature (that I am aware of)—the Azden and the KDK 2025. Finally, for some reason the rig scans much slower in the memory-scanning mode than in the band-scanning mode. It should be easy to speed up the scan rate; the first person to come up with a good mod is guaranteed an article in *73!*

These last two points are purely personal opinion, and others may never complain. The dim display is another matter and has plagued almost every two-meter rig I have used. It's time for the industry to correct this problem. I'd like to see a blue display like the one on the TS-830S, with a dim switch for nighttime driving. I realize that it would be expensive, but the ultimate solution might be a light-sensing circuit like the one found on the IC-701.

Conclusions

Simply stated, the Kenwood TR-7730 is one of the best two-meter FM rigs for mobile operation I have used. I have used rigs that offered more features, rigs with better receivers, and rigs with brighter displays, but I have yet to test anything that combines the features, performance, compact size, and reasonable price of the TR-7730. For home use I might prefer something with more memories, like the new KDK, the TR-7850, or the Azden. For installation in the small cars that Americans are wont to buy, the TR-7730 is sublime.

For more information, contact *Trio-Kenwood Communications, Inc., 1111 West Walnut Street, Compton CA 90220.* ■

KAHANER REPORT

Larry Kahaner WB2NEL
PO Box 39103
Washington DC 20016

CORRECTION

For those of you who wrote to me about my column on competition for AT&T in the local and long-distance market (Oct., 81), I noticed the error also. Seven digits comprise a local phone number, not five as mentioned.

STALKING THE WILD BUCK

The buck never stops anywhere in Washington. It just kind of makes the rounds.

The FCC complains it lacks the power to do its job. It says the Communications Act of 1934 is too out of date to allow the Commission the legal leeway it needs to cope with our new technological age. The Act never envisioned millions of private radio users, large numbers of radio and TV sets, and an era where information would be a money-making, fast-trading commodity like rice and wheat.

According to the FCC, the Act doesn't give it permission to pull licenses of violators—they must trek through lengthy court proceedings—or set minimum standards for receivers making them less susceptible to interference.

Congress, on the other hand, has tried to rewrite the Act every session for the last 10 years, but so far has only succeeded in tacking on some satellite amendments in the early 1960s. In addition, Congress complains that the FCC doesn't use the powers it does have under the Act and is afraid to flex its muscles fearing some court will overturn the administrative decisions. The bickering is boring.

During the peak CB surge of 1977, the Commission logged more than 110,000 interference complaints. About 85% were traced to CBers overloading nearby TVs or assaulting them with harmonic radiation. Since then, the average number of complaints has never dipped below 80,000 per year. And that's half the actual count; the FCC estimates that that figure represents less than half of interference incidents.

Again the FCC laments that it doesn't have the legal right to set minimum standards for TVs. Congress doesn't amend the Act, so nothing happens at all.

But although the FCC supposedly wants that power, and some others, it's not helping Congress to rectify the situation.

In 1978, the FCC launched an inquiry into interference. It was to be the final word on the subject. Part of the reason for the investigation was to present Congress with facts about interference so when the time came for it to tackle the problem, the lawmakers would be well prepared.

The unfinished 3-year-old report, broached at a recent FCC meeting, stated: "Minimum standards for receiving equipment might be necessary." It offered no details, no technical standards.

FCC commissioner James Quello angrily referred to the sparse report during the June 17 meeting and said: "There hasn't been any movement since 1978, and the interference is getting worse. How many more years do we need?"

The Commission wanted to present the report to Congress in response to several recurring bills to regulate TV susceptibility to interference. Congress asked for FCC comments and guidance and this report was supposed to supply it. Said Quello: "And what do we tell them [Congress]?"

Commissioner Anne Jones responded sadly: "Let's start with an apology."

Even though the FCC is supposed to know more about communications than any other governmental agency, their input to Congress in this case appeared minimal.

This year, Congress seems closer to revamping the Communications Act than during any other session. Although most of the bill—commonly referred to as the Domestic Telecommunications Act of 1981 (S-898)—deals with common carrier and broadcast matters, some provisions affect hams, CBers, and other private radio licensees.

Now that the bill heads for the Senate floor, the FCC has jumped up and put in its 2 cents worth. If the FCC suggested any courses for Congress to follow during the writing, the lawmakers certainly didn't pay that much attention. Some FCC suggestions—called amendments—deal with semantics, others with substance.

Without going into the bill's details, here are some FCC amendments submitted to Congress:

- Give the FCC permission to employ volunteer amateur radio operators to administer tests to those seeking licenses of equal or lower rank.
- Allow use of volunteer hams and CBers to monitor airwaves for violations.
- Permit aliens to obtain operator licenses.
- Allow elimination of CB licenses.
- Allow suspension of licenses of those who aid and abet violators.
- Allow the FCC to issue cease and desist orders in cases of safety.

The FCC proposes many other items, but these most directly impact hams and CBers.

You might know that the FCC doesn't need Congressional mandate to permit volunteer license proctors. General class license holders and above now administer tests to Novice hopefuls. Nor does the FCC need permission to allow aliens to hold licenses. It does that now in some cases.

So, why bother? For one thing, a bill reassures the FCC that it really has all that power. Secondly, the Act ties it all up into one neat bundle, and the FCC doesn't have to take it upon

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Here's an updated reciprocal licensing/operating list:

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Austria
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Barbados
Belgium
Bolivia
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Brazil
Canada
Chile
Colombia
Costa Rica
Denmark
Dominican Rep.
Ecuador
El Salvador
Fiji
Finland
France
West Germany
Greece
Grenada
Guatemala
Guyana
Haiti
Honduras
Iceland
India
Indonesia
Ireland
Israel
Italy
Jamaica
Jordan
Kiribati
Kuwait
Liberia
Luxembourg
Monaco
Netherlands
Netherlands Ant.
New Zealand
Nicaragua
Norway
Panama
Paraguay
Peru
Philippines
Portugal
St. Lucia
Seychelles
Sierra Leone
Solomon Islands
Spain
Surinam
Sweden
Switzerland
Trinidad & Tobago
Tuvalu
United Kingdom
Uruguay
Venezuela
Yugoslavia

LATEST THIRD-PARTY AGREEMENTS

The FCC issued an updated third-party list:

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Bolivia
Brazil
Chile
Colombia
Costa Rica
Cuba
Dominican Rep.
Ecuador
El Salvador
Gambia
Ghana
Guatemala
Guyana
Haiti
Honduras
Israel
Jamaica
Jordan
Liberia
Mexico
Nicaragua
Panama
Paraguay
Peru
Trinidad & Tobago
Uruguay
Venezuela

Also, ITU headquarters in Geneva, station 4U1ITU

itself, administratively, to change any regulations.

No one knows if the bill will pass, even though it seems well on its way. However, if it speeds towards the president for his signature, there's no guarantee that Congress will slow down and consider the FCC proposals.

At presstime, the Senate unanimously passed bill S-929 which gives the FCC absolute authority to set minimum standards for TV sets and other receiving equipment. Titled Amateur Radio Service and Private Land Mobile Services Act of 1981, the bill won't apply to existing equipment.

Other sections: License terms raised from 5 to 10 years, hams and CBers permitted to monitor the airwaves in their own services for violators, and hams may administer licensing tests.

The bill passed the Senate only after it added an amendment giving the FCC permission to eliminate CB licenses.

FCC chairman Mark Fowler lobbied for and received the last concession. He wants the Commission out of the CB licensing business and claims the move will save the FCC more than $½ million a year.

No one is sure if that bill will pass either.

Note the wording in each bill. Each gives the FCC permission to do all these new things, but doesn't force it to do so.

Perhaps it doesn't even matter. Each side has excellent excuses for not doing anything and neither wants to jeopardize that safe position. Make no decisions, make no enemies.

And the buck just keeps on passing.

LOOKING WEST

Bill Pasternak WA6ITF
c/o The Westlink Radio Network
Suite 718
7046 Hollywood Blvd.
Hollywood CA 90028

A CHRISTMAS PRESENT: SANTA BARBARA'S SUCCESSFUL REPEATER

We begin this year's Christmas special with a true success story, the story of a two-meter repeater located near the city of Santa Barbara, California. What puts this system a cut above the rest? Think in terms of other stories you have read in this column—stories depicting the rise and fall of other repeater systems. Also remember that the 2-meter FM scene in southern California has never been very stable. Rather, it's factionalized. Where else in the nation are 146.34/.94 and 146.16/.76 still simplex channels for the most part? Yet the WR6ANW repeater has survived and prospered. Not because it's away from Los Angeles proper, but rather because things were done right to start with. Here is the story as told by Jay Hennigan WB6RDV in the June, 1981, issue of *Key-Klix*, the monthly newsletter of the Santa Barbara Amateur Radio Club.

A HISTORY OF K6TZ/R

A Gift from Delco

The SBARC 2-meter repeater had its humble beginnings as a portion of a gift of surplus Motorola radio equipment donated by Delco Electronics. The equipment consisted of two 150-MHz dish antennas. All of the above was immediately scattered throughout the county, with the majority winding up in the garage of WA6OOO on Palisades Drive. This arrangement made it rather difficult for Darryl to put cars in his garage, considering that a certain individual had a Progress-Line autopatch and a jukebox or two stashed there as well. The dishes, and a lot of the less-immediately-usable gear, wound up in the backyard of Sonatech, Inc., work QTH of WB6RDV, WA6OQZ, and WA6LWJ.

Where to Put It?

Obviously, such a generous gift was destined to become a 2-meter repeater. The only remaining questions were at what location and on what frequency. Several physical locations were scouted out, with the final location picked as the city radio site on Lavigia Hill on the Mesa. One thing the city required was a statement by a licensed civil engineer that our tower, identical to several other towers installed by the city at the same location, would not fall down. This survey was provided free of charge by Dave Harris, father of KA6OFZ. The next question was one of frequency. Some people within the club felt that our repeater should be on a "common pair" such as 146.34/.94 or .16/.76. In those days, 99-plus percent of amateur 2-meter gear was crystal-controlled, which resulted in a conflict between having the repeater on one of these "common" frequencies, making it available to most amateurs passing through town, and the refusal of several hundred southern California FM pioneers to give up .94 and .76 as simplex frequencies. The club looked into several other pairs and eventually a tape recorder was installed at the site to listen to two different frequencies as possibilities (146.19 and 146.22). The selec-

tion was 146.19, having the least co-channel interference, and a sanction was received from the Southern California Repeater Association for its use. The club now had a location and a frequency. All that was needed was some personpower and a license.

A Taste of Root Beer

In the good old days, licensing a repeater was about as much of an ordeal as licensing a nuclear power plant is today. The FCC required numerous drawings, sketches, schematics, and calculations, and it seemed as if they were sadly lacking in the people needed to review and process all of this material. A thick packet was sent to Washington by the club's technical committee, and as we waited we were not idle. The duplexer, antenna, and tower were ordered and received, along with some 75-Ohm hardline, which was definitely *not* ordered. A call to the manufacturer revealed that it was their goof. UPS and the post office refused to carry the stuff back to LA for exchange, although it would and did fit in the back of a VW. Winnie, now KA6OFZ, ran it down to LA for exchange. After what seemed like an eternity with no word from the FCC, K6YX, our then-trustee, called on them in Washington (in person) and was informed that the license had been processed with a call of WR6ANW. The identifier was programmed and the repeater was tested. When the license arrived in the mail, it had the call of WR6ANW and the root-beer box was born.

Out of Control

Although we now had a working repeater, there was no way to control it. The club had installed a telephone line at the site for a dial-up control system, but no such control system had been built. The trustee stated that if there was no control system by January of 1977, the repeater would go off the air. WB6RDV and company worked feverishly on New Year's Eve and came up with a dial-up control system. No tone decoders were available at the time, so the control codes consisted of dialing an unlisted phone number. One call would turn the repeater off and the next call would turn it back on. Every so often, the repeater would mysteriously go off the air due to someone dialing a wrong number. This "temporary" control system was upgraded with the addition of some touchtone™ decoders to give a more positive on-and-off command, and was to be replaced when the new cactus-style control system was completed. Parts were ordered and meetings held with Alan Burgstahler WA6AWD, who agreed to sell us blank PC boards and plans to build the sophisticated control system that we have today.

The boards were farmed out to many club members for drilling and stuffing with parts. The temporary control system, it seemed, was going to be rather permanent as progress on completion of the new control system was exceedingly slow. A new receiver was donated by Dean Dods WB6IYW and installed to cure several problems which were developing with the old tube-type receiver. It became evident that the newness was wearing off and several corrective maintenance items were necessary. Our new antenna was taken down for repairs and the duplexer had one cavity go bad (which was sent back to the manufacturer). In addition, the city was in the process of expanding their building right over the area where the repeater was located. A work party retrenched the antenna cable and the repeater was moved to a wooden pallet about 10 feet from its former location. The electric power and telephone line were brought out by extension cords draped through the bushes, and the "temporary" control system was still in operation some three years later.

The Housing Crunch

It became obvious that some sort of permanent structure would be necessary to enclose the repeater. SBARC went to tremendous effort to build a very rugged plywood box large enough to enclose the repeater and duplexer. The box was delivered to Valley Telecom, Inc., the new business of WB6RDV, and it is still there. In the interim, the city had agreed to provide a separate building for the SBARC repeater. At some time during this period, the WR6ANW callsign expired and the new club call of K6TZ/R was programmed into the repeater.

The New Machine

As time took its toll on the older equipment and more frequent repair trips became necessary, it became obvious that the good old root-beer box might not stand up during an emergency. In addition, the club wanted features such as autopatch. A grassroots fund raising was spearheaded by WB6OBB and N6CPN and the club ordered a new all-solid-state GE repeater. The pace picked up on completion of the cactus control system. The new machine arrived and was installed in its new house, originally without the new control system. FCC rules had relaxed, allowing automatic repeater control, and the temporary control system was laid to rest along with the original repeater. The cactus control system, finally complete, was installed along with a 440-MHz control receiver and temporary autopatch on loan from W6YJO. The new control system functioned well for a time but was damaged by a nearby lightning strike during a storm. We are currently operating under automatic control once again.

The Future

Most of the problems with the control system have been repaired and a new, more sophisticated autopatch is in the design stage. The repeater now has full battery standby power as well as standby ac power provided by the city generator. The new control system is expandable to fulfill future needs, and the basic repeater has proved to be a very reliable machine. The SBARC repeater fund is still attempting to recover from the purchase of the new machine, and future improvements will be made as funds become available.

CHRISTMAS IN THE CITY OF THE ANGELS

I guess you all know that this is a special time of year. Even here in Los Angeles, most of the major thoroughfares are alive with holiday decorations and the spirit of the season is in the air. Also, on the air. Shortly, it will be time for "Operation Santa Claus 1981," in which amateurs from all over the area take their portables and hand-helds into local hospitals so that children confined in those institutions can get their chance to communicate with Jolly Old St. Nick.

We have written about this topic before. We told you how it was started more than 20 years ago on the old Mt. Wilson WA6TDD repeater by W6AOP and K6SJJ, among others, and how this event has withstood all forms of adversity over the years, including some organized jamming in recent times. No matter what, "Operation Santa Claus" will happen. It's become as important a Los Angeles area tradition as the decorations along Wilshire Boulevard. It will happen again this year, and it will succeed again this year.

Most hams belong to one or more radio clubs in their area. I wonder how many of you have ever thought of undertaking a project like "Operation Santa Claus," but failed to bring the idea to the attention of the rest of the members. True, it's a lot of work. You can't expect to start on Sunday with planning and be ready to roll the following Wednesday night. The logistics of this kind of operation are such that very careful consideration must be given to every detail. The obvious first step is to make contact with the hospitals in your area and simply offer the concept. Since this might be a bit of a job in itself, do give yourself ample lead time. Right now is a good time to plan for next year. The hardest part will be reaching the proper official with the power to make a decision. You may have to work through an intermediary, but if you've got the tenacity and can be convincing enough, you will probably get the green light. A good argument in favor of the project is the longevity of the Los Angeles area operation.

Next, you must select your operating mode. Here VHF and FM are naturals. This is because of the lightweight portability of equipment and the fact that no connection to power mains is needed. Avoid hand-helds unless they are equipped with external speaker-microphones. Many of the kids you will visit may not be ambulatory. As you know, using a hand-held while lying flat on your back is not the easiest thing to accomplish even for the trained operator. Now think of trying to be station in control for an invalid child who has never before seen a hand-held. If you don't have a speaker-mike for your rig, you might pluck that old TR-22 out of the closet and blow off the cobwebs. Radios like the TR-22, TR-33, and TR-2200 are best for this type of operation.

It's also necessary to avoid massive equipment installations which require outdoor antennas and connections to the ac power mains. If your particular site dictates that you must operate from a fixed location using ac power, be sure that all equipment is grounded properly using 3-wire line cords. Do not try to cheat the system with adapters and the like. Besides the fact that most hospitals will not permit this in the first place for safety reasons, you run the risk of personal liability if someone should be injured as the result of your negligence. Remember: You may be performing a public service, but you are still someone else's guest and you live by their rules.

What about Santa Claus himself and his North Pole home? Where should he be located? You play this one by ear. In Los Angeles, a large number of hospitals are visited every year. It would be all but impossible for Sid McCormack W6BWC, who is our Santa, to visit each. Sid operates from a centralized North Pole and communicates over a system of intertied repeaters to hospitals as far to the east as Riverside, to the west to the ocean, and to the south half the distance to San Diego. The logistics of the LA Operation San-

ta Claus seem to grow each year, but each independent geographic area and involved club will have to decide what's best for itself.

For example, if you can only visit one hospital, Santa can be on site. That is either in a vacant room, in his mobile, or anywhere near enough for full-quieting simplex operation. It's lunacy to tie up a busy repeater for an evening if Santa and his flock are within a few yards of one another. Also, avoid unintentional interference from outside. Stay off .52 or any other heavily used simplex frequency in your area. Choose some oddball away from the mainstream of 2-meter activity. True, you will lose your outside audience, but you will also avoid problems from outside your operation.

On the other hand, if logistics dictate the use of a repeater, possibly because your operation is quite large in nature, then try to find one that has a low utilization factor. While you might find this hard to believe, there are some hams who will object to having their favorite rag-chew session interrupted for any reason. These are the people who ratchet-mouth through tornado and hurricane alerts; unfortunately, we have our share of these un-public-spirited individuals among us. If you have no alternative but to use a specific system, then be sure to publicize the event well in advance. Make sure every member of the club knows that the repeater will be closed to all but the Santa Claus operation and emergencies during a specific time period. List the operating schedule in your newsletter and have someone make periodic announcements at least two weeks prior to the event. Make sure that hams from other repeaters and clubs know as well. Not only may you pick up some needed extra help, but you will also avoid hurting anyone's feelings the day of the operation when all on the frequency must be requested to vacate. Prepublication of your operating schedule will give all a chance to find alternate places to operate.

If your area is plagued with malicious interference—if the sick minds are out there just waiting to give some poor sick child a deluge of four-letter atrocities—then do not even consider the use of a repeater. Even a private tone-access system. Better you have a Santa on the run from hospital to hospital than demean the operation by letting some half-crazed jerk spoil the fun for the kids in order to get his own kicks. If the distance between locations makes having a Santa on the run an impossible task, then you might consider borrowing someone's remote base for operation from "Santa Central" to the field units. The very nature of a remote base, i.e., simplex channel operation, tends to minimize the kook factor. Also, even with a remote base, stay on some uninhabited simplex channel. Most potential jammers are not all that astute. Very few will go out and purchase a 220-MHz or 450-MHz synthesized radio in hope of locating your control channel just to cause you misery. Even so, be prepared for any eventuality, for any trouble-maker who might come along. Some people no longer believe in Santa Claus. Some of these object to you or anyone else believing either. Need I say more?

What about your Santa? First of all, he should have the kind of voice and personality that kids already associate with St. Nick: warm, friendly, and understanding. It will probably be hard to choose from among the many volunteers for the position. Who wouldn't want to be "Santa for a Day"?

Since Santa is supposed to be live and direct from the North Pole, some North Pole sound effects might be in order. Nothing elaborate... and nothing you can't get from a Christmas sound effects record from your local five and ten cents store. Transfer the sounds you need onto endless loop cassettes and put the player within range of your mike. Adjust the volume to where the background on another radio seems real and there you have it—instant North Pole. Loop cassettes or, if you prefer, endless loop cartridge tapes, will keep you from having to rewind tape at an inopportune time. Make a few different tapes or carts. If you have the equipment, you might want to edit and re-mix sounds for greater realism. You might even approach a local radio station for help on this, which could bring a side benefit of news coverage as well. A bit of good public relations for our hobby never hurts. Also, in relation to publicizing your event to the general public, I suggest you read "Free PR for Ham Radio" in the September, 1981, issue of *73*. Rob Diefenbach WD4NEK has been very successful in this department and his article shares his secrets with you.

One note from someone in the business. If you make arrangements for TV coverage, keep that schedule to the second. Television news is a split-second industry and it's very easy to get an assignment editor irate by having his crew show up to find nobody ready or the event completed. Blow it once, and you might as well forget it in the future. In news, especially electronic journalism, that's the name of the game.

Finally, what should Santa say to the kids, and what should he avoid? In most cases, the kids will have a list of gifts they want. Unless your club has an unlimited treasury, there will be no way to deliver on promises made, so make no promises. One of the worst things an adult can do to kids is promise and not deliver. Let Santa respond by saying something akin to "we will put it on the list and see what we can do." No hard and fast promises. Above all, keep conversations light, seasonal, and filled with "ho, ho, ho's"...and don't forget to ID at prescribed intervals.

When your operation is over, hold a critique over a cup of coffee. If you are smart, you will have recorded your "Operation Santa Claus." Use these tapes to critique the operation. Videotapes are even better. If you received TV coverage, chances are that the station probably sent a mini-cam crew to record the event. They probably recorded a lot more tape than ever reached the air, and very quick action (within 24 hours, before the cassettes are bulk-erased for reuse) might get you a dupe of the raw or unedited shoot.

Last year's Los Angeles "Operation Santa Claus" was the biggest and best to date. It was a delight to listen to and it received good press coverage from local TV, radio, and newspapers. What about this year? It's only a few days before I will know the whole story on "Operation Santa Claus 1981."

SEASON'S GREETINGS

I hope you have enjoyed this year's Christmas special. Next month, it will be business as usual. We may have some information on FCC actions against alleged (or proven) jammers, and definitely will have the last part of the SCRRBA series on voluntary frequency coordination for the 1980s. In the meantime, from those of us who write on the late shift in Los Angeles, our warmest wishes for a very Merry Christmas, Happy Chanukah, and...as the voice on the old WA6TDD repeater ID tape used to say...a Happy and Preposterous New Year. See you in 1982.

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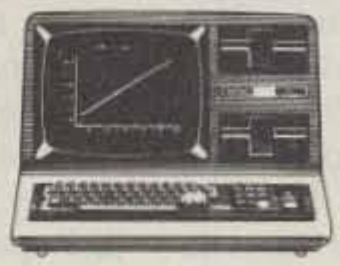

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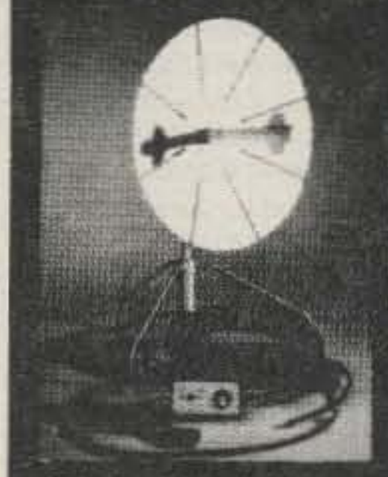

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P.C.Board with all parts for assembly. $49.99

P.C.Board with all parts for assembly plus 2N6603 $69.99

P.C.Board assembled and Tested. $69.99

P.C.Board assembled and Tested with 2N6603. $79.99

HMR II Downconverter with power supply , antenna (Dish) and all Cable for Instalation.180 Day Warranty .

1 to 5	$150.00	6 to 11	$140.00	12 to up	$125.00

Yagi Downconverter with Power Supply , Antenna (Yagi) and all cables for Instalation. 90 Day Warranty.

1 to 5	$150.00	6 to 11	$140.00	12 up	$125.00

Yagi Downconverter as above but Kit. (NO CABLES) With Box.

1 to 5	$125.00	6 to 11	$115.00	12 up	$100.00

HMR II Downconverter as above but Kit. (NO CABLES) With PVC.

1 to 5	$125.00	6 to 11	$115.00	12 up	$100.00

Special New Stock Of Carbide Drill Bits.

1.25mm	20	40	53	63
1.45mm	24	44	54	64
3.2mm	26	45	55	65
3.3mm	29	46	56	67
1/8	30	47	57	68
3/16	31	48	58	69
5/32	36	49	59	
7/32	37	50	60	Your Choice $1.99
13/64	38	51	61	
19	39	52	62	

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"FILTERS"

Collins Mechanical Filter #526-9724-010 Model F455Z32F
455KHz at 3.2KHz Wide. $15.00

Atlas Crystal Filters

5.52-2.7/8	5.52MHz/2.7KHz wide 8 pole	
5.595-2.7/8/U	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.595-.500/4/CW	5.595MHz/.500KHz wide 4 pole CW	
5.595-2.7/LSB	5.595MHz/2.7KHz wide 8 pole lower sideband	
5.595-2.7/USB	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.645-2.7/8	5.645MHz/2.7KHz wide 8 pole	Your Choice
9.0SB/CW	9.0MHz/ 8 pole sideband and CW	$12.99

Kokusai Electric Co. Mechanical Filter #MF-455-ZL-21H
455KHz at Center Frequency of 453.5Kc Carrier Frequency of 455Kc 2.36Kc Bandwidth
$15.00

Crystal Filters

Nikko	FX-07800C	7.8MHz	10.00
TEW	FEC-103-2	10.6935	10.00
Tyco/CD	001019880	10.7MHz 2 pole 15KHz Bw. Motorola #48D84396K01 Thru #48D84396K05	4.00
Motorola	4884863B01	11.7MHz 2 pole 15KHz Bandwidth	5.00
PTI	5350C	12MHz 2 pole 15KHz Bandwidth	5.00
PTI	5426C	21.4MHz 2 pole 15KHz Bandwidth	5.00
CD	A10300	45MHz 2 pole 15KHz Bandwidth (For Motorola Communications equipment)	5.00

Ceramic Filters

Murata	BFB455B	455KHz	$ 2.40
	CFM455E	455KHz +- 5.5KHz	6.65
	CFM455D	455KHz +- 7KHz	6.65
	CFR455E	455KHz +- 5.5KHz	8.00
	CFU455E	455KHz +- 1.5KHz	2.90
	CFU455G	455KHz +- 1KHz	2.90
	CFW455D	455KHz +- 1KHz	2.90
	CFW455H	455KHz +- 3KHz	4.35
	SFB455D	455KHz	2.40
	SFE10.7	10.7MHz	2.67
	SFG10.7MA	10.7MHz	10.00
Clevite	TO-01A	455KHz	5.00
	TO-02A	455KHz	5.00
Nippon	LF-B4/CFU455I	455KHz +- 1KHz	5.80
	LF-B6/CFU455H	455KHz +- 1KHz	5.80
	LF-C18	455KHz	10.00
Tokin	CF455A/BFU455K	455KHz +- 2KHz	4.80
Matsushira	EFC-L455K	455KHz	7.00

ROTRON MUFFIN FANS Model Mark 4/MU2A1
These fans are new factory boxed 115vac at 14watts 50/60cps. Impedance Protected-F
CFM is 88 at 50cps and 105 at 60cps. $ 7.99

SPECTRA PHYSICS INC. Model 088 HeNe Laser Tubes.

Power output 1.6mw.	Beam Dia. .75mm.	Beam Dir. 2.7mr.	8Kv starting voltage	
68K ohm 1watt ballast	1000vdc +-100vdc	3.7ma.	TUBES ARE NEW	$59.99

"AMPLIFIERS"

AVANTEK LOW NOISE AMPLIFIERS

Models	UTC2-102M	AP-20-T	AL-45-0-1	AK-1000M
Frequency Range	30 to 200MC	200 to 400MC	450 to 800MC	500 to 1000MC
Noise Figure	1.5dB	6.5dB	7dB	2.5dB
Voltage	+15vdc	+24vdc	-6vdc @ +12vdc	+12vdc @ -12vdc
Gain	29dB	30dB	30dB	25dB
Power Output	1dB Gain +7dBm	1dB Gain +20dBm	1dB Gain -5dBm	1dB Gain +8dBm
Price	$49.99	$49.99	$49.99	$69.99

Mini Circuits Double Balanced Mixers

Model RAY-3
Very High Level (+23dBm LO) 70KHz to 200MHz LO,RF,DC to 200MHz IF
Conversion Loss,dB One Octave From Band Edge 6Typ./7.5Max. Total Range 6.5Typ./8Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 55Typ./45Min. Mid. Range (LO-RF/LO-IF) 40Typ./30Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 30Typ./25Min.
Price $24.99

Model TSM-3
Standard Level (+7dBm LO) .1MHz to 400MHz LO,RF,DC to 400MHz IF
Conversion Loss,dB One Octave From Band Edge 5.3Typ./7.5Max. Total Range 6.5Typ./8.5Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 60Typ./50Min. Mid. Range (LO-RF/LO-IF) 50Typ./35Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 35TYP./25Min.
Price $11.99

Hewlett Packard Linear Power Microwave RF Transistor HXTR5401/35831E

Collector Base Brakedown Voltage at Ic=100ua	35volts min.
Collector Emitter Brakedown Voltage at Ic=500ua	30volts min.
Collector Cutoff Current at Vcb=15v	100ua max.
Forward Current Transfer Ratio at Vce=15v,Ic=15ma	15min,40typ,125max
Transducer Power Gain at Vce=18v,Ice=60ma,F=2GHz.	3dBmin,4dBtyp
Maximum Available Gain at Vce=18v,Ic=60ma,F=1GHz/F=2GHz	14dB typ,8dB typ
Price	$29.99

Motorola RF Power Amplifier Modules

Model	MHW612A	MHW613A	MHW710	MHW720
Frequency Range	146 to 147MHz	150 to 174MHz	400 to 512MHz	400 to 470MHz
Voltage	12.5vdc	12.5vdc	12.5vdc	12.5vdc
Output Power	20watts	30watts	13watts	20watts
Minimum Gain	20dB	20dB	19.4dB	21dB
Harmonics	-30dB	-30dB	40dB	40dB
RF Input Power	400mw	500mw	250mw	250mw
Price	$57.50	$59.80	$57.50	$69.00

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"TRANSISTORS"

WATKINS JOHNSON WJ-M62 3.7 to 4.2GHz Communication Band Double Balanced Mixer $100.00

SSB Conversion Loss	4.9dB Typ.	6dB Max.	fR 3.7 to 4.2GHz
	5.5dB Typ.	6.5dB Max.	fI DC to 1125MHz fL fR
			fI 880MHz fL fR
SSB Noise Fiqure			fR 3.7 to 4.2GHz
	4.9dB Typ.	6dB Max.	fI 30 to 1125MHz fL fR
	5.5dB Typ.	6.5dB Max.	fI 880MHz fL fR
Isolation			
fL at R	30dB Min.	40dB Typ.	fL 2.8 to 5.35GHz
fL at I	25dB Min.	30dB Typ.	fL 4.5 to 5.35GHz
	20dB Min.	30dB Typ.	fL 3.6 to 4.5GHz
	15dB Min.	25dB Typ.	fL 2.8 to 3.6GHz
Conversion Compression	1dB Max.		fR Level +2dBm
Flatness	.2dB Peak to Peak Over any 40MHz Segment of fR=3.7 to 4.2GHz		
Third Order Input Intercept	+11dBm		fR1=4GHz fR2=4.01GHz Both at -5dBm fL=4.5GHz
Group Time Delay	.5ns Typ.	.75ns Max.	fR3.7 to 4.2GHz fL 3480MHz @ +13dBm
VSWR	L-Port	1.25:1 Typ.	2.0:1 fL 2.8 to 5.35GHz
	R-Port	1.25:1 Typ.	2.0:1 fR 3.7 to 4.2GHz fL fR
		1.4 :1 Typ.	2.0:1 fR 3.7 to 4.2GHz fL fR
	I-Port	1.5 :1 Typ.	2.0:1 fI=100MHz
		1.3 :1 Typ.	2.0:1 fI=500MHz
		1.8 :1 Typ.	2.5:1 fI=1125MHz

SGS/ATES RF Transistors

Type.	BFQ85	BFW92	MRF901	2N6603
Collector Base V	20v	25v	25v	25v
Collector Emitter V	15v	15v	15v	15v
Emitter Base V	3v	2.5v	3v	3v
Collector Current	40ma	25ma	30ma	30ma
Power Dissipation	200mw	190mw	375mw	400mw
HFE	40min. 200max.	20min. 150max.	30min. 200max.	30min. 200max.
FT	4GHZ min. 5GHz max.	1.6GHz Typ.	4.5GHz typ.	2GHz min.
Noise Fiqure	1GHz 3dB Max.	500MHz 4dB Typ.	1GHz 2dB Typ.	2GHz 2.9dB Typ.
Price	$1.50	$1.50	$2.00	$10.00

Motorola RF Transistor

National Semiconductor Variable Voltage Regulator Sale !!!!!!!!!

LM317K	LM350K	LM723G/L	LM7805/06/08/12/15/18/24
1.2 to 37vdc	1.2 to 33vdc	2 to 37vdc	5, 6, 8,12,15,18,24vdc
1.5Amps	3Amps	150ma.	1Amp
TO-3	TO-3	TO-100/TO-116	TO-220/TO-3
$4.50	$5.75	$1.00 $1.25	$1.17 $2.00

P & B Solid State Relays Type ECT1DB72

5VDC Turn On 120VAC Contact 7Amps
20Amps on 10"x10"x.062" Alum.Heatsink with
Silicon Grease $5.00

*May Be Other Brand Equivalent

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$ POR	SK626	Chimney	$ 7.70
SK406	Chimney	35.00	SK630	Socket	45.00
SK416	Chimney	22.00	SK636B	Chimney	26.40
SK500	Socket	330.00	SK640	Socket	27.50
SK506	Chimney	47.00	SK646	Chimney	55.00
SK600	Socket	39.50	SK711A	Socket	192.50
SK602	Socket	56.00	SK740	Socket	66.00
SK606	Chimney	8.80	SK770	Socket	66.00
SK607	Socket	43.00	SK800A	Socket	150.00
SK610	Socket	44.00	SK806	Chimney	30.80
SK620	Socket	45.00	SK900	Socket	253.00
SK620A	Socket	50.50	SK906	Chimney	44.00

JOHNSON TUBE SOCKETS

124-115-2/SK620A	Socket	$ 30.00	124-113	Bypass Cap.	$ 10.00
124-116/SK630A	Socket	40.00	122-0275-001	Socket	
			(For 4-250A,4-400A,3-400Z, 3-500Z)		10.00 2/$15.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_o), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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"TUBES"

TUBES	PRICE	TUBES	PRICE	TUBES	PRICE
2E26	$ 4.69	5721	$200.00	8462	$100.00
2K28	100.00	5768	85.00	8505A	73.50
3B28	5.00	5836	100.00	8533W	92.00
3-500Z	102.00	5837	100.00	8560A	55.00
3-1000Z/8164	300.00	5861/EC55	110.00	8560AS	57.00
3CX1000A/8283	200.00	5876A	15.00	8608	34.00
3X2500A3	200.00	5881/6L6	5.00	8624	67.20
4-65A/8165	45.00	5894/A	45.00	8637	38.00
4-125A/4D21	58.00	5894B	55.00	8647	123.00
4-250A/5D22	68.00	6080	10.00	8737/5894B	55.10
4-400A/8438	71.00	6083/AX9909	89.00	8807	1000.00
4-400C/6775	80.00	6098/6AK6	14.00	8873	260.00
4-1000A/8166	300.00	6115/A	100.00	8874	260.00
4CS250R	69.00	6146	6.00	8875	260.00
4X150A/7034	30.00	6146A	6.50	8877	533.00
4X150D/7035	40.00	6146B/8298A	7.50	8908	12.00
4X150G	50.00	6146W	14.00	8916	1500.00
4X250B	30.00	6159	11.00	8930/X651Z	45.00
4CX250B/7203	45.00	6161	70.00	8950	10.00
4CX250F/7204	45.00	6291	125.00		
4CX250FG/8621	55.00	6293	20.00	6BK4C	5.00
4CX250K/8245	100.00	6360	4.00	6DQ5	4.00
4CX250R/7580W	69.00	6524	53.00	6FW5	5.00
4CX300A	99.00	6550	7.00	6GE5	5.00
4CX350A/8321	100.00	6562/6794A	25.00	6GJ5	5.00
4CX350FJ/8904	100.00	6693	110.00	6HS5	5.00
4X500A	100.00	6816	58.00	6JB5/6HE5	5.00
4CX600J	300.00	6832	22.00	6JB6A	5.00
4CX1000A/8168	300.00	6883/8032A/8552	7.00	6JM6	5.00
4CX1500B/8660	300.00	6884	46.00	6JN6	5.00
4CX3000A/8169	300.00	6897	110.00	6JS6B	5.00
4CX5000A/8170	400.00	6900	35.00	6JT6A	5.00
4CX10000D/8171	500.00	6907	55.00	6KD6	5.00
4CX15000A/8281	700.00	6939	15.00	6K66/EL505	5.50
4E27/A/5-123A/B	40.00	7094	75.00	6KM6	5.00
4PR60A	100.00	7117	17.00	6KN6	5.00
4PR60B/8252	175.00	7211	60.00	6LF6	6.00
KT88	15.00	7289/3CX100A5	34.00	6LQ6	6.00
DX362	35.00	7360	11.00	6LU8	5.00
DX415	35.00	7377	67.00	6LX6	5.00
572B/T160L	44.00	7486	75.00	6ME6	5.00
811	10.00	7650	250.00	12JB6A	6.00
811A	13.00	7843	58.00		
812A	15.00	7868	4.00	"WE ARE ALSO LOOKING FOR TUBES NEW/USED ECT."	
813	38.00	7984	12.00		
4624	100.00	8072	55.00		
4665	350.00	8121	50.00	WE BUY SELL OR TRADE	
5551A	100.00	8122	85.00		
5563A	77.00	8236	30.00		
5675	15.00	8295/PL172	300.00		

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"MICROWAVE COMPONENTS"

		MICROWAVE COMPONENTS	
AIL	70A	Noise Source	$100.00
AIL	7010	Noise Source .2 to 2.6GHz	100.00
AIL	07050	Noise Source	100.00
AIL	07051	Noise Source 7.05 to 10GHz	150.00
AIL	07091	Noise Source 12.4 to 18GHz	200.00
ARRA	KU520A	Variable Attenuator	100.00
ARRA	2416-20	Variable Attenuator 0-20dB .5 to 1GHz 10w	50.00
ARRA	3614-60X	Variable Attenuator 0-60dB 1 to 2GHz 10w	50.00
ARRA	4684-20C	Variable Attenuator 0-20dB 3 to 4GHz 10w	75.00
ARRA	6684-20F	Variable Attenuator 0-20dB 7 to 11GHz	75.00
Alfred	1151	Sampler Attenuator 1 to 2GHz 0 to 50dB	200.00
Alfred	1152	Sampler Attenuator 2 to 4GHz 0 to 50dB	200.00
Alfred	1153	Sampler Attenuator 4 to 8GHz 0 to 50dB	200.00
Americon	2000-6254	Adapter X to SMA 8.2 to 12.4GHz	75.00
Americon	2020-6600	Directional Coupler .5 to 1GHz 6dB	75.00
Boonton	41-4B	Power Detector	75.00
Coaxial Dynamics	3023	Directional Power Detector 60wfwd/15wrev/225-400mc	50.00
Coaxial Dynamics	3025	Directional Power Detector 60wfwd/15wrev/116-150mc	50.00
FXR/Microlab	CW-A21	Coupler	35.00
FXR/Microlab	XP-A39	Crystal Detector	35.00
FXR/Microlab	S164A	Variable Attenuator 0-50dB 2.6 to 3.95GHz	450.00
FXR/Microlab	N414A	Frequency Meter 3.95 to 11GHz	450.00
FXR/Microlab	601A07	Adapter	35.00
FXR/Microlab	G601B	Adapter	35.00
General Microwave	N402A-3	Power Detector	100.00
General Microwave	N710-20	Directional Coupler 2 to 4GHz 20dB	75.00
General Microwave	4276-2	100:1 Divider 1MC to 250MC	35.00
Hewlett Packard	G281A	Adapter G to N 3.95 to 5.85Gc	50.00
Hewlett Packard	H281A	Adapter H to N 7.05 to 10Gc	35.00
Hewlett Packard	X281A	Adapter X to N 8.2 to 12.4Gc	35.00
Hewlett Packard	MX292B	Adapter 10 to 15Gc	75.00
Hewlett Packard	NK292A	Adapter 15 to 22Gc	75.00
Hewlett Packard	345B	Noise Source IF 30/60Mc	200.00
Hewlett Packard	G347A	Noise Source 3.95 to 5.85Gc	250.00
Hewlett Packard	H347A	Noise Source 7.05 to 10Gc	250.00
Hewlett Packard	S347A	Noise Source 2.6 to 3.95Gc	325.00
Hewlett Packard	X347A	Noise Source 8.2 to 12.4Gc	250.00
Hewlett Packard	349A	Noise Source 400Mc to 4Gc	300.00
Hewlett Packard	355C	Variable Attenuator .5w DC to 1Gc	150.00
Hewlett Packard	360D	Low Pass Filter 4100Mc	50.00
Hewlett Packard	G382A	Variable Attenuator 0 to 50dB 3.95 to 5.85Gc	500.00
Hewlett Packard	J382A	Variable Attenuator 0 to 50dB 5.85 to 8.2Gc	500.00
Hewlett Packard	P382A	Variable Attenuator 0 to 50dB 12.4 to 18Gc	350.00
Hewlett Packard	X382A	Variable Attenuator 0 to 50dB 8.2 to 12.4Gc	325.00
Hewlett Packard	411A-21D	N Tee For 411A	35.00
Hewlett Packard	H421A	Crystal Detector 7.05 to 10Gc	50.00
Hewlett Packard	H421A	Crystal Detector 7.05 to 10Gc Matched Pair	200.00
Hewlett Packard	H424A	Crystal Detectot 7.05 to 10Gc Matched Pair	400.00
Hewlett Packard	477B	Thermistor Mount For 430 Series 10Mc to 10Gc	75.00
Hewlett Packard	G485A	Barretter Mount 3.95 to 5.85Gc	65.00
Hewlwtt Packard	J485B	Detector Mount 5.85 to 8.2Gc	85.00
Hewlett Packard	J486A	Thermistor Mount 5.85 to 8.2Gc	180.00
Hewlett Packard	H487B	Thermistor Mount 7.05 to 10Gc	50.00
Hewlett Packard	K487C	Thermistor Mount 18 to 26Gc	135.00
Hewlett Packard	P487B	Thermistor Mount 12.4 to 18Gc	155.00
Hewlett Packard	X487A	Thermistor Mount 8.2 to 12.4Gc	65.00
Hewlett Packard	X487B	Thermistor Mount 8.2 to 12.4Gc	85.00
Hewlett Packard	G532A	Frequency Meter 3.95 to 5.85Gc	300.00
Hewlett Packard	H532A	Frequency Meter 7.05 to 10Gc	500.00
Hewlett Packard	J532A	Frequency Meter 5.3 to 8.2Gc	400.00
Hewlett Packard	M532A	Frequency Meter 10 to 15Gc	500.00
Hewlett Packard	P532A	Frequency Meter 12.4 to 18Gc	400.00
Hewlett Packard	X532A	Frequency Meter 8.2 to 12.4Gc	350.00
Hewlett Packard	536A	Frequency Meter .94 to 4.2Gc	600.00
Hewlett Packard	G752D	Directional Coupler 20dB 3.95 to 5.85Gc	200.00
Hewlett Packard	X752A	Directional Coupler 3dB 8.2 to 12.4Gc	200.00
Hewlett Packard	X752C	Directional Coupler 10dB 8.2 to 12.4Gc	200.00
Hewlett Packard	X752D	Directional Coupler 20dB 8.2 to 12.4Gc	200.00
Hewlett Packard	766D	Dual Directional Coupler .94 to 1.975Gc 20dB	50.00
Hewlett Packard	767D	Dual Directional Coupler 1.9 to 4Gc 20dB	50.00
Hewlett Packard	787D	Directional Detector 1.9 to 4.1Gc	200.00
Hewlett Packard	G910B	Termination 3.95 to 5.85Gc	75.00
Hewlett Packard	X914B	Moving Load 8.2 to 12.4Gc	100.00
Hewlett Packard	2830A	Sensor Oscillator	50.00
Hewlett Packard	3503	Microwave Switch 500mc to 12.4Gc SPST	100.00
Hewlett Packard	8431A	Bandpass Filter 2 to 4Gc	200.00
Hewlett Packard	8436A	Bandpass Filter 8 to 12.4Gc	200.00
Hewlett Packard	9471A	RF Detector	75.00
Hewlett Packard	8472A	Crystal Detector .01 to 18Gc	100.00
Hewlett Packard	8732A	Pin Modulator 1.8 to 4.5Gc 80dB	400.00
Hewlett Packard	8733A	Pin Modulator 3.7 to 8.3Gc 35dB	350.00
Hewlett Packard	10100B	Termination 50 ohms	25.00
Hewlett Packard	10855A	Preamp. 2 to 1300Mc	200.00
Hewlett Packard	11660A	Tracking Generator Shunt	50.00
Hewlett Packard	11693A	Limiter	300.00
Hewlett Packard	13510	Transistor Test Jig	150.00
Hewlett Packard	33001C	Pin Absorptive Modulator	200.00
Hewlett Packard	33102A	Microwave Switch 100Mc to 18GHz	100.00
Hewlett Packard	C79-33602A	Microwave Switch DC to 18Gc SPDT	75.00
Hewlett Packard	39098A	Microwave Switch	100.00
Kay	30-0/432D	0 to 101dB Variable Attenuator DC to 1Gc	100.00
Kay	NM781	Noise Source	250.00
Kay	7921A	Noise Source 10 to 900Mc	200.00
Kay	7921A1	Noise Source 10 to 1000Mc	250.00
Lectronic	503A	Tube Mtg./Attenuator and 2K25	50.00
MDL	90LW26-1	X Band Load	50.00
MECA	715-1S2	Directional Coupler 4 to 8Gc 20db (Narda 3044B20)	100.00
Merrimac	AU-26A/	801162 Variable Attenuator	75.00
Microtech	214972	Microwave Switch	50.00
Military	AT-68/UPM	Horn Antenna 8.5 to 9.6Gc	25.00
Military	UG-528/U	6dB Attenuator	35.00
Narda	708	Variable Attenuator 0 to 40dB	100.00
Narda	792FM	Variable Attenuator 2 to 2.5Gc 0 to 17dB min. 2.5 to 12.4Gc 0 to 20dB min.	250.00
Narda	2301-20	Directional Coupler 2 to 4Gc 20dB	100.00
Narda	2301-30	Directional Coupler 2 to 4Gc 30dB	100.00
Narda	2366	Variable Directional Coupler 1.2 to 1.4Gc 7 to 12dB	90.00
Narda	2863		
Narda	2864		
Narda	2979	BiDirectional Coupler 4 to 8Gc 20dB	100.00
Narda	3002-10	Directional Coupler .95 to 2Gc 10dB	100.00
Narda	3002-20	Directional Coupler .95 to 2Gc 20dB	100.00
Narda	3003-10	Directional Coupler 2 to 4Gc 10dB	100.00
Narda	3003-30	Directional Coupler 2 to 4Gc 30dB	100.00
Narda	3004-10	Directional Coupler 4 to 10Gc 10dB	100.00

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TEST EQUIPMENT

Boonton	202J	AM FM Signal Generator 195 to 270MHz	450.00
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CMC	931	Heterodyne Converter 200 to 1200Mc	200.00
Chushman	MCM5	Monitor	750.00
Alfred	8000/7051	Sweep Network Analyzer 100KHz to 40Gc	800.00
Meguro	MSG-2282A	Standard Signal Generator For CB	250.00
Gertsch	FM3	Frequency Meter 20 to 1000Mc	150.00
Systron Donner	1037/1291A	Frequency Meter 0 to 50Mc with Plug In to 500Mc	500.00
Singer	SPA3/25A	Spectrum Analyzer 1Kc to 25Mc and a G-6 Campanion Sweep Generator 0 to 15Mc and PS-19 Power Supply	1500.00
Measurements	65B	Standard Signal Generator 75Hz to 35Mc	250.00
Measurements	140	Standard Deviation Meter 25 to 1000Mc	200.00
Polarad	MSG-2	Signal Generator 2150 to 4600Mc	500.00
E.H.	574	Microwave Swept Oscillator 8 to 12.4Gc	750.00
Monsanto	1107	Time Interval Plug In	50.00
Military	TS-1011/	UPM84 Spectrum Analyzer 10Mc to 40Gc with 1Each Filter F335/F336/F337/F338/F341/1Each Attenuator CN411/CN410/CN409 and 1Each Adapter UG1239/UG1240/UG1241/UG1242	1800.00
General Radio	805C	Standard Signal Generator 16Kc to 50Mc	300.00
Hewlett Packard	230A	Power Amplifier 10 to 500Mc 4.5watts	400.00
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Hewlett Packard	431B	Power Meter 10Mc to 40Gc	150.00
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Hewlett Packard	5260A	Frequency Divider to 12.4Gc For above	1000.00
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Hewlett Packard	5327B	DVM and Frequency Meter to 550Mc	1500.00
Hewlett Packard	DY5636	H Band Generator/Test Set 7.1 to 8.5Gc	1000.00
Tektronix	491	Spectrum Analyzer Solid State 10Mc to 40Gc.	7000.00
Micro Tel	MSR903	Microwave Receiver to 40Gc Digital Readout	9000.00
Tektronix	190B	Signal Generator 350KHz to 50Mc	150.00
Telonic	2003	Sweep/Signal Generator Systems 3305 5 to 1500Mc Autoplex,2/3323 1 to 2000Mc Variable Marker,3340 RF/Output Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370Display Prcoessing.	1000.00
Telonic	2003	Sweep/Signal Generator Systems 3303 5 to 500Mc Sweep,3323 1 to 2000Mc Variable Marker,3343 RF/Output 50 ohms,3340 RF Output/Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370 Display Processing.	750.00

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Narda	22540A/	4013C10 Directional Coupler 2 to 4Gc 10dB	75.00
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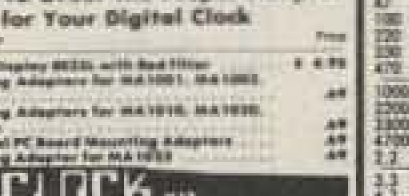

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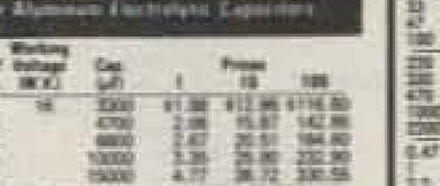

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74LS10N	.25	NE555V	.39	74C10	.35	6522	9.95				
74LS13N	.45	NE556A	.85	74C14	.75	6530	9.50				
74LS14N	.99	NE565A	1.00	74C20	.35	6800	8.95				
74LS20N	.25	NE566V	1.50	74C30	.35	6802	11.95				
74LS22N	.25	NE567V	1.00	74C48	1.95	6820	4.95				
74LS26N	.35	NE570B	4.75	74C74	.85	6850	4.75				
74LS30N	.25	78L05	.60	74C76	.80	8080A	3.95				
74LS33N	.55	78L08	.60	74C90	1.25	8085	8.50				
74LS38N	.35	78M05	.85	74C93	1.25	Z80	8.95				
74LS74N	.45	75108	1.49	74C154	3.25	Z80A	9.95				
74LS75N	.50	75491CN	.50	74C160	1.69	8212	2.25				
74LS90N	.60	75492CN	.55	74C175	1.19	8214	3.90				
74LS93N	.65	75494CN	.89	74C192	1.65	8216	2.25				
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74LS113N	.45	8700CJ	13.95	74C914	1.95	8253	8.95				
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74LS136N	.49	8750CJ	13.95	74C923	5.50	8257	9.00				
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74LS367N	.69	CD4006	.95	8T09	1.25						
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LINEAR		CD4008	.95	8T13	1.40	**PROM**					
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CA3082	1.90	CD4012	.25	8T25	3.20	2716TI	8.50				
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DL747/750	CA/CC	.600	1.49
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Model 950 $1010.00

4116 200ns Dynamic RAM
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RCA Cosmac 1802 Super Elf Computer $106.95

The Super Elf is a small single board computer that does many **big** things. It's an excellent computer for training and for learning programming with its machine language and yet it's easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Moews Video Graphics **$3.50,** Games and Music **$3.00,** Chip 8 Interpreter **$5.50,** Starship 4K cassette **$14.95.**

Free 14 page brochure
of complete Super Elf system.

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply below).

ELECTRONIC SYSTEM KITS

Apple Peripheral Kits

SERIAL I/O INTERFACE 0 to 30,000 baud, D.T.R., Input & output from monitor or basic, or use Apple as intelligent terminal, Bd only (P/N 2) **$14.95,** Kit (P/N 2A) **$51.25,** Assembled (P/N 2C) **$62.95.**

PROTOTYPING BOARD (P/N 7907) **$21.95.**

PARALLEL TRIAC OUTPUT BOARD 8 triacs, each can switch 110V, 6A loads, Bd only (P/N 210) **$19.20,** Kit (P/N 210A) **$119.55.**

OPTO-ISOLATED INPUT BOARD 8 inputs, can be driven from TTL logic, Bd only (P/N 120) **$15.65,** Kit (P/N 120A) **$69.95.**

Interface Kits

SERIAL/PARALLEL INTERFACE Bidirectional, Baud rates from 110 to 19.2K, sw selectable polarity of input and output strobe, 5 to 8 data bits, 1 or 2 stop bits, parity odd or even or none, all characters contain a start bit, +5 & −12V required.Bd only (P/N 101) **$11.95,** Kit (P/N 101A) **$42.89.**

RS-232/TTL INTERFACE Bidirectional, requires ±12V, Kit (P/N 232A) **$9.95.**

RS-232/20mA INTERFACE Bidirectional, 2 passive opto-isolated circuits, Kit (P/N 7901A) **$14.95.**

RS-232/TTY INTERFACE Bidirectional, 2 active circuits, (P/N 600A) **$9.95.**

Supplies

VERBATIM DISKETTES Datalife box of 10, 5¼" **$29.95,** 8" **$39.95.**

FLOPPY DISK JACKETS Fits 3 ring binder, 5¼" holds 2, 8" holds 1, **69¢** each.

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Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00.** Tiny Basic **$30.00.**

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Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

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Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range ±.17E^{38}), 32 bit integer ±2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O routines included.

Super Basic on Cassette $55.00.

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All of the above have powdered iron cores.

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UHF/VHF RF POWER TRANSISTORS
CD2867/2N6439
60 Watts output
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6.5 uH	1.00 ea. or 10/7.50
7.5 uH	1.00 ea. or 10/7.50
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15 uH	1.00 ea. or 10/7.50
20 uH	1.00 ea. or 10/7.50
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1.65 mH	2.99
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200 mH	2.99
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237 mH	2.99
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All parts returned due to customer error or decision will be subject to a 15% restock charge. If we are out of an item ordered, we will try to replace it with an equal or better part unless you specify not to, or we will back order the item, or refund your money.
PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. Prices supersede all previously published. Some items offered are limited to small quantities and are subject to prior sale.
We now have a toll free number, but we ask that it be used for *charge orders only*. If you have any questions please use our other number. We are open from 8:00 a.m. - 5:00 p.m. Monday thru Saturday.
Our toll free number for *charge orders only* is 800-528-3611.

SEMICONDUCTORS SURPLUS

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See List of Advertisers on page 162

✓12

BULLET ELECTRONICS

P.O. BOX 401244E GARLAND, TX 75040 214/278-3553

★SUPERSTAR SALE!★

ALL ITEMS WITH STARS
BUY 3 GET ONE FREE
(No Mixing)
OFFER EXPIRES DEC. 31, 1981

★Sound Effects Kit $18.50★

The **SE-01 Sound Effects Kit has** all you need to build a programmable sound effects machine except a battery and speaker. Only the SE-01 provides you with additional circuitry that includes a **Pulse Generator, Mux Oscillator and Comparator** to make more complex sounds a snap. **Includes TI76477,** (w/specs) assembly instructions and programming examples. You can easily create **Gunshots, Explosions, Steam Trains, Wind & Surf** and much more.

Complete Kit **$18.50**
With quality PC Board
(Less battery & spkr.)
76477 Chip is Included
Extra chips **$3.15 ea.**

★ ZULU II Clock Kit ★

$19.95 LESS CASE

- 1/2" LED Readouts
- Quartz XTAL Timebase
- Calendar
- Unique NOX™ Circuit Will Display Readouts On Handclap
- Battery Backup (battery not included)
- High Quality Drilled & Plated PC Boards; Clear Instructions

★
PLASTIC CASE WITH FRONT & REAR PANELS FOR ZULU II $4.95.★

New! ★Doomsday Alarm ★

If you have trouble sleeping and you would like the rest of the neighborhood to share your misery then this little kit will be for you! There is no way to accurately describe the unearthly howls, screams and tones that come out of this kit. Four separate tone oscillators are mixed, cancelled and stepped at a varying rate. 10 Watts of crazy sounds. A great fun kit or a practical burglar alarm. Complete with PC board and all necessary components less speaker. For 6–12 VDC. **9.95** KIT ORDER *DA-02*

7 Watt Audio Amp Kit $5.95

SMALL, SINGLE HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT.

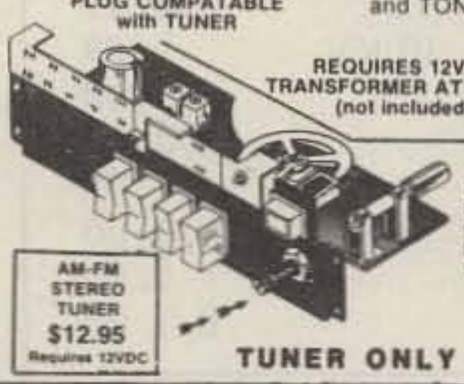
Overvoltage Protection Kit $6.95

Protect your expensive equipment from overvoltage conditions. Every computer should have one! **Works with any fused DC power source** from 10 to 20 volts up to 25 amps.

Stereo AMP/Power Supply Board

Takes low level audio and drives 8 ohm speakers ON-BOARD Rectifiers and Filter supply power for AMP **AND** TUNER, VOLUME, BALANCE, and TONE SLIDE CONTROLS

PLUG COMPATABLE with TUNER



REQUIRES 12VAC TRANSFORMER AT 400 MA (not included)

$6.95 AMP ONLY

FEATURES: AM, FM Stereo, Phono Input, Aux Input, AC Cord, 300 Ohm Antenna Input AM Loopstick Antenna, Standard Turntable Plugs.
BUY 3 SETS (Tuner Amp combos) for $50.00

AM-FM STEREO TUNER $12.95 Requires 12VDC

TUNER ONLY

See Special Fall Prices Below

PRICES GOOD THROUGH DEC. 31, 1981
SHOP EARLY FOR CHRISTMAS!

The Super Music Maker
REVISION 2
$24.95
(Basic Kit)
Does not include speaker switches or 2708 ROM

Now you can play hundreds of songs using the Bullet **Super Music Maker.** The unit **features a single factory programmed microprocessor IC** that comes with 20 pre-programmed short tunes. By adding the additional PROMS (2708's) the system can be expanded to play up to **1000 notes per PROM.** Just think ... a compact electronic instrument that will play dozens, hundreds or even thousands of selections of music. The kit comes with **all electronic components (less the PROM),** and a drilled, plated and screened PC Board which measures 4" x 4½". The **7 watt amplifier** section is on the same PC board and drives an 8 ohm speaker (not included), from a whisper to ear splitting volume. Since the unit works on **12 VDC** or **12 VAC*,** vehicle or portable operation is possible. **What do you get for $24.95? Everything but a speaker, transformer, case, switches,** and **PROM.** Additional 2708 albums containing popular tunes are available for **$15.00** each or you can program your own PROMS using information provided with the kit instructions. Lists of available PROM albums are available on request. *(Note: Unit plays electronic music one note at a time, it is not possible to play chords or a melody with harmony simultaneously.)*

★ Envelope control gives decay to notes.

★ On board inverter allows single voltage (+12) operation.

OPTIONAL ACCESSORIES

DIP Switches	One 8 pos., One 5 pos. (Can be **directly soldered** to PC Bd. to access tunes)	**2.00/Set**
Rotary Switches	Two 5 position (For **remote wiring** to PC Bd. to access tunes)	**2.50/Set**
Attractive	**Plastic Case**	**6.50**
Wallplug Transformer	(For operation on 117VAC house voltage)	**3.00**

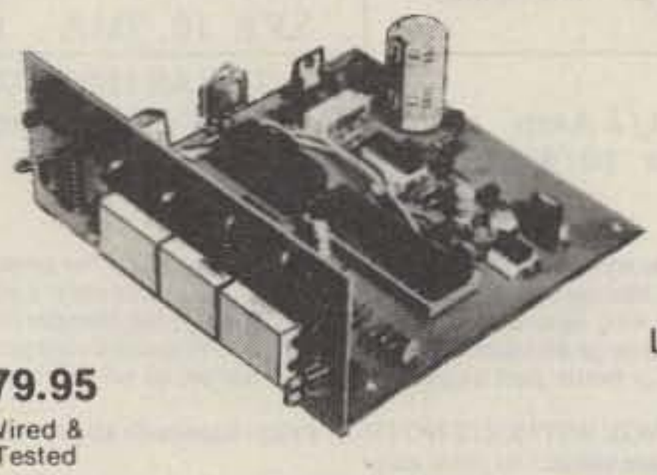
Microprocessor Station Clock $49.95

The **ZULU 3TZ** is a full blown **ROM** and **MICRO-PROCESSOR** unlike other standard clock IC's, it allows exceptional flexibility. Almost a year in design, it is **the most advanced station clock on the market.**

Adjustable Brightness
.6" - High Intensity
Orange Led Readouts
Seconds Reset/Hold
provides easy syncronization with WWV

Quartz Crystal Timebase and **Battery Backup**

QUALITY SOLDER MASKED & SCREENED PC BOARDS MAKES ASSEMBLY A SNAP



12 Volts AC or DC

ZONE CHANGE FEATURE
Select one of **three World Time zones,** Local Time (12 Hr. format) and **TWO** 24 hr. zones of your choice.

RFI Protected

ID FEATURE
LED Indicator lights when activated flashes at 10 min. Different audio tones at 8 and 9 min.

$49.95
Complete Kit Including Case & Wallplug XFMR for 117VAC Operation

$79.95
Wired & Tested

FALL SPECIALS: *GOOD THRU DEC. '81*

1. Super Music Maker with case and two 5-position rotary switches **$32.00**
2. Super Music with one 2716 2K X 8 PROM filled with over 50 selections of additional music (>1500 notes) **$32.00**
3. The Whole Ball of Wax! #2 + case and switches. **$39.95**

PS 14 REGULATOR CARD KIT

This is the Regulator Card from our famous **20A Power Supply Kit.** Although we ran out of the transformers and heatsinks, many customers have been able to locate their own. The regulator card performs the actual voltage regulation and has adjustable fold back current limiting. Output voltage **is stable to 200MV from 0 to 20 Amps and adjustable from 11 to 14 Volts.** Designed to drive 2 high current NPN transistors (2N3771 2N5301 or equiv.) The unit assembles quickly. Included are all the on board components including a driver transistor and over-temp shutdown sensor. Designed to screw down to a standard 3" diameter computer grade filter cap. The quality plated PC card is 3-1/2" x 4 3/4".

WITH INSTRUCTIONS

REGULATOR CARD KIT **$14.95**
HIGH CURRENT PARTS
(2 - 2N3772 & 25A Bridge) **$5.00**
51,000 MFD @ 40V Computer Grade **$3.50**

Requires Transformer with 16 - 19 VAC Out @ The Current You Expect To Draw.

- **NO C.O.D.'s.**
- **SEND CHECK M.O. OR CHARGE CARD NO.**
- **PHONE ORDERS ACCEPTED ON VISA AND MASTERCHARGE ONLY.**
- **ADD 5% FOR SHIPPING.**
- **TX. RES. ADD 5% STATE SALES TAX.**
- **ALL FOREIGN ORDERS ADD 30% FOR SHIPPING CHARGES. U. S. FUNDS ONLY.**

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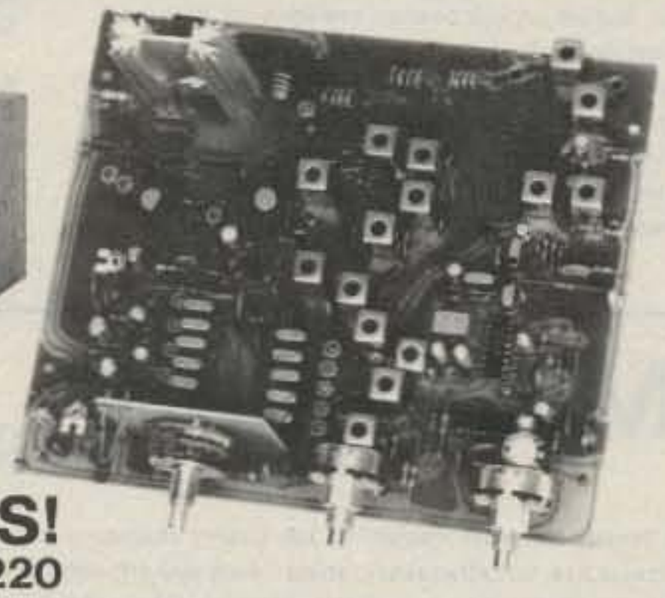
• FM • SSB • CW • ATV • OSCAR
• LINKS • REPEATERS • TRANSMITTERS
• RECEIVERS • PREAMPS • CONVERTERS
• TRANSCEIVERS • POWER SUPPLIES • PA'S

QUALITY VHF/UHF KITS AT AFFORDABLE PRICES



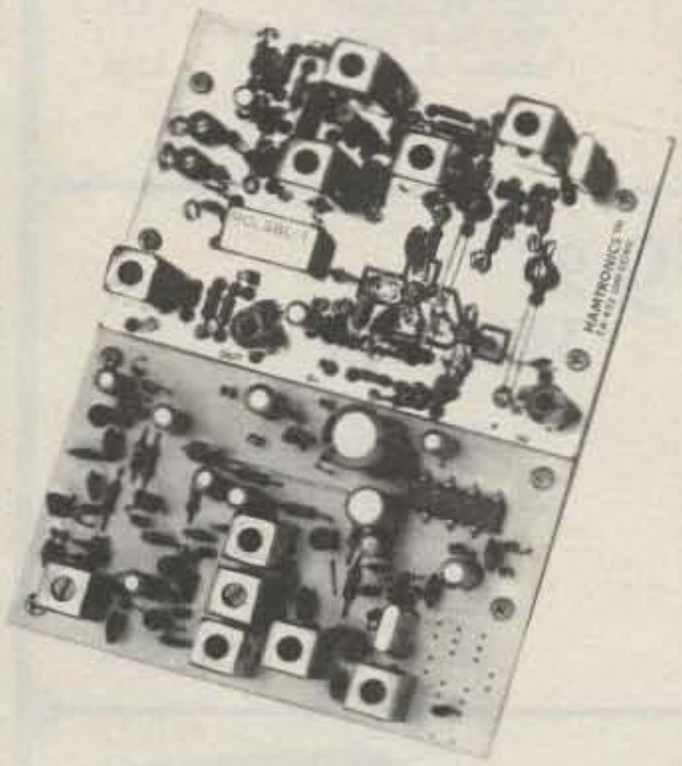
SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

10 watts, 5 Channels, for 6M, 2M, or 220

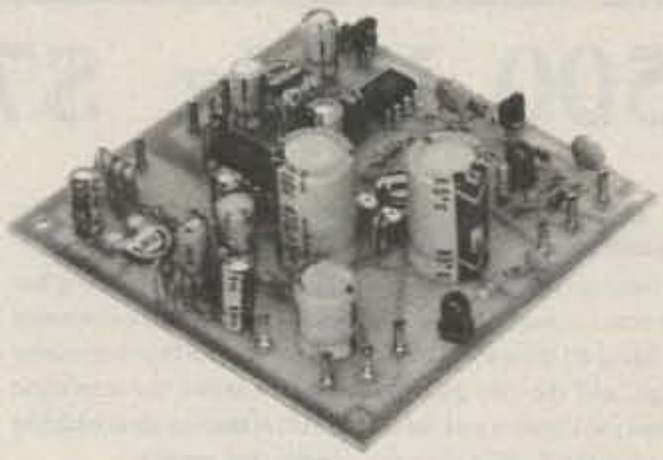
FM-5 PC Board Kit – ONLY $159.95
complete with controls, heatsink, etc.

★ **HOLIDAY SPECIAL** ★

Free cabinet kit, complete with speaker, knobs, connectors, hardware. A $59.95 value, yours free with purchase of kit before Jan. 30th. Hurry! Offer limited.



HIGH QUALITY FM MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.



- **R75 VHF FM RECEIVER** for 10M, 6M, 2M, 220, or commercial bands. 4 fantastic selectivity options. Kits from $84.95 to $119.95
- **R450 UHF FM RECEIVER** for 380-520 MHz bands. Kits in selectivity options from $94.95
- **R110 VHF AM RECEIVER** Kit for vhf aircraft band or ham bands. Only $84.95.

- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.
- **SCANNER CONVERTERS** Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $54.95.
- **T451 UHF FM EXCITER** for 450 ham band or adjacent. Kits only $64.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

VHF & UHF TRANSMITTING CONVERTERS

For SSB, CW, ATV, FM, etc. Available for 6M, 2M, 220, 440 with many IF input ranges. Converter board kit only at $79.95 (VHF) or $99.95 (UHF) or kits complete with PA and cabinet as shown.

VHF & UHF RECEIVING CONVERTERS

20 Models cover every practical rf and if range to listen to SSB, FM, ATV, etc. on 6M, 2M, 220, 440, and 110 aircraft band. Even convert weather down to 2M! Kits from $39.95 and wired units.

VHF & UHF RECEIVER PREAMPS. Low noise.

VHF Kits from 27 to 300 MHz. UHF Kits from 300 to 650 MHz. Broadband Kits: 20-650 MHz. Prices start at $14.95 (VHF) and $18.95 (UHF). All preamps and converters have noise figure 2dB or less.

- **Call or Write for FREE CATALOG**
  (Send $2.00 or 5 IRC's for overseas MAILING)
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9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

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DIGITAL RESEARCH: PARTS

"TOP QUALITY PARTS FOR LESS"

Precision Hybrid Oscillator Module

Has both 1 MHZ and 2 MHZ TTL - outputs — Hermetically sealed — Ultra high stability over wide temp. range — originally cost over $40.00 each — We made a super purchase from a major computer manufacturer — 5 Volt operation - fits standard 24 pin socket - Manufactered by Motorola oscillator division.

MC6871A
CRYSTAL OSC.
1.0 MHz
MOTOROLA

MC6871A

3/20.00

7.50 w/data

NEO 2137 by NEC

- Microwave R.F. transistor (N.P.N.)
- Micromold package #37
- Dual Emitter leads
- FT to 4.5 GHZ
- VCEO 10V-CC 20 MA. HFE 40-200
- Gain 10V-20MA-1GHZ = 14DB Typical
- Very low noise - High gain 1.5 DB @ 500 MHZ
- Cleared for high reliability space applications

COMPARE **1.50**

LM117

An easy to use adjustable Voltage Regulator - only two external resistors needed to set the output voltage - TO-3 Case - adjustable from 1.2 to 37V - Regulator is floating, so it can be used in a wide variety of applications, as long as the input-to-output differential voltage is 40V or less - 1.5A output current - house numbered - prime - Motorola.

1.75

Video Game Board

Hockey • Tennis • Handball

- General Instruments AY3-8500
- Features Exciting Sounds
- On Screen Scoring
- 1 or 2 Players
- Speed & Paddle Controls
- Works on 9 Volts D.C.

4.45

3 for 12.00

Each board comes with RF Modulator (Ch. 3 or 4) and schematic. The only parts needed to complete game are speaker, 2-1 Meg Pots & Switches.

Video Paddle Controls

2 for 1.00

Can be used with game board at left.

POWER SUPPLY TRIPLE OUTPUT

25 Volts @ .18A
5 Volts @ .8A
15 Volts @ 1.25A
Isolated independent outputs
Positive or negative operation
Constant Voltage Regulation
25 Volt line adjustable with 10 turn pot from 23.5 V to 28 Volts. 120 Volt - 60 Hz input Fused - H=3¾" W=5½" D=4"

$14.95

Transformer

32VCT @ 1 amp
6V @ 1 amp

3.25

Measures:
2" x 2¼" x 2¼"
2⅜" Mounting Centers

SCOTCH LOK

Great for connecting a wire to an existing wire without stripping. Absolutely invaluable in hard to reach areas such as under car dash, inside television, etc. Simply put Scotch Lok over existing wire. Insert new wire to be connected. With a standard pair of pliers, compress metal on insulator. No need for tape. Super neat installation. Once you use this, you will never go back to the "old" way.

15/1.00

IC Specials

MC1488-1489 - RS232 Driver and Receiver **99¢ pr.**

NE556-Dual NE555

2/1.25

NE555

3/1.25 or 10/3.30

Micro Mini Toggle Switch

99¢

6 for 5.00

SPDT • Made in USA with Hardware

JFET OP AMP

Super High Input Impedance (10^{12} OHMS) — High Frequency Response. TO 4 MHZ. Large DC Voltage Gain 106 DB — New generation OP-AMP with Vastly Superior Features!

LF356BH - **75¢ or 3/2.00**

UNIVERSAL TIMER KIT

★ **Adjustable from 1 sec to 1 hr.**
★ **Control up to 1 amp**

"Turn Things On Or Off"

Kit includes all parts necessary to build this exciting kit. Uses: Children's T.V. programs - Darkroom exposures - Amateur 10 min. I.D.er - Egg Timer - Intermittent Windshield Wiper. Absolutely endless uses. Complete kit including power supply, p.c. board DPDT relay, and all parts to make timer operational.

$8.95

Fixed Inductors

.39 uh - **6/1.00** 12.5 uh - **8/1.00**
500 uh - Hash Filter
@ 2 Amps - **4/1.00**

Molded Choke

13 uh - **8/1.00** 50 mh - **6/1.00**
1.2 mh - **8/1.00**

Variable Inductors

30-40 uh
.9 uh - 1.2 uh
11 uh to 20 uh
.25 uh - .35 uh
.85 uh - .95 uh

4/1.00

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Microwave - Schottky barrier diode

HP-Hot Carrier diodes
5082-2835

99¢ or 6/5.00

NEXT MONTH — The most exciting item we have ever seen — MOHO

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See List of Advertisers on page 162

INTRODUCING SONY'S NEW DIGITAL DIRECT ACCESS RECEIVER!

Revolutionary Instant Access Digital Shortwave Scanner

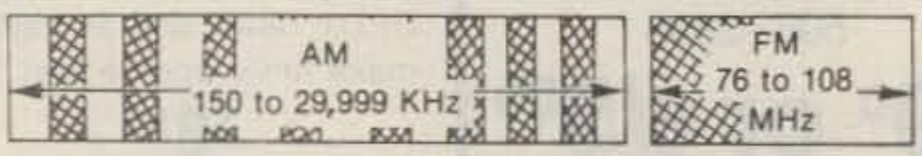
- **Continuous Scanning of LW, MW, SW, & FM Bands**
- **Instant Fingertip Tuning—No More Knobs!**
- **6 Memories for Any Mode (AM,SSB/CW, & FM)**
- **Dual PLL Frequency Synthesized—No Drift!**

A WHOLE NEW BREED OF RADIO IS HERE NOW! No other short wave receiver combines so many advanced features for both operating convenience and high performance as does the new Sony ICF-2001. Once you have operated this exciting new radio, you'll be spoiled forever! Direct access tuning eliminates conventional tuning knobs and dials with a convenient digital keyboard and Liquid Crystal Display (LCD) for accurate frequency readout to within 1 KHz. Instant fingertip tuning, up to 8 memory presets, and continuous scanning features make the ICF-2001 the ultimate in convenience.

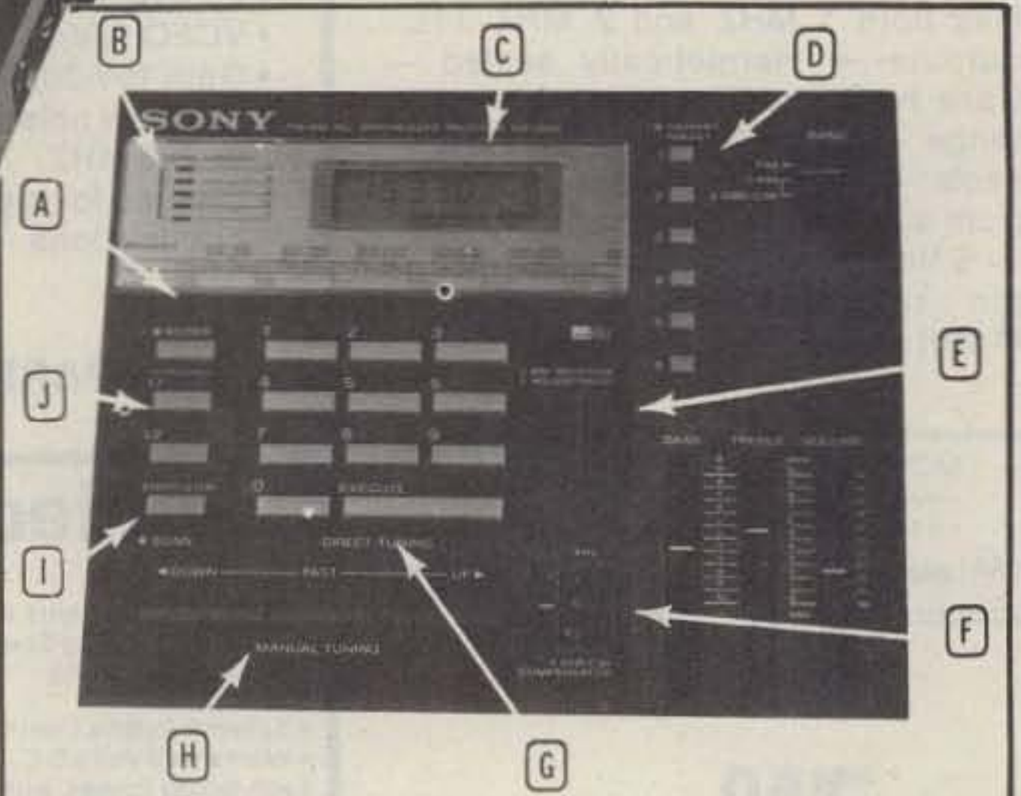
Compare the following features against any receiver currently available and you will have to agree that the Sony ICF 2001 is the best value in shortwave receivers today:

DUAL PLL SYNTHESIZER CIRCUITRY covers entire 150 KHz to 29.999 MHz band. PLL_1 circuit has 100 KHz step while PLL_2 handles 1 KHz step, both of which are controlled by separate quartz crystal oscillators for precise, no-drift tuning. **DUAL CONVERSION SUPERHETERODYNE** circuitry assures superior AM reception and high image rejection characteristics. The 10.7 MHz IF of the FM band is utilized as the 2nd IF of the AM band. A new type of crystal filter made especially for this purpose realizes clearer reception than commonly used ceramic filters. **ALL FET FRONT END** for high sensitivity and interference rejection. Intermodulation, cross modulation, and spurious interference are effectively rejected. **FET RF AMP** contributes to superior image rejection, high sensitivity, and good signal to noise ratio. Both strong and weak stations are received with minimal distortion.

EXTENDED SPECTRUM CONTINUOUS TUNING



only **$299.95** plus $5.00 shipping
(NOW IN STOCK)



A Enter Button
B Signal Strength Indicator
C Liquid Crystal Display
D Memory Preset Buttons
E Antenna Adjustment Dial
F SSB/CW Compensator
G Execute Bar
H Manual Tuning Buttons
I Scan Button
J High/Low Limit Buttons

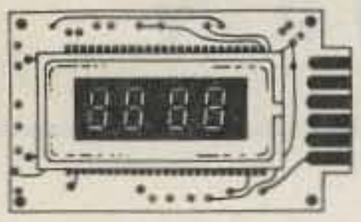
OPERATIONAL FEATURES

INSTANT FINGERTIP TUNING with the calculator-type key board enables the operator to have instant access to any frequency in the LW, MW, SW, and FM bands. And the LCD digital frequency display confirms the exact, drift-free signal being received. **AUTOMATIC SCANNING** of the above bands. Continuous scanning of any desired portion of the band is achieved by setting the "L_1" and "L_2" keys to define the range to be scanned. The scanner can stop automatically on strong signals, or it can be done manually. **MANUAL SEARCH** is similar to the manual scan mode and is useful for quick signal searching. The "UP" and "DOWN" keys let the tuner search for you. The "FAST" key increases the search rate for faster signal detection. **MEMORY PRESETS.** Six memory keys hold desired stations for instant one-key tuning in any mode (AM, SSB/CW, and FM), and also, the "L_1" and "L_2" keys can give you two more memory slots when not used for scanning. **OTHER FEATURES:** Local, normal, DX sensitivity selector for AM; SSB/CW compensator; 90 min. sleep timer; AM Ant. Adjust.

SPECIFICATIONS

CIRCUIT SYSTEM: Fm Superheterodyne; AM Dual conversion superheterodyne. **SIGNAL CIRCUITRY:** 4 IC's, 11 FET's, 23 Transistors, 16 Diodes. **AUXILIARY CIRCUITRY:** 5 IC's, 1 LSI, 5 LED's, 25 Transistors, 9 Diodes. **FREQUENCY RANGE:** FM 76-108 MHz; AM 150-29,999 KHz. **INTERMEDIATE FREQUENCY:** FM 10.7 MHz.; AM 1st 66.35 MHz., 2nd 10.7 MHz. **ANTENNAS:** FM telescopic, ext. ant. terminal; AM telescopic, built-in ferrite bar, ext. ant. terminal. **POWER:** 4.5 VDC/120 VAC **DIMENSIONS:** 12¼ (W) X 2¼ (H) X 6¾ (D). **WEIGHT:** 3 lb. 15 oz. (1.8 kg)

National Semiconductor Clock Modules



12VDC AUTOMOTIVE/ INSTRUMENT CLOCK

APPLICATIONS:
- In-dash autoclocks
- After-market auto/ RV clocks
- Aircraft-marine clks.
- 12VDC oper. instru.
- Portable/battery powered instrumnts.

Features: Bright 0.3" green display. Internal crystal time-base. ± 0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete—just add switches and lens.

MA1003 Module (3.05"Lx1.75"Hx.98"D) . **$16.95**

CLOCK MODULES

MA1023 .7" Red Digital LED Clock Module	8.95
MA1026 .7" Dig. LED Alarm Clock/Thermometer	18.95
MA5036 .3" Red Digital LED Clock/Timer	6.95
MA1002 .5" Red Digital LED Clock & Xformer	9.95
MA1010 .8" Red Digital LED Clock	7.95
MA1032 CBA .5" Digital LCD Clock	17.95
MA1043 .7" Green Digital LED Clock	8.95

TRANSFORMERS

102-P20 Xformer for MA1023, 1043 & 5036 Mods.	3.49
102-P22 Xformer for MA1026 Clock Modules	3.49
102-P24 Xformer for MA1010 Clock Modules	3.49

NEW! **Sun Power Your Electronics!**
SOLAR CELL PANEL KIT

Features:
- **Output: 10VDC, to 100mA in Series 5VDC, to 200mA in Parallel**
- **Panel may be easily connected for Series or Parallel out**
- **Over 11 square inches of active cell surface**
- **Voltage line tap @ 0.5V increments**
- **Provision for charging batteries**
- **Overall panel size: 4¾"L x 4½"H x ⅛"D**

The JE305 Solar Cell Panel Kit contains 20 each solar cells. On the panel board are power line taps which allow the user to select voltages (one voltage at a time) from 0.5VDC to 10VDC. The applications of each panel can be further expanded by coupling additional panels in series for more voltage or in parallel for more current. The premium grade solar cells provide the current necessary for the operation of most portable transistor radios, small battery powered cassette tape players and unlimited experimental solar projects.

JE305 . . . . . $39.95

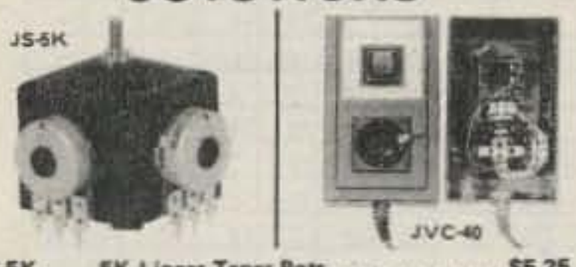
EPROM Erasing Lamp

- **Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.**
- **Erases up to 4 chips within 20 minutes.**
- **Maintains constant exposure distance of one inch.**
- **Special conductive foam liner eliminates static build-up.**
- **Built-in safety lock to prevent UV exposure.**
- **Compact — only 7-5/8" x 2-7/8" x 2"**
- **Complete with holding tray for 4 chips.**

UVS-11EL Replacement Bulb $16.95

UVS-11E $79.95

JOYSTICKS



JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JVC-40	40K (2) Video Controller in case	$4.95

ALLIGATOR CLIP TEST LEADS

Heavy-duty leads, color coded. Insulated alligator clip on each end. 15" long. Two each black, red, blue, white and yellow.

#ALCP (10 per pack) . . . . . $2.95/pkg.

NEW! **JE215 Adjustable Dual Power Supply**

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2"w x 5-1/16"L x 2"H

JE215 Adj. Dual Power Supply Kit (as shown) . . $24.95

(Picture not shown but similar in construction to above)

JE200 Reg. Power Supply Kit (5VDC, 1 amp) . .	$14.95
JE205 Adapter Brd. (to JE200) ±5,±9 & ±12V.	$12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp.	$19.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

INS8080A-	CPU	4.35
DP8212	8-Bit Input/Output	3.25
DP8214	Priority Interrupt Control	5.95
DP8216	Bi-Directional Bus Driver	3.49
DP8224	Clock Generator/Driver	3.95
DP8226	Bus Driver	3.49
DP8228	System Controller/Bus Driver	4.95
DP8238	System Controller	5.95
INS8243	I/O Expander for 48 Series	9.95
INS8250	Asynchronous Comm. Element	16.95
DP8251	Prog. Comm. I/O (USART)	6.95
DP8253	Prog. Interval Timer	8.95
DP8255	Prog. Peripheral I/O (PPI)	5.95
DP8257	Prog. DMA Control	9.95
DP8259	Prog. Interrupt Control	9.95
DP8275	Prog. CRT Controller	19.95
DP8279	Prog. Keyboard/Display Interface	5.95
DP8303	System Timing Element	6.95
DP8304	8-Bit Bi-Directional Receiver	3.95
DP8307	8-Bit Bi-Directional Receiver	3.95
DP8308	8-Bit Bi-Directional Receiver	3.95
DP8310	Octal Latched Peripheral Driver	5.25
DP8311	Octal Latched Peripheral Driver	5.25

6800/6800 SUPPORT DEVICES

MC6800	MPU	7.95
MC6802CP	MPU with Clock and RAM	14.95
MC6810AP1	128x8 Static RAM	4.95
MC6821	Peripheral Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	17.95
MC6830L8	1024x8-Bit ROM (MC6830-8)	14.95
MC6850	Asynchronous Comm. Adapter	6.95
MC6852	Synchronous Serial Data Adapter	6.95
MC6860	0-600bps Digital MODEM	10.95
MC6962	2400bps Modulator	12.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS

Z80 (780C)	CPU (MK3880N) (2MHz)	11.95
Z80A (780-1)	CPU (MK3880N-4) (4MHz)	13.95
COP1802	CPU	19.95
2650	MPU	16.95
IDM2901ADC	CPU—4-Bit Slice (Com. Temp. Grade)	19.95
MC6502	MPU w/Clock (65K Bytes Memory)	11.95
INS8035N-6	MPU—8-Bit (6MHz)	7.95
INS8039N-6	CPU—Sgl. Chip 8-Bit (128 bytes RAM)	9.95
INS8040N-6	CPU (256 Bytes RAM)	24.95
INS8070N	CPU—64 Bytes RAM	24.95
INS8073N	CPU w/Basic Micro Interpreter	29.95
P8085	CPU	9.95
TMS9900JL	MPU—16-Bit	39.95

SHIFT REGISTERS

MM500H	Dual 25-Bit Dynamic	.50
MM503H	Dual 50-Bit Dynamic	.50
MM508H	Dual 100-Bit Static	.50
MM510H	Dual 64-Bit Accumulator	.50
MM1402N	256-Bit Dynamic	2.95
MM5013N	1024-Bit Dynamic/Accumulator	1.95
MM5016H	500/512-Bit Dynamic	1.95
MM5033N	Octal 80-Bit	9.95
MM5035N	Octal 80-Bit	9.95
2504V(1404A)	1024-Bit Dynamic	1.95
2516N	Hex 32-Bit Static	3.95
2532V	Dual 132-Bit Static	2.95
2524V	512-Bit Dynamic	.99
2525V	1024-Bit Dynamic	2.95
2527V	Dual 256-Bit Static	2.95
2528V	Dual 250-Bit Static	4.00
2529V	Dual 240-Bit Static	4.00
2532N	Quad 80-Bit Static	2.95
3341PC	Fifo (Dual 80)	6.95

DATA ACQUISITION

AF100-1CN	Universal Active Filter 2.5%	5.95
AF121-1CJ	Touch Tone Low Band Filter	19.95
AF123-1CJ	Touch Tone High Band Filter	19.95
LM308CH	Super Gain Op Amp	1.15
LM334Z	Constant Current Source	1.30
LM335Z	Temperature Transducer	1.40
LF356N	JFET Input Op Amp	1.10
LF398N	Sample & Hold Amplifiers	3.95
LM399H	Temp. Comp. Prec. Ref. (.5ppm/C°)	5.00
ADC800LCN	8-Bit A/D Converter (1 LSB)	4.95
DAC800LCN	8-Bit D/A Converter (0.78% Lin.)	2.25

DATA ACQUISITION (CONTINUED)

ADC0809CCN	8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0817CCN	8-Bit A/D Converter (16-Ch. Multi.)	10.95
DAC1000LCN	10-Bit D/A Conv. Micro. Comp. (0.05%)	13.95
DAC1008LCN	10-Bit D/A Conv. Micro. Comp. (0.20%)	8.95
DAC1020LCN	10-Bit D/A Converter (0.05% Lin.)	8.49
DAC1022LCN	10-Bit D/A Converter (0.20% Lin.)	5.95
DAC1222LCN	12-Bit D/A Converter (0.20% Lin.)	9.96
CD4051N	8-Channel Multiplexer	1.19
AY-5-1013	300K BAUD UART	6.95

RAM'S

1101	256x1 Static	1.49
1103	1024x1 Dynamic	.99
2101 (8101)	256x4 Static	3.95
2102	1024x1 Static	1.75
2102L02	1024x1 Static	1.95
2111 (8111)	256x4 Static	3.95
2112	256x4 Static MOS	4.95
2114	1024x4 Static 450ns	3.25
2114L	1024x4 Static 450ns Low Power	3.49
2114-2	1024x4 Static 200ns	3.95
2114L-2	1024x4 Static 200ns Low Power	4.95
745200	256x1 Static	6.95
4116N-4 (UPD416)	16K Dynamic 250ns (MMS290N-4)	2.95
4164N-3	64K Dynamic 200ns	19.95
MM2147J	4096x1 Fast 70ns	7.95
5101	256x4 Static	7.95
MMS301	1024x1 Dynamic Fully Decoded	.99
MMS262	2Kx1 Dynamic	.49
MMS280/2107	4096x1 Dynamic	4.95
MMS290N-2 (4116)	16K Dynamic 150ns (UPD416C-3)	3.95
MMS298J-3A	8K Dyn. 200ns (lower ½ of MMS290J)	1.95
HM6116-4	16K (2Kx8) Static 200ns	14.95
82S25	64 Bit RAM (16x40C)	2.49
UPD434/MK4027	4K Dynamic 16-pin	4.95
TMS4044-45NL	4K Static	5.95
TMS4046	1024x4 Static	9.95

PROMS/EPROMS

1702A	2K UV Erasable PROM	5.95
2708	8K EPROM	4.95
TMS2716	16K EPROM (-5V, +5V, +12V)	9.95
2716(Intel(2516)TI	16K EPROM (Single +5V)	8.95
2732Intel TI	32K EPROM	17.95
2758	8K EPROM (450ns) (Single +5V)	7.49
2764Q	64K EPROM (Hitachi HN462764)	49.95
5203	2048 PROM	14.95
82S23(74S188)	32x8 PROM (Open Collector)	3.95
82S135	4096 Bipolar PROM	14.95
82S123(74S288)	32x8 Tri-State Bipolar PROM	3.95
82S185	8K PROM	14.95

— Over 30 More PROMS Listed in Our Catalog —

ROM'S

2513(2340)	Character Generator (Upper Case)	9.95
2513(3021)	Character Generator (Lower Case)	9.95

NMOS READ ONLY MEMORIES

MCM66710P	128x9x7 ASCII Shifted w/Greek	13.50
MCM66740P	128x9x7 Math Symbol & Pictures	13.50
MCM66750P	128x9x7 Alpha, Control Char. Gen.	13.50

MICROPROCESSOR MANUALS

M-Z80	User Manual	7.50
M-COP1802	User Manual	7.50
M-2650	User Manual	5.00

SPECIAL FUNCTION

DS0025CN	Dual MOS Clock Driver (SMZ)	2.50
DS0026CN	Dual MOS Clock Driver (SMZ)	1.95
INS1771N-1	Floppy Disc Controller	24.95
INS8881N	Communication Chip	19.95
MM5837N	Microprocessor Real Time Clock	6.95
MM5816N	Microprocessor Compatible Clock	11.95
COP402N	Microcontroller with 64-Digit RAM and Direct LED Drive	6.95
COP402MN	Microcontroller with 64-Digit RAM & Direct LED Drive w/N Bus Int.	7.49
COP470N	32-Seg.VAC Fluor. Driver (20-pin pkg.)	3.25

TELEPHONE/KEYBOARD CHIPS

AY-5-9100	Push Button Telephone Dialer	14.95
AY-5-9200	Repertory Dialer	14.95
AY-5-9500	CMOS Clock Generator	4.95
AY-5-2376	Keyboard Encoder (88 keys)	11.95
HD0165-5	Keyboard Encoder (36 keys)	7.95
74C922	Keyboard Encoder (36 keys)	5.49
74C923	Keyboard Encoder (20 keys)	5.75
MMS2350N	Push Button Pulse Dialer	7.95
MMS7495N	96/144-Key Serial Keyboard Encoder	8.95

RADIO CONTROL CIRCUITS

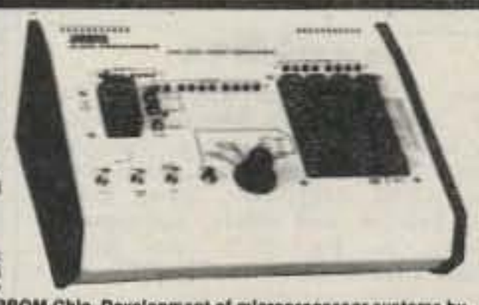
Ideal to use for: Toys, hobby crafts, robots, trains, burglar alarms, IR data link, remote slide projector control, consumer remote data links, energy-saving remotely switched lighting systems.

LM1871N R.C. Encoder/Transmitter Chip $5.49
A complete 6-channel dig. encoder and R.F. transmitter, low power, at freq. of 27MHz or 49MHz, a field strength of 10,000uV meter at 3 meters. 9V operation on chip RF oscillator/transmitter, on chip 4.5V reg. Up to 80MHz carrier freq. operation.

LM1872N R.C. Receiver/Decoder Chip $5.49
A complete R.F. receiver/decoder, used at either 27, 49 or 72MHz. It provides 4 independent channels when used w/LM1872 (2 analog, 2 dig.) operates from 4-1.5V cells. Crystal controlled.

SRX1504 49.435MHz Crystal (LM1872N) $4.95
SRX1505 49.890MHz Crystal (LM1871N) $4.95

JE608 PROGRAMMER
2704/2708 EPROM PROGRAMMER



GENERAL APPLICATIONS:
- **To program EPROMS 2704 and 2708.**
- **Developmental system for microcomputer circuits**
- **To read the contents of a pre-programmed EPROM**
- **To compare EPROM(s) for content differences**
- **To emulate a programmed EPROM**
- **To store program in RAMS for alterations**
- **Three separate Display Registers: 8 LED's for Hex Key entries, 10 LED's (2^-2") for Address Register and 8 LED's for Data Memory Register. The Data Memory Register displays the content of the RAMs from the EPROM Chip. Development of microprocessor systems by means of a ribbon cable from the programmer panel test socket to the EPROM socket on the microprocessor board. Rapid checking verification of programmed data changes. User may move data from a master to RAM's or write into RAM's with keyboard entries. Allows manual stepping manipulation (up and down) at any address location. Stand-alone EPROM Programmer consisting of: A 19-key Hexadecimal Keyboard assembly, Programmer Board assembly with 4 power supplies and a LED/Test Socket Panel Board assembly. The Test Socket is zero force insertion type. Power requirements: 115VAC, 60Hz, 6W. Compact desk-top enclosure: Color-coordinated designer's case with light tan panels and molded end pieces in mocha brown. Size: 3¼"H x 11"W x 8¼"D. Weight: 5 lbs.**

The JE608 EPROM Programmer is a completely self-contained unit which is independent of computer control and requires no additional systems for its operations. The EPROM can be programmed from the Hexadecimal Keyboard or from a pre-programmed EPROM. The JE608 Programmer can emulate a programmed EPROM by the use of its internal RAM circuits. This will allow the user to test or pretest a program for a system, prior to programming a chip. Any changes in the program can be entered directly into the memory circuits with the Hexadecimal Keyboard so that rewriting the entire program will not be necessary. The JE608 Programmer contains a Programmer/Board w/25 IC's & includes power supplies of: -5V, +5V, +12V and +26V. The Hexadecimal Keyboard and LED/Test Socket Panel board are separate assemblies within the system.

JE608K Kit $399.95
JE608A Assembled and Tested $499.95

JE608-16K ADAPTER BOARD
FOR 2716/2758 EPROMS

GENERAL DESCRIPTION:
The JE608-16K Adapter Board allows the JE608 Programmer to be modified for the additional programming of the 2716 and 2758 EPROMS. The adapter provides for adding an address switch for the 2^11 bit and also for selecting the proper power and timing pulses to be applied to the EPROM. Programming and emulating the 2716 (16K) EPROM is done separately to each half (1024x8) of the EPROM because of the existing 8K RAM capacity in the JE608 Programmer.

JE608-16K	Adapter Board Kit	$29.95
JE608-Upgrade	(Send assembled JE608 to factory for adapter installation of the JE608-16K Adapter Board Kit)	$99.95
JE608A-16K Mod.	Assembled JE608 w/Adapter (JE608-16K) Installed	$599.95

$10.00 Min. Order — U.S. Funds Only
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BOOKS
National Semiconductor — Intersil — Intel

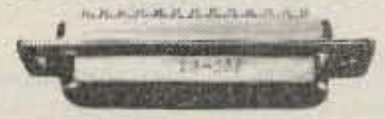
30001	**National CMOS Data Book** (640 pages) 74C, CD4000, and A/D Converters	$6.95
30002	**National Interface Data Book** (704 pages) DP, DS8000, DS3800, DS75000, etc.	$6.95
30003	**National Linear Data Book** (1376 pages) LM, LF, ADC, DAC, LH Series	$8.95
30004	**National Series 80 — Board Level Computer** (224 pages)	$4.95
30005	**National TTL Logic Data Book** (624 pages) 7400, LS, L, H, S, and DM8000 Series	$8.95
30006	**Buy above (3) 30001,3,5 as a set**	$18.95/lot
30009	**Intersil Data Book** (1074 pages)	$6.95
010400	**Intel Component Data Catalog** Full data sheets for Intel's products incl. memory devices, microproc., peripherals & indust./mil. products (1328 pages)	$10.00
205610	**Intel Peripheral Design Handbook** Full data sheets, appl. notes for Intel peripheral device components (644 pages)	$7.50

AC and DC Wall Transformers

Ideal for use with clocks, games, power supplies or any other type of AC or DC application.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12 VAC 250mA	$3.95
AC 500	117V/60Hz	12 VAC 500mA	$4.95
AC1000	117V/60Hz	12 VAC 1 amp	$5.95
AC1700	117V/60Hz	9 VAC 1.7 amp	$3.95
DV 9200	117V/60Hz	9 VDC 200mA	$3.25
DC 900	120V/60Hz	9 VDC 500mA	$3.95

CONNECTORS



DB25P	D-Subminiature Plug	$2.95
DB25S	D-Subminiature Socket	$3.50
D20418-2	Screw Lock Hdwr. (2) DB25S/P	2/$.99
DB51226	Cover for DB25P/S	$1.75
22/44SE	P.C. Edge (22/44 Pin)	$2.95
UG88/U	BNC Plug	$1.79
UG89/U	BNC Jack	$3.79
UG175/U	UHF Adapter	$ .49
SO239	UHF Panel Recp.	$1.29
PL258	UHF Adapter	$1.60
PL259	UHF Plug	$1.60
UG260/U	BNC Plug	$1.79
UG1094/U	BNC Bulkhead Recp.	$1.29

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
★ 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
★ Documentation for Conversion

TRS-16K2 *150NS	$29.95
TRS-16K3 *200NS	$24.95
TRS-16K4 *250NS	$19.95

JE610 ASCII Encoded Keyboard Kit

The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and −12V @ 10 mA for operation. Features: 60 keys generate the 126 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3⅜"H x 14½"W x 8¾"D

JE610/DTE-AK (After assembled as pictured above) . . . **$124.95**

JE610 Kit	62-Key Keyboard, PC Board, & Components (no case)	$ 79.95
K62	62-Key Keyboard (Keyboard only)	$ 34.95
DTE-AK	(case only — 3¾"Hx11"Wx8¾"D)	$ 49.95

NEW! **JE212 — Negative 12VDC Adapter Board Kit for JE610 ASCII KEYBOARD KIT**
Provides -12V DC from incoming 5V DC . . **$9.95**

JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT 19-KEY KEYBOARD

The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3½"H x 8¼"W x 8¾"D

JE600/DTE-HK (After assembled as pictured above) . . . **$99.95**

JE600 Kit	19-Key Hexadec. Keyboard, PC Board & Cmpnts. (no case)	$59.95
K19	19-Key Keyboard (Keyboard only)	$14.95
DTE-HK	(case only — 3½"Hx8¼"Wx8¾"D)	$44.95

✓See List of Advertisers on page 162

DEALER DIRECTORY

Phoenix AZ

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Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego. Call us for a low quote.

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

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Homebrewers' haven; tons of new and used Ham/Computer gear and components. Serving Hams since 1958. We specialize in ICOM, KLM, Mirage, Comptronix. We ship worldwide. **Tele-Com Electronics, 15460 Union Avenue, San Jose CA 95124, 377-4479.**

San Jose CA

Bay area's newest Amateur Radio store. New & used Amateur Radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1378 So. Bascom Ave., San Jose CA 95128, 998-1103.**

Denver CO

Experimenter's paradise! Electronic and mechanical components for computer people, audio people, hams, robot builders, experimenters. Open six days a week. **Gateway Electronics Corp., 2839 W. 44th Ave., Denver CO 80211, 458-5444.**

Miami FL

Amateur Radio Center, Inc. "Everything for the Amateur" Since 1960, **2805 N.E. 2nd Avenue, Miami FL 33137, 573-8383, TWX 522035.**

Smyrna GA

For your Kenwood, Yaesu, ICOM, Drake and other amateur needs, come to see us. **Britt's Two-Way Radio, 2506 N. Atlanta Rd., Smyrna GA 30080, 432-8006.**

Preston ID

Ross WB7BYZ, has the Largest Stock of Amateur Gear in the Intermountain West and the Best Prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Terre Haute IN

Your ham headquarters located in the heart of the midwest. **Hoosier Electronics, Inc., #9 Meadows Center, P.O. Box 3300, Terre Haute IN 478003, 238-1456.**

Littleton MA

The ham store of N.E. you can rely on. Kenwood, ICOM, Wilson, Yaesu, DenTron, KLM amps, B&W switches & wattmeters, Whistler radar detectors, Bearcat, Regency, antennas by Larsen, Wilson, Hustler, GAM. **TEL-COM Inc. Communications & Electronics, 675 Great Rd., Rt. 119, Littleton MA 01460, 486-3040.**

Hudson NH

New England's Distributor and Authorized Service Center for all Major Amateur Lines. **Tufts Radio Electronics, Inc., 61 Lowell Road, Hudson NH 03051, 883-5005.**

Ann Arbor MI

See us for products like Ten-Tec, R. L. Drake, Dentron and many more. Open Monday through Saturday, 0830 to 1730. WB8VGR, WB8UXO, WD8OKN and W8RP behind the counter. **Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor MI 48104. 668-8696.**

Charlotte NC

Santec, Hy-Gain, Cubic Comm., Antenna Specialists, Wilson, W2AU/W2VS, B&W, Pathcom, Nye Viking, Electra, MFJ, Bash, CQ, Arrl., Ameco, Callbook Service. Sales New & Refurbished. **Home-Tronics, 1217 Plaza, Charlotte NC 28205, 334-7974.**

Somerset NJ

New Jersey's only factory-authorized ICOM and YAESU distributor. Large inventory of new and used specials. Most major brands in stock. Complete service and facilities. **Radios Unlimited, 1760 Easton Avenue, P.O. Box 347. Somerset NJ 08873, 469-4599.**

Amsterdam NY
UPSTATE NEW YORK

Kenwood, ICOM, Drake, plus many other lines. Amateur Dealer for over 35 years. **Adirondack Radio Supply, Inc., 185 West Main Street, Amsterdam NY 12010, 842-8350.**

Central NY

Amateur radio hardwood displays made to your specifications—callsigns, plaques, awards or special orders. High quality, fast service, low prices. **A.&M. Woodcraft, 313 N. Madison St., P.O. Box 243, Rome NY 13440, 337-5642.**

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Featuring: Kenwood, Yaesu, ICOM, Drake, Ten-Tec, Swan, DenTron, Alpha, Robot, MFJ, Tempo, Astron, KLM, Hy Gain, Mosley, Larsen, Cushcraft, Hustler, Mini Products. You won't be disappointed with equipment/service. **Radio World, Oneida County Airport-Terminal Building, Oriskany NY 13424, 337-0203.**

Columbus OH

The biggest and best Ham Store in the midwest featuring quality Kenwood products with working displays. We sell only the best. Authorized Kenwood Service. **Universal Amateur Radio Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

Scranton PA

ICOM, Bird, CushCraft, Beckman, Fluke, Larsen, Hustler, Antenna Specialists, Astron, Avanti, Belden, W2AU/W2VS, CDE, AEA, Vibroplex, Ham-Key, CES, Amphenol, Sony, Fanon/Courier, B&W, Ameco, Shure. **LaRue Electronics, 1112 Grandview St., Scranton PA 18509, 343-2124.**

Houston TX

Experimenter's paradise! Electronic and mechanical components for computer people, audio people, hams, robot builders, experimenters. Open six days a week. **Gateway Electronics Inc., 8932 Clarkcrest, Houston TX 77063, 978-6575.**

San Antonio TX

Complete 2 way service shop. Call Dee, W5FSP. Selling Antenna Specialists, Avanti, Azden, Bird, Hy-gain, Standard, Vibroplex, Midland, Henry, CushCraft, Dielectric, Hustler, ICOM, MFJ, Nye, Shure, Cubic, Tempo, Ten-Tec and others. **Appliance & Equipment Co., Inc., 2317 Vance Jackson Road, San Antonio TX 78213, 734-7793.**

Vienna VA

The Washington metropolitan area's leading supplier of the latest in Amateur Radio and Test Equipment. On your next trip to the Nation's Capital, stop by and see us. **Electronic Equipment Bank, Inc., 516 Mill St. N.E., Vienna VA 22180, 938-3350.**

Casper WY

Serving Wyoming Hams with lots of good stuff like Callbook, antenna parts, specials and bargains. Willy and Larry Dean invite you to drop in anytime. **Radio Activity, 531 W. Collins Dr., Casper WY 82601, 237-5248.**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the February '82 issue must be in our hands by December 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	21	21A
ARGENTINA	14	7	7	7B	7B	7	14	14A	21A	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	21	21	21	21A
CANAL ZONE	7A	7	7	7	7	7	14	14	21	21A	21	14A
ENGLAND	7	7	7	7	7	7	14	14A	21A	14A	14	7
HAWAII	21	7A	7B	7	7	7	7	7B	14	21	21	21A
INDIA	7	7	7B	7B	7B	7B	14	14A	14	7B	7B	7
JAPAN	14A	14B	7B	7B	7	7	7	7B	7B	7B	14B	14
MEXICO	14	7	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	14A	7B	7B	7B	7B	7B	7B	14B	14B	14B	14B	14
PUERTO RICO	7A	7	7	7	7	7	7A	21	21A	21A	21	14
SOUTH AFRICA	7A	7B	7	7B	7B	7A	14A	21A	21A	21A	21	14
U. S. S. R.	7	7	7	7	7B	7B	14	21A	21	14	7B	7
WEST COAST	21	7A	7	7	7	7	7	14	21	21A	21A	21

CENTRAL UNITED STATES TO:

ALASKA	21	14	7	7	7	7	7	7	14	14	21	21A
ARGENTINA	14A	14	7	7B	7B	7	14	14	21	21A	21A	21A
AUSTRALIA	21	14	7B	7B	7B	7B	7B	7B	14	14A	21A	21A
CANAL ZONE	14	7	7	7	7	7	7A	14	21	21A	21A	14A
ENGLAND	7	7	7	7	7	7	7B	14	21A	14	14	7B
HAWAII	21A	7A	7	7	7	7	7	7	14	21	21A	21A
INDIA	7B	7B	7B	7B	7B	7B	7B	14	14	7B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7B	7B	14	21
MEXICO	14	7	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7	14B	14B	14B	14
PUERTO RICO	14	7	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	7A	7B	7	7B	7B	7B	7	14A	21A	21A	21	14A
U. S. S. R.	7B	7	7	7	7	7B	7B	14A	14A	14B	7B	7B

WESTERN UNITED STATES TO:

ALASKA	21A	14	7	7	7	7	7	7	7	14	21	21
ARGENTINA	21A	14	7	7B	7B	7	7B	14	21	21A	21A	21A
AUSTRALIA	21A	14A	14	7	7B	7B	7B	7B	14	14A	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14	14	21A	21A	21
ENGLAND	7B	7	7	7	7	7	7B	14B	21A	14A	14B	7B
HAWAII	21A	14A	14	7	7	7	7	7	14	21	21A	21A
INDIA	7A	14	7B	7B	7B	7B	7B	7B	14	7B	7B	7B
JAPAN	21A	14	14B	7B	7	7	7	7	7	7B	14	21A
MEXICO	21	14	7	7	7	7	7	7A	14A	21A	21A	21
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7	14	14	14B	14
PUERTO RICO	21	7A	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	14	7B	7	7B	7B	7B	7B	14	21	21A	21A	14
U. S. S. R.	7B	7	7	7	7B	7B	7B	7B	14	14B	7B	7B
EAST COAST	21	7A	7	7	7	7	7	14	21	21A	21A	21

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G/G	2 G/F	3 G/F*	4 F/F*	5 G/F
6 G/G	7 G/G	8 G/G	9 G/G	10 G/F	11 F/F	12 G/F
13 G/G	14 G/G	15 F/F*	16 F/P*	17 G/P	18 G/G	19 G/G
20 G/F	21 G/F	22 G/F	23 F/F	24 G/F	25 G/G	26 G/G
27 G/G	28 G/G	29 G/G	30 G/F	31 F/F		

THE EVOLUTION OF A Cchampion!

FT-101ZD Mk III

The FT-101ZD Mk III is the latest chapter in the success story of the FT-101 line. Armed with new audio filtering for even better selectivity, the FT-101ZD now includes provision for an optional FM or AM unit. Compare features and you'll see why active operators everywhere are upgrading to Yaesu!

Variable IF Bandwidth

Using two 8-pole filters in the IF, Yaesu's pioneering variable bandwidth system provides continuous control over the width of the IF passband — from 2.4 kHz down to 300 Hz — without the shortcomings of single-filter IF shift schemes. No need to buy separate filters for 1.8 kHz, 1.5 kHz, etc.

Improved Receiver Selectivity

New on the FT-101ZD Mk III is a high-performance audio peak/notch filter. Use the peak filter for single-signal CW reception, or choose the notch filter for nulling out annoying carriers or interfering CW signals. In the CW mode, you can choose between the 2.4 kHz SSB filter and an optional CW filter (600 or 350 Hz) from the mode switch.

Diode Ring Front End

The FT-101ZD now sports a high-level diode ring mixer in the front end. This type of mixer, well known for its strong signal performance, is your assurance of maximum protection from intermod problems on today's crowded bands.

WARC Bands Factory Installed

The FT-101ZD Mk III comes equipped with factory installation of the new 10, 18, and 24 MHz bands recently assigned to the Amateur Service at WARC. In the meantime, use the 10 MHz band for monitoring of WWV!

RF Speech Processor

Not an additional-cost option, the FT-101ZD RF speech processor provides a significant increase in average SSB power output, for added punch in those heavy DX pile-ups. The optimum processor level is easily set via a front panel control.

Worldwide Power Capability

Every FT-101ZD comes equipped with a multi-tap power transformer, which can be easily modified from the stock 117 VAC to 100/110/200/220/234 VAC in minutes. A DC-DC converter is available as an option for mobile or battery operation.

Convenience Features

Designed fundamentally as a high-performance SSB and CW transceiver, the FT-101ZD includes built-in VOX, CW sidetone, semi-break-in T/R control on CW, slow-fast-off AGC selection, level controls for the noise blanker and speech processor, and offset tuning for both transmit and receive. The Mk III optional FM unit may be used for 10 meter FM operation, or choose the optional AM unit for WWV reception or VHF AM work through a transverter (AM and FM units may not both be installed in a single transceiver).

Full Line of Accessories

See your Yaesu dealer for a demonstration of the top performance accessories for the FT-101ZD, such as the FV-101Z External VFO, SP-901P Speaker/Patch, YR-901 CW/RTTY Reader, FC-902 Antenna Tuner, and the FTV-901R VHF/UHF Transverter. Watch for the upcoming FV-101DM Digital Memory VFO, with keyboard frequency entry and scanning in 10 Hz steps!

Nationwide Service Network

During the warranty period, the Authorized Yaesu Dealer from whom you purchased your equipment provides prompt attention to your warranty needs. For long-term servicing after the warranty period, Yaesu is proud to maintain two fully-equipped service centers, one in Cincinnati for our Eastern customers and one in the Los Angeles area for those on the West Coast.

Note: A limited quantity of the earlier FT-101ZD (with AM as standard feature) is still available. See your Yaesu dealer. FT-101ZD Mk III designates transceivers bearing serial #240001 and up, with APF/Notch filter built in and AM/FM units optional.

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Price And Specifications Subject To Change Without Notice Or Obligation

YAESU ✓83

The radio.

YAESU ELECTRONICS CORP., 6851 Walthall Way, Paramount, CA 90723 ● (213) 633-4007
YAESU Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246 ● (513) 874-3100

Small wonder.

Processor, N/W switch, IF shift, DFC option

TS-130S/V

An incredibly compact, full-featured, all solid-state HF SSB/CW transceiver for both mobile and fixed operation. It covers 3.5 to 29.7 MHz (including the three new Amateur bands!) and is loaded with optimum operating features such as digital display, IF shift, speech processor, narrow/wide filter selection (on both SSB and CW), and optional DFC-230 digital frequency controller. The TS-130S runs high power and the TS-130V is a low-power version for QRP.

TS-130 SERIES FEATURES:

- **80-10 meters, including three new bands**
  Covers all Amateur bands from 3.5 to 29.7 MHz, including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz. VFO covers more than 50 kHz above and below each 500-kHz band.
- **Two power versions...easy operation**
  TS-130S runs 200 W PEP/160 W DC input on 180-15 meters and 160 W PEP/ 140 W DC on 12 and 10 meters. TS-130V runs 25 W PEP/20 W DC input on all bands. Solid-state, wideband final amplifier eliminates transmitter tuning, and receiver wideband RF amplifiers eliminate preselector peaking.
- **CW narrow/wide selection**
  "N-W" switch allows selection of wide and narrow bandwidths. Wide CW and SSB bandwidths are the same. Optional YK-88C (500 Hz) or YK-88CN (270 Hz) filter may be installed for narrow CW.
- **Built-in speech processor**
  Increases audio punch and average SSB output power, while suppressing sideband splatter.
- **SSB narrow selection**
  "N-W" switch allows selection of narrow SSB bandwidth to eliminate QRM, when optional YK-88SN (1.8 kHz) filter is installed. (CW filter may still be selected in CW mode.)
- **Sideband mode selected automatically**
  LSB is selected on 40 meters and below, and USB on 30 meters and above. SSB REVERSE position on MODE switch.
- **Built-in digital display**
  Six-digit green fluorescent tube display indicates actual operating frequency to 100 Hz. Also indicates external VFO or fixed-channel frequency, RIT shift, and CW transmit/receive shifts. Backed up by an analog subdial .
- **IF shift**
  Allows IF passband to be moved away from interfering signals and sideband splatter.
- **Built-in RF attenuator**
  For optimum rejection of intermodulation distortion.
- **Single-conversion PLL system**
  Improves stability as well as transmit and receive spurious characteristics.
- **Built-in VOX**
  For convenient SSB operation, as well as semibreak-in CW with sidetone.
- **Effective noise blanker**
  Eliminates pulse-type interference such as ignition noise.
- **Compact and lightweight**
  Measures only 3-3/4 inches high, 9-1/2 inches wide, and 11-9/16 inches deep, and weighs only 12.3 pounds.

Optional DFC-230 Digital Frequency Controller
Allows frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Includes four memories (handy for split-frequency operation) and digital display. Covers 100 kHz above and below each 500-kHz band. Very compact.

More information on the TS-130 Series is available from all authorized dealers of Trio-Kenwood Communications 1111 West Walnut Street, Compton, California 90220.

KENWOOD
...pacesetter in amateur radio

Matching accessories for fixed-station operation:

- PS-30 base-station power supply (remotely switchable on and off with TS-130S power switch).
- SP-120 external speaker
- VFO-120 remote VFO
- MC-50 50kΩ/500Ω desk microphone

Other accessories not shown:

- YK-88C (500 Hz) and YK-88CN (270 Hz) CW filters
- YK-88SN (1.8 kHz) narrow SSB filter
- AT-130 compact antenna tuner (80-10 m, including 3 new bands)
- MB-100 mobile mounting bracket
- MC-30S and MC-35S noise cancelling hand microphones
- PC-1 phone patch
- TL-922A linear amplifier
- HS-5 and HS-4 headphones
- HC-10 world digital clock
- PS-20 base-station power supply for TS-130V
- SP-40 compact mobile speaker
- VFO-230 digital VFO with five memories

Specifications and prices are subject to change without notice or obligation.