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Cover: Photo by J. D. Binder KB7NW.
ENERGIZER...OR NICAD?
If you are anything like me, you keep buying these new electronic toys which are coming on the market. Since most of them require batteries to run, you probably are also buying up a storm of AA batteries. My flash units use 'em. My portable stereo recorders use 'em. My Sony Walkman uses 'em. My Sony Typecorder uses 'em.

The next question is: What type of battery should you get? It is positively bewildering to go into my friendly radio store and see a wide assortment of batteries facing me. There are heavy-duty batteries, long-life batteries, energy cells, and so on. I'm sure that you, too, have faced this problem and wondered what to do. Unfortunately, the tendency is to suck in and go for the most expensive battery, figuring you usually do better if you go first class...after all, it's only a few cents extra to go first class.

Salvation is here, so pay attention. The answer to the problem may not be what you think. The fact is that once I made a study of the situation I was amazed to find that I had been blowing a good deal of money on the wrong batteries.

The best bargains of all, probably not surprising to you, are the nicads. These are the most expensive, but if you keep 'em charged your cost per hour of use will eventually be the lowest. If you are going to buy anything except a nicad for regular use you will do best to buy the cheapest battery you can. Sure, some of the high-priced batteries will last almost twice as long...but they will also cost four times as much. That's no bargain.

A WORD FOR DX OPS
The ham who is living in a third-world country has a special responsibility both to amateur radio and to the country. In the long run, amateur radio will grow as a result of the development of local amateurs rather than having to depend entirely on visitors.

In many of the counties I have visited, the hams have taken this seriously but have been frustrated at almost every turn...particularly in Africa. When you start out with most of the population having a very low level of education together with extreme poverty, your possibilities are immediately limited to a handful of the wealthier people. In most of the countries, the kids have to be sent outside the country if they are going to get much of a high school education...the age when amateur radio is most likely to take hold...so you really can't do a lot within the country.

What is the motive for a teenager in a small African country to go to the trouble to learn about electricity, radio, and electronics so he can talk with middle- and older-aged hams around the world? Only a tiny percentage could ever hope to own a station...and for what? His peers would pull him down and there would rarely be enough interest for a club to get started.

Some of the kids have school available, but the conditions are not exactly encouraging. There are few, if any, books, and teachers are poorly trained and paid. The classes are crowded, so little interest or enthusiasm is developed for continuing the experience.

WARC BAND BEACON
The 10-, 18- and 24-MHz bands, allocated to amateur radio by the 1979 World Administrative Radio Conference (WARC), are not yet available to US amateurs for general use. However, experimental station K82JXM, licensed to W4MB, transmits on these bands every Friday, Saturday, and Sunday. Since most newer transceivers are equipped to receive the new bands, many amateurs have the capability to monitor the K82JXM beacon and learn about propagation at these frequencies.

K82JXM begins its transmissions at 0000 UTC every Friday, continuing through 2400 UTC Sunday. During the last two weekends in April and the first two weekends in May, all transmissions will be made on whichever of the three bands provides the best propagation to Europe. The last two weekends of May and the first two of June will find the emphasis on South America. Again, the band selected will be the one offering the best signal into the target area.

The frequencies used for these experiments are 10.140, 18.108, and 24.930 MHz, with an effective radiated power (ERP) of 30 Watts. The frequencies may change without notice. To QSL or to obtain further information, contact R. P. Haviland W4MB, 2100 S. Nova Road, Box 45, Daytona Beach FL 32019.

But what about the governments, you ask? Why aren't they spending more money on schools? It's obvious to us that the way out of many of the problems they have in these third-world countries requires education...and that, even with a good education available, it is going to take several generations before things are able to change significantly.

You have to understand that in a country where there are very few educated people, you have a special political problem. The head of the country, whether he is a king, president, or dictator, stays in power by virtue of his taking care of those who are supporting him. He, and they, are primarily involved in two pursuits...staying in power and getting all that they can from the situation. Thus there is little interest or money available for long-range projects such as education.

When do-good organizations or countries can be talked into sending money for projects, the money goes almost entirely to the politicians, not to the people. These governments laugh at the countries which are suckered into sending money...all the while asking for more and more.

Countries such as Jordan, where the king takes a real interest in his people and invests money and time in their education, are few. The instability of the other countries makes it impractical for their leaders to invest in anything but their own short-term enrichment.

Thus it is going to be almost impossible to get much in the way of official encouragement when it comes to developing amateur radio in most of the third-world countries. The visiting amateur can keep an eye out for those few children of the elite who might benefit from exposure to the hobby and try to get them started. They at least will have the possibility of getting enough education to be able to grasp the basics. And they have the opportunity to go abroad and further their education. The more you can get to some of these kids, the better shape amateur radio will be in that country. This will eventually be reflected at conferences in Geneva.

Remember, too, that these kids may grow up to be the leaders of the country in ten years or
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Participating Trio-Kenwood Authorized Dealers:

This page contains a list of authorized dealers across various locations, each with their contact information and product offerings. The dealers are listed under states such as Alabama, California, Alaska, Arizona, and others, with individual city names and phone numbers provided for each location.

The document also includes advertisements for cash offers and bonuses on specific products like the TS-130SE, TR-8400, and TS-530S. The offers range from $15.00 to $30.00 off the purchase price.

In summary, the document is a promotional piece for KENWOOD's BONUS BUCKS program, offering discounts on various communication products and listing participating dealers across the United States.
so. Perhaps in another generation it will be possible to do
more with amateur radio. There are
some hints at better and
gerder educational systems
which could eventually benefit
these small, poor countries,
making it possible for kids to
surmount the terrible conditions
under which they are living. With
amateur-radio-oriented leaders,
who knows?

BLITZ CODE LEARNING

Letters from readers indicate
that it has been a while since
I've written about Morse code.
I guess I should have thought
about that, because when I talk
at hamfests I find that most of
those present are not really
aware of what is involved
with learning the code. Some myths
have developed which need ex-
plaining.

The historical system for
teaching the code is to start
people off with the individual
characters, teaching them the
dot and dash equivalents of
each letter, number, and punc-
uation mark. Then the code is
sent very slowly and people try
to remember the appropriate
character to go with the dot and
dash combination.

This process is speeded up
gradually until one reaches a
plateau, where the increase in
copying speed suddenly stops
...often for a long and discour-
aging period of time. This is
when we lose an estimated 90% of
our prospective hams. At
around ten words per minute,
one finds that the brain no lon-
erg longer will work fast enough
to hear the sound, translate it into
dots and dashes, look the com-

bination up in a table in the mind, and write it down.

This plateau holds fast until
the person develops a complete-
ly new way of translating the
code. With some people, this is
not difficult. With others, it is vir-
tually impossible. The system
which permits the breaking of
the plateau has to do with hear-
ing the code groups as sound
patterns and having them trans-
lated into writing or typing on
the subconscious level. If you
have to think, you can't really
copy code.

Modern brain research shows us
that the plateau results from the
limitations on brain speed in
shifting information from the
left to the right part of the
brain... and back. We get up

Continued on page 117

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

by Bandel Linn K4PP

"You have scored higher in the contest than anyone else in history! President
Reagan wants you to be a White House guest for two weeks!"
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HAL Puts MORE Behind The Buttons

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- MSG2100 2000 Character "Brag Tape" ROM

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- **New!** The very effective NB7 Noise Blanker is now standard.
- **New!** Mic audio available on rear panel to facilitate phone patch connection.
- **State-of-the-art design** combining solid-state PA, up conversion, high-level double balanced 1st mixer and frequency synthesis provided a no tune-up, broadband, high dynamic range transceiver.

### R7A Receiver
- **CONTINUOUS NO COMPROMISE** 0 to 30 MHz frequency coverage.
- **Full passband tuning (PBT).**
- **New!** N7RA Noise Blanker supplied as standard.
- **State-of-the-Art features** of the TR7A, plus added flexibility with a low noise 10 dB rf amplifier.
- **New!** Standard ultimate selectivity choices include the supplied 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity. Capability for three accessory crystal filters plus the two supplied, including 300 Hz, 1.8 kHz, 4 kHz, and 6 kHz. The 4 kHz filter. when used with the R7A's Synchro-Phase a-m detector, provides a-m reception with greater frequency response within a narrower bandwidth than conventional a-m detection, and sideband selection to minimize interference potential.
- **Front panel pushbutton control** of rf preamp, a-m/ssb detector, speaker ON/OFF switch. i-f notch filter, reference-derived calibrator signal, three agc release times (plus AGC OFF). integral 150 MHz frequency counter/digital readout for external use, and Receiver Incremental Tuning (RIT).

### The "Twins" System
- **FREQUENCY FLEXIBILITY.** The TR7A/R7A combination offers the operator, particularly the DX'er or Contest, frequency control agility not available in any other system. The "Twins" offer the only system capable of no-compromise DSR (Dual Simultaneous Receive). Most transceivers allow some external receiver control, but the "Twins" provide instant transfer of transmit frequency control to the R7A VFO. The operator can listen to either or both receiver's audio, and instantly determine his transmitting frequency by appropriate use of the TR7A's RCT control (Receiver Controlled Transmit). DSR is implemented by mixing the two audio signals in the R7A.
- **ALTERNATE ANTENNA CAPABILITY.** The R7A's Antenna Power Splitter enhances the DSR feature by allowing the use of an additional antenna (ALTERNATE) besides the MAIN antenna connected to the TR7A (the transmitting antenna). All possible splits between the two antennas and the two system receivers are possible.

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See your Drake dealer or write for additional information.

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far above average!

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versatility and value are spelled D-R-A-K-E . . .

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The dynamic range of the TR5 is unexcelled by any transceiver in its class. The TR5's greater than 0 dBm third order intercept point (85 dB two-tone dynamic range) at 20 kHz spacing can be achieved only by the use of a passive diode-ring double balanced mixer. Drake was the first to bring this technology to the Amateur market with a high-level mixer in the TR7.

**RELIABLE SERVICE**

When you purchase a TR5, or any Drake product, you acquire a product of the latest production techniques, which provide reliable performance. Yet with a product as sophisticated as one of today's transceivers, after-sales service is a must. Ask any Drake owner. Our Customer Service Department has a reputation second to none.

**ACCESSORIES**

Drake is the only Amateur Radio manufacturer who offers a full complement of accessories to satisfy almost every desire the HF Amateur may have. This wide selection allows any operator to assemble a station which meets his needs, and assures compatible interfacing and styling instead of a desk full of equipment with a variety of styling and poor operation as a system.

**KILOWATT AMPLIFIER**

Everyone wants to be heard! The accessory L75 and its 3-500Z (1200 watts PEP input) and a decent antenna will do the trick. This rugged self-contained amplifier/power supply will put the TR5 on an even footing with the best of them.

**ENGINEERING**

The TR5 and all Drake Transceivers, are backed by the best in engineering. The TR5 is the result of an extensive engineering effort, combining proven past techniques and ideas with new state of the art concepts. As a result, the TR5 will not be superceded by a new model every six months. It represents a true radio communications value that will provide many years of operating enjoyment.

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R. L. DRAKE COMPANY

540 Richard St., Miamisburg, Ohio 45342, USA
Phone (513) 866-2421 • Telex: 288-017
Pacific Odyssey
—the Kingman/Palmyra adventure

Kingman; Palmyra. For most hams, these are names which simply mean two new countries, new call signs, necessary on the road to the DXCC Honor Roll. But to me, Kingman/Palmyra means the most physically demanding and mentally trying of all the DXpeditions I've ever taken part in. Located nearly one thousand miles south of the Hawaiian Islands, these uninhabited coral islets are among the most remote and difficult places to get to in the world.

Born out of a rag-chew session between Harry Mead VK2BJL and myself while my ship, the sailing yacht Banyandah, was en route to Japan early in 1980, Kingman/Palmyra (K/P) was to be just one of many DX locations planned in a grand transpacific DXpedition spree for 1981. Originally, Harry (of Mellish VK9ZR and Spratly 151DX fame) was to organize operators, licenses, and financial backing for a series of DXpeditions through the Pacific Locations would include Kingman/Palmyra, Samoa, Tokelau, Kermadec, and a grand finale back where it all began, Mellish Reef.

During numerous rag-chew sessions spanning most of 1980, our plans...
solidified; Banyandah was to sail to Hawaii early in 1981, outfit herself with complete base-camp equipment, and be ready for the first group of operators by spring. Unfortunately, Harry’s time to organize such a massive undertaking diminished as his electronic repair business in Sydney grew, and by late 1980 it became obvious that he would not be able to help on the first leg of this epic adventure.

At that time, the thirty-eight foot Banyandah was in the mid-north Pacific, battling heavy seas and gale-force winds on an early-winter crossing from Japan to Hawaii. It appeared that K/P would be an all-American operation, so I turned to my good friend, Karl Jensen K17B, in Seattle for help. With his usual efficiency, Karl put the word out through all the DX clubs and bulletins while spreading it across the airwaves. The initial response for the three operators needed was terrific; within a week he had a two-page list of potential candidates. But these glad tidings were short-lived; after the full requirements were explained to each candidate, all but two dropped out. To some, the three-thousand-dollar financial commitment was too steep (although as full-scale DXpeditions go, it was cheap). But to all, the real problem lay in the enormous time required to complete the two operations and make the 2,300-mile voyage. Not many people can afford thirty-five to forty days away from family or employer.

Upon our arrival in Honolulu in early December, we still had only two operators willing to challenge K/P. One, the eventual DX King of Kingman, was a quiet, family man from Minnesota. George Carleton AD0S had a burning desire to try his hand at big-time DXing. In our chats, enthusiasm seemed to ooze from his every rf wave. He was a social worker at one of the state hospitals back in Bremer, Minnesota. A plodder, a converted CB operator, he took to the challenge of DXing like a big gun from W6-land. George and his friends outgrew the local radio club when they met resistance for more DX activities. They formed their own club, the Paul Banyan Wireless Association, immediately entered every club contest around, and offered night courses for future hams.

George and I were so diametrically opposite in backgrounds that we immediately formed a fast friendship. While I’ve always been a globe-traveling gypsy, working and living in almost every part of the world, George had never left his native mid-America. He married his childhood sweetheart, stuck with his original employment, and carved a homestead out of thirty acres of rural forested land.

The other operator, the third corner of the triangle, was a fine and proven contest operator from California. Kingman was his dream and an allband operation his goal. More about him later.

As the New Year rolled in, Banyandah lay under the highrises at Waikiki and we still had four months of preparations before us. A daily planning session was set up on 15m, with Karl K17B acting as the group’s central coordinator. Tasks were assigned, with one operator to solicit equipment from manufacturers, the other to solicit financial aid and sponsors. My wife, Juddith, and I started the laborious chore of purchasing the numerous supplies and modifying our ship to hold them.

For the base camp, we purchased two large Coleman tents, three folding tables and chairs, a propane cooker, pots and pans, dishes, water containers, sleeping bags and air mattresses, flashlights and internal lighting, all with spares and backups. In other words, our list included everything necessary to exist on a bare pile of shells in the middle of the ocean. On the critical power plant side, we chose the best: two Onan 2.5-kW portable gasoline generators modified especially with automatic oil feeders. They were expensive, but they came with built-in fuel pump, oil pressure pump, and a robust cast-iron engine. A selection of spares also was taken so that any breakdown could be remedied, including a broken crank rod. Hundreds of other items also were loaded aboard for the base camp: large-capacity plastic fuel drums, funnels, fuel transfer pumps, separate power leads for each station, and home-made twenty-seven foot push-up towers with four-foot long stainless steel anchoring stakes.

And let’s not forget the food. Case after case came aboard as Judith returned from her forays into Hono-lulu’s markets. Can you imagine the quantity and variety necessary to feed five adults plus our two children for five weeks without a supermarket in sight for a thousand miles?

On the electronics side, matters were not progressing as smoothly. Manufacturers’ budgets were getting tighter and tighter. In the past, outright donations...
could have been expected—or at least the loan of equipment—but this year all the major equipment producers were willing only to sell their goods at dealer cost. We were still short the third operator, and hence money was tight. George suggested that he buy one Wilson tribander, the System 33 with 40m add-on on the condition that the next group, the ZM7 group, purchase a similar beam, then both groups could share them. For a third antenna, one for low-band operation, George would bring his DenTron doublet. By March, all equipment except the transceivers was either on board or en route.

As one equipment manufacturer after another refused our requests for the loan of equipment, George offered to break down his home station and send it along with borrowed equipment from his newly-formed club. A generous offer, after all, anything can happen to sensitive gear carted halfway around the world by airplane, sailing yacht, and dingy. Not to mention the hazards of operating it in an exposed salt-laden environment under the rigors of portable power. But equipment was needed, or we wouldn't be going anywhere.

One night George started thinking about how this expedition was shaping up to be an all-American DXpedition. We had Onan generators, Coleman tents, Wilson antennas, and American operators—and Kingman/Palmyra is American. The light must have blinked on in his brain, for early the next morning he contacted the Ten-Tec Corporation in Tennessee and put forth his request. At last we had found a manufacturer eager to help, for they offered the outright loan of three complete stations with power supplies and outboard vfos in their Omni-C range. Like a runner clearing the final hurdle, we all let out a collective sigh of relief. A departure date was set, air travel tickets were purchased, and Banyandah loaded aboard the last supplies: gasoline, diesel fuel, and engine oil.

We were now a going concern. Permissions had been granted and every bit of gear had been arranged, but we still had only two financial members, neither of whom could afford a red cent more. As a last ditch effort, an alternate financial arrangement was offered: Banyandah would chip in the remaining third share on the proviso that the boat be paid back first from any forthcoming contributions. This was applauded as an excellent solution and was readily accepted by the other two members.

I must admit that I was not as enthusiastic about it as the others since our past DXpeditions had always been straight-out charters. But my wife and I are avid adventurers who get personal satisfaction in overcoming obstacles—and we're a little DX-mad to boot. We had a sincere desire to see the K/P duo reactivated. Besides, we firmly believed that the amateurs of the world would support our expedition—a mistaken belief which proved costly.

All went well for several weeks; George chopped extra wood to warm his house in his absence, the other operator cleared his desk, and we took a much needed rest with our two young sons—for we had been on the go since our grueling, forty-five-day crossing of the north Pacific.

When the disaster struck, it fell like a meteorite from the heavens. Our California operator dropped out when there were only two weeks to go before departure. Great! Thousands of dollars and hundreds of hours of labor and planning down the drain since two men cannot set up DX stations at a place as dangerous and physically difficult as Kingman, nor can they operate and survive with one man ashore and the other minding the boat.

We definitely had a serious problem! George's reaction was as I expected: "We'll do it alone!" His faith was like an injection of adrenaline into my waning spirit. But in the end it was a Honolulu amateur who came to our rescue. Bill Boykin W6HT/H6 already had stood by us during the hectic preparations in Honolulu. He had helped coordinate and track down equipment, he had run errands and loaned us his car for the months that it all took.

Bill, a retired salt from the Navy, is an ex-electronics technician who had been stationed in many a foreign port. He was not the typical DX hound since his true love was six meters. But as each new item was stored aboard, I could see the dream germinate and grow in his eyes. A long sea voyage across the balmy trade winds to a wild and rarely visited patch of land, the excitement of setting up the beams and stations, and, the topper, his six-meter beam proudly atop the tallest tower! Time wasn't his problem, but money was. He could not offer any financial support. So instead he kindly volunteered his time, muscles,
“all other gear gave us trouble… the TEN-TECs just kept working great.”

KINGMAN REEF, PALMYRA, TOKELAU —
33,000 contacts without a miss.

As George Carleton (AD0S ex KH5K) said in a letter to TEN-TEC… “12,100 QSO’s from Kingman, 8100 for me, 3100 in the first sitting with the rig on a continuous 33 hours except for 2 minute gas breaks… all other gear gave us trouble due to salt spray – the TEN-TECs just kept working great.

“This is the most QSO’s ever from Kingman and all were barefoot. A few times generators ran out of gas during rainstorms with rigs operating on TX… no problem with voltage drop, and no damage. No tuners were used… only your rigs and (antennas). The wind blew continuously from 20 knots to 50-60 knots and we literally had to open the tent to let the rain out, salt water and spray everywhere, watches quit, keyers and linear (other brands) quit after the first QSO — arcing due to salt spray, but the TEN-TECs never even got warm when the tent was around 100°F.

“… American gear is best.”

The TEN-TEC OMNI-Cs went on to serve on Palmyra and Tokelau with equally impressive results and we thank the group for their letters—we couldn’t have said it better.

See your TEN-TEC dealer for the great All-American transceiver — TEN-TEC OMNI-C.

The spectacular performance of the TEN-TEC OMNI-C results from these fine features:
- 9 hf bands
- Total solid state—from the pioneer
- Broadband—from the pioneer
- 3-mode, 2 range offset tuning—receiver, transmitter or transceiver
- Optimized receiver sensitivity
- Greater dynamic range
- Optimized bandwidth—seven response curves—up to 16 poles of filtering
- Notch filter
- Noise blanker
- “Hang” agc for smoother operation
- Full or semi break-in (QSK)
- WWV reception on 10 MHz band
- Digital readout
- Separate receive antenna input
- Automatically switched S/ SWR meter
- 200 watts input all bands
- VOX and PTT
- Phone patch jacks
- Zero-beat switch
- Adjustable volume and pitch sidetone
- Adjustable threshold ALC
- Front panel band switch also controls linear or antenna
- Automatic sidetone selection
- Super audio quality—less than 2% THD
- Impeccable signal—exceeds FCC requirements
- High stability—less than 15 cycles change per degree F temp. change
- High articulation keying—set to 3 msec rise and decay time
- Compression loaded speaker
- Plug-in circuit boards
- Operates on 12-14 V dc mobile, 115/230 V ac with external supply
- Made in U.S.A. by pioneers in solid state amateur radio—TEN-TEC.
The “country” of Kingman is about seventy-five yards long and towers five feet above sea level in calm weather. Accommodations on Kingman Reef were anything but luxurious, but George and Bill didn’t seem to mind.

and skills, and replaced our California operator.

With that I faced another difficult decision: Banyan-dah lay at the dockside fully equipped and ready to go; our dollars and hours of labor had already been expended, but financially we were in a mess. What should I do? Our new-dropped-out operator was to have arranged sponsors, and now there was no time. I had had no experience with the returns from QSL cards but believed (like so many) that a green stamp per envelope was the minimum to be expected. Well, if that was the case, we’d just have to work that many more stations.

The night of April 7th was cool and clear; the twin volcanic peaks of Mauna Loa and Mauna Kea stood behind us, finely etched by the intense curtain of starlight. At their base, where the sea greets these giants, lay the tiny pleasure-boat harbor of Honakahou, carved out of a solid river of lava. Banyan-dah lay at dockside like a fine race horse waiting in the gates. A child-like atmosphere of excitement and anticipation prevailed as the last baskets of papayas, pineapples, and stalks of bananas were lashed into place. A final tug on the ropes securing the drums of gasoline, and everything was secure. The ship’s diesel engine was started, roaring into life and shattering the quiet loneliness and shattering the quiet loneliness of gasoline, and shattering the quiet loneliness of gasoline, and we were in a mess. What should I do? Our new-dropped-out operator was to have arranged sponsors, and now there was no time. I had had no experience with the returns from QSL cards but believed (like so many) that a green stamp per envelope was the minimum to be expected. Well, if that was the case, we’d just have to work that many more stations.

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bed and then brewed a fresh pot of coffee for the night watch before turning in. Our normal routine was to split the long night hours into two watches, dust to midnight and midnight to dawn. During the daylight hours, watches were more relaxed as the world’s commercial shipping has a better chance of seeing our tiny craft.

At daybreak, Ka Lae, the most southern point of the United States, could just be seen through the haze, while the ship’s log held steady at six and a half knots. By 1000 hours, we had our last sight of land and we were completely alone, a white dot at the center of a disk of blue.

Days merged into nights and back into day, each the same and yet somehow quite different. We had time to study each cloud, each wind swell; we had time to talk or to be alone with our private thoughts. We caught fish on our constantly trailing lure—mostly small bonito. Sometimes a powerful dolphin fish, a mahimahi, would strike and the battle would be on. This fine-tasting fish with its firm white flesh would battle with all its immense strength until at last it could be hauled aboard flapping and jumping, changing its body color from yellow through green to an electric blue until death took it and it turned to silver.

Each noon, after my celestial sight, I would plot our position on the chart. Each day, the tiny dot marking our position would inch its way closer to the cross marked Kingman Reef as jumps of 136 miles, 138 miles, and, once, 144 miles were plotted. After seven full days of sailing, we were only fifty miles away from our goal. The week had been perfect: fifteen-knot northeast winds, sunny days, and starry nights. No ships, airplanes, or other man-made objects had been sighted.

Originally, we had set sail for, first, the palm-clad islands of Palmyra, and then Kingman, since finding that five-foot-high speck after a one-thousand-mile ocean voyage would require perfect conditions and the utmost skill. But Kingman was the real challenge. And by the halfway point, George had convinced me that it required a fresh and eager group to do it justice and should come first. I altered our course to make the attempt. But on that last evening, alone on watch, as the sky darkened with the approach of rain clouds, I began to doubt the wisdom of my choice.

Ocean currents are
strange forces. For thousands of miles they will remain constant, flowing in one direction at a reliable rate, but upon an approach to land, with the sea bottom suddenly rising, they become unpredictable. To make matters worse, somewhere in this area we would leave one current and enter the world's strangest current, the equatorial countercurrent. This narrow band of water defies all sense by moving directly opposite to the normal trade winds. Its northern limit shifts back and forth across the region at a whim of some unseen force, causing distress among all ship captains who sail this area. Normally, a very wide berth would be given to Kingman, but it was my job to find it safely.

Soon the wind freshened and swung ominously to the southeast. Rain began to fall. It increased until my vision was down to a scant fifty feet. But Banyanah heedlessly sailed on, blindly cutting through the water while closing the distance between us and one of this ocean's worst navigational hazards. As the miles ticked off, I held my breath and prayed that my instruments and sights were correct and that our luck would hold. Every few minutes I poked my head above the spray dodger and peered into the rain and gloom, expecting to see that flash of white signalling breakers and destruction.

By 0400 hours, I had had enough and dropped the headsail and mizzen. Quietly, the ship came into the wind, gently rocking in the swell. I woke Judith and crawled into the bunk. "Wake me if the stars show," I said, and immediately fell asleep.

Just before 0600, I was up again. The storm had passed and the first tingles of pink lit the eastern horizon. Quickly Judith and I measured the angle between horizon and our favorite navigational stars, jotting down the exact time of each sight. My voice calling out "Mark!" at each sight must have woken George and Bill; sleep was still in their eyes when they crawled out of the stern cabin. George scanned the blank horizon and said with a grin, "No trees in sight yet." And we all laughed since this was the Minnesotan's usual way of greeting a new day at sea.

The star sights didn't take long to work out and showed that we were still thirty miles from that danger which had seemed so near in the rain and the dark. The current had worked its magic and had pushed us away instead of closer. The wind had gone with the passing rain, leaving a calm sea and a bright, hot day. Now under power, we continued on a new heading. A scum line was passed—a convergence of currents trapping bits of floating plastic and discarded light bulbs, all alive with small crabs and tiny fish. All morning I tracked the sun with my sextant, and my chart became a mess of intersecting position lines, each a bit closer. By the time the sun reached its azimuth we were very close, and conditions were perfect for a landing.

At 1300 hours I climbed our forty-five-foot mast and scanned the horizon. The sea was flat and calm, the horizon sharp but empty. At 1400, with (supposedly) only six miles to go, I climbed again. There! Just near the edge of the world a vague splash of white showed for a moment and I couldn't believe my luck.

The breakers of Kingman Reef were in sight! At deck level, the rest of the crew jumped up and ran to the rail, but nothing could be seen. For the next hour they strained for their first glimpse. Finally, with only two miles to go, George let out a whoop of delight. The rest happened fast. One moment a flat sea, the next a long line of small breakers off our beam and the sea changed from deep blue to aquamarine. Coral heads seemed to rush up to meet us. As we crossed the sunken reef, they were plainly visible even though the depth meter recorded seventy-five feet.

Portable KH5/K first appeared as a heap of brilliant yellow-white sand, sterile and completely devoid of vegetation. The ridge of fine coral rubble and upturned coral boulders was the result of thousands, maybe millions, of years of the sea crashing against the outer barrier reef and washing the broken bits of coral and dead shells into a pile. Excitement ran high as we toured the area in the lee of the cay, taking soundings for anchoring.

It was then that we met the first evidence of Kingman's wilderness. Although the depth recorder showed a steady bottom, it was over two hundred feet down! And it was all the same, right up to the perpendicular cliff of reef. At a quarter mile off, I said a silent prayer and lowered the anchor down into the blue, paying out every inch of warp, shaking my head as it slithered over the bow rollers and disappeared from sight.

The cay seemed to grow smaller instead of bigger as we approached in our ten-foot aluminum dingy. Soon it could be seen that its side was steep and not the long gentle slope we had first seen. Kingman was not smooth sand but an

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mense pile of six-inch-wide clam shells bleached white by the intense tropical sun. By crawling on all fours we reached the summit, and my heart sank even further when I realized that this forsaken pile of shells went hardly six feet across at the top before tumbling down again into the sea.

We walked the full length of the cay—all seventy-five yards of it. Decomposed bits of wire and the remains of a vertical’s base marked the spot of the last DXpedition, probably Kingman’s last human visitors. On the northwest end, nature had scalloped out a hollow with a flat area about ten feet square, backed by a near-vertical wall of shell and large coral rock. It looked tailor-made for the smaller of our two tents. Its only threat was the water, which lay only two feet away. Was this high or low tide? A quick look at the debris line indicated that it was nearly high. I mentioned that the hollow might be swept by swells if the sea got nasty. George’s only comment was that he didn’t mind getting his feet wet as long as he stayed on the air. And so the smaller tent was set up there—a move which later proved to be a key to our success.

Tropical night comes quickly, and the fiery reds and oranges of twilight are short-lived. Soon it became impossible, even dangerous, to carry on in the half-light, and reluctantly we returned to Banyandah. Once “home,” Judith prepared a celebration landfall and birthday dinner, for we just happened to land on her birthday, April 15th. A special dining table was set up in the cockpit and all our “at anchor” crockery was laid out. That night we rode a wave of euphoria.

At dawn the next morning, the boat came alive as we began the back-breaking job of hauling equipment ashore. Each item was unloaded into one of three piles: power, tent, or antenna. By mid-morning the bulk of it was there, and Bill and George started assembling the beams while I lugged generator supplies to the top of the ridge and established the power plant. For a while, Jason and Jerome ran little errands, but boredom set in and they disappeared down the cay, running from one pile of flotsam to another, beachcombing the most untouched beach in the world.

They returned dragging a large pink fishing float and a long barnacle-encrusted length of bamboo. Thirty minutes later Old Glory was raised, fluttering proudly from its bamboo staff supported at the surf line by a pile of dead coral boulders. Little did we know that storms were to snap that staff like a match stick three times before we left!

Noon was approaching, and the day was becoming alarmingly hot and airless. Worst of all, our ankles started to swell and turn black and blue from numerous painful jabs from the saucer-shaped shells. We cautioned each other about heat exhaustion, but DX fever was growing inside of us. The tribander with the 40m add-on was put right out in the low-tide area of the reef. The other tower held both a tribander and the six-meter beam. Raising it was a hellish job, and several moments of near-disaster passed before the guys were finally secured. The rest went much like any Field Day back home. The two stations were set up, coax and power connections were made, and the beams were checked for swr. Everthing looked fine; Kingman was ready.

At 0057Z April 17, George made the first contact using the callsign AD05/KH5/K. A huge grin spread across his face as he spoke on 15 meters with his life-long friend Mike AF0T, back in Bremer, Minnesota. Mike surely deserved that first contact. He was an unseen member of our team whose cheerful encouragement and traffic patches eased the loneliness of the thousands of miles.

After Mike it was first come, first served. Immediately the pileup swelled into a gigantic opening day beast, and George’s eyes bulged with the onslaught of decibels. The last Kingman group had not lasted long, and no one was going to miss this chance. George lit a fresh cigarette, let out a deep sigh, and called, “QRZ, Kingman Reef calling.”

We had never planned our on-shore operation. In the first place, plans and schedules seldom work out when you are at a really rare and hard-to-get place. All we knew was that George was to be the king DXer. It was obvious; Bill had never beat his way through a pileup before and had come along to help set up. And although I had been on several really big DXpeditions, I had always been too busy running supplies, maintaining equipment, and minding the boat to do much operating.

Undoubtedly George was a novice, the new boy, the country operator, but he had a desire so indomitable that I knew nothing would stop him—and nothing did. After those first few moments of hesita-

Land ho! The good ship Banyandah makes for a landfall on Palmyra. The base of operations on Palmyra was the green building at the center of this idyllic scene.
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The Rugged, Reliable 10, 15, and 20-Meter Yagi You've Been Waiting for Is Now Available.

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tion, he sat in his chair making contact after contact nonstop, giving a new country to over three thousand stations before finally collapsing on the floor of the tent, ending forty-eight grueling hours without sleep. He awoke three hours later when I came ashore with fresh coffee, a hot meal, and a new supply of gasoline. A couple of hoarse comments passed between us, and after a sip of coffee and a new smoke, it was "CQ hello CQ," and he was back on the air, his breakfast untouched and growing cold beside the rig.

Yes, Kingman was a tough one. Tougher than Mellish or Spratly, and much harder than Palmyra or Tokelau. Not only was our foothold precarious, but the weather was always unpredictable, changing from sunshine and twenty-mph trade winds to storms which hit quickly after building for thousands of miles of open ocean.

The most frightening of these storms struck our first night ashore. The day had been quiet, but as the sun set, a breeze sprang up from the clear night sky. At first it was a cooling relief, but soon it began to build in jumps with gusts of thirty-five knots. As it increased, so did the tide until just at high water the horizon darkened with the advance of brooding black thunderheads and the real storm began. The wind howled past gale force and the sea went crazy. Huge waves crashed over the barrier reef and pounded against our puny coral rock barricade. Salt-laden spume flew against the tent sides and was driven through by the torrent of rain. The inside of the tent was a horror scene. Gear was drenched and pools of water formed at our feet. At the storm's fullest fury, we were forced to bodily support the tent, and the harsh lighting showed our strain and fright as each man expected to be catapulted into the nearby lagoon by the next blast or breaker. Fortunately, the storm passed at dawn, and hurriedly brought the larger tent ashore. Guy lines were doubled or tripled. Coral boulders were placed inside along the tent's periphery with an equal number around the outside to hold the tent in place.

Band conditions were fantastic with the big three always open to somewhere. The Ten-Tec Omni-C receivers performed well, with such powerful barefoot signals that they controlled the pileups with ease. But that is not to say that we didn't have equipment problems. Bill had forgotten his earphones, and mine were so uncomfortable and tinny that we were forced to go without. George's Autek filter shorted out during the first night's storm, as did his new DenTron linear. He straightened out the Autek by changing a couple of the ICs, but the DenTron never even got looked at.

The biggest problem was the wash-over between the two stations. At first we thought it was insufficient grounding and ran extra wires into the sea. Then we blamed the broadness of the tribanders, but in the end we accepted it as a shortcoming in the receivers. Most of the time it wasn't a problem, since George had priority with his skill at pulling callsigns out. At the worst times, it was terribly frustrating for Bill and me as we'd wait and then yell, "Go now! He's not transmitting!"

Considering that this was Kingman and one of the most difficult DX locations in the world, everything went amazingly well. All bands were covered except 160 meters, which was absolutely dead. Once again it was proven to me that the time used to search out the twenty-seven 80-meter and the ten 6-meter contacts would have been far better used to give many other stations the new country on the higher bands. More time was lost with inconsiderate operators who grabbed two, three, and even four contacts on the same band and mode, stealing the contact from hundreds of others. Why can't all DX operators learn that expedition time is precious? Asking for QSL information and forced chit-chat during a pileup only breaks the stride of the operator. They could have listened a while for QSL and band-change information.

We also had the usual number of weirdos fanning their egos by whistling, mooing, and breathing heavily into the mike. Plus we had one particular crazy who obscenely attacked Bill and then George. It saddened and embarrassed us to hear such crude talk, and, as it happened, both my wife and children were listening, too!

On the brighter side, US operators proved the easiest to work as long as we worked each district fairly. JA and European operators were frantic and sometimes unruly, while the South Americans politely got their share. And lastly, my cobbbers from down under were still the same: callsign, name, signal report, and 73, all at a two-minute rate.

A total of 12,176 QSOs were logged. The last one went into the book at 1457Z April 22, five days and four-
Robot celebrates FCC ruling on use of SSTV on General Class Phone Bands

$100 CASH REBATE ON ROBOT 400 SSTV SCAN CONVERTER

$100 CASH REBATE ON ROBOT 800 SUPER TERMINAL

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With the new FCC ruling approving SSTV on the General Class Phone Bands, and with our $100 rebate, now is the perfect time to add slow scan TV to your station. Purchase a Robot 400 or 800 from your Robot dealer and receive a check from the Robot factory for $100.

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See your Robot dealer for complete information on this money saving offer and for a free demonstration.

World leaders in Slow Scan TV, Phone Line TV and Image Processing Systems.
teen hours after we began. Not surprisingly, it was between George and Mike AFØT, with a “job well done” message from Minnesota. It had been a job well done, for George had logged 66% of the total contacts. His beam heading had never moved, and a whopping 80% of his contacts were with North Americans. The total breakdown per area was: North America—74%, JA—15%, VK/IZ—4%, and the rest of the world—7%.

We shut down in the wee hours of Wednesday morning, extremely happy and proud of our combined efforts. We sat at the door of the tent and watched the dawn break over the stark beauty of Kingman—we felt an immense bond of comradeship. We planned to spend one day breaking camp and repacking the boat, and sail the following day for Palmira. That would allow us enough time to be established at Palmira for the weekend.

And that’s just what we did. After the last box came aboard at midday, George and Bill collapsed. They woke briefly for dinner and then hit the sack once more to sleep the night through. Early pre-dawn Thursday morning, the hundreds of pounds of anchor and chain slowly rose from the ocean’s depths, needing three hours of coaxing by the ship’s anchor winch. By first light we were under sail and heading for Palmira, forty-five miles away.

That sail was terrible, and seas knocked us about, but by twilight we were in. We located the airstrip and the crashed plane from a previous ill-fated expedition. We moored right alongside the sea-plane ramp and stepped directly on shore. It was a great DX spot and we would have really appreciated it had it been our first or only stop. But it wasn’t, and we were simply DXed out, spent, and a little homesick, with a two-week voyage separating us from family and friends. Furthermore, we didn’t expect much of a demand since the previous visitor had logged big thousands of contacts. For us, there was simply no challenge at Palmira; it appeared nothing more than a deserted holiday camp—quite a comedown after the herculean task of activating Kingman.

Setting up camp the next morning was a breeze. We merely walked along the ramp with our gear, boat to shack—the old bunk house for flying boat service personnel. We ran our power supply straight into the building’s fused junction box and had lighting at the flick of a switch. An old refrigerator also came to life and soon we even had cold beer. Ah! What a life! A gorgeous view out onto a peaceful lagoon ringed by islands alive with swaying palm trees and a DX station ready to tackle any pileup. Unfortunately, our mood, the mosquitoes, and the rats which infested our shack all combined to sour the dream.

George and Bill were on the air by 2116Z that same morning—after a mere four hours to set up. The pileups were there, all right, but not the kind that shoot adrenaline into your veins as you fight to keep them under control. They died out so quickly that we even shut down for dinner.

During the Palmira mornings, we all relaxed, fished, or explored the islands. In the afternoons and evenings, George and Bill worked DX while Judith and I prepared the boat for the fourteen-hundred-mile voyage to Pago Pago.

Propagation worsened while the longings for home grew stronger, finally, we closed the station after making the last contact at 0341Z April 29. The total number of contacts logged was 5,320. The breakdown per area was almost identical to that for Kingman.

The rest of the adventure was sort of mundane; a celebration dinner that night, a slow and careful packing up of the boat the next day followed by a refreshing final shower from one of the numerous rainwater storage tanks, and then a long sail halfway across the Pacific to American Samoa. For eleven days, the horizon remained empty. No ships, no aircraft, nothing but a fifteen-mile-diameter visible circle of sea. Finally, at 0930 hours on the twelfth day, from Palmira and the thirty-fourth since leaving Hawaii, the 2,141-foot peak of Matafao on American Samoa pierced the skyline and the great adventure began its last act.

We rounded the island’s eastern tip just after lunch and sailed along its southern shore, feasting our eyes on the greens and yellows while savoring the aroma of land. It was a quiet, easy sailing day and George stood in the companionway describing the lush jungle, quaint villages, and dilapidated buses to Gwen, his wife, who was on the patch.

We entered Pago Pago harbor marveling at the beauty of the gorge and holding our noses from the smell of the fish factory. The anchor went down, the authorities were notified, and the vessel was cleared. That night the final rites for this unique experience were held at a nearby restaurant where we stuffed ourselves on steak and salads. Two days later, George and Bill were gone, and the 1981 Kingman/Palmyra DXpedition became a memory.

The expedition cost $10,000 not including airfares, hotel bills, and miscellaneous shore expenses. Of that, $4,740 is still owed to the boat. Most of that will probably have to be written off since our efforts at obtaining post-operation sponsorship died in a flurry of kind words. To date, with nine thousand cards received, little will be left after postage. In fact, we had great plans for a beautiful and dramatic full-color QSL card, a fitting tribute to the achievement, but even this had to be replaced with a two-color card as there just wasn’t any money for it.

Nevertheless, it was a true chunk of adventure; it is a memory of achievement, comradeship, and beauty to hold the rest of our lives. And as George recently said, “I don’t know when or how, but I’m going to do Kingman again!”

Written on board the S.Y. Banyandah, Wallis Island, South Pacific, 1981

The S.Y. Banyandah in search of new adventures.
The IsoPole antenna is building a strong reputation for quality in design and superior performance. Innovative IsoPole conical sleeve decouplers (pat. pend.) offer many new design advantages.

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Top-Notch for Top Band
—super antennas for 160

The 160-meter band, which is in the process of being rediscovered as manufacturers have added the top band to transceivers, poses a special challenge with respect to antenna performance. One of the fascinations of 160 is that it remains the band for which readily-available commercial antennas are not the answer. The situation is further complicated by the fact that an effective 160-meter transmitting antenna is not always a good receiving antenna. Hence, it is often desirable to use a separate receiving antenna. This article describes a specific 160-meter antenna installation with emphasis on the system aspects, as opposed to antenna and circuit design and construction details.

Transmitting Antenna and Ground

The general objective was to provide an antenna installation for all HF bands with good performance on 160 meters, preferably without a tower, which for a number of reasons is not well suited to my property and house configuration. The property available for the installation provides a straight shot of about 120 feet down a narrow open area surrounded by trees about 50 feet high. Ground conductivity is good in the general area and in the specific location.

Because of its flexibility for all band, all-frequency operation (with a transmatch), and because of its suitability to the property configuration, a quarter-wave (at 160 meters), end-fed, inverted-L was chosen as the primary antenna. The shack end is supported by a guying halyard on a 15-foot steel TV-type antenna mast secured to a vent pipe on the roof of the house. Stainless-steel hose clamps are used to secure the mast to the vent pipe. See Fig. 1. The halyard is tied to a TV antenna mount that happened to be conveniently in line with the vent pipe. The center of the flat-top is supported by a line stretched across the top of two trees on either side of the antenna run. The far end is supported at a height of about 55 feet with a line over a third tree. The lines are supported high in the trees and their ends are tied around the trunks of the trees at a convenient height a few feet above the ground. No pulleys, weights, or springs are used. The tree limbs themselves act as the flexible elements that give in the wind.

The antenna wire is connected to a transmatch about two feet from a ground-floor window, passes through an antenna insulating panel, rises nearly vertical for about 40 feet, and runs out about 95 feet with the flat-top at an average height of about 50 feet.

A note about antenna halyards: Nylon line is excellent but expensive; polypropylene line is much less expensive but deteriorates quickly in the sunlight; with limited experience of only several months, parachute cord (available at surplus

Fig. 1. House-end antenna support. Tension is taken by a halyard tied to a TV antenna mast mount rather than by the bending strength of the inverted-L support mast. Side guys would be a desirable improvement.

Fig. 2. System ground arrangement.
stores) appears to provide a good, inexpensive solution.

Ground

A quarter-wave antenna requires a low-resistance ground to be an efficient radiator. The station equipment must be properly grounded to keep rf off the equipment chassis and to prevent rf feedback. The grounding arrangement that met these requirements is shown in Fig. 2. The heavy straps shown are all 3/8" braid.

It is common practice to increase radiating efficiency (reduce ground losses) of electrically short antennas by laying quarter-wave conductors out in all directions from the base of the antenna either on or below the ground—the more radials the better. Since in this installation the base of the ended inverted-L is terminated at the house and because of the narrow width of the lot, even a small number of radials cannot be accommodated.

I settled for one 135-foot radial connected to the common ground point inside the window, dropping directly from the window to the ground below and running approximately under and approximately parallel to the horizontal portion of the antenna. The single radial is buried a few inches under the ground to get it out of harm's way.

It did not take long to determine that this antenna and ground combination was a good radiator. However, it left much to be desired as a receiving antenna. Consistently, I was being copied by stations that I could not pull out of the noise. Consistently, the other stations were copying stations that I could not copy. My station was "receiving limited."

Receiving Antenna and Preamplifier

In searching for a better receiving antenna, I came across the 5-foot, single-turn, shielded loop in The ARRL Antenna Handbook (see Fig. 3). Much to my surprise and delight, this little loop mounted two feet above the ground and working into a preamplifier proved to be a simple, convenient antenna with superior performance. The loop was made of RG-58/U coax mounted on a 6½-foot wooden dowel mast with light wood cross pieces. The mast was mounted on a TV antenna rotor which was in turn mounted on a 2-foot-square plywood base. RG-58/U was also used for the feedline. With the recent re-opening of 160, it would be better to construct the loop and feed using lower-capacitance RG-59/U foam cable. This would provide increased performance across the band.

The signal level produced by the loop antenna is quite low but easily can be boosted to an acceptable level with a simple transistor preamplifier. Because the preamp I used was home-built and because there are some associated system ramifications, a description of the circuit is included here (Fig. 4).

This simple preamp was not designed, but rather built from the simplest FET circuit I could find out of available parts. The input and output tuned circuits were arranged to cover 1800 to 1850 kHz. It could undoubtedly be improved, possibly by broad-bandening, to eliminate the need for tuning. It provides a gain approaching 20 dB, but in my "brassboard" model is uncomfortably close to oscillation. It performed well enough on the first try that no effort was put into improving it. It would have to be modified to cover more than the 1800-to-1850-kHz portion of the band.

Since this article was first written, the 160-meter band has been opened to 1900 kHz and the loop performance has been improved by replacing the preamp in Fig 4 with an untuned broadband preamp at the base of and connected directly to the loop.

Note the protective diodes in both the input and output of the preamp. The input is wide open on transmit and there is a danger of transmitting into the output, hence the diode protection on both ends. With 100 Watts into the inverted-L and with the loop antenna about 10 feet from the downlead, a peak audio-frequency signal of 6 volts is developed across the
220-Ohm source resistor. This results in a peak current of about 27 mA, equivalent to a peak transistor dissipation of approximately 230 mW. Although not a rigorous analysis, the FET dissipation appears to be well below the 300-mW rating. At a distance of 150 feet, the voltage across the resistor is only a fraction of a volt. In the system arrangement described in a later section, the T-R switching transient into the preamp output causes a 2-volt peak about 8 ms long across the source resistor.

Tuning the loop is simplified because it can be adjusted at ground level. Tuning was accomplished with the length of the feedline to be used in operation and with the loop and preamp connected to the receiver. Subsequent experimentation indicated that the loop tuning was affected somewhat by the length of the feedline. A grid-dip meter was used as a signal source. Receiver S-meter readings were observed for incremental adjustments of the loop tuning capacitor until a maximum meter reading was obtained. A 430-pF capacitor was required to tune the 5-foot square of RG-58/U to 1815 kHz.

**T-R Relay and Isolation Transformer**

Since some surprises were encountered in obtaining satisfactory performance of the T-R relay and associated isolation transformer, these components will be described in some detail. See Fig. 5.

The B & W coaxial T-R relay is rated at 50 to 120 V, 60 kHz. It turned out to be a 28-volt dc relay with series dropping resistors and full-wave rectifying diodes as shown. Since in the system being described the relay was expected to be energized for long periods during operation on other than the 160-meter band, it was considered desirable to operate the relay at the low end of its current rating. The relay would not pull in on 50 volts until the dropping resistors were shorted. With the resistors shorted, the relay operated satisfactorily on 60 volts.

Isolation of the electric service ground is required because one of the transceiver T-R relay contacts is grounded to the chassis. Using two heater transformers back-to-back was less expensive than the purchase of an available, standard-size isolation transformer and provided a convenient means of reducing the voltage to half the line voltage. The original transformer used for T1 was a 300-mA size; it ran far too hot. It was determined that although rated for 15-Watt output, it was drawing 7.2 VA at no load (disconnected from T2). In operation with the relay-coil load on continuously, T2 runs cool and T1 runs at about 110°F (40° above ambient); surprising, but not unacceptable.

**System Integration**

A functional schematic diagram of the overall antenna system is shown in Fig. 6. The relays are shown in the "R", or "receive," position. The control box located conveniently on the operating desk contains a miniature switch allowing the coax T-R relay to be actuated with the transceiver in receive. In this way, the receiver can be instantaneously switched back and forth between the two antennas for comparison. On other than the 160-meter band, the T-R switch is kept in the "T", or transmit, position and the "transmitting" antenna is used for both transmit and receive.

When the transmitter is keyed, or the PTT or VOX switch is actuated, a 13-volt transmit control voltage (T-voltage) actuates RY1 and RY2. RY1 grounds the receiver input and leaves the final amplifier output connected to the antenna connector. RY2 actuates RY3, which in turn grounds the output of the loop preamp and connects the transceiver to the transmatch. Note that the coil circuit of RY3 is grounded only at the external T-R jack.

At the same time the T voltage is applied to RY1 and RY2, it is applied to the transmitter rf amplifier bias bus through a solid-state delay switch, Q1. The resis-
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tor and capacitor in series with the base of Q1 applies a decaying pulse to the base until the capacitor is charged, after which the base voltage returns to zero.

When the positive pulse is applied to the base, Q1 conducts and shorts out the T-voltage on the bias bus. As the pulse decays, the base returns to zero voltage, thus applying the turn-on bias to the final amplifier drivers. This decay softens the keying on CW.

One set of contacts on RY3 grounds the output of the loop preamp on transmit. Since RY3 is in series with RY2, the transmit delay pulse will be completed and the transmitter will be turned on before the amplifier can be grounded. An oscilloscope across the preamp FET source resistor shows a rounded-front switching transient with a fast fall time. This transient is following the transmitter soft keying characteristic followed by a sharp cut-off as the RY3 contacts ground the preamp output. As explained previously, the back-to-back diodes are shunted across the preamp output to suppress this switching transient to a level that will not damage the FET.

CW operation requires further consideration of system functions. RY1 and RY2 are fast-acting relays that can follow high-speed keying. RY2, however, has an adjustable drop-out delay feature to allow proper relay sequencing of external equipment being controlled. The drop-out can be adjusted to keep RY3 actuated during CW keying. In this mode, RY3 will have no effect on keying. The transceiver also can be operated QSK in which mode RY3 can be kept actuated (by the switch in the control box) to use the same antenna for receiving and transmitting. QSK operation with a separate receiving antenna will be limited in keying speed.

RY3 is not intended as a high-speed keying relay. The 8-ms system keying delay, the 2.2-ms minimum RY2 drop-out delay, and the drop-out time of RY3 will limit keying speed to less than 13 wpm (estimated). This feature has not been tested. The system can, of course, accommodate high-speed semi-break-in operation.

The control circuit shown in Fig. 6 has the weakness of not being fail-safe. That is, if the voltage to RY3 fails, the transceiver will transmit directly into the output of the loop preamp. To make the circuit fail-safe would require transceiver T-R contacts to be normally-closed. A fail-safe control circuit is shown in Fig. 7. The switch in the control box is connected in series with RY3. The grounding contacts in RY3 should be connected to the T contacts instead of the R contacts as they are in Fig. 6. The relay terminals marked R and T on the relay case are interchanged from the circuit in Fig. 6.

Performance

I have had the opportunity to compare a full-length 160-meter sloping dipole (by extending about 2/3 of it into an adjacent unused property) to the inverted-L and the loop/preamp. The loop was tried in several locations around the yard with the bottom of the square always two feet above the base, including a ground-level, reinforced-concrete slab and a reinforced-concrete slab porch ten feet above the ground.

No difference in performance could be detected at any of the locations except possibly some interaction from the inverted-L when the loop was a few feet from the downlead. At any given time, different signals would be stronger from any one of the three antennas. The dipole seemed to favor signals from closer stations out to about 250 miles. More distant stations, particularly around 800 miles out, were favored by the inverted-L. The loop preamp, however, delivered stronger signals from more stations more of the time at all distances. Numerous weaker stations were increased to a solid-copy level when smothered in noise on the other two antennas.

The station location is in the high field of broadcast stations about one mile away on 1500 and 1540 kHz resulting in a host of spurious heterodyne and splatter signals. The loop appears to be less susceptible to this interference than either of the other two antennas. In some cases, the loop brought a signal right out of a heterodyne or splatter on either of the other two antennas.

The loop, however is particularly susceptible to TV receiver horizontal-sweep harmonics, a real disadvantage. In one respect, the loop did not perform as expected. It did not exhibit deep nulls in the plane of the loop. Also, nulls on all ground-wave signals and noise were always in the same direction, possibly because of distortion due to the close inverted-L and two houses.

The end result is a station with convenient operation of a separate receiving antenna and a 160-meter antenna system that is better balanced between transmit and receive performance. More stations are at a comfortable copy level, and more stations can be pulled out of the noise and made readable. The improvement is not worth-shaking, but a 6- to 10 db improvement in receiving capability has been achieved.
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CNW518—Frequency range: Amateur bands 3.5 - 30 MHz including new WARC bands • Power Rating: SSB-2.5 kW PEP, CW-1 kW (50% duty) • Two antenna outputs for unbalanced lines • Dimensions: 225 W x 90 H x 275 D mm

CNW418 (not shown)—Same specifications as CNW518 except. Power Rating: SSB-500 watts PEP, CW-200 watts • Dimensions: 225 W x 90 H x 245 D mm

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The Fun-Amp
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The Fun-Mitter transmitter, described in 73 Magazine (February, 1981), has provided an easy, affordable, and fun way to explore home brew and QRP. Some amateurs have expressed an interest in an amplifier that would boost the output of the 5-Watt Fun-Mitter. The Fun-Amp described in this article will do just that. The Fun-Amp is a CW amplifier that will provide about 20 Watts of output power. It is also based on the same criteria as for the other Fun gear, to make for a simple, inexpensive way to quadruple the Fun-Mitter power.

The Fun-Mitter, Funceiver, Fun-Oscillator, and now the Fun-Amp have all been designed with the casual home brewer in mind. The objective for this entire series has been to provide designs for gear that can be duplicated easily by all amateurs. All parts are available at Radio Shack outlets and each piece of gear is designed for a “notuning-adjustment” approach.

The Fun-Amp fits in quite nicely with this approach. In fact, it is probably the simplest and easiest to build of all of the items described so far. Total parts count in the Fun-Amp is under twenty, which includes the bypass capacitors.

The objectives for the Fun-Amp are basically the same as for the other Fun gear:

- Approximately 20 Watts output
- No modifications to the Fun-Mitter
- Same size PC board, same size case as for the other Fun projects
- No tuning adjustments
- All parts available from Radio Shack
- Cost less than $25

The objectives not only were met, but as the design evolved into its final form, the Fun-Amp became the best example of the philosophy behind this series.

Circuit

One of the exciting parts of this project is the use of the latest state-of-the-art technology. The active devices Q1-Q3 are VMOS FETS (Vertical Metal Oxide Semiconductor Field Effect Transistors). These devices have been available for several years but are just recently being used in amateur gear. I found it exciting to design and experiment with these devices and to discover that they truly do live up to their textbook billing. They also are very rugged, something that is a definite asset for home construction.

The advantages of VMOS FETS are numerous. Of utmost importance to this design is the lack of thermal runaway and the freedom from “mismatch” burnout. Thermal runaway is the condition that exists in regular transistors when the collector current increases the heat of the transistor, which causes more current flow, which causes
more heat, which causes more current. Eventually, the transistor can self-destruct. VMOS FETs have just the opposite effect—more heat tends to decrease current flow.

Mismatch burnout occurs in regular transistors when an impedance mismatch occurs between the load (antenna) and the output network. This is seen when a high SWR exists—such as with an open line or non-resonant antenna. This condition can destroy most transistors quickly, but the VMOS FET comes through with flying colors.

Additional benefits of the VMOS FET are the ease of parallel use and ease of matching input and output. In order to reach the 20-Watt output level with Radio Shack parts, it was necessary to parallel three VN67AF VMOS FETs. No current hogging exists with VMOS, so no "ballasting" resistors were needed.

One problem of the VN67AF VMOS is the built-in static protection zener diode. This diode limits the maximum gate-to-source voltage which in turn limits the output power. Unfortunately, Radio Shack sells only the VN67AF. VMOS devices are manufactured without the zener diode, but in order to meet the objective of Radio Shack part usage, they were not used.

Fig. 1 shows the simple schematic of the Fun-Amp. I decided to use as simple a design as possible and thus eliminated an input network and an intricate output transformer. A good design goal for home-built equipment is "make it as simple as possible." The amplifier, however, does not suffer in performance due to the simplicity.

The input from the Fun-Mitter is applied to a "pi-type" attenuator (R1, R2, R3). This reduces the input power to the VMOS FETs to the needed level. The Fun-Amp can be driven with only 2 Watts, if desired, to reach the 20-Watt output level. This will be described in detail later. Three VN67AF VMOS FETs are used in parallel to generate the 20 Watts of RF power. Each FET supplies about 1/3 of the total power.

Because of the VMOS’s built-in zener diode, CR1 has been added to the circuit. It clips the input sine-wave signal so that it does not go negative. If CR1 was not in the circuit, the FET would quickly be destroyed.

There is no forward bias used on the FETs and thus the amplifier operates in Class C. This is significant for two reasons. One, the amplifier can be used only for CW operation. SS operation will result in severe distortion. Secondly, Class C operation results in high efficiency (power in/power out), which is a definite plus.

The output network consists of L2, L3, and C3. This network is commonly referred to as a T-network and its function is to match the output impedance of Q1-Q3(16Ω) to the 50Ω antenna load. It also offers some harmonic attenuation. L2 and L3 are constructed from Radio Shack 10-μH rf chokes—a technique familiar to builders of the earlier gear.

The amplifier is operated from +24 V, same as the Fun-Mitter. Current needed for the amplifier is around one Amp. The power supply described in the Fun-Mitter article should work fine, provided the regulator is mounted on a good heat sink, such as part number 276-1361. Total demand from the supply if both the Fun-Mitter and Fun-Amp

---

**Parts List**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>C1</td>
<td>570 pF (470 and 100 in parallel)</td>
<td>272-125</td>
</tr>
<tr>
<td>C2, C5</td>
<td>0.1 μF</td>
<td>272-123</td>
</tr>
<tr>
<td>C3</td>
<td>80pF: 1000 pF</td>
<td>272-126</td>
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<tr>
<td></td>
<td>40pF: 470 pF</td>
<td>272-125</td>
</tr>
<tr>
<td>C4</td>
<td>0.1 μF</td>
<td>272-131</td>
</tr>
<tr>
<td>C6</td>
<td>10 μF, 35 V dc</td>
<td>272-1013</td>
</tr>
<tr>
<td>CR1</td>
<td>1N914 small signal silicon</td>
<td>276-1122</td>
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<tr>
<td>CR2</td>
<td>1-Amp, 50-V diode</td>
<td>276-1101</td>
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<tr>
<td>J1, J2</td>
<td>SO-239</td>
<td>278-201</td>
</tr>
<tr>
<td>J3, J4</td>
<td>Phono jack</td>
<td>274-346</td>
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<tr>
<td>K1</td>
<td>DPDT relay</td>
<td>275-206</td>
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<tr>
<td>L1</td>
<td>10-μH rf choke</td>
<td>273-101</td>
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<tr>
<td>L2</td>
<td>Modified 10-μH rf choke</td>
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<td>For 40 meters remove 19 turns</td>
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<tr>
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<td>For 40 meters remove 15 turns</td>
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<td>Q1-Q3</td>
<td>VN67AF VMOS power FET</td>
<td>276-2071</td>
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<tr>
<td>R1, R3</td>
<td>For 5-Watt Fun-Mitter use 150Ω, 1/2 W</td>
<td>271-013</td>
</tr>
<tr>
<td>R2</td>
<td>For 5-Watt Fun-Mitter Use 33Ω, 1/2 W</td>
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<tr>
<td>R4</td>
<td>47Ω, 1/2 Watt</td>
<td>271-009</td>
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<tr>
<td>R5</td>
<td>47K, 0.1/4 Watt</td>
<td>271-1342</td>
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<tr>
<td>R6</td>
<td>155Ω (three 470Ω, 1/2 W in parallel)</td>
<td>271-019</td>
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<tr>
<td>S1</td>
<td>SPDT switch</td>
<td>275-612</td>
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<td>Misc.</td>
<td>TO-220 heat sink (3)</td>
<td>276-1363</td>
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<td>Heat sink grease</td>
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<td>Case</td>
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<td>Hardware</td>
<td>64-3012</td>
</tr>
<tr>
<td></td>
<td>Wire</td>
<td>278-1304</td>
</tr>
</tbody>
</table>

---

**Fig. 1. Schematic.**
are used will be less than 1.5 Amps, which is within the LM317 ratings. Because of CW operation, the actual average current will be around 3/4 Amp (50% duty cycle). Also, four lantern batteries can be used in series to provide +24 volts. Battery life will be reduced, however, due to the higher current levels of the Fun-Amp. Transmit/receive switching is accomplished by K1. This DPDT relay switches the Fun-Amp from receive to transmit when needed.

Construction

The Fun-Amp is built on the same size PC board as all earlier projects (2-1/4" by 3"). The PC layout is given in Fig. 2. Constructing the Fun-Amp should be very easy. However, as has been discovered by some hams building the earlier goof-proof projects, there is always a possibility for error. Basically, any problems that hams have encountered have been in one of three areas:

- Poor soldering (good soldering practices are a must!)
- Faulty Radio Shack components.
- Non-use of PC boards.

In building the Fun-Amp, use a low-wattage soldering iron and rosin-core solder. Heat each PC pad and then apply the solder. A good connection will have a shiny appearance.

PC board use is recommended, particularly for first-time builders. Use the pattern given in Fig. 2. This will help avoid wiring errors. PC boards are available from me for $7 for those who are not inclined to build their own.

Because of the increase in power, a method is needed to dissipate the heat produced in Q1-Q3. Radio Shack heat sinks designed for a TO-220 transistor case are used for this purpose. Q1-Q3 are TO-202 devices, so a slight modification is needed. A new hole (approximately 1/8") needs to be drilled through the heat sink below the existing one. Use one of the FETs for a pattern, ensuring that the tab is flat on the heat-sink body. A #6 screw and nut can be used to mate the FET to the heat sink. Use a small amount of heat-sink grease (part number 276-1372) between the FET tab and the heat sink. These heat sinks work quite nicely even though they will become quite warm during CW operation.

To construct C1, connect one 470-pF and one 100-pF capacitor in parallel. Piggyback the two caps and solder the leads. Insert only one wire per leg into the PC-board hole.

To construct L2 and L3, use the same method as was used in all of the earlier projects. Remove the exact number of turns specified in the parts list, depending on whether your Fun-Amp is for 80 or 40 meters. These coils are less than optimum as inductors at the higher power level, but they work quite well and are particularly easy to reproduce.

Coax should be used for all rf connections to and from the relay and the PC board. Number 18 gauge (or similar) hookup wire can be used for the supply lead to and from K1 and S1.

The amplifier should be mounted in an enclosure. This provides rf shielding as well as protecting the PC board and relay from accidental shorting from outside devices. The Radio Shack cabinet mentioned in the parts lists is easy to work with and fits the PC board nicely.

As mentioned earlier, a relay-control voltage is needed to operate K1 which switches the amplifier in and out of the circuit. This voltage comes from the Fun-Mitter and is tapped off the +24 T-R voltage. If the Fun-Mitter was modified for use with the Fun-Ciever, then merely run another wire from the jack to 14 of the Fun-Amp. If the Fun-Mitter has not yet been modified, it should be modified as shown in Fig. 3.

The key to goof-proof construction is to have all parts available at construction time and then to load and solder all parts carefully. This approach should yield a product that will work "first-time," a truly exciting moment in homebrewing. The Fun-Amp construction, as mentioned earlier, should be completely goof-proof from loading to using!

Operation

Turning on the Fun-Amp should be even easier than building. No tune-up adjustments are needed. Merely apply 24 V, a relay-control voltage, and an input signal—and an output signal should appear!

Before applying +24 V, however, it might be wise to check for shorts. Visually inspect the PC board for solder or etching shorts. If an ohmmeter is available, a reading of greater than about 100 to 200 Ω should
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occur between ground and the drains of Q1-Q3 (with S1 off). This reading will vary depending on the model of ohmmeter you have and the polarity of the leads. However, if it is near zero Ohms, re-inspect the board and components for a short. If you don’t have an ohmmeter available, feel at ease to merely visually inspect the board as that will reveal nearly all potential shorts.

If an ammeter is available, connect it in series in the +24 V line going to J3. With no drive applied to the Fun-Amp (and S1 on), there should be a small amount of current flowing (about 50 mA). This current is due to the relay current. Always use a 50Ω dummy load at J2 during tune-up.

Next, apply drive by keying the Fun-Mitter. (Don’t forget to connect the relay control voltage to J4.) A reading of around one Amp should exist on the ammeter and about 20 Watts of rf should appear at J2 as seen on a wattmeter.

If desired, the Fun-Amp can be driven with less than the 5 Watts available from the Fun-Mitter. The attenuator circuit dissipates power, which creates an inefficient circuit. If the Fun-Mitter is run off only 18 V instead of 24 V, then there is less wasted power. About 2 Watts of power output will occur from the Fun-Mitter at 18 V. With two Watts of power input to the Fun-Amp, the values of R1, R2, and R3 should be changed to 330Ω, 15Ω, and 330Ω, respectively. This change will necessitate a change in dc supply voltage to the Fun-Mitter, however, which may be more of an inconvenience than the small amount of wasted power. It is mentioned for two reasons. First, if battery operation is used, going from 24 V to 18 V (for the Fun-Mitter) is very simple and the reduction in current helps prolong battery life. Second, this illustration should help those with other types of transmitters to envision ways to drive the Fun-Amp.

Conclusion
The Fun-Amp should help increase the signal strength of the Fun-Mitter when conditions warrant. It should also be an enjoyable way to construct a useful piece of home-brew gear. I would be very interested in hearing from hams who have constructed any of the Fun gear, for your suggestions and to learn of your experiences.

Acknowledgements
I would like to thank the many hams who have responded to earlier articles in this series for their suggestions and for their interest.

Special thanks go to Sam Babb for his design suggestions on the Fun-Amp.

Also, I would like to thank my wife, Dottie, for her enthusiastic encouragement and excellent typing skills. She makes writing these articles possible.

Fig. 3. Connections between Fun-Mitter and Fun-Amp.
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**TE-12PA**

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<th>Frequency</th>
<th>CTCSS Tone 1</th>
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<th>CTCSS Tone 3</th>
<th>CTCSS Tone 4</th>
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<td>79.7 SP</td>
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- Frequency accuracy, ±.1 Hz maximum - 40°C to +85°C
- Frequencies to 250 Hz available on special order.
- Continuous tone

**TE-12PB**

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<th>Test Tones:</th>
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<td>2605</td>
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<td>1800</td>
</tr>
</tbody>
</table>

- 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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The CCD Antenna Revisited
— does it measure up on 40m?

The articles which appeared in 73 Magazine, describing the concept of the CCD antenna, really hit a high spot with me. After all these years of experimenting with and building dipoles and beams, the CCD antenna certainly presented a fresh and exciting project. W4ATE and W4FD deserve a pat on the back for exploring the applications of this concept for amateur use.

My objective in building this antenna was to see if the concept put forth by W4FD, W4ATE, and others who had built this antenna really measured up to the specifications. This antenna performs better than any single wire antenna I have ever built in the past.

I decided on using center feed for this antenna simply because it suited my real-estate layout. The feedline was a good grade of 300-Ohm TV line. Prior to installing the feedline, I applied a heavy coating of floor wax over the entire length of the line. This paid off, especially during wet weather; the impedance of the antenna system remained quite stable. I also tried a 4:1 balun fed with 50-Ohm coaxial cable. At the resonant frequency of the antenna, the swr was 1.6:1, and at the extreme high frequency end of 40 meters, the swr was 2.5:1.

I cannot quote specific figures of gain, radiation patterns, or angles of radiation for this antenna because I do not have the necessary test equipment nor an antenna range to perform such tasks. However, I can state that I am hearing more stations and have had many more solid QSOs than I’ve ever had with my inverted V antenna. One thing in particular that I have noticed is that this antenna is much quieter than any other antenna I have used. It’s much easier to hear and work weak stations. Don’t let the length of the 40-meter antenna deter you from trying it; the amazing thing is that you can zigzag this antenna in just about any plane, including through trees. Another thing that I’ve noticed is that when I contact another station that is using a CCD antenna, there seems to be much less QSB on the signals. I have used this antenna on 15 and 20 meters with excellent results. I have no interest in 10 meters, but I’m certain that it will perform well on that band. The other night I had to get on 75 meters to meet a sked, and for the fun of it I tuned up using the antenna matching network. I was able to put out a respectable signal for local work.

It didn’t take me long to gather up the parts for this antenna. I had to make the insulators, and for the wire I used the secondary of an old power transformer, which was number 22 wire. It was easy to handle and didn’t cost a cent.

Basically, I wanted to build this antenna in such a manner that I could experiment with it and make changes if needed. This approach resulted in the following mechanical configuration. I used 140 feet of thin nylon cord with a tensile strength of 350 pounds. This cord was used as a messenger from which the an-

---

Fig. 1. Insulator with mounted resistor and capacitor.
Fig. 2. Feedpoint insulator with feeder clamp in place.
and suspended the insulator about 3 inches below the messenger. I continued this process until all the sections were installed and soldered. Using this method of suspending the wire sections allows the antenna to ride free, with no mechanical strain on it whatsoever. So far the antenna has withstood 45-mph winds, rain, and hot sun without any problems. Fig. 3 shows a section of the completed antenna.

The mechanical work is now completed, and we're ready to begin the preliminary antenna tests. I used the authors' design criteria for a 40-meter antenna with a low frequency cutoff of 7050 kHz. I connected a 3-turn loop at the feedpoint insulator and, using a grid dip meter, resonance occurred at 7002 kHz. Next, the 300-Ohm TV feedline was connected to the feedpoint. About 80 feet of line was needed to reach the shack. I prefer the use of an antenna tuner rather than a 4:1 step-up transformer, because a tuner permits you to tune out any residual reactance in the overall antenna system. Next, I tuned up the transceiver on 7200 kHz and adjusted the antenna tuner for minimum swr between the exciter and the input of the antenna tuner. Using a Bird wattmeter, I set the output of the exciter to 1 Watt. Any swr meter will serve the same purpose; the main consideration here is that only a minimum of power is required to excite the antenna. The rf indicator which I used to check each section of the antenna consisted of a 50 µA meter, using a couple of 1N34s as rectifiers. A 6-inch piece of wire was used as the rf probe. Next, I walked the entire length of the antenna, holding the rf probe at a uniform distance from the antenna, and checked each section. At the ends of each section, I recorded 12 µA, and near the middle of each section, the rf probe indicated 29 µA. These same approximate readings occurred at each section, right down to each end. In other words, I had a uniform radiating surface over the entire length of the antenna. Remember, this antenna is only 3½ feet above ground. It didn't take me long to get back into the shack and fire up on 40 meters.

The first thing that I noticed was that the receiver was very quiet. Signals were right up there in strength. I made three contacts (about 200 miles) and my reports were Q5 and 59 plus. This was with 100 W dc input. I left the antenna at 3½ feet for about a month and did a lot of listening and QSOing. The results have been more than gratifying.

My next task was to raise the antenna to 50 feet. This was a snap with the nylon messenger. All I had to do was coil the antenna up, take it to the mast, stretch it out, attach the feedpoint insulator to the halyard, and pull it up. Next the ends of each messenger were snaked through and among the trees and secured wherever convenient. I find it difficult to describe the physical configuration of the antenna, but the feedpoint is up about 50 feet and the rest of the antenna is hidden among the trees. I have 86 trees on the property and an XYL who loves trees; 'nuff said.

All in all, I'm very happy with the results of this antenna and I'm thankful to W4FD and W4ATE for providing me with a very interesting and rewarding project.

References
Antenna-Raising: The Good-Neighbor Policy
—sidestepping civil war

While working as a public relations representative for one of the top five U.S. oil companies, I have learned, among other things, that the truth isn't nearly as important as what the public perceives the truth to be. I knew the instant I put up my very first beam ever, over my new suburban Houston home, that my neighbors were not going to know what it was and what they perceived it to be could cause me a lot of trouble.

My concern for ensuring good relations with my neighbors might have been prompted by paranoia from continuously explaining oil-company profits and prices, but more than likely it was the fact that my house sat only ten feet away from my neighbors on each side. I lived right in the middle of my subdivision, where the standard lot size was 50' x 100'. Wherever the concern came from, it caused me to plan a little public relations into the installation of my beam. If you're planning to install a beam and/or tower for the first time, you might want to include some public relations, too, especially if you live close to your neighbors.

In the oil industry, our public relations efforts are often in reaction to something, like bad publicity. You know—high gasoline prices, shortages, excess profits, and the like. We're learning that the more we educate the public about our business, the better understanding and acceptance there is of what is taking place. That makes our jobs in PR a lot easier.

I didn't want to confront problems with my neighbors after I put up my beam, so I set out to educate them about what was going to be on top of my house. Not that I thought that fact alone would persuade them to let me live in peace on 20-meter CW, but I felt sure that if these folks saw an antenna on top of my house without knowing exactly what it was, they were sure to think that I was a CBer running 5000 Watts into stereo, televisions, telephones, and intercoms. Thus, they would try to have my antenna taken down the minute they saw it.

My first action was to make sure that my installation was going to be legal. Like many high-density subdivisions in metropolitan areas, my subdivision had a homeowners association with a list of strict deed restrictions. Living ten feet apart we needed them! Antennae were covered in paragraph 17: "Maximum Height of Antennae: No radio or television aerial wires or antennae shall be maintained on any portion of any residential lot forward of the front building line of said lot; nor shall any free-standing antennae of any style be permitted to extend more than ten feet above the roof of the main residential structure of said lot."

This wasn't news to me. It was the first thing I checked before buying the house. (For some reason my XYL kept looking at wallpaper.) I already had planned my installation to include a 4" x 4" post anchored to my attic floor, going through the roof at its point, and extending three feet above the roofline. I would attach a nine-foot piece of 2½" galvanized pipe to the 4" x 4", with the bottom of the pipe flush with the roof.

With the rotor and beam on top of the pipe, the in-
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stallation would be exactly ten feet above the roof. I had a two-story house with the point of the roof 25 feet above ground level, so the beam would rest nicely at 35 feet. Cushcraft recommended a minimum of 33 feet, a half-wave at 20 meters, for their ATB-34 tri-band beam.

My next action was to inform the chairman and members of the subdivision's architectural control committee of my plans. Though my installation was going to be legal, if my neighbors started calling these guys, it really could stir up a mess. I wanted to get to them first with facts instead of speculation. Instead of a personal visit to a committee meeting, I decided to write a letter. Here's what I said:

"I am writing to let you know about an antenna I am erecting on top of my house, and to assure you that it complies with the deed restrictions of our community. "The antenna is an amateur radio beam antenna used for directing radio signals to a predetermined geographical area. Unlike a Citizens Band (CB) radio operator who is limited to 40 channels in one frequency band and five Watts input power, an amateur radio operator, or ham, is licensed to operate on a multitude of frequencies in several different frequency bands using 1000 Watts input power. Thus, it is as common for amateur radio operators to talk with hams in foreign countries as it is to hams in their own hometowns.

"I have been a ham for seven years and have talked with other hams in Europe, Africa, and Asia, including the Soviet Union. The antenna I am erecting will allow me to direct my signals using frequencies in three amateur bands. This antenna will also allow me to conduct emergency communications in our neighborhood should the need ever exist. "Like most homeowners, I am concerned about the aesthetics of our community and adherence to the community's deed restrictions. In accordance with our deed restrictions, my antenna will not be ten feet higher than the highest point of my roof and it will not have any part forward of the front of my house. For your review, I have enclosed a drawing of how my installation will look. Would you please inform me about your acceptance of these plans. Respectfully, . . . "

I accomplished several objectives with this letter. I let the architectural control committee know that I was not a CBer, that I had expertise in my hobby, that I was concerned about making sure my installation adhered to our deed restrictions, and that I cared about neighborhood aesthetics. Plus, I asked that the board respond about acceptance of my planned installation.

About two weeks after I mailed the letter, I received a reply from the committee: "Your planned installation of an amateur radio station antenna is in accordance with the deed restrictions of our community and we plan no action regarding it at this time. " There it was in black and white: " . . . is in accordance with the deed restrictions . . ." Believe me, that was a valuable document.

Now to get ready for the installation. I had the 4" X 4" post, 9' piece of pipe for the mast, rotator, and beam. I began working to place the post through the roof and run the coax and rotor cable. A few days away from installation, I wrote another letter, one I planned to give each of my neighbors who would be able to see my antenna from their homes.

I walked up and down the street in front of my house with an eye on my roof. I did the same from the street in front of my neighbors' houses behind mine. I figured there were 26 homes from which my neighbors would be able to see my beam from their yards. My plan was to give each of these neighbors a letter about the beam the day I put it up. Here's what it said: "You have probably seen an antenna on top of my house at 7703 Hollow Glen Lane. I want to explain why it is there and assure you that it complies with the deed restrictions of our community."

I then duplicated the second, third, and fourth paragraphs of the letter I sent to the committee. The letter ended this way: "The chairman and members of the architectural control committee are aware of the installation of this antenna and have said that it is in compliance with the deed restrictions of our community. There are hundreds of thousands of amateur radio operators around the world, and communicating with them is truly an exciting hobby. If you, your friends, or children are ever interested in amateur radio, please let me know. I would be pleased for you to visit my shack for a demonstration. Respectfully, . . ."

Finally, everything was ready. I took a day off from work to put up the beam since I didn't want to do it on a Saturday or Sunday with the neighbors staring at me. A friend came over to help me and up it went without a hitch. Inside the shack, on the second floor directly beneath the antenna, I tuned up, checked the SWR, which was nearly one to one, and immediately began working 20-meter DX. It was early afternoon and I stopped long enough to deliver the letters. It is illegal to place such a letter inside someone's mailbox, so I attached the letters to the doors of the houses.

Then it was back to the shack. The efforts I made to put up the beam were justified, as I worked several new countries in a matter of an hour. My HW-101 was producing 599 signals from Europe, and as I began to turn the beam, my thoughts turned to the neighbors. I didn't know what to expect from them when they got in from work that afternoon and saw the addition to the neighborhood. Whatever happened, I felt good knowing that I had done a little PR in advance of their discovery.

I was kind of scared to go outside for a few days, but the weekend came and along with it yard work. I eased outside and started my Saturday-morning ritual of mowing and edging, along with several of the neighbors. Occasionally, I would look skyward to the beam and think, "My gosh, that's big!" Though there were quite a few folks in their yards who could have grouped to descend on me Lynch-mob style, I received nothing more than the usual friendly waves. The weekend passed with twelve new countries on CW and no threats from the neighbors.

A week passed, a month, then several months. Nothing. Not a word. Had I done a good PR job or was there apathy in the community? It's the same question often asked in public relations when we plan for a potential problem but nothing happens. The fact is, I'll never know what might have happened, but I do know what did happen. I operated with my beam for two years before being transferred, working DXCC-CW with about 100 Watts output. I never got any flak over the antenna, but I did get lots of questions about ham radio. I just wonder how many of my neighbors' thoughts changed from aesthetics to my signals around the world as they looked skyward to my beam.
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'Lite Receiver IV
— part I: building it is a breeze

This is the first installment of a two-part article on a complete, simple, home-brew satellite TV receiver. If you have been following our satellite TV articles in 73, you know that it is possible to build a home-brew LNA. And, with our simple downconverter, you have all of the hard parts of your home satellite TV system complete!

The LNA was described in the February, 1982, issue of 73, and the downconverter was described in the March, 1982, issue. With these two additional articles, you can easily build a complete, reasonably-priced satellite TV receiver capable of outperforming commercial units costing several times as much.

And, with the LNA and downconverter complete, you are down to a reasonable frequency with which to work, the 70-MHz intermediate frequency. If you are tired of dealing with gigahertz, then the remainder of the receiver will be a breeze!

Refer to the block diagram, Fig. 1. As we previously mentioned, the LNA and downconverter were covered in previous articles. In this installment of the receiver article, we will describe the bandpass filter/i-f amplifier board and the "heart" of the receiver, the video demodulator board.

Part II of the 'Lite Receiver IV article will describe the dual audio board and theafc/meter board. The block diagram also shows the interconnections between the various component parts of the system. The power supply board was described in the February LNA article.

Circuit Development

We started on our home-brew system well over a year ago. It took us about seven months to actually get a picture from the bird(s), and we have spent the last six months optimizing our design, simplifying it so that we feel that any
One stage of the low noise amplifier (LNA) described in “Job’s Own LNA,” 73 Magazine, February, 1982.

average technician can easily duplicate our system. You don’t have to be a microwave engineer to make it work.

To develop the complete satellite TV receiving system, we used 15 square feet of printed circuit board, 18 pounds of ammonium persulfate etchant for the board, 5 pieces of 10" x 20" photo reversing film making negatives for boards, 48 pounds of coffee, and 32 cartons of cigarettes. We designed, built, and debugged approximately 40 individual printed circuit boards trying various circuits.

We will describe as we go some of the things we tried that either didn’t work or didn’t meet our expectations. During our development, we were extremely fortunate to have a professional video technician, Alex Guarino WA4OCC, to critique our received signal video and offer suggestions on improving it. Alex now favorably compares our received video with the commercial cable TV installations with which he is familiar.

We had never seen a satellite TV installation before we got our home-brew system working and, during the development of our system, we did not have access to any test equipment that functions on the satellite TV frequencies. The only test equipment used to debug the system was an old Heathkit Tunnel Dipper (grid-dip meter), a sweep generator, a marker generator, and a 5-MHz Heathkit oscilloscope. So, if we can make a receiver work with our very limited test equipment, we feel that any average technician, using our proven PC board designs, can easily duplicate our system.

The “IV” in the ‘Lite Receiver IV* signifies that it is the fourth generation receiver that we have built. The last two were built from the exact PC boards which are in these articles.

*Lite Receiver IV is a trademark of Martcomm, Inc.

and they worked the first time power was applied!

70-MHz Bandpass Filter and I-F Amplifier

Just like your ham band receiver, the signal from the mixer contains many signals and noise. Therefore, the first step after the mixer is to clean up the signal and eliminate all frequencies we don’t need. The output of the mixer is a low-level signal of approximately -50 dBm. Refer to Fig. 2, the filter/amplifier schematic. This low-level signal is applied to IC A-1, a Motorola MWA-120 broadband amplifier with 14 dB of gain.

Complete LNA with bias power supplies.

---

### 70-MHz Bandpass Filter/I-F Amplifier

**Parts List**

1. 2.1/4" x 4" x 2.1/2" minibox, Bud CU-3003A
2. 1 PC board, double-sided (Martcomm, Inc., Box 74, Mobile AL 36601)
3. 3 MWA-120 ICs
   - 1 7815 voltage regulator
   - 2 1-uF tantalum capacitors, 35 volts
   - 3 470-Ohm, ¥1-Watt resistors
   - 2 2200-Ohm, ¥4-Watt resistors
   - 1 470-Ohm, ¥4-Watt resistor
   - 1 51-Ohm or 47-Ohm ¥4-Watt resistor
   - 2 01-uF disc ceramic capacitors
   - 2 J. W. Miller coils, L1 and L4, 49A678MPC, .60-.074 uH
   - 1 J. W. Miller coil, L5, 49A347MPC, .250-415 uH
   - 2 J. W. Miller coils, L2 and L3, 49A537MPC, .393-.657 uH
4. Total cost is approximately $60.00.

---

![Fig. 2: 70-MHz filter/amplifier schematic.](image-url)
The output of IC A1 is fed to the 70-MHz bandpass filter consisting of coils L1 to L5 and their associated capacitors. The bandpass filter has a center frequency of 70 MHz and a 30-MHz bandwidth at the -3 dB points. The output of the filter is applied to IC A2, another MWA-120, for additional gain, and then through hot-carrier diodes D1 and D2 for some limiting. The output of the diodes feeds another MWA-120, A3, for another 14 dB of gain. The total gain of the 70-MHz stages, less the filter insertion loss, is approximately 43 dB.

A PC board for the filter/amplifier and a parts overlay are shown in Fig. 3 and Fig. 4, respectively. A phase-locked loop (PLL) was chosen for the video detector since it can demodulate very low signal levels. But the PLL is prone to overload, so one stage of limiting using hot-carrier diodes was needed to smooth the signal level. Limiting is necessary because signal levels vary from transponder to transponder.

Printed Circuit Board

The PC board was designed to accept readily available components. We found that the J. W. Miller pre-wound PC coils, although relatively expensive, are simple to work with and the filter can be duplicated more easily with known inductance values. The entire assembly fits in a 4" x 2-1/4" x 2-1/2" minibox with the input and output coax connectors being either BNC or type F. The +18 volts dc required for the MWA-120s is brought into the minibox through a 1500-pF feedthrough capacitor which is bolted to the minibox. The 1500-pF value is not critical, and you can substitute any reasonably close value. A word of caution about the Motorola MWA-120s. Buy them only from prime sources. We have had bad luck with the 120s, with about one out of three being bad. So, buy a couple of extras, just in case.

Construction

Construction is very simple if you use the double-sided printed circuit board layout shown in Fig. 3. A parts overlay is shown in Fig. 4.

First, mount the MWA-120s on the component side of the PC board. Be sure that they lie against the copper backplane and that the pins are in the correct holes. Solder the IC tab to the backplane. Then solder and clip the excess leads on the bottom of the board. Install the 3 feedthrough jumper wires very close to the ground pin of the MWA-120s. You can use a piece of resistor lead for the feedthrough jumper wires. Be sure to solder the jumper wires on both the bottom and top of the board.

Now install and solder the remaining components on the board. Some of the components are a tight fit due to the very compact size of the assembly. After the PC board assembly is complete, check to be sure that all components are in their proper place and that there are no solder bridges.

Next, drill the 3 holes in the minibox for the coax connectors and the feedthrough capacitor. Also drill the 4 holes for the PC board standoffs, which can be either regular standoffs or long 6-32 screws. Since the Bud minibox is 2-1/4" high and this height is not needed, we cut ours down to 1-1/2" high. When the box has been prepared, install the 1" standoff spacers. Use cutoff resistor
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leads or small pieces of bare wire to connect the center conductor of the coax connectors to the PC board. Use the same technique to connect the +18 volts dc from the feed-through capacitor to the board. Note that the board is installed in the minibox with the trace side toward the top of the box. There are holes in the PC board to allow access to the filter coils from the bottom of the board. This completes the construction of the board. Now comes the fun part, aligning the filter.

**Tune-Up**

The filter alignment is not nearly as difficult as everyone would have you believe. You can tune it in one of two ways: 1) with a sweepmarker generator and oscilloscope with a demodulator probe, or 2) with the receiver tuning meter (which is incorporated on the afc/meter board). We don't recommend using the tuning meter approach, the result was as good as using the sweep generator, but you have to have a lot of patience to do it that way.

To align the filter using the sweep generator and marker generator, connect the output of the sweep generator to the input of the filter (marked “IN” on the PC board). Connect the scope’s demodulator probe to the output (marked “OUT” on the PC board). See Fig. 5. Preset all coil slugs to mid-position in the coil forms. Apply power (+18 to +23 volts dc) and, with a voltmeter, check the output of the voltage regulator. It should be +15 volts. Next check the voltage from ground to each MWA-120/470-Ohm, ½-Watt resistor junction. The voltage should be approximately +5 volts at each of the three points. If your wiring is OK and the voltage is wrong, then you probably have a bad MWA-120. If this is the case, replace it.

Start with as low an rf level from the sweep generator as can be seen on the oscilloscope. Reduce the rf level as alignment proceeds. See Fig. 6 for the desired bandpass shape. If the sweep is set too wide on the sweep generator, a spike will appear on the left side of the scope trace at approximately 110 MHz. Don’t worry; the spike is the second harmonic of the 55-MHz coil resonance. Patience and persistence will reward you with a properly aligned filter. Just remember to make small changes in inductance. For the record, it took us about a day to align the first filter we built from Radio Shack’s 100 for $2.95 coil-form special. The filter built with the Miller coils took only 15 minutes to align!

**Video Demodulator**

Our first attempt at demodulation used the NE564. It worked for about 5 minutes before the IC got hot and quit working. We experimented extensively with the 564, ultimately arriving at a configuration which, although very simple, permits adjustment of the critical operating voltages. Our final configuration allows you to optimize for your particular NE564. But, being the experimenters that we are, we wanted to try more traditional ways of demodulating an FM signal.

We tried a bridge discriminator and the “classic” Travis discriminator. They worked, but believe us, aligning a traditional-type discriminator for a 30-MHz-wide signal is a real chore. The traditional types also require a much stronger signal, so extra stages of if-amplification and limiting were needed. The result offered only marginally better performance over our final 564 design.

We also tried a 70-MHz-to-35-MHz divider so that the 564 would operate com-

---

Fig. 5. Alignment setup for the filter/amplifier.

Fig. 6. Typical scope display. A spike will show up on the display at 110 MHz if the sweep generator is set to sweep too wide. This will not cause a problem. It is the second harmonic of the 55-MHz coil resonance.
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completely within its specifications. Only slightly better performance was obtained, primarily reduced smearing of bright colors. The divider approach required extra i-f amplification, too. So back to the Signetics NE564 and its simplicity.

**NE564 Specifications**

The NE564 maximum specifications which concern us are as follows: pin 1—12 volts dc, pin 10—6 volts dc, for a 75-MHz lock frequency at 0 degrees Centigrade. We reduced the pin 1 supply voltage to 8 volts dc and made the pin 10 voltage-controlled-oscillator (vco) supply voltage adjustable through a 1k pot. To try to keep the 564 as cool as possible, a small IC-type heat sink is glued to its top. Otherwise, the circuit is the “typical” FM demodulator circuit from the Signetics application notes. The circuit is very simple and gives excellent results. Although the PLL is being pushed a little beyond its specifications, we have found only one 564 out of half a dozen that gave marginal performance. The marginal performer only lasted an hour; it probably was defective to start with. Again, as with the MWA-120s, you should buy your 564 from a reputable supplier and avoid the surplus outlets. You might want to buy an extra just in case yours doesn’t want to hack it at 70 MHz.

**Circuit Description**

Refer to the video demodulator schematic, Fig. 7. The output of the 564 is dc-coupled to the base of a 2N2222 transistor. The

---

**Video Demodulator**

**Parts List**

<table>
<thead>
<tr>
<th>1 NE564 IC</th>
<th>1 NE592 IC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 2N2222 transistors</td>
<td>1 7808 voltage regulator</td>
</tr>
<tr>
<td>1 7815 voltage regulator</td>
<td>1 1k-Ohm pot, PC board mount</td>
</tr>
<tr>
<td>1 10k-Ohm pot, PC board mount</td>
<td>2 8-pF variable capacitor, Erie type 538-008A-2-8, or Erie type 518-008A-2-5-9</td>
</tr>
<tr>
<td>1 100-uH chokes</td>
<td>1 2.7-uH choke</td>
</tr>
<tr>
<td>1 4.7-uH choke</td>
<td>1 47-Ohm resistor</td>
</tr>
<tr>
<td>1 100-Ohm resistor</td>
<td>4 150-Ohm resistors</td>
</tr>
<tr>
<td>1 270-Ohm resistor</td>
<td>3 470-Ohm resistors</td>
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<tr>
<td>1 1510-Ohm resistor</td>
<td>1 1560-Ohm resistor</td>
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<tr>
<td>2 1k-Ohm resistors</td>
<td>1 2.2k-Ohm resistor</td>
</tr>
<tr>
<td>1 4.7k-Ohm resistor</td>
<td>4 10k-Ohm resistors</td>
</tr>
<tr>
<td>4 12k-Ohm resistor</td>
<td>1 22k-Ohm resistor, see * on schematic</td>
</tr>
<tr>
<td>1 22k-Ohm resistor, see * on schematic</td>
<td>6 01-uF disc ceramic capacitors</td>
</tr>
<tr>
<td>1 3.01-uF, 35-volt tantalum capacitors</td>
<td>1 22-uF, 16-volt capacitor</td>
</tr>
<tr>
<td>1 470-uF, 16-volt capacitor</td>
<td>1 6.2-volt zener diode</td>
</tr>
<tr>
<td>1 MBB-101 hot-carrier diode (1N914 will probably work)</td>
<td>1 23-pF silver mica capacitors</td>
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<tr>
<td>1 191-pF or 100-pF silver mica capacitor</td>
<td>1 300-pF silver mica capacitor</td>
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<tr>
<td>1 330-pF silver mica capacitor</td>
<td>1 2200-pF silver mica capacitors, or any combination equaling</td>
</tr>
<tr>
<td>1 4400-pF total capacitance of 4400 pF</td>
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</tbody>
</table>

*Note: All resistors 1/4-Watt, carbon composition.*

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**Fig. 7. Video demodulator schematic. The vco capacitor is an Erie type 538-008A-2-8 or 518-008A-2-5-9. All transistors are 2N2222 or 2N706. Set the 1k pot on the NE564 pin 10 for 5 volts. Set the vco to 70 MHz. After the picture is tuned in, adjust the 1k pot for best picture. The pin 10 voltage should be between 4.7 V and 6.0 V. The 27k resistor to pin 2 may need to be changed (22k to 47k) for stability. It is OK to use a socket for the NE592.**
audio and AFC-1 pickoff points are at the emitter of this transistor. The AFC-2 junction point is on the collector of this transistor. The de-emphasis filter also connects to the 2N2222 emitter, and then goes through an audio trap to the NE592 video amplifier.

The NE592 has complementary outputs, which makes it simple to provide video reversal (not all transponders use the same video polarity). The output of the 592 feeds the base of another 2N2222. The emitter of the second 2N2222 is ac-coupled to the base of a third 2N2222 whose base is clamped with a zener diode and a hot-carrier diode to keep the 30-Hz energy dispersed waveform from appearing at the video output. The 30-Hz component, if not removed, will wreck your vertical sync. The 1-volt video output is ac-coupled and terminated with a 100-Ohm resistor.

Construction

To make construction really simple, a PC board layout and parts overlay is provided. See Fig 8. The PC board is double-sided G-10. The parts overlay is shown in Fig 9.

For easiest assembly, install all resistors first and then the capacitors and chokes. Transistors are installed next, being sure that they are properly inserted. Power up the board and check the output of the voltage regulators for correct voltage before inserting the ICs. Save the ICs for last. You can use a socket for the NE592, but do not use a socket for the NE564.

Tune-Up

The joy of using the NE564 becomes evident when you get to the alignment procedure. Set the 1k pot and 10k pot at mid-position. Apply power. Adjust the 1k pot for 5 volts dc on pin 10 of the 564. Connect a frequency counter or grid-dip meter to the "VCO out" point on the board and adjust the variable capacitor for a 70-MHz VCO frequency. Assuming that you have the rest of your system working, connect the output of the 70-MHz filter i-f amplifier board to the video demodulator board. With a video monitor attached to the video output, you should have satellite TV! Congratulations!

The final adjustment is made while watching video on your TV. Adjust the 10k pot for 1-volt video out or at least good contrast on your monitor. Now is the time to adjust the 1k pot on pin 10 of the 564. Monitor the pin 10 voltage while adjusting the pot. Changing

Fig. 8. Video demodulator PC board.

Fig. 9. Component layout for video demodulator board.
The voltage on pin 10 also changes the frequency of the vco, so readjust the vco capacitor for 70 MHz after every voltage change. Do not, however, exceed 6 volts on pin 10. Adjust the two pots alternately for best picture and minimum color smear.

If you don’t have video, check the voltages as shown on the schematic. The values in a rectangular box are with a signal tuned in, and the voltages in the oval boxes are with no signal.

Please, if you write us concerning any of the articles and want an answer, send a self-addressed, stamped envelope for our reply.

Printed circuit boards are available from Martcomm, Inc., PO Box 74, Mobile AL 36601. The 70-MHz bandpass filter i-f amplifier board is $12.50 plus $1.75 for first-class postage and handling. The video demodulator board is $25.00 plus $1.75 for first-class postage and handling. Boards for other parts of a satellite TV receiver are available from Martcomm, Inc. Send an SASE for a flyer on availability and prices.

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TVRO Sound Decoders

— Satellite Central, part VI

There is more than just video up there! Besides the Lucy reruns, you can find special news and entertainment goodies, most of which are carried on separate subcarriers or in the TV vertical interval.

For the moment, let’s cover just the subcarrier services. While 6.2 MHz and 6.8 MHz are the usual frequencies used for satellite TV audio, other frequencies can be found with such things as background or stereo music, not to mention data and clandestine transmissions. But a typical TVRO receiver may have only two fixed-frequency audio detectors, leaving you wanting more!

**How Does It Work**

Most satellite audio services are carried on FM subcarriers, but sideband audio does appear in several places. At the uplink site, the subcarrier is applied with the video to the main FM video carrier. Once the main carrier is detected in the receiver, the combined video and audio are split. The video must be deemphasized and the dispersion waveform clamped out (see “Satellite Central,” 73, December, 1981, p. 54). But the audio subcarrier still must be demodulated. It is fed through a high-pass filter to a tuned FM detector.

The usual transmission format is wideband FM deviating the subcarrier ±75 kHz or so. Seventy-five μsec pre-emphasis is used. If this sounds strangely like commercial FM, you’re right! But the wider bandwidth possible from the video demands that the FM sound subcarrier be placed higher in frequency than typical TV sound (4.5 MHz). You may find carriers anywhere from 5.4 MHz to nearly 8 MHz, as seen in Fig. 1.

You can try several ways to detect satellite subcarriers. Surplus decoder units found at swap meets such as the tube-type Collins SC100C subcarrier demodulator work fine. Just connect a power supply and retune for whatever frequency you want. The coils on the Collins units are easy to tweak. While you can tune by ear, a signal generator always helps.

Another clever way is to mix the subcarrier with a local oscillator and shift it up in frequency to feed a conventional FM tuner. The configuration in Fig. 2 works very well if your tuner is well shielded from local FM interference. Bargain-base ment transistor radios don’t work too well in this capacity, but some of the old tube-type (low sensitivity) tuners gathering dust in the junk box seem to be perfect. The main advantage to this technique is the ease with which you can tune and the feeling

---

**Fig. 1.** FM subcarriers are located above the video. 6.8 MHz is the most-used frequency for TV sound. An additional eight more 15-kHz audio channels are possible without significant intermod.

**Fig. 2.** Use a good mixer and upconvert the video and subcarrier baseband to the commercial FM band for detection on your stereo. Shielding from local interference is very important.

**Fig. 3.** A typical FM subcarrier decoder. The tuned circuits are adjusted to resonate at the desired frequency. Additional prefiltering may be necessary for best quality. Pin 6 can be grounded for maximum output.
of infinite cleverness or wisdom you may enjoy when you recycle useless junk!

The Universal Circuit

Or you can build a fixed-frequency detector. The most popular circuit in use today is one using a single IC. Known by such names as the LM3065, CA3065, or MC1358, this simple chip is nothing more than a quadrature detector which forms the guts for most TV-set sound circuits. See Fig. 3. The subcarrier feeds a bandpass filter tuned to the appropriate frequency which in turn feeds the chip for detection and de-emphasis.

Deep in its heart of darkness, the chip amplifies the signal into limiting before it is detected. In addition, the chip also contains an electronic attenuator and an output driver amp. A variable resistor from pin 6 to ground controls the electronic attenuator. Minimum resistance gives maximum volume. The distortion specs on the amp are not too sweet so it is best ignored. Besides, you can get nearly 0 dBm out of the bare detector, anyway—more than enough to ionize the plastic transistors in any amplifier.

You can build one of these detectors in an evening, but there is a better way. Buy it already built! As I’ve mentioned before, regular TV sound detectors are just about the same thing, circuitwise, except that they are tuned to 4.5 MHz. They differ from satellite audio ever so slightly in frequency, de-emphasis, and bandwidth. Interestingly enough, the entire sound section for an RCA XL-100 TV contains just such a circuit on the small PC card seen in Fig. 4.

Build It Quick and Dirty

The XL-100 sound modules are available at most TV distributors. They cost about 15 dollars and are a bargain when you consider what your time is worth these days to build one from scratch. Order an RCA part number MAA001A.

The units come tuned to 4.5 MHz for TV sound. Just a few mods will make them tunable from 5 MHz to nearly 8 MHz. Change the value of C290 to 50 pF. Also change C295 to 25 pF. This will shift the unit from 4.5 MHz to about 6.5 MHz. Then solder a 0.01-µF capacitor from pin 13 on the chip to a ground trace. This sets the de-emphasis to 75 µsec.

Build a well-regulated supply the easy way by using a molded plug-in dc charger/power supply connected to a large-value capacitor and a 3-terminal regulator as seen in Fig. 5. Just be sure to include the capacitor on the output of the regulator or it will quickly lose its cool in the worst way.

Everything should fit into a small 2 X 5 box even if you use a soldering gun rather than a pencil iron. See Fig. 6 for an idea on layout. Use whatever connectors you have in your junk box. Nothing is critical except for the mandatory use of coax from the receiver to the unit. The tap-off in the receiver is simply the same place the other sound detectors connect, usually right after video detection.

Tune-up is easy. Use your ear and twist T299 and L299 until you hear sound. A better way is to feed your signal generator into the unit while looking at pin 9 on the chip with a scope. Once you see rf, back down the generator below limiting (done by the chip) and peak T299 and L299 for the frequency you want. If you can frequency-modulate the generator, by all means do so and set it for ±75-kHz deviation. Then look at the demodulated audio and adjust L299 for the best waveform. A THD analyzer can be used to improve the distortion specs with a variable resistor in parallel with C295 and L299 to lower the Q.

Next, align the bandpass-filter coils simply by peaking. You may not need the coils at all depending on the prefiltering done in the receiver. The ideal coil adjustment method is to first peak everything including L299. Then short the second coil with a 10-Ohm resistor (you’ll need more umph from the rf generator) and peak again. Remove the resistor, back down the generator, and re-peak the second coil.

Bells, Whistles, and Distortion

If the subcarrier decoder is intended as a TV sound detector, you’d better leave the 50k volume-control pot in the circuit so that you can adjust audio drive to a subsequent rf modulator. If you are feeding another amp, you could just as well forget the pot by grounding pin 10 on the board (pin 6 on the chip). This will set the output at maximum, about 0 dBm across 600 Ohms using a 12- to 16-volt supply.

You can save in the amplifier department, too. The amplifier for an RCA XL-100 is also available. Order MAN002A and use the circuit in Fig. 7 for intercon-

---

![Fig. 4. Known by TV servicemen as the PM200, this small card holds nearly an entire TV-set sound section. It's a natural for cheap satellite audio recovery.](image)

![Fig. 5. The PM200 becomes an FM subcarrier decoder with three mods and a few external parts. Use your ear or an rf signal generator to tweak it into operation. Forget the input bandpass network if the receiver already has a high-pass filter for subcarriers.](image)
nection. You'll need a nominal 24 to 26 V dc supply at slightly more than an Amp. Don't expect very hi-fi sound at all.

Subcarrier hunting can be fun. I've discovered some really weird stuff as I dial up and down the band. The list of sources in Table 1 is a good start. So is this project when it comes to jumping into your first home-brew TVRO gadget. Because so many subcarrier frequencies are used, you almost always can use another decoder. We've just scratched the surface of what soon will become that "big database in the sky."

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 a SASE.

---

Fig. 6. Everything but the charger/dc supply should fit in a small box. The PC board already has a hole in it for 6/32 hardware. Mount it on a fiber or plastic standoff.

---

Fig. 7. The PM200 with its companion audio amp form the entire sound section for an RCA XL-100 TV . . . and a cheapo satellite receiver! Don't expect anything but soup-can quality. Your best bet is to skip the XL-100 power amp and simply feed pin 8 on the PM200 through a blocking capacitor to a good amplifier.
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This antenna is a coaxial collinear with 9 dB gain over a dipole. The pattern is omnidirectional and works well for both ATV and FM service. While building the Mount Wilson ATV repeater, I explored an antenna system that would give omnidirectional coverage and have as much gain as was practicably available. Another consideration was environmental problems such as extremes of temperature and icing.

Commercially-manufactured antennas are available for the 432-MHz band even though their price tags are high. There are no commercially-manufactured gain vertical antennas for the 1241-MHz band. I needed antennas for both the repeater input of 434 MHz and the output of 1241 MHz; since I did not want to spend a bundle on the 432-MHz antenna, I decided to home-brew it.

The antenna is in the collinear family with its elements made of RG-213 coax stacked one on top of the other. The main elements are ½ wavelength and can be calculated from the formula 5904 divided by the frequency in megahertz (equals element length in inches). The next step is to find the velocity factor of the coax that will be used. I chose RG-213 as it has a good tight shield and a constant velocity throughout its length. RG-BA/U can also be used as long as it has a solid dielectric and tight-knit shield.

The last step is to multiply the element length by the velocity factor (.66 for RG-213) to yield the actual length; in this case, 8.9 inches for 434 MHz. This formula can be used for any frequency and coax.

Elements are transpose-connected at the end of the half-wave elements so that the phase of the signal is 180 degrees out of phase from the other end of the element. See Fig. 1. As the signal travels up the elements, less signal reaches the top because of radiation, so more elements are used to get the same gain, as with stacked dipoles but without the complicated phasing harness. A quarter-wave element is used at the top and bottom of the array to match the 52-Ohm feedline at the bottom and the whip at the top of the antenna.

If 6 dB is desired, 8 elements can be used, and 16 are used for 9 dB. A slight downtilt of the pattern can be obtained by cutting the elements three percent shorter. (Downtilt is desirable if the antenna is to be installed on a mountaintop.) Any small amount of VSWR can be minimized by the quarter-wave stub and trimmer capacitor in
the matching decoupling section.

**Construction**

Add one half inch to the calculated length to allow for exposing the center conductor so it can be connected to the other element. See Fig. 2. Cut the jacket, shield, and dielectric with one cut. A sharp knife or X-acto® miter saw should be used to make the cut. After all the elements are cut to length, then cut the jacket back three-eighths of an inch and tin both the center conductor and shield using a 25-Watt iron—too much heat will melt the dielectric.

Now that all parts are tinned, solder the parts together with a maximum of one-eighth-inch separation between elements. After completion, check for shorts by visual inspection as the antenna is at dc ground. Excess flux should be scraped off, but do not use any chemical flux remover as it can contaminate the dielectric. The whip on the top is connected to both the center and shield. The matching section is a quarter-wave coax stub shorted at both ends and a piston trimmer capacitor. See Fig. 3.

**Tune-Up**

Adjust the trimmer for minimum VSWR. If the minimum is at one end of the trimmer, then adjust the spacing of the stub to feedline distance. One-eighth inch is normal for the spacing.

**Housing**

The antenna is housed in PVC pipe. The heavy wall is the one to use and it is also known as schedule 40 PVC. One-inch diameter can be used for either the 1241-MHz model or the 434 model, but if the antenna is to be mounted as a free-standing antenna, the 434-MHz housing should be tapered. This can be done with ¼-inch, 1-inch, and 1¾-inch pipe. The pipe may need to be heated to make a better fit. Pipe caps are used to keep the rain out of the housing and the bottom should be open so it can breathe. The antenna can be mounted one half wavelength from a mast for a cardioid pattern and the gain will increase 2 dB over that of an omnidirectional pattern. See Fig. 4 for the patterns.

**Conclusions**

Construction time is one to two evenings. Take your time and you will have a better working antenna. The 434-MHz version has been in use for one year now on Mount Wilson and has survived all four seasons from 100 degrees heat to snow and ice. Many of these particular antennas in Los Angeles and San Diego have been built and used with the same results as I have obtained. Recently, a second 1241-MHz version was installed on Mount Wilson for the aural transmitter on the ATV repeater. It is identical to the one used for the visual transmitter and the results have been good.

**Acknowledgements**

I would like to thank Jay N6BDT for his help in testing the antenna, and also all others who helped me in this endeavor.

---

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Fighting Air Pollution
— why you need a tuner

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The primary purpose of an rf matching unit is to ensure that the output of the transmitter (transceiver, amplifier, receiver) looks into its design output impedance, usually 50 Ohms in today’s equipment. The matching units available today can transform complex impedances as high as several hundred and often as low as ten or twenty Ohms into the 50-Ohm resistive load that the radio was designed for. But there are other reasons for using an rf matching unit. These additional benefits will improve your station’s operation even if your rig is already working into a perfect match.

Rf matching units often provide increased attenuation of harmonics and spurious signals due to additional circuit Q and the filtering action of many types of matching networks. The degree of this benefit depends on the type of matching network employed, so let’s quickly review the popular types available from manufacturers and described in handbooks.

Network Types

The L-network (Fig. 1) makes up the simplest type of matching unit, consisting of a variable capacitor and a tapped coil. It may be used in combination with a pi-network to form a most effective pi-L matching network. The L-network alone is frequently employed in the simplest and least expensive matching units. The range of

Fig. 1. The L-network.

Fig. 2. The pi-network.

Fig. 3. The T-network.

Fig. 4. Inductive-coupling network.

Photo A. Two-Watt QRP solid-state rig on 3.5 MHz without rf matching unit.
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impedances it can match is limited.

The pi-network (Fig. 2) is the same network used at the output of many modern transmitters' final amplifier stages. Such a network external to the transmitter can be added to provide increased matching capability. The common pi-network will include two variable capacitors working against ground and a tapped, series coil. This type of arrangement has the network acting as a low-pass filter that serves to reduce harmonic output. An example of a matching unit using the pi-network in this way is the Drake MN-2700.

The T-network (Fig. 3) usually will consist of a combination of two variable capacitors on each side of a large tapped coil. This network can match a very wide range of impedances but may not provide significant harmonic attenuation under some circumstances. Examples of the T-network include the famous "Ultimate Transmatch" and many commercial models available from a host of manufacturers, including the Den- tron MT-3000.

Inductive coupling (Fig. 4), consisting of two coils air-coupled together and associated capacitors for tuning, allows a matching unit to function as a band-pass-type filter showing modest attenuation of frequencies above and below the operating band. A classic example of this type of unit is the Johnson Matchbox.

Test Results

Now let's take a look at some of these matching units in action in situations where a 1:1 match already exists between antenna and transmitter.

Photo A is the display on a spectrum analyzer showing a modern-design, solid-state QRP transmitter delivering two Watts at 3.5 MHz to a dummy load. Starting at the left (the high vertical peak along the border is the analyzer reference signal and is to be disregarded), each horizontal scale division is set for two megahertz and each vertical division is 10 dB. A third harmonic can be seen down about 35 dB just past center scale at 10.5 MHz. Up further, what appears to be the fifth harmonic is attenuated just a bit more. Below the fundamental are spurious signals appearing in the broadcast band (-31 dB) and in the
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73 Magazine  May, 1982  71
160-meter band (—38 dB)
No rf matching unit is in the circuit. If it were not for the low power level of this transmitter, it wouldn't meet today's FCC rules for attenuation of spurious and harmonic emissions.

Photo B shows a twenty-year-old tube-type transceiver operating at the same frequency and driving a similar vintage kilowatt amplifier for 600 Watts output. Notice the second harmonic near 7 MHz down about 40 dB, and the third harmonic down almost 60 dB. Of course, the fundamental is about 25 dB stronger than the same signal generated by the QRP rig. Again, no external rf matching unit is used.

Photo C shows the spectrum produced by one of today's higher-priced solid-state rigs driving a modern kilowatt amplifier to 600 Watts output on the same frequency. Note that the harmonics have been further reduced but spurious signals, generated by the solid-state transceiver, are present below the fundamental. Although these spurious signals are down about 60 dB, there may still be the potential here for BCI in neighborhood radios.

Photo D shows the result of adding an antenna tuner to the transmitter/amplifier combination in Photo C. An already clean signal has been made "sparkling clean" by still further reduction of harmonics and spurious signals. The result is less spurious signal being radiated by the kilowatt station (with antenna matching unit) than by the QRP station (without antenna matching unit). All equipment was connected to a 50-Ohm dummy load so that in all cases the swr was 1:1, with or without the matching unit.

In Photo E we see a partial spectral display of a QRP solid-state transceiver operating into a dummy load on 21.1 MHz. The horizontal divisions on the analyzer are now 5 megahertz each with the vertical scale remaining at 10 dB per division. Around 42 MHz is a second harmonic down about 30 dB, with a third harmonic down 38 dB and a large assortment of more significant spurious signals between 15 and 40 MHz, down 38 to 45 dB. There is no matching unit at the output of the transceiver.

Photo F shows the result of adding a popular antenna tuner incorporating a T-matching network. A dif-
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different distribution of spurious signals results, but no significant improvement.

In Photo G, we see the results of substituting an antenna tuner with a pi-network. Notice how this unit functions as a low-pass filter, greatly attenuating spurious signals above about 24 MHz.

Photo H shows a close-in view of a 29-MHz signal peaked at the center of the display with each horizontal division equaling 1 megahertz. Spurious signals are shown at 27 MHz (−42 dB) and at 27.5, 30.5, and 31 MHz.

In Photo I, the addition of a pi-network matching unit shows about an 8-dB average reduction in the close-in spurious signals. (The higher harmonics such as 58 MHz and above have been practically eliminated but are not shown in this picture.) Without the matching unit’s effect, this 8-dB reduction in the strength of the spurs would have been achieved only by the reduction of the main transmitting power from, say, 100 Watts to about 16 Watts.

There are, of course, tuner trade-offs for the additional benefits provided by the matching units. Some power is lost in the matching unit, but if large-size, good-quality components are used in a unit’s construction, these losses can be held at a few percent or a fraction of a dB. For portable operation, the additional bulk of another unit is a consideration, and with solid-state rigs the need to do some tuning is another factor.

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73 Magazine • May, 1982 75
Americanizing the German Quad
—the world's best antenna?

O ne beautiful day in June over three years ago, Joe W3LDV came over to my house, as he often does, only this time he had a special purpose.

"Hey, you love antennas! Have you read about this one in the latest issue of 73?"

Having a 100-foot tower with a tribander and phased two-meter arrays, plus inverted vee and various slopers (not to mention a Mor-Gain folded dipole), I did not need any new antennas on my farm!

Such being the case, my response was "What kind is it? Have you tried it? Have I got enough room? Let's try it anyway!"

He produced the June, 1978, issue of 73 Magazine and we got down to a serious discussion over cups of coffee.

This article was written by Christof Janker WD4CPK/DF3TJ of West Germany. He described a big quad that was mounted parallel to the earth and which was usable on all bands. The results he showed were almost phenomenal. His quad rivaled, yes, excelled, a two-element yagi beam. Joe, an active ham for many years and certainly longer than I have been, explained that by the appearance of this design there was much promise to its operational characteristics. We set about to get halyards into appropriately spaced trees.

Double-checking with the formula, \( L(\text{feet}) = \frac{1005}{F} \) (MHz), Joe and I erected a 69-foot-per-leg fairly square quad as described in Mr. Janker's article, using THHN insulated 7-stranded, 14-gauge wire, and fed it with a random length of 75-Ohm coax. We used plastic insulators on the four corners, tied our halyards to each of these, and pulled the antenna up (see Fig. 1). It was fairly square, but we found out that this is not critical. For horizontal polarization, we selected the feedpoint off one corner, according to its earth parallel elevation. The math said that this antenna would have its center resonant frequency at 3.6 MHz, and it did, with no further ado! At this happy point, we decided to do some listening and comparing to my other antennas. All comparisons were done against the following:

1) Inverted vee (80 and 40), apex at 90 feet, fed from common coax
2) Mor-Gain folded dipole at 60 feet.
3) A 40-meter sloper, highest end at 90 feet.
4) An endfed Hertz (130 feet long) with coupler at 40 feet.
5) An 80-meter dipole at 30 feet.
6) A Mosley Classic 33 on top of my tower at 100 feet.

It took Joe and me about five minutes to determine that this thing showed superior receive quality to all of the above except the beam! Swr was perfect for 80 CW and 40 phone just the way it stood. Contrary to Mr. Janker's statement, all other bands presented a very high swr without the use of a coupler except for one. The unique feature was that the noise level was dramatically less on the quad than on any of the other test antennas. My shack is plagued with nighttime noise levels of an interesting degree due to local residents involved in welding, grinding, and other "anti-receiver" hobbies. When we switched on the quad, signals dramatically quiet were unintelligible on the other wires.

Transmitting tests showed a constant three S-units better report on the quad on 80 and 40 than on any of the other antennas (not counting the beam, of course). As Mr. Janker pointed out in his article, there appeared to be no directivity exhibited on either band, even though the antenna is two full wavelengths long on 40 meters.

We then shortened the German quad to center resonate at 3.9 MHz in order to try 75 phone, and all results were identical to the above, with one sad note. This length made all the remaining bands useless without a tuner. But the use of one provided the same happiness as before—excellent reports all the way around the spectrum, beating everything except the Mosley. The beam had about six S-units on the quad on 10,
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100 W Taps 40 thru 10 ............ $ 25.00 per pair
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100 W 150 T/T taps switch ....... $17.05
100 W 500 T/T taps switch ....... $22.50

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CDE TAILIST ......................... $170.30
CDE CD-65 .......................... $ 92.55
CDE AR 22 ............................ $ 51.45

1983 CALLBOOKS
U.S. version ........................ $14.95
D. version ........................... $14.05

ANTENNAS
Mini-Products Mini Quad ........ $127.95
MINI PRODUCTS G-2 Vertical .... $ 35.00
Butterton 1/2 B ........................ $ 90.00
Butterton 2MCV ...................... $ 27.50
110 Cal & RF Gain ..................... call or write

FRS-80* I, III OWNERS:
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All you need to send and receive CW.

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TRS-80 Models I and III CW Transceive program and interface lets you send and receive CW. No modifications to rig or computer.

Tri-Split screen for receive, transmit, message index. On screen transmit/receive "LEDS", transmit speed indicator, "Fist Fixer.”


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Program listing.

10 CLS: CLEAR 2000
21 CLS: CLEAR 141: POKE 1642, 5

PROGRAM BY DR. RICHARD L. SCHATZ, W3GLV
BOX 318, PARADISE ACRES
SUGARLOAF, PA 18249

30 REM
40 REM
50 REM
60 REM
70 REM
80 REM
90 REM
100 REM
110 REM
120 REM
130 REM
140 REM
150 REM
160 REM
170 REM
180 REM
190 REM
200 REM
210 REM
220 REM
230 REM
240 REM
250 REM
260 REM
270 REM
280 REM
290 REM
300 REM
310 REM
320 REM
330 REM
340 REM
350 REM
360 REM
370 REM
380 REM
390 REM
400 REM
410 REM
420 REM
430 REM
440 REM
450 REM
460 REM
470 REM
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770 REM
780 REM
790 REM
800 REM
810 REM
820 REM
830 REM
840 REM
850 REM
860 REM
870 REM
880 REM
890 REM
900 REM
910 REM
920 REM
930 REM
940 REM
950 REM
960 REM
970 REM
980 REM
990 REM

...
Because you and the leading radio manufacturers want the best-performing, the best looking antenna; Centurion has grown to be the Duck leader. We’ve developed many smaller antennas to make the handheld radio perform better, and now the newest duck…the Tuf Duck “mini”. It’s shorter (about 3") yet it’s a full 1/4 wave radiator on VHF.

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SEE YOU AT DAYTON HAM FEST!
It took about two weeks with usable spare time to get the TRS-80 to spit out a configured compromise for Joe’s application—a quad 24’x32’ with 40-meter phone as the lowest usable subband. This quad had two ‘stubs’ draping down 13 feet each, meeting the RG-59/U coax. Further possible complications were that we could raise this only 15 feet high on one end, 8 feet high on the other, and one leg ran parallel and nearly against his rain gutter! Guess what? With minimum stub trimming, the thing not only took off at 12.1 on 7250 and was under 2.1 on 10 and 15 as well, but it was just a bit of a problem on 20.

In the next few weeks, we both piled up reports and pleas to send the specs of the monster to numerous hams who indicated their wishes to own a copy of this performer. Joe’s ‘little cutie’ was super on 40, intriguing on 15, and devilish on 10. He had wonderful reports from far-away places that he could hardly copy on his dipoles. While my family and I were vacationing last summer in New England, I had daily contacts to home with five of my local friends, including Joe. On 40, he constantly had the superior signal to the other four on our rig in Dad’s motor home. My folks and my wife, all hams as well, noted this. Dad made an appointment to have a quad erected at his place when we got home!

One day, near the end of the summer, Joe again nailed me with a challenge which turned out to be a personal vendetta. “Do you think we could all band this thing? You don’t need it with your beam, but it would be a blessing to a lot of hams who are short on real estate and whose pocketbooks cannot justify a tuner.”

The antenna was so good that I could not resist trying. It is clearly the best that I have ever had the pleasure of using.

I decided that maybe one could feed the square, or “flat-top,” of the antenna with different lengths of so-called stub wire much the same as several inverted-vees are fed with the same coax, assuming the rf would travel the least-resistance pathway. This is not only untrue with the quad configuration, but it also fouled up everything about the antenna, complete with lowered receive capability. I was giving it up as a bad job when Joe saved the day. He made some tests that concluded that the stub principle of my computer’s origin could be the key, that coupling to these stubs in a capacitive way might yield compromise pathways to rf, and that its being a voltage-fed antenna just might allow this effect to work. I altered the computer program to make theoretical tests on the possibility. It projected swr’s indicating that we might have something.

The bottom line turns out to be the following: Erect the quad with 3.9-MHz math in the flat-top. The total amount of wire should be figured for 3.5J and the difference between these two plus 60% of this difference shall drape down like tuned feeders, being spaced with a 2.3-inch constant. Altering this constant spacing does definitely affect the necessary feeder length—we chose this particular constant.

Table 1 presents construction data to those who want to stop reading right now and go to work!

As depicted in Table 1, the full-sized antenna will perform superbly from 160 through 40 meters, on 10 meters, and is flat on 2! The trick (for me, at least) was what we did next. Joe and I installed a pair of auxiliary wires from the coaxial feedpoint, and free-hanging on their other ends. With a little care in pruning these, 20 and 15 meters finally came into use for my touchy solid-state finals, showing about 1.6:1 swr or better on the phone subbands. This is alterable to suit your desires. These “free stubs” are about 40% of the length of the tuned feeders for starters, or about 8.2 feet. I must add that this is only valid on the 80-meter quad, the lengths for these free stubs would be too short for capacitive value on the miniature or configured versions.

So, now over three years later, we have ended up with four distinct design versions:

1. A tribander for 160 through 40 meters (being a half wave on 160; it radiates well).
2. An allbander, including 2 meters, with appropriate stubs.
3. A mini-quad, full wave on 40 meters, fine on 15 and 10, and still flat on 2.
4. A configured version, rectangular in shape, showing some directivity, good on 40, 20, 10, and 2. The configured version, I believe, will be of interest to many because of the relatively small amount of real estate necessary for its use. For a compromised setup, it seems to operate without compromise!

The general methodology for the configured, smaller-than-formula antenna, is: L = 1005/F, where the length of antenna in feet is equal to 1005 divided by the frequency in MHz.

<table>
<thead>
<tr>
<th>Flat-top</th>
<th>Total Wire</th>
<th>Length/Side</th>
<th>Feeder Length (Max) Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-Wave 80-Meter</td>
<td>257.70</td>
<td>283.10</td>
<td>64.42</td>
</tr>
<tr>
<td>Full-Wave 40-Meter (Miniature Quad)</td>
<td>138.62</td>
<td>141.55</td>
<td>34.65</td>
</tr>
</tbody>
</table>

Table 1. Full-size quad dimensions for 80 and 40.
Introducing incredible tuning accuracy at an incredibly affordable price: The Command Series RF-3100 31-band AM/FM/SW receiver. No other shortwave receiver brings in PLL quartz synthesized tuning and all-band digital readout for as low a price. The tuner tracks and "locks" onto your signal, and the 5-digit display shows exactly what frequency you're on.

There are other ways the RF-3100 commands the airways: It can travel the full length of the shortwave band (that's 1.5 to 30 MHz). It eliminates interference when stations overlap by narrowing the broadcast band. It improves reception in strong signal areas with RF Gain Control. And the RF-3100 catches Morse communications accurately with BFO Pitch Control.

Want to bring in your favorite programs without lifting a finger? Then consider the Panasonic RF-6300 8-band AM/FM/SW receiver (1.6 to 30 MHz) has microcomputerized preset pushbutton tuning, for programming 12 different broadcasts, or the same broadcast 12 days in a row. Automatically. It even has a quartz alarm clock that turns the radio on and off to play your favorite broadcasts.

The Command Series RF-300 and RF-6300. Two more ways to roam the globe at the speed of sound. Only from Panasonic.

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

1 Based on a comparison of suggested retail prices.

This Panasonic Command Series shortwave receiver brings the state of the art closer to the state of your pocketbook.

With PLL Quartz Synthesized Tuning and Digital Frequency Readout.
When needed boxes, the tended to those wonderful-11-meter band!

Above are solidly flat across the shouuld be at least 50% of the longer two. We also found that any measurements of available space should be at least 50% of the formula length for any one side of the lowest band chosen, no matter which version is used. I must point out here that all of the above are solidly flat across the whole of that dreaded 11-meter band!

There is no negativity intended to those wonderful-when-needed boxes, the tuners, but all the above findings were recorded without their use. We did hook my tuner to the wire, just to make sure one could be used, and had no trouble at all. One note: The miniature quad (a full wave on 40 meters) should be calculated the same way as the big one; use 7.1 (twice the 3.55 constant) in the loop formula. Then redo with 7.25, and subtract the two. The difference cut in half makes each feeder to be spaced 2-3 inches and fed with coax.

Computer Program
My program is in the hands of many hams who have asked Joe and me to please send to them the specs on the quad. Almost every query was as a result of response to these hams having been on the receiving end of our “Americanized quad.” I must admit that I delight in having a ham’s visit to my shack topped off with a printout for him of his choice of quad versions.

It is for this reason that I included the program with this article. It could be shortened for simplicity, but then only the programmer could enjoy or even use it. With this, one can run off the math for various frequencies and note the resonance changes on the other bands. I have allowed for the computer to demonstrate how the swr should change if one should alter the detuning stub length for 20-15-10 operational changes.

In case there is no printer available, the program could be typed over, changing all LPRINT commands to PRINT; however, line 140 contains POKEs to select either mode almost as comfortably. Line 35 ensures the normal condition. The math in various lines calculates values for each antenna version, as outlined previously. The decimal comparisons in lines 1110 through 1550 were made from proportions calculated from our swr findings; lines 1630 through 1730 contain eleven frequencies from each band tested for swr prediction. Lines 1810 through 1990 allow heading printing; lines 2170 through 2330 print findings under correct categories depending on user selection of antenna type; and 3000 through 3200 print out the schematic of each possible design.

Neither Joe nor I profess to be any sort of expert on antenna theory. We have, however, built many antennas, and to date, we feel that this is the best and probably least-expensive antenna one can use. It has performed well on the DX bands and superlatively on the rest. Has anyone got the real estate and equipment to stick up a full-wave on top band?

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<tr>
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<td>71.00</td>
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<td>20-R</td>
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<tr>
<td>35-R</td>
<td>227.00</td>
<td>161.00</td>
</tr>
</tbody>
</table>

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- Close MAILBOX
- Recall specific messages
- Delete specific message
- Send message directory
- De-activate MAILBOX system
- Send operating instructions
- Request 1 of 10 billboard messages
- Change operating speed
- Beacon mode
- User assigned key words

Contest Dupe Sheet & Personal Station Log

Also utilizes the 24k character battery-backed memory for permanent storage. Variable format allows for short "CONTEST" type entries with auto-assigned consecutive number & time with worked/not worked and automatic "CALL & LOG" features. Or, use a longer format for some personal info on each new QSO. You'll have instant recall of his name, QTH, & rig as well as the date & time of the last QSO.

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Insert blocks of text and make spot corrections. Here's a list of some of its features:

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24576 BYTES or characters of storage for you to run your BASIC programs, keep the station log or implement the MAILBOX. The internal battery will maintain ALL this memory as well as the normal ATR-6800 "HERE-IS" & parameter storage for up to a week. And, there's no need to keep the ATR on for one night to charge the battery. We've provided a jack for you to plug in an external low current 6 to 15 volt DC source for charging. (We have a small wall transformer power supply available.)

"BASIC" Language

Line Numbers may be from 0001 to 9999
Variables Simple Variables
Single alphabetic or
Single alphabetic and a
Single alphabetic digit
Arrays: One or two dimensions
Backspace
Delete
Panic Button
Should bring back to the READY mode regardless of what the BASIC user program is doing.

<table>
<thead>
<tr>
<th>Commands</th>
<th>Statements</th>
<th>Functions</th>
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</thead>
<tbody>
<tr>
<td>LIST</td>
<td>REM END</td>
<td>ABS</td>
</tr>
<tr>
<td>LLIST</td>
<td>DIM GOTO*</td>
<td>INT</td>
</tr>
<tr>
<td>RUN</td>
<td>DATA ON..GOTO*</td>
<td>RND</td>
</tr>
<tr>
<td>NEW</td>
<td>READ ON..GOSUB*</td>
<td>SGN</td>
</tr>
<tr>
<td>ATR</td>
<td>RESTORE IF..THEN*</td>
<td>CHR</td>
</tr>
<tr>
<td></td>
<td>LET* INPUT</td>
<td>USER</td>
</tr>
<tr>
<td></td>
<td>FOR PRINT*</td>
<td>TAB</td>
</tr>
<tr>
<td></td>
<td>NEXT LPRINT*</td>
<td>TAB</td>
</tr>
<tr>
<td></td>
<td>STOP PATCH</td>
<td>TAB</td>
</tr>
<tr>
<td></td>
<td>GOSUB* RETURN</td>
<td>TAB</td>
</tr>
</tbody>
</table>

*Flags statements that may be used in the direct mode (No statement numbers)

<table>
<thead>
<tr>
<th>Math Operators</th>
<th>Relational Operators</th>
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<tbody>
<tr>
<td>Unary negation</td>
<td>= Equal</td>
</tr>
<tr>
<td>Multiplication</td>
<td>&lt;&gt; NOT equal</td>
</tr>
<tr>
<td>Division</td>
<td>&lt; Less than</td>
</tr>
<tr>
<td>Addition</td>
<td>&gt; Greater than</td>
</tr>
<tr>
<td>Subtraction</td>
<td>&lt;= Less than or Equal</td>
</tr>
<tr>
<td></td>
<td>&gt;= Greater than or Equal</td>
</tr>
</tbody>
</table>

NOTE: With the addition of this total package all of the programs contained in applications module one are internal to the ATR-6800 except SSTV. In other words, you do not need an external module in the communications mode. "Basic" and Message Editor programs are, however, provided in a new applications module. (A separate SSTV module is available for $49.95 if ordered with this package.)

See List of Advertisers on page 130

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<thead>
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<td>Foreign Callbook</td>
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PHASE IIIB PROGRESSES

The long-awaited launch of the Phase IIIB amateur satellite is now set for July 6, 1982. It has been nearly two years since the original Phase III satellite was destroyed when its Ariane launch vehicle exploded shortly after liftoff from the European Space Agency (ESA) launch facility in French Guiana. Supporters of the amateur space program are hoping fervently for a more successful outcome this time.

The first four launches of Ariane were test flights, and the AMSAT Phase IIIA bird had the misfortune of riding aboard the ill-fated second test launch. Since then, Ariane has flown successfully twice, and is now considered to be an operational launch vehicle. The Phase IIIB satellite will be a passenger on Ariane's second operational flight.

The Phase IIIB satellite is quite similar to Phase IIIA, but there are some differences. The on-board rocket motor, which is used to boost the satellite from its initial low orbit into a high elliptical orbit, is now a liquid-fuel device, as opposed to the solid-fuel design on IIIA. An additional communications transponder is included as well, a so-called "Mode X" transponder, with an uplink in the 23-cm band and a downlink at 70 cm. Phase IIIB will also carry a Mode B transponder, with its 70-cm uplink and 2-meter downlink.

The high orbit of Phase IIIB has several benefits. For much of the world, the satellite will be above the horizon, and available for communication, for hours at a time, rather than for 20-25 minutes as in the case of previous amateur birds. Tracking will also be simplified, since the satellite will appear to move quite slowly across the sky. The major disadvantage of the high orbit is that reliable communications through Phase IIIB will require a higher effective radiated power (ERP) than the low-orbit satellites required. Estimates range from 500-1,000 Watts for Mode B to 1,000-2,000 Watts ERP for Mode X. These levels can be achieved with reasonable amounts of power and high gain antennas.

AMSAT Satellite Report (ASR), a biweekly publication, is now running a "Phase III Countdown" article series to keep those interested in amateur satellites apprised of the events leading up to the Phase IIIB launch. Subscriptions to ASR are $18 a year. Write to Satellite Report, 221 Long Swamp Road, Wolcott CT 06716.

RADIO MOSCOW

For an unusual source of RS information, try tuning your short-wave receiver to Radio Moscow's DX program. This five-minute show airs several times a week, but was recently heard on Sunday from 1725-1730 UTC. A typical program includes listener reports of interesting shortwave broadcasts heard, technical information on antennas and receivers, and sometimes a special feature, such as news of the RS satellites.

Radio Moscow broadcasts to North America on many frequencies, as any 40-meter op will attest. The 31-meter transmissions on 9710 and 9685 kHz seem particularly strong during the afternoon.

Thanks to AMSAT Satellite Report for portions of the above. — WB8BTH.

SOCIAL EVENTS

NEENAH WI

MAY 1

The 3F Amateur Radio Club Swapfest will be held on Saturday, May 1, 1982, from 8:00 am to 3:00 pm, at the Labor Temple, Neenah WI. Admission is $1.50 in advance and $2.00 at the door.

Tables are $1.50 in advance and $2.00 at the door. There will be prizes, food and beverages, an auction, and a semi-formal banquet on Saturday evening. The banquet cost is $8.00 per person to advance ticket holders and no banquet tickets will be available

OWEGO NY

MAY 1

The Southern Tier Amateur Radio Clubs will host their 23rd annual hamfest on Saturday, May 1, 1982, from 9:00 am until 5:00 pm at the Owego Treadway, Owego NY. Take NY Rte. 17 to exit 65. Outside flea market space will be available. Features will include dealer displays, technical and non-technical talks, door prizes, and refreshments. Talk-in on 146.225.62 and 146.18.76. For additional information, contact Craig England KF2X, RD 1, Box 144, Vestal NY 13850.

MEADVILLE PA

MAY 1

The eighth annual Northwestern Pennsylvania Hamfest will
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IN THE COLD.

The Canadian Arctic presents some of the world's most difficult communications conditions. And when you're keeping track of expensive equipment recording crucial information, you can't afford to lose it in a snow drift. The need for a reliable antenna is a cold hard fact. It's a long way back to the shop for a replacement whip or coil.

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be held on May 1, 1982, begin-
ing at 8:00 am at Crawford County Fairgrounds, Meadville PA. Admission is $3.00 and children under 12 will be admitted free. Inside display area is $5.00 (bring your own tables) and outside space is $2.00. There will be refreshments, and commercial displays are welcome. Talk-in on .04/.64, .81/.21, and .63/.03. For more details, write CARS, Attn: Hamfest Committee, PO Box 653, Meadville PA 16335.

LYNNFIELD MA MAY 1
The Quannapowitt Radio Asso-
ciation (QRA) will hold an indoor/outdoor hamfest on Sat-

day, May 1, 1982, from 9:00 am to
4:00 pm at South Hall Fire Sta-
tion, corner of Salem and Sum-
mer Streets, Lynnfield MA. Ad-
mission is $1.00 at the door. Re-
erved tables are $5.00; at the ham-
est, $7.00. Food will be avail-
able. Talk-in on 146.19/79 or .52. For additional information, write Dave Meldrum KA1M1, 28 Cedar Lane, North Andover MA 01845.

GREENVILLE SC MAY 1-2
The Blue Ridge Amateur Ra-
dio Society will hold the Green-
ville Hamfest on May 1-2, 1982, at
the American Legion Fair-
grounds, White Horse Road, ½
mile north of I-85, Greenville SC. Ad-
mission will be $3.00 at the
gate (no advance sales). Talk-in
on 146.01/61 and 223.46/224.06.
For further information, write
Gary D. Whidy, Hamfest Chair-
man, Rte. 6, Box 268, Travelers Rest SC 29690.

GRAY TN MAY 1-2
The Bristol Amateur Radio
Club, the Johnson City Amateur
Radio Association, and the Kings-
port Amateur Radio Club will hold their second annual Tri-
cities Hamfest on May 1-2, 1982, from 9:00 am to 5:00 pm on Saturday and from 8:00 am to 4:00 pm on Sunday at the Appalachian Fairgrounds, north of Johnson City (off Highway 137), Gray TN. The dealer space charge is $25.00 in advance and $30.00 at the door for the weekend for a 10'x12' space. The dealer charge also includes security and admission for five employees. There are approximately 40 RV spaces with com-
plete hookups renting for $5.00 per night inside the fairgrounds. Motels are available nearby. Dealers can set up anytime after Friday noon or after 6:00 am Saturday and Sunday. Further information can be obtained by writing Mary S. Biggs, Secre-

tary-Treasurer, Tri-Cities Ham-
fest, PO Box 3688 CRS, Johnson
City TN 37601, or phoning (615)-
926-1818 after 5:30 pm and on
weekends.

YAKIMA WA MAY 1-2
The Yakima Amateur Radio
Club, W7AQ, will hold its annual
hamfest on May 1-2, 1982, at the
Ahtanum Youth Activities Park,
Yakima WA. There will be over-
night camping Friday and Sat-

day night at the site, ham equip-
ment dealers, a raffle, and a free
swap and shop. Doors open at
9:00 am on Saturday with lunch
available on both days. Breakfast begins at 6:00 am on
Sunday. No admission will be charged. Talk-in on 148.84/24 and
148.52. For more information,
contact Dave Pankey N7BB, 512 South 7th Street, Yakima WA 98901.

STIRLING NJ MAY 2
The Tri-County Radio Associ-
cation will hold its annual ha-
fest/feast on Sunday, May 2,
1982, from 9:00 am to 4:00 pm,
at the Passaic Township Youth
Center, Valley Road, Stirling NJ. Donations are $2.50 each and tables are $6.00. Hot food and re-

freshments will be available and
door prizes will include an Icom
IC-2AT. Talk-in on 147.85/255
or 146.52. For additional in-
formation, write Jack Sammarco,
2062 Emerson Avenue, Union NJ 07083, or call Herb Klawunn WZ2CH at (201)-647-3461.

CENTRALIA IL MAY 2
The Centralia Wireless Asso-
ciation, Inc., will hold its annual
hamfest on Saturday, May 2,
1982, at the Kaskaskia College


gymnasium, 3 miles northwest
of Centralia IL. Admission is free and there will be no charge for flea market and exhibit space. Doors will open at 7:00 am for setups and a limited number of tables will be provid-
ed on a first come, first serve basis. Food, refreshments, and plenty of free parking will be available. Various prizes will be
given away throughout the day; the main prizes will be awarded at 2:00 pm. Prize tickets are $1.00 each or 6 for $5.00. They may be purchased in advance by sending an SASE to Centra-
list Wireless Association, Inc.,
Hamfest Tickets, PO Box 1166,
Centralia IL 62801. Talk-in on
147.27/67 and 146.52. For fur-
ther information, contact Bud
King W5BQEG at (618)-532-6606, Lou Hodges W9IL at
(618)-533-4724, or write to CWA,
Inc., at the above address.

DORCHESTER MA MAY 2
The New England Amateur TV
(NEAT) Group, Inc., will sponsor a general amateur radio outdoor flea market on May 2, 1982, rain or shine, at Freeport Hall, Dor-
cheter MA, just off the SE Ex-
pressway. Admission is $1.00. There will be 300 selling spaces
in a secured area and sellers’ ad-
mission is $7.00 at the gate. Plenty of parking will be avail-
able. Talk-in on 145.29 and .52.

ROSEVILLE CA MAY 2
The North Hills Radio Club
of Sacramento will hold its 10th an-
ual hamfest on May 2, 1982, from 9:00 am to 3:00 pm, at the Placer County Fair-
grounds, Highway 65, north of Roseville CA. Admission and
door prize tickets are free. There
will be dealer displays, a large
flea market area, and a grand
prize of a Kenwood TR-7800
2-meter synthesized 40-Watt
transceiver. Features will in-
clude club auctions, food and refreshments, and raffles. Talk-in
on 144.59/145.19 and
223.18/224.78 (K6IS).

EAST HARTFORD CT MAY 2
The Pioneer Valley Radio
Association will hold the fifth
annual PVRA Flea Market on
Sunday, May 2, 1982, at the
George Penny High School,
East Hartford CT (exit 91 off I-86)
from 10:00 am to 4:00 pm. The admission donation is $1.00 and tables are $8.50. For an advance table reservation or further information, contact Arnie
DePascale K1NFE, PO Drawer
M, Plainville CT 06062.

FEEDING HILLS MA MAY 7
The Hampden County Radio
Association will hold its annual
flea market on May 7, 1982, at
8:00 pm at the Feeding Hills
Congregational Church, junc-
tion of Rtes. 57 and 187, Feeding
Hills MA. Talk-in on 146.34/94.
For more information, contact
Larry Langevin K1GXU at
(413)-583-8236.

BREWSTER NY MAY 8
The Putnam Emergency Ama-
teur Repeater League (PEARL)
will hold its first annual indoor
hamfest on Saturday, May 8,
1982, from 9:00 am to 4:00 pm at the JFK Elementary School,
Foggintown Road (off Farm-to-
Market Road from Rte. 312),
Brewster NY. General admis-
sion is $3.50 and exhibitors’ ad-
mission is $2.00. Talk-in on
145.135/144.535 and .52. For ad-

tance ticket registration and in-
formation, contact Frank Kon-
encik W2P2TP, RD1-224C, Car-
nel NY 10512.

CEDARBURG WI MAY 8
The Ozaquez Radio Club will
sponsor its 4th annual swap fest
on Saturday, May 8, 1982, at the

circle B Recreation Center,
located on Highway 60, Cedar-
burg WI (20 miles north of Mil-
waukee) from 8:00 to 1:00 pm.
Admission is $2.00 in advance,
$3.00 at the door. All 8-foot tables are $3.00. Door prizes, food, and refreshments will be featured. Sellers will be admit-
ted at 7:00 am for table setup.
For further information or tickets, send an SASE to Ozaquez Radio Club, PO Box 13, Port Washington WI 53074.

DULUTH MN MAY 8
The Arrowhead Radio
Amateur Club will hold its an-

cual swapfest on Saturday, May
8, 1982, at the First United
Methodist Church, 230 East Sky-
line Parkway, Duluth MN. Ad-
mission is $2.00 in advance or
$2.50 at the door. Door prizes
will include an Icom IC-2AT. A raffle
will also be held and prizes will include a Regency D100 pro-

grammable scanner and a porta-
ble B/W TV. Raffle ticket dona-
tions are $1.00 or $5.00. Re-
served 4-foot tables are $3.00 in
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You probably have some idea of what a Zepp antenna is. It's end-fed with open-wire line and has to be tuned using a transmatch, right? Well, Zepp is a nickname applicable to many kinds of antennas. Generally, any end-fed, half-wave antenna is a variation of the Zepp.

How did they ever come up with a name like Zepp? How does the Zepp antenna work? Can you use a Zepp, or variation, to advantage at your station?

The True Zepp

The Zepp originated from the demand for an end-fed antenna that did not require a substantial ground to work against. At first thought, this might seem like an unrealistic idea. But it can be done.

Fig. 1 shows the evolution of the Zepp, so named because it was first used as an antenna dangled from a zeppelin! A full-wave antenna has a low resistive impedance when fed at a current maximum (a). Current feed of a full-wave antenna mandates that one side be 1/4 wavelength and the other side be 3/4 wavelength. The apex angle at (a) is 180 degrees, but smaller angles will work. The antenna will work even if the apex angle is zero degrees (b). When the apex angle is zero degrees, we in fact have a half-wave piece of wire fed at the end by a quarter-wave section of parallel-wire line.

At the input point of the transmission line in Fig. 1(b), the impedance is a pure resistance of a very low value. The quarter-wave piece of line, formed from the folding over of the original full-wave antenna, acts like an impedance transformer, bringing a high impedance down to a low one.

How the Zepp Works

The radiating part of the Zepp is, of course, the half-wave part extending past the parallel-wire line. One end of the line is just left hanging. How can this work?

Fig. 2. The version of the Zepp most commonly used among hams. It operates at the fundamental and all harmonics.

Fig. 3. Harmonic operation of the half-wave Zepp. At (a), operation on the fundamental (1/2-wave); at (b), second-harmonic operation (full-wave); at (c), third-harmonic operation (3/2-wave).

Fig. 4. The J-pole. The bottom end is shorted and the matching point adjusted for minimum swr at resonance. The height of the matching section in feet is 2.80/f, where f is given in MHz. The overall height of the structure is 700/f. This is a monoband antenna.
The voltage at the end of the half-wave radiator is applied across a theoretically infinite impedance, which causes rf current to flow along the wire. It's kind of like shaking the end of a loose clothesline to make waves up and down the rope; although we never actually pull on the rope, the waves nevertheless occur along its length.

In theory, the Zepp is a balanced antenna because the impedance is infinite both at the free end of the line and at the terminated end. In practice, however, there is no such thing as an infinite impedance. The impedance at the free end of the line is extremely high, that at the terminated end is very high. They're a little different, and this unbalances the currents in the feedline. Consequently, the line radiates to some extent. This radiation can be minimized by ensuring that the impedance at the feedpoint is a pure resistance and is as high as practical. This requires that the radiating part of the Zepp be exactly a half wavelength long,1 and also that the antenna be placed as much in the clear as possible, to maximize the impedance at the ends of the radiating length of wire.

Yet, even if we dangle this contraption from a zeppelin at 40,000 feet, it won't be perfectly balanced. The feedline will invariably radiate a little energy. A properly operating Zepp is not too bad about this—it’s almost as good as a center-fed antenna.

The Usual Zepp

Most hams who use a Zepp have an installation something like that shown in Fig. 2. With this kind of system, a transmatch is necessary since we don’t know what the impedance will be like at the station. This kind of Zepp will work at the fundamental frequency (the band where it’s 1/2 wavelength) and all harmonic frequencies. At any harmonic, the Zepp has a current node at the feedpoint. Harmonic operation of the Zepp is shown in Fig. 3.

The Zepp is somewhat temperamental about departures from its resonant frequency. Even a tiny change in frequency will move the current node away from the feedpoint—either out onto the radiating part of the antenna (frequency too high) or down into the transmission line (frequency too low). But the node at the loose end of the line cannot move. The result: line radiation! The Zepp is a narrow-band antenna.

What if you have no transmatch and do not exactly feel like running out to your local ham shop and plunking down a hundred dollars or so to buy one of those fancy things they’re selling nowadays? Can you still use a Zepp? Definitely. Fig. 4 shows one way to get a good match to 52- or 75-Ohm coaxial cable. Fig. 5 illustrates a second method. When the correct matching point is found, the SWR is 1 at resonance.

Vertical Sans Radials

Of course, we can orient a Zepp in any direction we want. Figs. 4 and 5 show two vertical Zepp antennas. The antenna in Fig. 4 is often called a J-pole and is fairly common at VHF. But it is practical down to about 20 meters, and if you're ambitious, you might want to try building one for 40. In Fig. 5 is a method of feeding a half-wave radiator. This is definitely practical down to 40 meters. Both of these schemes constitute Zepp feed. Both of these antennas are monobanders, though, because of the matching technique used.

These antennas do not need any radial system. In both instances, the base impedance is very high and thus ground loss is kept to a minimum. Adding radials to the antenna in Fig. 5 will improve its performance, because of the gain resulting from the image signal. (This will provide the equivalent of a 2-element collinear.)

Other Zepps

A half-wave slope may be fed at the end instead of in the center. The performance of the antenna will be the same in either case. This is shown in Fig. 6(a). Zepp feed, because of its convenience, allows an exotic method of getting the antenna up in the air. This is shown in Fig. 6(b). The feedline should be TV-type twinlead, in order to minimize the weight, and the kite may have to be pretty big. But this idea has been used successfully on 160-meter endeavors when the wind is strong enough! One word of caution: Make sure the system is not flown.

---

1. The length of the open-wire matching section in feet is 275/f. (Don't use TV twinlead!) Adjustment of the matching point is required; a good starting point is 1/6 of the way from the shorted end to the antenna end of the matching section for this antenna and for the J-pole.

---

Fig. 5. Zepp feed for a half-wave vertical. The length of the open-wire matching section in feet is 275/f. (Don't use TV twinlead!) Adjustment of the matching point is required; a good starting point is 1/6 of the way from the shorted end to the antenna end of the matching section for this antenna and for the J-pole.

Fig. 6. At (a), end feed for a half-wave slope. At (b), well, end feed for a half-wave slope! These antennas will work at the fundamental and all harmonics.
Conclusion

The Zepp is versatile because end feed is physically convenient. This results in some line radiation, but if the antenna is located wisely and cut to the proper length, this problem is not serious.

The Zepp may be operated at any harmonic, although the bandwidth tends to be narrow. As a rule, consider the useful bandwidth of a Zepp to be 50 kHz either side of resonance, whether it is operated on the fundamental or a harmonic. Example: A Zepp that is a half wavelength at 7050 kHz may be used between about 7000 and 7100, 14050 and 14150, 21100 and 21200, and 28150 and 28250 kHz. (Outside these ranges, the antenna will work, but there will be significant radiation from the feedline.)

Now dig out those old porcelain insulators (you did save them, didn't you?) and that 300-foot roll of stranded no. 14 copper wire you bought last year at Dayton for $1.50 and thought you could never use. Hang a Zepp someplace!

Notes

1. For wire antennas, use the formula: length (feet) = 468/f, where f is given in MHz, for the length of a half wave. This is only approximate and may have to be pruned, but it represents the best average value.
2. After the antenna has been cut according to the formula, you can find its resonant frequency by using a field-strength meter placed a few feet from the feedline near the transmitter. The resonant frequency is the frequency where the field strength is minimum, indicating minimum line radiation. Then, the antenna may be pruned until its resonant frequency is as desired.
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from page 90

.34/94. For more info, advanced reservations, or raffle tickets, send an SASE to Jerry Frederick NB8NG, 1127-104th Avenue West, Duluth MN 55806.

**LUFKIN TX MAY 14-16**

The Region Four Air Force MARS will hold their annual convention on May 14-16, 1982, at the Ramada Inn, Lufkin TX. Friday night there will be an administrative meeting of all headquarters personnel and all Region Four officials, and Saturday there will be a series of programs. A banquet will be held on Saturday night. For further details, please contact Ed Langston APA4KH, Convention Chairman, 1123 Sayers Street, Lufkin TX 75901.

**CADILLAC MI MAY 15**

The 22nd annual Swap Shop & Eyeball QSO will be held on Saturday, May 15, 1982, from 8:00 am to 4:00 pm at the Wexford Civic Arena, US 131 North, Cadillac MI. Tickets are $2.50 and 8-foot tables are $4.00. There will be prizes, plenty of parking, and lunches available. Talk-in on 146.37/97. For further information, contact Wexxamateur Radio Association, PO Box 163, Cadillac MI 49601-0163.

**DURHAM NC MAY 15**

The Durham FM Association will hold the annual Durhamfest on May 15, 1982, at the South Square Mall, US 15-501 south, Durham NC. Admission is $3.50 with no additional charge for tailgating or dealers’ spaces. Features will include prizes and a flea market. Motels, a restaurant, facilities, tables, and power will be available. Talk-in on 147.625/225. For more information, write Durhamfest, Box 777, Hillsborough NC 27278.

**ROGERS AR MAY 15**

The Northwest Arkansas Amateur Radio Club, Inc., will hold its 2nd annual hamfest/swapmeet on Saturday, May 15, 1982, from 8:00 am to 4:00 pm at the Community Building (Old Armory), US Hwy 71, Rogers AR. Commercial exhibitors' and flea market tables and spaces are free. Doors will open at 6:00 am for setup. Main prize tickets are 3 for $5.00 or $2.00 each and prizes include a complete Kenwood station consisting of TS-130S, ac power supply, and MC-50 mike. There will also be door prizes, free parking, and programs, including MARS, DX, and Skywarn. Talk-in on 146.16/76 or 146.52. For more information, write Mary Webb KASHEV, PO Box 338, Prairie Grove AR 72753, or call (501)-846-2847.

**BATON ROUGE LA MAY 15-16**

The Baton Rouge Amateur Radio Club will hold its annual hamfest on Saturday and Sunday, May 15-16, 1982, at Catholic High School, 855 Heathstone Drive, Baton Rouge LA. There will be swap tables, dealers’ exhibits, technical forums, and activities for the non-ham wives and children. Talk-in on .191.79 and .52 simplex. For further information, write BRARC, PO Box 4004, Baton Rouge LA 70821.

**ATHENS OH MAY 16**

The Athens County ARA annual hamfest will be held on Sunday, May 16, 1982, from 8:00 am to 4:00 pm at the Athens City Recreation Center, East State Street, Athens OH. There will be a free flea market for electronics-related items on a large paved area and some indoor space available on a first come, first served basis. Setup is at 7:00 am. Food, free parking, and several nearby restaurants will be available. Tickets are $1.00 in advance and $2.00 at the gate. Talk-in on .34/94. For further information, send an SASE to ACARA, PO Box 72, Athens OH 45701, or phone Joe Folfrd WB8DO at (614)-797-4874.

**MARSHALL MO MAY 16**

The Indian Foothills Amateur Radio Club will hold its 7th annual hamfest on May 15, 1982, at the Saline County Fairgrounds building, Marshall MO. Tickets are $2.00 each or 3 for $5.00 at the door, or 5 for $5.00 in advance. There is no charge for tables but reservations are requested. Registration will be held at 8:00 am and coffee and breakfast rolls will be available from 8:00 am to 10:00 am. Lunch (all you can eat) will be at 11:30 am. The drawing will be held at 2:30 pm with a first prize of a KDK 2025 Mark II. Talk-in on .52/.28/88 and 147.84/24. For additional information and advance tickets, contact Jim Little KB9DA, 405 E. Rosehill, Marshall MO 65340, or call (816)-886-8583 after 5:00 pm, or K8SVB at (816)-886-2837.

**EASTON MD MAY 16**

The eighth annual Easton Amateur Radio Society Hamfest will be held on May 16, 1982, rain or shine, from 8:00 am to 4:00 pm at the Easton Senior High School cafeteria, Rte. 50, just south of Easton at mile marker 66. The donation is $2.00 with an additional $2.00 for tables or tailgaters. Talk-in on .52 and 146.445/147.045. For more details, write Van Herridge WB3HGS, Box J, St. Michaels MD 21663 or Easton Amateur Radio Society, Inc., Box 781, Easton MD 21601.

**WEBSTER MA MAY 16**

The Eastern Connecticut Amateur Radio Association will hold its 8th annual flea market and auction on Sunday, May 16, 1982, starting at 9:00 am, rain or shine, at the Point Breeze Restaurant, Webster Lake, Webster MA. Admission is $1.00 and table reservations are $5.00 in advance or $7.00 at the door. Food and drinks will be available as well as free parking. The auction will be held at 1:00 pm. Talk-in on 147.885/285 K1MUJ and 146.52. For reservations and additional information, contact Dick Spahi K1SY1, Lake Parkway, Webster MA 01570, or phone (617)-843-4420 after 7:00 pm.

**WASHAB IN MAY 16**

The Wabash County Amateur Radio Club will hold its annual hamfest on Sunday, May 16, 1982, from 5:00 am until 4:00 pm at the Wabash County 4-H Fairgrounds, Wabash IN. Admission will be $3.00 at the gate or $2.50 in advance. There will be plenty of food and parking available, as well as free overnight camping on Saturday. Talk-in on 147.63/03 or 146.52. For tickets or more info, send an SASE to Dave Spangler N9ADO, 45 Grant Street, Wabash IN 46992.

**EVANSVILLE IN MAY 16**

The Tristate Amateur Radio Society (TARS) will hold its annual hamfest on Sunday, May 16, 1982, beginning at 6:00 am CDT at the Vanderburgh County 4-H Center, Evansville IN. Admission is $2.00. Tables will be available in the air-conditioned indoors. An outdoor flea market will also be featured. Talk-in on 147.75/15 and 146.19/79. For additional information and table reservations, contact Hal Wilson WB9FNN, RR 8, Box 427B, Evansville IN 47711.

**WRIGHTSTOWN PA MAY 16**

The Warmister Amateur Radio Club will hold its annual hamfest on Sunday, May 16, 1982, from 7:00 am to 3:00 pm at the Middletown Grange Fairgrounds, Wrightstown PA, near Philadelphia. Admission is $3.00 at the gate with an additional $2.00 for each 8-foot seller’s space. Children and spouses will be admitted free. If pre-registered by May 1, 1982, the admission fee will be $1.00 less. Door prizes will be awarded every half hour beginning at 9:00 am. Talk-in on 147.690/090 and 146.520. For more information, write PO Box 113, Warmister PA 18974, or call Bill Scott KA3CHB at (215)-249-0568 after 6:00 pm.

**FRESNO CA MAY 21-23**

The Fresno Amateur Radio Club, Inc., will hold its 40th annual hamfest on May 21-23, 1982, at the Hacienda Inn, Clinton and Highway 99, Fresno CA. The full advance registration cost is $20.00. On Friday, activities will include registration, a golf tournament, and wine tasting; on Saturday, swap tables, commercial exhibits, a luau program, a CW contest, MARS meetings, a transmitter hunt, a No Host Cocktail Hour, and a banquet with speaker, Dr. Henry Richter; on Sunday, a...
WPSS Breakfast. Talk-in on 146.34/94. For advance registration or more information, contact the Fresno Amateur Radio Club, Inc., PO Box 783, Fresno CA 93712.

GORHAM ME MAY 22
The Portland Amateur Wireless Association and the Southern Maine University Radio Club will hold their annual flea market on May 22, 1982, from 8:00 am to 4:00 pm (inside if it rains) at the Gorham ME campus. The cost is $1.00. Food will be available. Talk-in on 146.73R and 146.52S. For additional information, write John Taylor N1SD, 44 Milton Street, Portland ME 04102, or call (207)-773-2651.

GREEN BAY WI MAY 22
The Green Bay Mike and Key Club will be holding its seventh annual swapfest on Saturday, May 22, 1982, from 8:00 am to 3:00 pm at the Norwood School, Norwood and Ninth, Green Bay WI. Admission is $1.50 in advance by May 1st, and $2.00 at the door. Table space is $2.00, and there will be one free admission for every 2 tables bought. Door prizes will be given away and food and beverages will be available. Talk-in on 147.72/12 and 146.52. For more information, contact Bob Duescher KA9BXG, 1011 13th Avenue, Green Bay WI 54302 or phone (414)-497-7880.

WEYMOUTH MA MAY 22
The South Shore Repeater Association will hold its ham radio/electronic/computer flea market on Saturday, May 22, 1982, at Weymouth South High School Cafeteria, 300 Pleasant Street, Weymouth MA. Admission is $1.00 for each buyer and tables are $5.00 in advance or $8.00 at the door. Doors open for sellers at 9:00 am and for buyers at 10:00 am. Food and refreshments will be available. For directions or table reservations, please contact SSRA, c/o David Newman, PO Box 447, Abington MA 02351.

KNOXVILLE TN MAY 22-23
The 1982 ARRL Delta Division Convention and the sixteenth annual Knoxville Hamfest will be held on Memorial Day Weekend, May 22-23, 1982, at Bearden High School, Knoxville TX. Forums will be on the future of amateur radio, DXCC, the CQ 5B-WAZ program, fast-scan TV, computers and amateur radio, and the ARRL. Other activities include programs for non-ham ladies, a shuttle bus to the World's Fair, an indoor and outdoor flea market, an exhibit area, and the verifying of QSL cards by Don Search W3AZD and Bob May K4SE. Both 4-land QSL bureaus will be in attendance and cash prizes will be offered in the Ron McKeen Memorial CW competition. For more information, please write Delta Division Convention, c/o Ray Adams N4BAQ, 5833 Clinton Highway, Suite 203, Knoxville TN 37921, or phone (615)-687-7771 (days) or (615)-687-5410 (nights).

HARTWELL GA MAY 22-23
The Anderson, Hartwell, and Toccoa Amateur Radio Clubs will hold the 4th annual Lake Hartwell Hamfest on May 22-23, 1982, at the Lake Hartwell Group Camp, located on Highway 29, 4 miles north of Hartwell GA. Features include free admissions, free camping, and free flea market space. Activities include a left-footed CW contest, horseshoes, bingo, and many other activities for the whole family. Fishing, swimming, and camping are available on the site. The campground will open at 6:00 pm Friday and the main prize drawing will be held at 2:00 pm Sunday. Talk-in on 146.1979, 147.93/33, and 146.89/295. For further information, contact Ray Pettit WB4ZLG, Rte 1 Dooley Drive, Toccoa GA 30577.

BOULDER CO MAY 23
The Rocky Mountain VHF Society will hold its annual spring hamfest on Sunday, May 23, 1982, from 9:00 am to 3:00 pm, rain or shine, at the Boulder National Guard Armory, 4750 North Broadway, Boulder CO. The admission donation will be $2.00 per family and there is no seller's charge. The gates will open for sellers at 8:00 am and they suggest you bring your own table. The door prizes will include a synthesized FM transceiver, and extra raffle tickets will be available. In addition to the big ham swap, there will be technical demonstrations and seminars, covering topics such as fast-scan ham TV, microwaves, satellite communications, etc. Food and drink will be available. Talk-in on 146.16/76 and 146.52. For more information, contact Richard Ferguson KA9DXM, 1150 Albion Road, Boulder CO 80303, or phone (303)-449-2871.

NATCHES MS MAY 23
The Old Natchez Amateur Radio Club (ONARC) will hold its hamfest on Sunday, May 23, 1982, at the Natchez Convention Center, Natchez MS. Doors will open at 8:00 am and there will be food available as well as free admission and free swap tables. Talk-in on 146.31/91. For further information, contact S. W. Gates NSAXV, PO Box 203, Natchez MS 39120.

ISLIP LI NY MAY 23
The Long Island Mobile Amateur Radio Club will hold the ARRL Hamfair '82 on May 23, 1982, at the Islip Speedway Li NY. General admission is $2.00 and $5.00 per car space will be charged for exhibitors. Food and refreshments will be available at the track. There will be door prizes and special prizes drawn all day from 9:00 am to 4:00 pm. Talk-in on 146.85 (a 42 PL will extend your range into New York City). For more information, call Sid Wolin K2LJH at (516)-379-2861, or Hank Wener WB2ALW at (516)-484-4322 in the evening.

BURLINGTON KY MAY 23
The Northern Kentucky Amateur Radio Club (ONARC) will hold its annual Ham-a-rama on Sunday, May 23, 1982, at the Burlington Fairgrounds, Burlington KY (off 275, Burlington-Florence exit). Individual tickets are $4.00, family tickets are $6.00, and each ticket entitles you to the major prize drawing at 4:00 pm. First prize is a Kenwood low-band TS-130S or $500, second prize is a Kenwood HC-10 station clock, and there will be a special raffle for an icom 2AT. Features will include a synthesized FM transceiver, and extra raffle tickets will be available. In addition to the big ham swap, there will be technical demonstrations and seminars, covering topics such as fast-scan ham TV, microwaves, satellite communications, etc. Food and drink will be available. Talk-in on 146.16/76 and 146.52. For more information, contact Richard Ferguson KA9DXM, 1150 Albion Road, Boulder CO 80303, or phone (303)-449-2871.
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Today they hauled out the last of the Civil-Defense supply cans from our office building. It wasn't much of a loss, however, because long ago the familiar drab green cans with their black lettering had been emptied of their contents. Once they had stored food, water, medical supplies, radiation-monitoring equipment, clothes, etc., enough material for several hundred people to survive for two weeks after a worldwide nuclear holocaust.

But the food grew rancid and the other materials deteriorated. With several reorganizations of the building, the cans constantly were reshuffled into corners until, finally, there was no other place to put them but out with the trash. Tonight they most likely grace the garage of a member of the maintenance staff who saw them as too good to discard and recovered them to use for workshop trash, discarded cuttings from his table saw, or some such refuse.

The case here is common. The once-familiar sight of fallout shelter supplies gracing the basements of public buildings has all but disappeared. Only a few of the once-common fallout shelter signs remain. Most likely, if you care to check a building displaying a shelter sign, you will find plenty of shelter and no usable supplies.

So, what would happen if our nation's 225 million people suffered an attack by a nation using nuclear warheads? Are we totally unprotected? Out of luck? Frankly, according to civil-defense planners, people heading for those old-style shelters might be out of luck, anyway. The shelters are often located in downtown areas of large metropolitan areas. With a direct hit to one of these cities, it is very likely that the shelter would provide as much protection to its occupants as no shelter at all. Cities where this problem is expected to occur are shown.
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- Deluxe CMOS memory
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- Example: send CO CD CO DX on WIDE ANT M - then play second message on contact of WIDE ANT M.
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PLUS:
- Self completing dots and dashes
- Both dot and dash memory
- Jambic Keying with any squeeze paddle
- 5.50 m.p.m.
- Speed volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation - portable
- Rear panel Jack for auxiliary power
- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid rings
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- Both dot and dash memory
- Jambic Keying with any squeeze paddle
- 5.50 m.p.m.
- Speed volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation - portable
- Deluxe quarter-inch jacks for keying and output
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in Fig. 1, which is a map of cities most likely to receive direct hits in an all-out nuclear war.

The idea of these home cities being targets of some foreign nuclear power is not a pleasant thought. But in a world of increasing tensions, there no doubt will be an increased interest in our praying for peace, and also preparing for our own personal defense in the event our world leaders some day fail to keep the peace.

As an alternative to hiding in big-city shelters, planners suggest that it may be better to move people out of the crucial areas where devastation is most likely to occur. (Fig. 2 shows the sphere of effect for each 1-megaton device.) This plan is apparently patterned after a Russian plan discovered several years ago.

According to a recent publication of the Federal Emergency Management Agency, which now handles civil defense, the new plan is as much a negotiation plan as anything. They feel that in a game of superpower brinkmanship, where each side will see just how far the other will go before "pushing the button," the Russians would most likely evacuate their cities as a defense mechanism before launching an attack on us. Naturally, the planners feel our intelligence sources would let us know of the evacuation. At that point, we would rely on our country's availability of rapid transit and family cars to completely evacuate the Russians do. We would then declare that since we're safe and they're not, they should back off and forget about blowing us to oblivion.

There are some good points about the plan. It is true that the United States has great versatility due to our widespread use of private cars, while the Russians cannot afford to have a car in every garage and would need to rely on trains, buses, and "marching routes" to move their people 30 to 200 miles from major cities. An illustration of their plan is shown in Fig. 3. The weather, however, complicates survival, as shown in Fig. 4.

Calculating the cold harsh facts and the alternatives of attack plans, civil-defense authorities in the US figure that if the Russians attacked before evacuating, they would lose about 100 million civilians. On the other hand, if they evacuate first, they would lose a mere 20 million.


"1) The Soviets probably have sufficient blast-shelter space in hardened command posts for virtually all of the leadership elements at all levels (about 110,000 people).

2) With a few hours of warning or less, the Soviets would suffer over 100 million casualties, but a large percentage of the leadership elements probably would survive.

3) With 2 or 3 day of preparation, the Soviets would suffer less than 50 million casualties.

4) With a week (or more), they would suffer casualties in the low tens of millions.

5) Therefore, the critical decision to be made by the Soviet leaders in terms of sparing the population would be whether to evacuate cities. Only by evacuating the bulk of the urban population could they hope to achieve a marked reduction in the number of urban casualties."

The same reasoning applies to the United States. The most horrifying part of the statistics is that at the very least we're talking about tens of millions of lost lives. And that doesn't count radiation sickness, burns, exposure, starvation, etc.

The United States system was scheduled to be in place for most all cities during 1981. Under the system, planners believe that 80% of our population would survive to rebuild. Again, they do not estimate the aftereffects of such a disaster on the survivors of any nation.

Even after the plans are completed, there will be much additional work to be done: Shelters need to be constructed; managers need to be trained; tests of the system must be made, followed by evaluation of the tests and redirection based on the results of the tests.

Amateur radio is not mentioned in the FEMA publication sent to me regarding the crisis relocation plan. The response I received from an FEMA official states, "Those amateur radio operators who operate with Radio Amateur Civil Emergency Services (RACES) are still a very important part of civil preparedness. RACES licenses as such are no longer being issued by the FCC, but each RACES operator uses his own call letters. However, these persons must be recognized as part of the civil preparedness organization in order to operate during emergencies under the auspices of RACES. Any RACES planning should be done with your own state of Iowa and the FCC."

Such planning is of little consolation to the residents of a state when they find out that nearly all of the state's (Iowa) 4,000 hams cannot operate, and the few licensed to operate the state's RACES station left the state one day ahead of a nuclear attack.
By comparison, the May, 1980, issue of 73 Magazine carried an article which described amateur activities when about 300,000 people came to Des Moines, Iowa, for an afternoon visit with Pope John Paul II. More than 150 local and statewide amateur radio operators provided excellent health and welfare services that day. The ratio of ham operators to population was about one amateur station for every 2,000 people. A substantially greater ratio was provided in areas where the sick and invalids were.

The situation in Des Moines was perhaps the best possible test of a crisis relocation program anywhere in the world since planners considered the notion of relocating hundreds of thousands of people. It was a complex program which was not easily undertaken. But on the specific point of supply of amateur radio operators, if the same ratio of amateur radio stations to population were applied to a national crisis relocation program, one out of every three amateur radio stations in this country would need to be on the air in some assigned duty all the way from two meters through 160 meters. CW, FM, and SSB, in hundreds of orderly, planned, and tested networks, would be needed.

It is extremely unlikely that the present RACES system could come close to meeting the needs. As of December, 1979, there were only 610 officially licensed RACES stations on the FCC's books. We would need no less than 112,000 dedicated patriotic and very brave volunteers and their equipment.

The time is definitely here for amateurs to approach their local civil-defense authorities and the FCC to have this now sophisticated service available on a widespread basis to every interested amateur radio operator in the event of a national emergency. Amateur radio is the only service which can provide a most-reliable communications system under severe circumstances when, for example, the entire telephone system would be rendered totally useless, merely because major switching locations would no longer exist!

Ham radio operators should be encouraged to improve their Morse-code capabilities, because under such strenuous situations, when even an amateur system may reach its peak in traffic-handling capabilities, every cycle of bandwidth of spectrum space is vital to the proper completion of the task. Currently, only CW operation can offer a bandwidth of just a few hundred cycles.

Right now, none of us, in our wildest dreams, can imagine how horrifying the world would be after a nuclear war. Our surviving population would need all the possible assistance that could be mustered, including medical supplies, food, and shelter, to name only a few. The existence of the top-notch amateur system like the one we now have could be the single most important item and could provide the key to our success.

In part II of this article, I will provide some details on just what can be done at each of our ham stations to lessen the danger to our communications systems. Some methods are simple, others incredibly expensive, but all of us can do something.

Acknowledgement

Bill Gosney KETC
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

AWARDS

Countless letters and phone calls have been received regarding a proposed award directory, supposedly being sponsored by this magazine. To set the record straight and to avoid any further confusion, allow me to say that such a 73 publication just does not exist. That, of course, does not mean one will not be available in the distant future!

To attempt such an endeavor, the compiling of precise and up-to-date information becomes paramount and obviously the most difficult task. Unfortunately, too often, the author of such a publication has to be at the mercy of the various amateur radio clubs and organizations to provide him with the necessary input to make such a volume a reality. However, due to the apparent lack of interest of so many to submit information about their respective awards programs, we have almost discounted the idea altogether. Those who are theory-oriented will understand that no input is directly proportional to negative output.

However, to preserve the well-known Wayne Green tradition, "never say die," another attempt will be made to remuster the readership for their help to fill this void in our award files. We could use data on any award program you or your local club may be sponsoring, as well as any information regarding other award programs you may be aware of.

When you forward the various rules for each award, be sure to include an original of each award certificate so that it may be published in its entirety. After all, this is free advertising, ladies and gents! Don't you realize the exposure you'll begetting? The fact is, you will not have to pay $1500 per page as all advertisers have to just get their message across to the readers. Take advantage of this unbelievable offer which only Wayne Green himself could experience to the readers of the most popular magazine in the hobby!

Send your award program rules and original award certificates directly to: Awards Directory, Attn: Bill Gosney KETC, 2665 Busby Road, Oak Harbor WA 98277. Do not delay—send me your input today. Then, over the months ahead, perhaps we can put together the directory you've all been waiting for.

INTERNATIONAL AMATEUR RADIO SOCIETY

The International Amateur Radio Society (IARS) is an achievement, educational, public service, and amateur radio honor fraternity. It is the parent organization for the International Certificate Hunters Club (ICH), the International Shortwave Listeners Certificate Hunters Club (SWL-ICH), the International Amateur Radio Journalistic Society (IARJS), and the International Flying Hams Club (FHC), along with many affiliated subdivisions worldwide called either chapters or amateur radio associations.

The IARS publishes the International Amateur Radio Society Annual, which incorporates The Directory of Certificates and Awards, copyrighted internationally. The IARS also publishes the newsletter Dialog, through the IARJS, and the newsletter Xtra, the official house organ, which reports news, special events, DX forecasts, and other items of interest to all members.

Through the CHC, the IARS sponsors many operating events, community services, achievement awards, and on-the-air nets. The IARS and its affiliates do not engage in partisan politics, but do take interest and action with regard to matters concerning the world's radio amateurs. It seeks to assist and cooperate with the many national amateur radio organizations (such as the ARRL, RSGB, JARL, etc.) in nations the world over. Although we may not always agree with what or how they do things, we acknowledge their efforts and lend them our support and participation.

The purposes of this organization are:

• to create and maintain an international communications system composed primarily of on-the-air amateur radio networks for all amateurs;
• to institute educational training programs and activities designed to advance the radio amateur's operating proficiency and technical knowledge, with emphasis on on-the-air gentlemanly conduct and compliance with the intent and interest of applicable national regulatory laws;
• to institute worldwide educational programs promoting improved human relations, international goodwill, and fellowship among men and women everywhere, without restriction or discrimination as to race, creed, color, national origin, political views, or religious belief;
• to promote the concept that shortwave listeners (SWLs) are fraternal kin to licensed amateurs and should be included in their programs and affairs;
• to promote the general welfare and survival of amateur radio as established under the International Communications Treaty;
• to publish educational books, magazines, newsletters, and literature in fields relating to international amateur radio; and
• to provide a comprehensive awards program, through the CHC, and to encourage and document the communication skills displayed by licensed radio amateurs and shortwave listeners.

The IARS, IARJS, CHC, SWL-ICH, and the FHC were created by Cliff Evans K6BX in 1960 and have been protected as part of the copyrighted works of the Directory of Certificates and Awards. At the time of OM Cliff Evans' death, the IARS, IARJS, CHC, SWL-CHC, and the FHC, along with 100 charted, affiliated subdivisions called either chapters or associations, had over 22,000 members on the rolls, representing over 250 countries from all six continents.

They are making every effort possible to contact all of the members they have lost touch with since the death of Cliff Evans and the closing of the old headquarters. Individual notification has been sent to each member via the bureau, and new club literature has been sent (via air mail) to all previous officials and office holders along with many national organizations and radio clubs around the world.

They look forward to all of their members around the world returning to active status.

The International Amateur Radio Society is a yearly publication containing operating information and technical data, schedules of coming events of interest to the amateur community, net listings, DX tips, and much more. Included in the IARS Annual is The Directory of Certificates and Awards, the most comprehensive digest and guide to award-hunting ever offered to the amateur. The IARS Annual is also the organization's yearbook, offering a retrospective view on the past year and a look into the coming year, complete with IARS information on rules, codes, membership listings, and other items of interest to both the membership and amateurs at large.

The IARS Annual is published, revised, and updated annually in November and contains in depth those topics not found in other handbooks. No amateur radio library is complete without it!

IARS Divisions Defined

IARJS: an international organization that provides a free and uncensored outlet for ideas, opinions, and proposals on behalf of amateur radio, through articles submitted by its members. These articles appear in the IARJS newsletter, Dialog, which provides its contributors an opportunity to inform radio amateurs throughout the world of conditions and situations affecting amateur radio. Dialog is a forum in which journalists and editors from around the world can exchange thoughts, ideas, and opinions on all matters concerning the future of amateur radio.

CHC: an international organization created to maintain an international communications system composed primarily of on-the-air amateur radio networks for all amateurs. The CHC also provides a comprehensive awards program and a means for the procurement of awards from the many organizations around the world. Through its
system of networks, it provides the availability of contacts necessary for the achievement of these awards.

SWL-CHC: a mirror image of the CHC. SWL-CHCers seek the same achievement as radio amateurs except on a heard basis. All radio amateurs are also SWLs in half of all they do on the bands and are invited to participate in this division. The SWL-CHC also can provide the call sign necessary for QSLing through the bureau.

FHC: self-explanatory. Membership is available to any licensed radio amateur or SWL who holds, or has ever held, any nature of pilot's license or designation: aircraft, lighter-than-air vehicle, space, or glider.

Net Activity

CHC nets are 10, 15, 20, 40, and 75 meters as the demand dictates. Some of our nets are: CHC DX net, 0200 to 0500 UTC, 14,358 ± QRM, daily; CHC DX net, 1900 to 2200 UTC, 21,370 ± QRM, daily; and CHC Pacific family hour, 0000 to 0300 UTC, 21,370, daily.

Old CHC/New CHC

If you were familiar with the previous organization under Cliff Evans K6BX, you will notice that they have instituted some drastic changes in both the way the club is handled and its value system. The new organization bears little resemblance in many areas to its predecessor, and they are sure you will find the changes to your liking. It is a blend of old and new and should be worthy of your review.

Membership is not a requirement for participation in either the awards program or any net activity. Membership is available with each division independently. Inquiries regarding membership are solicited. A bonafide interest in amateur radio is the only essential qualification (unless otherwise specified). When membership is attained, a membership number is issued which one holds forever regardless of change in name, call, QTH, class or license, or status of membership. Membership numbers and certificates are issued independently by each division. Membership in one division does not constitute membership in another.

Dues are payable during the first month of each year, January 1-31, following initial joining. Failure to pay dues will result in the member status being changed to inactive. Inactive members do not receive newsletters, special club services, or voting rights when applicable. Inactive members always retain their original number. A member can go inactive in one division and still stay current in another. Payment of only present year's dues (not past) will restore any member to active status.

Newsletters are included with each membership, but are only available to members on active status. Articles are solicited from the members. They welcome information on all subjects pertaining to amateur radio, including hints and kinks, your local club's activity, awards issued by other organizations, etc.

Certificates of membership are issued to each new member with the approval of their application. They are of the highest quality and are very worthy of display. Fees/dues for the IARS, CHC, SWI-CHC, and FHC are as follows: joining each division—$6.00 (overseas—$7.00, no pro rating); yearly dues, each division—$4.00 (overseas—$5.00), all due Jan. 1st.

For additional information about this complex organization, address all inquiries to: Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

CENTER OF POPULATION AWARD

The geographical population center of the USA is close to St. Louis MO. To achieve this award, work one station in each state which borders Missouri. Work one station in Arkansas, Illinois, Iowa, Kentucky, Kansas, Nebraska, Oklahoma, and Tennessee, plus one station in St. Louis MO. Send list showing calls and log data plus $1 to Dean Cowden KKQV, 2317 Lee St., Poplar Bluff MO 63901.

USA AWARDS PROGRAM

There is no limit to the frequency this award is issued an applicant. An applicant can work any band or mode of operation. Endorsements are $1.00 each. Application for this awards program should be made to Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

The Worked All United States Award is issued in four classes. Class AA is for DX stations only and requires the applicant to work all 50 US states. Class A1 is for domestic stations and they, too, must work all 50 states for this class of award. Class A2 requires 40 states be worked while class A3 requires 30 states be worked and confirmed.

There is a Double Worked All States Award and the only requirement here is that you work two separate stations in the required number of states for the class of award you are attempting to pursue. Likewise, there is a Triple Worked All States Award for which you must work a minimum of three separate stations in each of the required US states.

While you are at it, consider the Worked US States and State Capitals Award. Here, points are accumulated for each state and capital city worked. A single point is earned for each. To qualify for class A (DX only), 100 points must be earned. Class B requires 80 points, while class D requires 60 points.

To add insult to injury, included in the USA Awards Program is the Worked All States, Capitals, and Counties Award. Here again, the award is based on a point system. Each state is worth one point, two points are earned for each state capital city worked, and a total of ten points is earned for working all counties in a single state. Should you accumulate 600 county points, a trophy will be awarded. The class AA award is given for 600 points, class A for 500 points, class B for 400 points, class C for 300 points, class D for 200 points, class E for 100 points, and class F for 75 points.

ALL ALASKA COUNTIES

The Moose Horn Amateur Radio Club of Penal Peninsula, Alaska, announces the availability of their award for the State of Alaska. The award, in the form of a certificate, is available to licensed amateurs worldwide.

Certificates will be issued with endorsements for special modes or bands such as: class 1 (CW), class 2 (AM), class 3 (SSB), class 4 (RTTY), class 5 (mixed mode), and suffixes A (one band) and B (mixed bands). For example, certification or endorsement for an award on 20-meter SSB would be class 3A.

To qualify for this award, applicants must make four contacts in Alaska, one for each of the four judicial districts of Alaska. Of these, one contact must be made with a member of the Moose Horn Amateur Radio Club. All contacts must be made on or after August 15, 1961. It should be noted that the present system of judicial districts will be used in lieu of counties until such time that the State of Alaska adopts a system of actual counties.

To apply for the AACA, provide a list of confirmed contacts, certified by either two amateur operators, a local radio club official, or a notary public. Forward the verified list along with one US dollar or three (3) IRCs to cover air mail return of your award. All applications should be addressed to Ken Smith KL7JFY, PO Box 1682, Soldotna AK 99669.

By the way, here is a list of the 73 Magazine • May, 1982 115

USS LING

On May 8, 1982, the weekend before Armed Forces Day, so as not to conflict with the operations of the Armed Forces activities, the Meadowlands Amateur Radio Association will be on board the USS LING (SS297), docked on the Hackensack River in Hackensack, New Jersey, and will be operating under club station call N2BWN. The operation will begin on Saturday, May 8, at 1500Z and end at 2100Z. The following frequencies will be operated throughout the day, alternative between CW, SSB, and FM.

MODE FREQ. BAND

CW 14.060 20m
SSB 14.310 30m
CW 7.115 40m
SSB 7.060 40m
CW 28.110 10m
SSB 28.060 10m
CW 28.650 10m
CW 144.100 2m
SSB 144.150 2m
FM 146.150 2m
FM 146.550 2m

For confirmation of QSO, please send a large SASE (8.5" x 11") to Ralph Francavilla N2BWN, 154 Redneck Avenue, Little Ferry NJ 07643.

NETHERLANDS-AMERICAN BICENTENNIAL

The Holland (Mi) Amateur Radio Club will operate K8DAA plus other participating stations for the Netherlands-American Bicentennial during Tulip Time, May 12 through May 16, 1982. Operations will be in all phone bands and possibly some CW. One contact with K8DAA (club station) or two participating stations qualifies for a certificate. QSL to: HARC, PO Box 92, Zeeland MI 49464.

ARMED FORCES DAY

This year's observance of Armed Forces Day will include the operation of an amateur radio station from the United States Air Force Museum at Wright-Patterson Air Force Base, near Dayton, Ohio. Operating under the call sign K8DMZ, the station will be on the air from 1400Z to 2200Z on Saturday, May 15th. Operators will work primarily in the General class phone segments of 75, 40, 15, and 10 meters with periodic CW excursions to the Novice subbands. FM and SSB operations on 2 meters also are planned. The specific frequencies to be used will depend upon existing band conditions. To commemorate the event, the Museum will issue a special certificate for each two-way contact. This will be the first time an amateur radio has operated from the Museum in conjunction with a special event.

First established in 1923, the United States Air Force Museum is the oldest and largest military aviation museum in the world. It is located six miles northeast of Dayton at historic Wright-Patterson Air Force Base and is close to the Huffman Prairie site where the Wright Brothers conducted many experimental flights following their first successful powered flight at Kitty Hawk, North Carolina.

For further information, contact: Mr. Joe Ventolo, USAF Museum, Wright-Patterson AFB, Ohio 45433, (513)-255-3284, or the Museum's Public Affairs Officers, Dick Baughman or Linda Smith.

CAPE HATTERAS Lighthouse I

The weekend of May 15 and 16, the Rockingham County ARC will be operating from the Cape Hatteras Lighthouse on the outer banks of North Carolina. This lighthouse, which at 208 feet is the tallest brick lighthouse in the country, is designated as a national historic landmark and is seen by over a million visitors each year. But this beautiful sentinel is in danger of falling victim to the Atlantic's turbulent forces. Once 1500 feet from the shoreline, it now stands less than 70 feet from the water—despite various efforts to control the erosion.

The RCARC hopes its mini-expedition will help to draw national attention to this graceful and historic landmark. Operating frequencies will be 30 kHz up from the bottom of the General portion in each band, both phone and CW.

CAPE HATTERAS Lighthouse II

When the Cape Hatteras Lighthouse was completed in 1870, it was 1500 feet from the shoreline. Today, it is 70 feet— and closing. The Cary Amateur Radio Club, Cary, North Carolina, will draw world attention to the peril of this keeper of the "graveyard of the Atlantic." On May 29-30, whether the lighthouse is still standing or not, Cary ARC members and friends will put two HF stations on the air from a site close to "the big candle." The targeted time for operation is 9:00 am (1300Z), Saturday, May 29, to noon (1600Z), Sunday, May 30, 1982. Operation may start sooner and last longer, depending on conditions and people power.

Planned frequencies for operation are: CW—3552, 7052, 14052, 21052, and 28052 kHz; SSB—3988, 7288, 14288, 21388, and 28588 kHz. The callsign will be NB4L (New Blood for Lighthouse).

Each station making contact with NB4L during the special event can receive a commemorative 8.5" x 11" certificate by sending an appropriate SASE (1 oz., folded or unfolded) with QSL card containing the correct log information to Chuck Davis NB4I, 304 Atchison St., Garner NC 27529.

There is a public effort to raise funds to save the Cape Hatteras Lighthouse from the onslaught of the Atlantic. While many of the Cary ARC members may favor this project, this special event is only meant to focus attention on the peril of the Lighthouse. There is no connection with any fund raising.

SECOND ANNUAL COMMEMORATION OF MT. STE. HELENS ERUPTION

W7AQ, the Yakima Amateur Radio Club, will operate a special event station in commemoration of the second anniversary of the eruption of Mt. St. Helens in Washington State.

On May 18, 1980, at approximately 8:32 am local time, Mt. St. Helens, located in southwestern Washington State, erupted violently. The 9677-foot summit was reduced to Boreapit. A crater 2100 feet in depth was produced. Over one cubic mile of matter was thrown into the atmosphere.

Yakima, Washington, is located 80 miles northeast of the volcano. W7AQ was starting its hamfest activities that morning. By 10:30 am, the sky became as black as midnight. The light of the sun would not be visible until the next day.

Over 600,000 tons of volcanic dust and ash, which covered the city of 50,000 up to one inch in depth, was removed by cleanup over the next several weeks.

Join us in commemoration from May 16 at 1800 to 0200 of May 17 UTC. Frequencies will be 25 kHz up from the bottom of the General phone edge, ± QRM and band conditions. CW will be up to 25 kHz from the Novice band.
MID-AMERICA **

The annual Dogwood Festival QSO Party on Saturday, May 8th. Members of the club will operate on six amateur bands starting at 1300-2200 UTC May 8 and 30 May 2000-2000 UTC.

PORT JERVIS, NEW YORK

The Orange County ARC will operate WB2TSA to celebrate the tenth anniversary of the club and the diamond jubilee of the city of Port Jervis, New York, on May 29 from 1400-2200 UTC and May 30 from 1400-2000 UTC.

W2NSD/1

NEVER SAY DIE

editorial by Wayne Green

from page 8

against the speed of the brain and are stopped.

Once this limitation was understood, it made sense to stop trying to learn code with the old system. Articles were written about it and new code courses devised to get around that old slow method and the resulting plateau. I tried to get the ARRL to recognize the futility of their old system but got nowhere. Hams had always learned code that way and they were not going to change.

After giving up on the ARRL trying to help hams learn the code, I sat down and made up my own code tapes, using the new, much faster and easier, learning system. I brought these out on cassettes as the 73 Blitz Code Course. I soon was getting letters from thousands of new hams thanking me for breaking the situation for them. Many had tried and tried the ARRL tapes and had thought they were never going to learn the code. Now they found that within a few hours they were on top of it.

My "Genesis" cassette starts off the beginner with the simplest of code characters, starting with E, I, S, and H. Then, instead of going on to the rest of the 26 letters, I immediately start sending simple words. These characters are each sent at 13 wpm speed, right from the start, thus reinforcing the sound of the character. The letters are spaced for five wpm copying.

The quick change to sending words gets the student used to success. Simple messages are being copied within minutes of starting to learn the code. This is a tremendous psychological boost.

The next step is my "Stickler" tape...again with all characters sent at 13 wpm speed, but spaced for six wpm throughput. By standardizing on 13 wpm sound patterns, the groundwork is laid for passing the 13 wpm exam. The "Stickler" is all five-character code groups and has been designed by me to be frustrating as possible. By the time you are able to copy this code tape 100%, you should be able to breeze through any FCC exam at 5 wpm, half drunk and in your sleep. Many hams tell me that the time they can handle this nasty tape they can copy 13 wpm of clear text with no problems.

I want to be sure that my students are overtrained. The test, particularly if it is in front of an FCC examiner, can throw even a normal person into panic. Well, there is nothing which calms the nerves as much as sitting down to do a code test and having the code sound like it is coming at two wpm. It's all in the psychology.

For the next test, I have the most miserable tape you've ever heard. The "Back Breaker," at 14 wpm, will drive you right up the wall. You won't believe what a bastard I am until you try my "Back Breaker" tape and suffer. Heh. Heh. But again, when you sit down for 13 in plain text you will not believe how slow it sounds. Many students start laughing when they hear it, losing all their tensions.

Every now and then someone writes in asking for a copy of the code groups on my cassettes. I flatly refuse to send them a copy. The reason is simple...I don't want them using the tapes to test code-copying speed. The system is to use the tapes, pick out the characters you recognize. You keep working at this until you automatically copy all of them. You'll know full well what to do.
when you miss one, so you don't need a cheat sheet to check. I want you to practice without the pressure to perform. Such pressures take all the fun out of code. Learning the code should be and can be fun. The more you can do to make it fun, the faster you are going to learn it. The more pressure you put on yourself, the longer it is going to take and the more unpleasant it is going to be.

The fact is that a skill with the code is a lot of fun to have. I'm hoping that we can eliminate the pressures entirely by getting the code test out of the ham license requirements, replacing it with a technical exam which means something. Then I think we will have a lot more hams developing their code ability... and enjoying it.

For the Extra class license, I have a 21 wpm cassette. Once you can handle this one you will be able to copy plain language at almost 30 wpm.

From a practical point of view there is little difference in learning the code at 13 wpm, 20 wpm, or even 50 wpm. The process is about the same and the length of time it takes to master any of these speeds is about the same. We have had some interesting experiments with starting newcomers right out at 50 wpm... and succeeding!

The 73 code courses are available from us by mail order. They are also stocked by most ham stores. These stores are still selling the ARRL course... the one which I feel has lost us several hundred thousand hams. Many clubs are still taking hour after hour, struggling with the 1930s code system from the League. Modern ideas are sure to be difficult to get across.

FIGHTING BACK

Every now and then I get a stroke of inspiration. The other day, while I was sitting in the lounge of a restaurant waiting for my name to be called to get a table, a chap next to me started smoking a cigar. Being, as you may know, a non-smoker, I had immediate need of a gas mask. Cigarettes are annoying, but a cigar or pipe is just too much. I got up and went to another restaurant.

There must be some way to fight back. There really has to be a way. That was the train of thought that brought on one of my all too few strokes of semi-genius. If these turkeys can stink up the air I have to breathe, what's wrong with me stinking right back at them? How about an aerosol can of stink?

The first thought was to see about getting some cans of methane. Then I could sort of spray it and pretend that I fired back with a built-in weapon. But, alas, that might get ignited by the cigar or pipe and blow both of us to smithereens. No, the stink should be as offensive, but not be explosive. Perhaps skunk juice or hydrogen sulphide (rotten eggs). Yes, that would do it.

Put out in small pocket-(purse)-sized cans, I think it would sell. We might call it FIGHT BACK. It would be the first way for non-smokers to even the score. At $1 a can, it should sell well, Hmm, I'll have to look into this.

FOREIGN AID

One of the great benefits of amateur radio is that it allows us to sit and talk at length with hams in foreign countries. Unfortunately, few of us take the time to try to get to know amateurs in other countries, which is both our loss and theirs. Most of us are so swept up with contests and working countries that we say to hell with the chap at the other end.

I remember when I first moved to New Hampshire and went on the air. I found myself being called quite often by hams "need New Hampshire." This quickly got to me. These chaps had no interest in me or in New Hampshire. All they were interested in was a QSL card. Now what is the possible value of a card from someone you didn't even bother to do more than casually bump into on the band? Hams needing New Hampshire seem to go out of their way not to get involved with any real conversation. They are almost always uninterested in paying any dues for the card in the way of an interesting contact. The QSL card is supposed to be the final courtesy. In this case, it is often the only courtesy involved.

Amateurs in all foreign countries run into this syndrome. In the rare ones, they seldom run into much else. If they get fed up with non-contacts with hams in search of their pasteboards and start making contacts by calling some of the stronger stations... or hams they know... the hunters make their lives miserable with break-ins, tail-endings, and the like. If ignored, these QSL hunters can get vicious. This can diminish the fun of amateur radio substantially.

There probably isn't much that can be done about this whole sissy situation as long as the fascination continues for being high on the ARRL Honor Roll. Can I call it a dishonor roll?

At any rate, if you should want to fight the self-destructive urges to treat DX operators as mere QSL factories for your collection... providing you with an ever higher listing on an occasionlly printed list in an obscure magazine and not much else to show for a lifetime of DXing... then perhaps you can join me in finding out that many DX hams are highly interesting people. I can tell you this: Once you start talking with them, you are sure to become addicted to it.

You know that in a country where there are from one to ten hams you are not likely to be talking with a blue-collar worker. It is highly likely that you will be talking with a relatively important or wealthy person. He is also likely to be particularly interesting, if you can get him to talk.

One of the conversational openings which I've found to work has to do with asking about their country. From there, I just sit back and listen. You know, it wouldn't hurt you to invest in one of the almanacs and read up on some of the smaller third-world countries. That you'll have some questions to ask which show more than a casual interest.

One of the subjects which may interest you has to do with aid funds the country is probably getting from ours. This can bring about an interesting conversation in some cases... and embarrassed silence in others. I have the advantage of getting around to visit hams in many of the third-world countries, so I ask about foreign aid when I visit them... and find many open to give vent to their feelings about this.

Since this is where I was heading when I started, it isn't exactly a digression. This business of foreign aid has been bugging me for a long time. The way the situation is set up right now, this money is wasted for the most part. It doesn't have to be.

As I wrote recently, the heads of a great many of the third-world nations are kept in position by virtue of the money they are able to grab for their supporters. Even the poorest of countries can be bled further by these pirates. But they are expert at working on the sympathies of the wealthier nations to get aid funds. The US is a particularly good sucker for this. Rarely does even 10% of this "aid" money accrue to the benefit of the poor people of the countries.

Presuming that Uncle Sap is going to continue to try to buy friendship (a commodity which seemingly can't be bought) with handouts, we could at least send aid which would be more difficult to turn into cash and at the same time provide some feedback of the money to US industries. My proposal is for future aid to take the form of goods, not cash, and that this should be goods from small business manufacturers rather than the big corporations. That would keep most of the lobbyists out of the pork barrel.

When we send cash, the most desired commodity, to these countries, most of it ends up in Switzerland, without even coming near the people for whom it was intended.

Getting back to amateur radio, as you talk with the DX amateurs I think you'll find them enthusiastic for you to visit them. And I've found that a surprisingly high percentage of these amateurs manage to get to the US now and then. See if you can get them to include a day or two visiting you. You'll be able to find out a lot of things which they really couldn't talk about over the air.

Remember that 97.1e has to do with your ability to contribute to international goodwill. Pile-ups and tail-ending are not likely to do this. Presenting the friendly face of America to the world will. It's up to you whether we look like ugly Americans or not.
LETTERS

"CRACK THE WHIP"

First of all, I do enjoy your magazine and respect your right to an opinion on various topics (although sometimes I disagree), but on this business of a code-free license, I must make an objection.

I don't understand how Japan can have so many more amateurs than the US when the current Callbooks don't support this statement. But regardless, I will accept your word as you are in a better position than I am to know.

In my opinion, the reason why the US is declining, in new engineers and high technology, is because the youth of America is not made of the same fabric as that of our oriental brothers. At age 30, I am currently enrolled in an electronics program at a local community college and it is my impression that most of the "fresh-out-of-high-school" crowd are those merely because of parental pressure to get a degree. This school has one of the most thorough and modern electronics programs in the state and can compete equally with any big university on the educational level.

But the fact still remains that most of the younger students are "just going for a degree" and could really care less about the field they are pursuing. Possibly at one time they happened to open up a transistor radio, marveled at how it could do what it does, and decided this would be a less boring field then, let's say, social science or psychology.

The Japanese seem always to do things a little better, kind of a oneupsmanship, if you will, than their counterparts of the west. It is because they want to, Wayne...not because someone is standing over them with a whip.

If there is a minute problem with lids in Japan, what with their code-free licensing, that doesn't necessarily mean the same will hold true here.

You have stated that our technology could be much improved by technicians and engineers who were "sparked on" by being exposed to amateur radio during their youth. Well, if this is the case, then why didn't this happen with the Citizens Band service of the past? You couldn't have an easier way to get a ticket and get on the air than just to send off to the FCC for an instant license. Granted, a lot of superior hams graduated from the CB ranks and a lot of them probably went on to become technicians and engineers, but you know as well as I that the overwhelming majority did not. And look what the CB service is now without the discipline! Notice the emphasis on the word discipline? Learning code is a matter of discipline, period! There is no other word for it; that is, in black and white. The matter of fact, they are noted for it. Maybe that is why they can handle a code-free licensing program without any problems.

How would you compare American youth to Japanese youth? Is one better than the other? No, but one is more disciplined. In WWII, we destroyed Japan and rebuilt it and, as a consequence, they became more disciplined. Given that fact, who do you think would be more arrogant? We have enough arrogance on the bands already. Let's try to get more discipline on the bands and not open up the floodgates for more arrogance. I don't think your theory holds too much water, Wayne. I teach new Novices and they can learn the code and enjoy doing so. It's just a matter of presentation and a little discipline.

It's been a while since this country has led the industry and I'm afraid it will be a lot longer until we can change the attitude of the people, especially that of the youth. Besides, if the overwhelming majority of hams today don't prefer a code-free license, why fight it? This is supposed to be our service, isn't it? We should have some say about how we want it. There will always be enough people to keep us a viable commodity on the FCC "exchange." And those are the ones we want. Disciplined!

Dave Peckham KD9D
Decatur IL

Dave, such a bunch of questions! Good ones, though, so let me tackle them one at a time. First, regarding the Callbook. If they listed only the Extra class US hams, the US Callbook would be small, too. The Japanese Callbook is huge because they list all classes of licenses, over a million of them. Note about American kids and technology... the magic happens in the teen years. In the past, about 75% of the new hams were teenagers, with the old ARRL polls showing 50% being either 14 or 15 years old. There is now and there always has been an enormous difference between the type of engineer we get from dedicated teenage hams and from people who decide to just go for a degree. That's the same now as it always was and the chap who goes for a degree is usually a grave disappointment by comparison. Boy, I've known a lot of 'em.

Now about CB. Dave, think about it... the mess is awful, with piles of interference, contacts which are even more boring than most ham contacts (yes, I know that's hard to believe), bodacious signals, and so on... how do you honestly expect anything good to come from such an incubator? The few CBers who managed to be salvaged by friendly hams are a blessing to us and to CB, but they are few, with most of those exposed to CB recollecting from the gong. Now, there is a world of difference between an interference-hassled contact on one of the CB channels and a half-hour rag chew with someone in Germany or Australia, so please don't try to equate the two in your mind.

The Japanese aren't any better than we are. They just went the right way when we went the wrong with that foolish attempt to return to prewar Class A and B licensing in 1963. We now know how to fill our bands with crazies... use a code test and let Bash do away with the technical requirements with his books and blitz one-day memorization bashes. If you want garbage, you know how to get it. And Dave, remember that in 1969 the overwhelming percentage of the hams hated two-meter FM and didn't want to read about it or hear about it. Every now and then amateur radio needs someone to provide some leadership. I've found that in the long run people (even hams) will think things through and eventually get away from slogan thinking and work for what is in the long-range interest of amateur radio. We really couldn't ask for more proof that the code is a total failure as far as keeping out the nitwits (my apologies to any nitwits reading this and taking offense... which is an unlikely prospect) out of the hobby. Now that we have a way to easily cheat on the technical test, all we need is a way to cheat on the code and you have what you asked for: open sesame. I want to throw out the proven loser, code, and substitute a meaningful technical entry exam... one that can't be washed.

If we get our spirit up, we can beat the hell out of any country in the world... including Japan. We can out-invent them, out-produce them, and out-quality them... if we decide that it is important to us. I want to get this started by getting kids infected with the ham bug when it is the easiest to pass along this infection in high school. Dave, if we can get even half of the ham clubs to get some enthusiasm for selling amateur radio... classes... monitoring systems to keep our bands clean... emergency cadres so we will be ready to provide quick service for any kind of emergency... pressures on our high schools to start and support ham clubs... we'll be able to change the world in ten years. Or we can sink and let amateur radio rot away the way it has for the last few years. Your choice. — Wayne.

CATCHING THE DREAM

Wayne, your editorials always ring my bell. You have the best interests of amateur radio at heart — we know that. I admire your business acumen; you are a true pioneer. I met you a couple of times at Dayton and enjoyed your magnetic and energetic personality.

Yet, agreement we don't have. You constantly compare American and Japanese amateurs to our disadvantage. Each has different goals and attitudes. The civilizations are vastly different. Japan may have no code requirement for entering amateur radio, but many Japanese amateurs are competent CW operators. I just don't believe our declining ranks results from the code requirement.

With that out of the way, what makes a prospective American

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strict guidelines... and are kids respond better to much...and even made QSO tapes for me so that I could become more proficient at code and be really ready for the General exam. His assistance has been invaluable to me.

Through people like this I have come to truly appreciate the amateur radio spirit. I am no baby-in-the-woods: I have heard the foul language on 20 and am aware of the other problems that Frank and Tom illustrate, but I am certainly not convinced that things are as bad as they say. Elmer is sure alive and well here. All of the hams I know are courteous, helpful, and represent their hobby as true gentlemen. It is my privilege to join their ranks. I only hope that someday I can provide as much help and encouragement to a potential licensee.

Gregory L. Darrow, M.D. Janesville WI

CALL FOR PAPERS

Papers are invited for the 1982 Annual VHF Conference to be sponsored on October 23, 1982, by the Electrical Engineering department, Western Michigan University. Principal emphasis will be placed on engineering developments applied to radio communication, design, and construction on the frequencies of 30 to 1200 MHz. Papers on a wide range of subjects are solicited including, but not necessarily limited to, these:

Antennas and transmission lines
Applications of microprocessors
Audio-frequency equipment used with VHF transmitters and receivers
Emergency gear
Grounding and shielding
Keying, break-in, and control circuits
Measurements and test equipment for VHF
Mobile and portable equipment
Modulation and mixing
Narrowband voice modulation
Noise reduction
Phase-locked loop uses
Picture transmission and reception
Power supplies including inverters
Production technology and model building
Propagation
Recent equipment/new apparatus
RTTY
Satellite and Moonbounce topics
State-of-the-art semiconductors, ICS, and filters with applications
Transceivers

One of the basic purposes of this Conference is to provide a minimum opportunity to present findings by those experimenting, designing, constructing, testing, and inquiring into problems and methods applicable to VHF radio. This is an opportunity for beginning or mature researchers to report their findings to their peers. We especially encourage the inexperienced inquirers to obtain some experience by presenting a paper at our VHF Conference.

Authors wishing to present papers should send a synopsis or abstract (typically one or two pages with diagrams) describing the paper to Dr. Glade Wilcox W9UHF, Chairman, VHF Conference, Department of Electrical Engineering, Western Michigan University, Kalamazoo MI 49008. Foreign authors are requested to have a US contact.

Deadline for submission of synopses is June 30, 1982. Speakers will be notified of acceptance by July 4, 1982. Reproducible copy for the printed proceedings should be mailed to the Chairman two weeks prior to the day of the Conference.

Glade Wilcox W9UHF Kalamazoo MI

ELMER LIVES

After reading the November, 1981, issue, and noting the letters to the editor from Frank D. Windsor and Tom Taormina, I felt that I could no longer be silent. I am an aspiring Novice who hopefully will have upgraded to General by the time you receive this.

I became interested in ham radio as a youngster, but did not have the time necessary to devote to college, medical school, residency, and early struggling years of practice. In November, 1981, I learned the code and began to study theory. I immediately ran into problems, and needed to discuss my problems with someone more knowledgeable than myself. One of my patients (N9ATB) overheard my predicament and offered his services. Within two weeks, he had guided me past all of the rough spots; frequently he allowed me to listen and observe at his home while he made QSOs. He administered my Novice examination for me in early January.

As I progressed and started to increase my code speed, several other hams became known to me. I also discovered that another physician in my community was a ham. KB9DD has spent many hours working with me and has even made practice QSO tapes for me so that I could become more proficient at code and be really ready for the General exam. His assistance has been invaluable to me.

I read your article by Jeff DeTray WB8BTH regarding memory scan for the TR-9000. I am the owner of one myself and, like Jeff, realized to top off a great rig surely Kenwood could have had a memory scan. Well, here's the bottom line: the TR-9000 does have a memory scan; they just haven't brought the function out to a control! I sympathize with Jeff. His memory scan cost him $39.95, mine cost the price of one silicon diode, two pieces of wire, and some thinking.

The TR-9000 is microprocessor-controlled. (At this point, get your TR-9000 manual out.) Find the circuit diagram of board X53-11G0-11. (If you don't have a manual, rip the lid off your rig and remove the front control section by removing 4 screws, 2 on each side — allowing the front section to be moved to see and work on the board behind it.) Note Q15, the microprocessor, now all you have to do is connect pin 13 (PE-1) through a silicon diode to pin 38 (PB-1). Obviously, you won't want the scanner running continually, so a switch is needed. As soon as the switches on the TR-9000 are DPDT and only used as SPST, I used the unused side of the NB switch.

Trace PE-1 + PB-1 on the board 'til a suitable pick-off point is found. Then remove the front panel, remove the power volume control, and you will see
on the circuit board where one side of the NB switch is not used.

The result is that when NB is out, the scanner is in and can be controlled by scan and hold buttons manually. And when a signal is present, it will stop until it ceases, and then continue. If mike P/T is operated, the scanner will stop and has to be restarted manually by pushing SCAN on your rig.

A simple addition to a fine rig.

R. M. Somann-Crawford VK7RC Tasmania, Australia

FAR SCHOLARSHIPS

The Foundation for Amateur Radio, Inc. (FAR), a nonprofit organization with headquarters in Washington DC, plans to award nine scholarships for the academic year 1982-1983. The Foundation, composed of fifty local area amateur radio clubs, fully funds two of these scholarships from the proceeds of the Gaitersburg (MD) Hamfest. It administers, without cost to the donors, two scholarships for the Quarter Century Wireless Association and one each for the Richard G. Chichester Memorial, the Radio Club of America, the Young Ladies' Radio League, the Edmund B. Redington Memorial, and the Amateur Radio News Service. The last-named award is new this year.

Radio amateurs holding at least an FCC General class license or equivalent may compete for one or more of these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled or have been accepted for enrollment in an accredited university, college, or technical school. The scholarship awards range from $300 to $900, with preference given in some of them to residents of specific geographical areas or the pursuit of certain study programs.

Additional information and an application form can be requested by a letter or QSL/postcard postmarked prior to May 31, 1982, from me.

The Foundation is devoted exclusively to promoting the interests of amateur radio and to the scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Hugh A. Turnbull W3ABC
6903 Rhode Island Avenue
College Park MD 20740

WOODEocker REFORMED?

Over the past several months, the amateur bands have experienced a varying degree of interference that has acquired the label "The Woodpecker."

I have read of efforts to have this interference eliminated, by political and non-political bodies. However, all efforts in the past have not been effective. Based on the old-time adage of "If you can't lick 'em, ...", perhaps we could take advantage of this activity.

There are various propagation indicators and forecasts to aid amateurs in their efforts to communicate. Why cannot the Woodpecker be used in the same manner? It should certainly provide band-opening information, at least in some direction.

I wonder, if worldwide attention were given to this activity on a scheduled basis, perhaps the instigators of this noise might feel they are contributing too much to the welfare of others. When WWV and others give the solar-flux index, they could also give the "Woodpecker: forecast for various frequencies and times." I'm sure this information is being kept somewhere; let's put the Woodpecker to good use!

Glenn A. Churchill KA2IOI
Hudson Falls NY

FCC SPELLING

This is in reference to the letter from Bill Crowley on page 121 of the February, 1982, issue of 73 Magazine.

There are no incorrectly spelled words in any of the Morse code tapes which the FCC uses to test amateur radio operators. The word "Springfield" is contained in some of the tapes, and it is spelled correctly, not with a "C" as Mr. Crowley alleges.

After the publication of Mr. Crowley's letter, the cassettes used by the Boston office were double-checked to see if the tapes had somehow been garbled or partially erased. It was found that these tapes are in good condition.

I regret that Mr. Crowley felt it necessary to encourage others to complain about a situation which does not exist. The Commission continues to make every possible effort to ensure that the amateur radio examinations are unambiguous and straightforward.

Vernon P. Wilson
Chief, Regional Services Division
FCC
Washington DC

Now we have heard the FCC's side of the story. What has been your experience? — N8RK.

AMATTER OF CHOICE

Sorry, Wayne, but Jim Owens W5QFE's letter (January, 1982) hit the nail on the head. My wife renewed last year's subscription only because she got it mixed up with QST.

Mitch Armstrong W7CDM
Puullup WA

This letter was forwarded to us by QST. — Ed.

ATLANTA SCHOLARSHIPS

The Atlanta Radio Club announces that three (3) cash $500.00 scholarships will be awarded to graduating high-school seniors who enter an accredited college or university in the fall of 1982. Recipients must be duly licensed amateur radio operators at the time of application.

This is the fourth consecutive year in which the Atlanta Radio Club has been able to award scholarships to deserving amateurs. The three scholarships to be awarded in 1982 represent an increase of one additional scholarship over past years.

For additional information and application forms, write to Phil Latta W4GTS, Secretary, Atlanta Radio Club Scholarship Committee, 259 Weatherstone Parkway, Marietta GA 30067.

Completed applications, along with the required high-school transcript, must be postmarked not later than July 1, 1982.

Morris Johnson KB4IT
Atlanta GA

FATHER OF SSB?

Jeanne Hammond's excellent article, "The Father of FM," in the February, 1982, issue does not mention single sideband. I believe Major Armstrong was the first to use this type of radio communication, and I mentioned this in my book, Radio Stations Common? Not This Kind. If anyone does not agree with this record, would they please provide the source of the detail on who they believed was first with sideband? Major Armstrong had so many firsts that we now take for granted that Jeanne probably did not mention this one because she was concentrating on his accomplishments with FM.

Spud Roscoe VE1BC
Samboro Head NS
Canada

EYEBALL TIME

July of this year marks the 25th reunion of the VHF radio amateurs who were members of the Oklahoma Central 6-Meter Club, later known as the Oklahoma Central VHF Club. All persons who were at any time members of this group are urged to write immediately to T. W. Stevens W5VCJ, PO Box 976, Edmond OK 73083. Give him your name, address, and present call and indicate whether you are interested in attending the reunion, which will be held at the same time as but not in conjunction with the Oklahoma City "Ham Holiday."

CARL C. Drumeller W5JJ
Warr Acres OK

HAM HELP

I need a schematic and manual for a Fluke 8120A digital multimeter. I will pay for copies or will copy and return originals.

Geoff. Chadwick KA7MKN
Box 361
Red Lodge MT 59068

I will pay any reasonable price for a manual and schematic for the Model 680-0 ltron frequency counter, or I will copy and return your original.

James Dickinson W4LLF
1408 Monmouth Ct. W.
Richmond VA 23233

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NEW PRODUCTS

PROFESSIONAL-AMATEUR ANTENA SERIES

Valor Enterprises has introduced the Pro-Am (Professional-Amateur) line of antennas, mounts, and accessories that are compatible with the Motorola TAD and TAE mounts, a system used extensively by the amateur and commercial communities.

Four mounts are offered. The model PAS ($11.25) is a basic surface mount that installs in a ½" hole (lower left in photo). Valor's model PAS38 ($11.25) basic surface mount installs in a ½" hole (lower right), while the model PAT ($14.85) is a no-hole trunk mount (upper right). The fourth mount, model PAM ($22.00), is a low-profile magnetic base (upper left).

The Pro-Am antennas are available in four categories. Left to right in photo: models PAQ ($5.95), of which there are twelve versions, act as ½-wave whips for frequencies between 136 and 886 MHz; model PUB ($24.50), a 5-DB collinear series, available for 440-512 MHz; model PLB ($26.35), a ½-wave, base-loaded antenna that can be selected to cover any frequency in the 27-to-54-MHz spectrum, and model PHB ($23.25), a ½-wave design that offers 3 DB of gain on the two-meter and 70-cm bands. (Another model PAQ is on the right.)

All models are engineered for demanding environments, featuring stainless-steel whips, nickle-chrome-brass parts, and "O"-ring seals. For more information, contact: Valor Enterprises, 185 West Hamilton St., West Milton OH 45393. Reader Service number 482.

KENWOOD'S TS-930S HF TRANSCIEVER

Trio-Kenwood has announced the development of a top-of-the-line, all solid-state, high-frequency transceiver, the TS-930S. Designed to cover all amateur bands from 160 to 10 meters, the TS-930S also incorporates a 150-kHz-to-30-MHz general-coverage receiver which offers excellent dynamic range. Among the more interesting features to be found on this model are an automatic antenna tuner, dual digital vlos, eight memory channels, dual-mode noise blanker, I-f notch filter, fluorescent tube display, rf speech processor, rf step attenuator, and 100-kHz marker.

Special circuitry allows the operator to adjust the I-f pass-band characteristics for rejection of interference and includes a tunable audio filter for CW reception. Power input is 250 W PEP SSB, 250 W dc on CW, 140 W dc on FSK, and 80 W dc on AM. The built-in power supply operates on 120, 220, or 240 V ac. Kenwood's newest HF transceiver will have a list price under $2000. For more details, write to Trio-Kenwood Communications, PO Box 7065, Compton CA 90224.

220-MHZ ALL-MODE AMPLIFIER

Mirage Communications Equipment, Inc., has announced the release of a new 220-MHz amplifier. The C106 amplifier is a solid-state, "all-mode" amplifier designed to be used in the 220-to-225-MHz amateur band. It will amplify a 10-Watt radio to more than 60 Watts output, or a 2-Watt radio to 25 Watts out. Since the C106 is biased as a linear amplifier, it can be keyed with as little as 300 milliwatts.

Other features include remote operation with the optional RC-1 remote head, and external or internal keying circuitry. The C106 lists for $199.95. For further information, contact Mirage Communications Equipment, Inc., PO Box 1393, Gilroy CA 95020. Reader Service number 490.

Cushcraft has introduced the R3, a no-radial 10-, 15, and 20-meter gain antenna. The R3 is perfect for limited-space applications like condominiums, apartments, mobile homes, and small urban lots. It is a ½-wave-length, endfed 22' radiator with remote tuning for broadband coverage.

Installation is very simple, with only one square foot of space needed. It also can be telescoped for easy carrying and storage. Because of its unique design, the R3 does not need a tower, rotator, large support mast, or tuner. For more in-

Valor Enterprises' Pro-Am antennas.

Valor Enterprises' Pro-Am antenna mounts.

Kenwood's TS-930S HF transceiver.

NO-RADIAL VERTICAL ANTENNA

Cushcraft has introduced the R3, a no-radial 10-, 15, and 20-meter gain antenna. The R3 is perfect for limited-space applications like condominiums, apartments, mobile homes, and small urban lots. It is a ½-wave-length, endfed 22' radiator with remote tuning for broadband coverage.

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Cushcraft's R3 no-radial vertical antenna.
ALL-CHANNEL MARINE PORTABLE

Henry Radio is introducing a marine VHF-band portable, the Tempo M1. The M1 operates on every marine channel, both US and international, with all the necessary offsets built in. It also includes all weather channels and a channel 16 override function. Channel selection is made by a thumbwheel switch on the top panel.

Other features include a one-hour, quick-charge-type battery, permanent memory, a high-power, 2 1/2-Watt position, and a low-power, 1-Watt position. Accessories will include a charger, holster, amplifier, and high-capacity batteries.

The Tempo M1 is available through the Marine Division of Henry Radio. The suggested list price is $495.00. For more details, contact Henry Radio, 2050 S. Bundy Dr., Los Angeles CA 90025; (213)-820-1224. Reader Service number 480.

TELEREADER TERMINAL

The Hal Communications CWR-670 is a compact electronic communications terminal designed for reception of Baudot and ASCII radioteleprinter signals as well as Morse code signals. The CWR-670 includes built-in RTTY and Morse demodulators and video-generation circuits. The very small size of the CWR-670 makes it ideal for applications where space is limited.

Since the terminal operates from 12 V dc, it may easily be used in locations where ac power is not readily available. The video-output screen of the CWR-670 is formatted in pages of 16 lines, 32 characters per line; a total of two page screens may be selected. The internal RTTY demodulator allows selection of three standard shifts. A parallel ASCII-printer output is also provided. The CWR-670 has a list price of $495.00. For more information, contact Hal Communications, Box 365, Urbana IL 61801; (217)-367-7373. Reader Service number 483.

REPEATER CONTROLLER

Advanced Computer Controls has introduced its new microcomputer-based RC-850 repeater controller. The controller's characteristics are remotely configured by the repeater owner with highly-secure tone commands. No hardware or software changes are required to modify control operator and user codes, ID and tail messages, Morse code speed, pitch and level, and a host of other functions.

The RC-850 controller's autopatch is based on a storeforward technique where the user enters a phone number and the controller actually dials the phone using either touchtone™ or dial pulses. Logic outputs allow remote control of equipment at the repeater site. A voice-telemetry option adds a natural-sounding speech synthesizer with analog-measurement capability.

The controller uses CMOS logic and low-power, analog circuitry to minimize constant consumption. The RC-850 is priced from $1850. For more information, contact Advanced Computer Controls, 10816 Northridge Square, Cupertino CA 95014; (408)-253-8085. Reader Service number 478.

RTTY PROGRAM

The Egbert RTTY program transmits and receives RTTY without the need for any expensive interface hardware. The Apple cassette ports connect directly to the transmitter/receiver. Program capabilities include 60-, 67-, 75-, and 100-wpm Baudot and 110-baud ASCII, type-ahead buffer, canned messages, and automatic CW identification.

The program runs on the 48K Apple II and requires an Apple disk with DOS 3.2 or 3.3. The program and instruction manual cost $42.45 and are available from W. H. Nail Co., 275 Lodgeview Dr., Oroville CA 95965. Reader Service number 487.

STANDBY POWER SYSTEM

The Portable Battery Division of Gould, Inc., has announced a Standby Power System (SPS) which provides 200 Watts of emergency power at 120 volts for 20 minutes, taking over the job of supplying power within one cycle of power failure.

As long as the power is constant into the SPS, the current passes through to the computer or other device being powered. However, if power drops below 102 volts, a sensing device immediately switches to an internal battery and turns on a red indicator light. If the power outage is brief, the device will automatically transfer back to line power and recharge the internal battery. Gould's standby power system is available for $429.45 and includes the power supply, control panel, and charger.

FLEXIBLE ANTENNA

Centurion International has introduced a new flexible UHF gain antenna for use with handheld radios. The antenna features an endfed design and represents a 1/4-wave radiator with approximately 2.5 dB gain over a 1/4-wave portable whip antenna.

The antenna is factory-tuned to discrete frequencies from 406 to 512 MHz and has a usable bandwidth of 20 MHz. The base is fitted with a BNC connector. Designated Style G, the new antenna ranges in length from 7 to 13 inches and lists for $17.50. For more information, write or call Centurion International, PO Box 92846, Lincoln NE 68501; (402)-467-4491. Reader Service number 484.

The Hal CWR-670 Telereader terminal.

The RC-850 repeater controller.

Centurion International's flexible antenna.

The very small size of the CWR-670 makes it ideal for applications where space is limited. Since the terminal operates from 12 V dc, it may easily be used in locations where ac power is not readily available. The video-output screen of the CWR-670 is formatted in pages of 16 lines, 32 characters per line; a total of two page screens may be selected. The internal RTTY demodulator allows selection of three standard shifts. A parallel ASCII-printer output is also provided. The CWR-670 has a list price of $495.00. For more information, contact Hal Communications, Box 365, Urbana IL 61801; (217)-367-7373. Reader Service number 483.

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MORSEOMATIC KEYER UPDATE

Advanced Electronic Applications, Inc., has announced the latest generation of the MorseMatic keyer, the MM-2. The MM-2 is a full-feature, paddle-input keyer that offers virtually all the features of the MM-1 predecessor plus CMOS memory and a new price. Like the MM-1, the MM-2 offers features that include an automatic serial-number generator, an automatic beacon mode, and an automatic speed-increasing Morse code trainer mode.

The MM-2 keyer comes in an rf-protecting metal package and is powered by 10 to 15 V dc. Independent + and − output keying allows connection to virtually any amateur transmitter. For further information on AEA's new $139.95 keyer, write Advanced Electronic Applications, Inc., PO Box 2160, Lynwood WA 98036, or call (206)-775-7373. Reader Service number 486.

COMPANDOR KIT

Advanced Analog Systems has announced a design evaluation kit for the Signetics NE572 dual-programmable compandor. The kit, designated AAS572, contains a printed circuit card, integrated circuits, and all components necessary to construct a complete audio compandor.

The system consists of two compressors and two expanders. Input to the compressor section consists of a high-performance, low-noise voltage follower. The system can be evaluated with either a single 2:1 compressor or by switching the ratio selector for 4:1 compression. There is also a choice between 1:2 and 1:4 expansion. Power requirements are plus and minus 15 V. The AAS572 costs $65.00 in single quantities. For more details, contact Advanced Analog Systems, 790 Lucerne Dr., Sunnyvale CA 94086, (408)-730-9786. Reader Service number 488.

BOOSTER AMPLIFIER

Daiwa announces a compact, lightweight amplifier, the LA2030, intended for the owners of two-meter, hand-held transceivers. It is available in three versions, depending on the power output of your transceiver. All versions can deliver a maximum of 15 or 30 Watts from 144 to 148 MHz.

The Daiwa LA2030 includes rf power metering and protection circuitry. The unit comes equipped with a BNC input and SO-239 output. Three feet of coax and BNC connectors are included in the $121.00 price. For more information, contact MCM Communications, 858 E. Congress Park Dr., Centerville OH 45459, (513)-434-0031. Reader Service number 481.

TWO-METER DDDR ANTENNA

High efficiency and small size are two key features of the Comrad Industries CR2A two-meter antenna. The CR2A is an adaptation of the Northrop Direction Discontinuity Ring Radiator (DDRR). Comrad's CR2A offers vertical polarization in a low-profile package suitable for either base or mobile use. Priced at $39.00, the CR2A is available from Comrad Industries, 1635 Van Ness St., San Francisco CA 94109; (415)-775-9080.
Marc I. Leavey, M.D. WA3AJR
4006 Winley Road
Randallstown MD 21133

Last month I described what may be the ultimate in RTTY output devices: a synthesized voice. Using the new Votrax Type 'N Talk, a self-contained speech synthesizer, and a 6800 computer, this setup allows conventional RTTY to be presented to the operator as text on a page or view screen, but as an easily understandable computerized voice, capable of pronouncing whatever is sent. This month, let's look at the programming.

The program is written for my 6800 system, which, in its current state of evolution, uses the GIMIX GMXBUG version 3.0 monitor, the GIMIX VDM, and a Smoke Signal disk system, running under DOS68 version 6.1. Along with the video board, assigned to port #4 in the GIMIX system, GMXBUG supports a printer or other output device on either port #3 (serial) or port #4 (parallel). Output vectors are provided to direct data to the VDM, printer, or both. By connecting the Type 'N Talk to port #3, as a serial device running at 1200 baud, we can take advantage of this capability in the demonstration program. Lacking this feature, as in a system using another monitor, separate video and speech output routines could be used with minimal rewriting.

The program itself follows the flowchart presented last month fairly closely. Beginning at $0100, the first chores taken care of are housekeeping; clearing the screen, setting the GIMIX-software-controlled bell to a high pitch and short duration, and initializing the PIA for input. The output vector is also set so that both the screen and voice are initially active.

The actual receiving loop is next down the line. The keyboard is checked for input first. If there is no data found (we will cover what happens when there is input in a little bit), the PIA is checked. The RTTY input is fed to the least significant bit of the "B" side (80) of a PIA located in port #5. If a START pulse is not found, then a loop back to the keyboard check is executed. By the way, since we are interfacing via an RS-232-type line to the modulator, recall that the START, which is sent as a "0" level (or space), is represented by a positive voltage. Thus, reading a "1" on the B0 line translates to a space; a "0" is mark, the resting condition.

Once a START pulse is found, a counter is set up and five data pulses are read in. The step-by-step process is covered in the remarks in the program source listing. After screening for case shifts, spaces (which initiate a downshift-on-space), and carriage returns, otherwise unremarkable letters are decoded in a simple indexed table lookup.

The ASCII character, once retrieved from the table, is output by way of the GIMIX OUTCHR routine. As stated above, this routine will vector to either the screen only, the printer (voice) only, or both. However, I only provide the facility within this program to select screen only or screen and voice.

Now, let's get back to keyboard input. I wanted to provide a way to give commands without worrying over accidentally hitting a key and messing something up. So, in the best tradition of secure devices, only one key is recognized while receiving: the ESCAPE key. Hitting any other key is ignored. Striking the ESC key results in two effects. A flag, called the Command Flag (CMDFLG) is set to "1". This indicates that an ESC has been.
hit, and that the next keyboard input should be examined as a command character. Then the local bell is rung, to verify receipt of the ESC.

Once the Command Flag has been set, several commands will be recognized by the system. A look at them reveals: V = voice on; S = silent—voice off; C= caps mode on; D= caps mode off.

The voice on and off commands are handled by storing a $01 or $00 in the output vector, respectively. The CAPS mode of operation was touched on last month, but deserves another word now. In the conventional mode, CAPS off, words are pronounced as they are spelled. However, groups of letters which are unpronounceable are still attempted, no matter how mangled they are tried; thus, a typical RTTY sign off, such as "N3BRD DE WA3AJR BNCU KKKK," is pronounced...well you get the picture if you try it yourself. To get around this problem, a CAPS mode is available, in which groups of capital letters will be spelled out one by one. This is exactly what we need in a RTTY program, and the "C" and "D" commands allow you to turn this mode on or off as needed.

One other command is recognized, by the way. Sending a second ESC will terminate the program and return to DOS. Just provides a clear getaway, if you follow me. Sending any other character will clear the CMDFLG and send nothing out to the Type 'N Talk or VDM.

Granted, this demonstration program is just that, a demonstration. But it shows the kernel of a system that would be useful to many hams — especially visually-handicapped ones.

One feature of this column, that many of you have expressed a particular fondness for is the range of material covered. I don't want to disappoint you, so let's go from high tech to basics. Bob Henry, a Boston MA reader, dropped me a line with some questions. He begins by asking what a "cursor" is for.

For the uninstructed, the cursor is the little box, blinking or solid, or sometimes an underline, that scoots along on a video screen just ahead of where you last typed. Why? Try to imagine a typewriter, Bob, where the whole page was somehow suspended in front of you. When you hit the keyboard the characters are placed on the page in order, but that little plastic thingy that normally sits dead center, and through a hole in the center of which the typewriter hits the paper, is missing. How do you know where you are? Where to space? If a new line has started? A typewriter all that information is provided by that guide and the position of the carriage. With a video screen, there ain't no such guide. That is what the cursor is for!

Bob's other question involves an item touched upon above: unshift-on-space. Recall that on RTTY, using five-level Murray code, two cases — letters and figures — are available. Now, if you miss a "LTRS" or "FIGS" code, the proper case will not be selected, and gibberish will result. On ham RTTY, numeral groups are rarely sent. The odds is that a space is sent, what follows is in the letters case. Let me illustrate. If I send "DE WA3AJR IN MARYLAND," recall that the "3" is preceded by a FIGS and followed by a LTRS. If that LTRS is missed, what prints out is "DE WA3-'4 8,-46-,5", all after the 3 being in figures case. With downshift on space, the first space forces letters case, and "DE WA3-'4 IN MARYLAND" results. Less is missed.
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73 Magazine • May 1982

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CONTESTS

County Hunters SSB Contest
Contest Periods:
0001 to 0800 GMT May 1
1200 GMT May 1 to 0800 May 2
1200 to 2400 GMT May 2

Please note the two 4-hour rest periods. Mobiles may be worked each time they change counties or bands. Mobiles that are worked again from the same country on a different band count for point credit only. Mobiles that are contacted on a county line count as one contact but 2 multipliers. Fixed stations may be worked by other fixed stations only once during the contest. Repeat QSOs between fixed stations on other bands are not permitted. Fixed stations may be worked by mobiles each time they change counties or bands. Repeat contacts between mobiles are permitted provided they are on a different band or county. Mixed-mode contacts are permitted provided that one station is on SSB. Contacts made on net frequencies will not be allowed for scoring in this year’s contest.

EXCHANGE:
Signal report, county, and state or country.

FREQUENCIES:
Suggested frequencies are as follows: 3920-3940, 7220-7240, 14275-14295, 21375-21395, 26625-26650. There will be a “mobile window” of 10 kHz on the following frequencies: 3925-3935, 7225-7235, 14280-14290. Mobiles will be in this 10-kHz segment and fixed stations are asked to refrain from calling “CQ contest” in the mobile window. After working mobiles in the “window,” fixed stations are requested to QSY outside the “window” to work fixed stations in the contest. This will allow the mobiles running lower power a chance to be heard and worked in the contest. There will be a special effort to work DX on 28.636 by mobiles.

SCORING:
Contact with a fixed US or Canadian station = 1 point; contact with a DX station (KL7 and KH6 count as DX) = 5 points; contact with a mobile station = 15 points. The multiplier is the total number of US counties plus Canadian stations worked. The final score is this multiplier times the total QSO points.

AWARDS:
MARAC plaques to the highest scoring fixed US or Canadian station, DX station, and top 2 scoring mobile stations. Certificates to the top 10 fixed and mobile stations in the US and Canada, and to the highest scoring station in each DX country.

ENTRIES:
Logs must show date and time, station worked, reports exchanged, county, state, band, claimed QSO points (1, 5, or 15), and each new multiplier must be numbered. Logs and summary sheets are free for a #10 SASE or SAE and appropriate IRCs. Write John Ferguson WB0WS, 3820 Stonewall Ct., Independence MO 64055. All entries must be received by June 15th to be eligible for awards. DX entries should use air mail. Winners will be announced at the 1982 Independent County Hunters Convention during July and in the MARAC newsletter.

SEVILLE WORLDWIDE CONTEST
Starts: 1600 UTC May 1
Ends: 2000 UTC May 2

This contest is sponsored by the Seville (Spain) City Council and organized by the Seville Radio Club. Only single-operator entries are eligible. You may operate 24 hours of the 28-hour contest period, with 4 hours of rest taken in one or two periods. Contacts are allowed on SSB and CW, but a station may be worked only once per frequency band.

BANDS:
80 through 10 meters.

EXCHANGE:
RS(T) plus QSO number beginning with 001.

MULTIPLIER:
DXCC countries worked on each band.

POINTS:
Contacts between stations in the same country count 2 points. Contacts between stations in different countries count 3 points. Exception: Contacts between EA, E6, E8 and EA9 count only 2 points.

AWARDS:
Total QSO points times sum of multiplier points.

ENTRIES:
All times must be in UTC. Indicate multipliers in your log the first time they are worked on each band. Make a separate log and dupe sheet for each band. Include a summary sheet containing scoring information for each band, a station description, and a signed declaration that you have observed the contest rules and the regulations for amateur radio in your country. Please include your comments and photographs. Entries must be postmarked no later than June 30th. Send entries to: Seville Worldwide Contest, Radio Club Sevilla, PO Box 555, Sevilla, Spain.

DISQUALIFICATION:
Violation of the contest rules, violation of amateur radio regulations, unsportsmanlike conduct, excessive duplicate contacts, or unverified QSOs will be deemed sufficient cause for disqualification. Decisions of the Contest Committee are final.

MICHIGAN QSO PARTY
Contest Periods:
1800 GMT Saturday, May 15 to 0300 GMT Sunday, May 16
1100 GMT Sunday, May 16 to 0200 GMT Monday, May 17

This year’s QSO party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Michigan stations can work Michigan counties for multipliers. A station may be contacted once on each band/mode. Portable mobiles may be counted as new contacts each time they change counties.

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MICRO CRAFT CORPORATION
73 Magazine - May, 1982 133

See List ofAdvertisers on page 130
GSL OF THE MONTH: KX6SS

The colorful flag of the Marshall Islands provides an attractive design for the QSL of Keith R. Merrick KX6SS. Keith also holds callsign KG6SS and WA1GYS.

To enter our QSL of the Month Contest, put your card in an envelope and mail it, along with your choice of any book from 73’s Radio Bookshop, to 73 Magazine, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which are not sent in an envelope (the Postal Service does occasionally damage cards) and do not specify a book will not be considered.

state, country, or Michigan county.

FREQUENCIES:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Phone</td>
<td>1815, 3905, 7280, 14280, 21380, 28580.</td>
</tr>
<tr>
<td>CW</td>
<td>1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125.</td>
</tr>
<tr>
<td>VHF</td>
<td>50.125, 145.025.</td>
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SCORING:

Multipliers are counted only once. Michigan stations score 1 point per phone QSO and multiply by the total number of states, countries, and Michigan counties. Each CW contact counts 2 points; KL7 and KH6 count as states; VE counts as a country. Maximum multiplier is 85.

Others take QSO points times the total number of Michigan counties. QSO points are 1 point per phone QSO and 2 points per CW QSO. Maximum multiplier is 83.

All stations score 5 points for each club station contact with W8MB.

VHF-only entries: same as above except multipliers per VHF band are added together for total multiplier. Score 5 points for each OSCAR QSO. No repeater contacts are allowed.

AWARDS:

Michigan trophies to high Michigan score, high Michigan (Upper Peninsula) score, high aggregate club score. Plaque to high VHF-only entry and high mobile. Certificates to high score in each county with a minimum of 30 QSOs. Out-of-state high trophy and certificates for high score in each state and country. Added this year is a trophy for the highest scoring Michigan multi-operator score.

ENTRIES:

A summary sheet is requested showing the scoring and other pertinent information, name and address in block letters, and a signed declaration that all rules and regulations have been observed. Michigan stations include club name for combined club score. Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated. Members of the Michigan Week QSO Party Committee are not eligible for individual awards. Decisions of the Contest Committee are final. Results will be final on July 31st and will be mailed to all entries. Mailing deadline is June 30th to: Mark Shaw K8ED, 3810 Woodman, Troy MI 48084.

MICHIGAN ACHIEVEMENT AWARD

This will be the 24th year that hams have had their own program to publicize Michigan and its products. Just as for past years, the Governor will award Achievement Certificates to hams who take part in telling the world of Michigan’s unlimited resources, opportunities, and advantages. Certificates are awarded on the following basis:

1. A Michigan ham submits log information and names and addresses (if possible) of 15 or more contacts made to out-of-state or DX hams with information regarding Michigan.

2. An out-of-state ham, including Canada, submits log information and names and addresses (if possible) of at least five Michigan hams who relate facts to him about Michigan.

3. A foreign ham, excluding any resident of Canada, submits the call letters and name and address plus log information for at least one Michigan ham who has told him about Michigan.

Only QSOs made during Michigan Week, May 15-22, will be considered valid. All applications for certificates must be postmarked by July 1st and mailed to Governor William Milliken, Lansing MI 48902.

MT. SAINT HELENS QSO PARTY

Starts: 0001 GMT, May 22
Ends: 2359 GMT, May 23

The Clark County Amateur Radio Club, W7AIA, is pleased to announce the second annual QSO party marking the second anniversary of the cataclysmic explosion of nearby Mt. Saint Helens. This disastrous volcanic eruption took the life of Reid Blackburn K47AMW, who was an active member of their club. Reid was monitoring a USGS observation station near the base of the mountain at the time of the eruption.

Any amateur station making one contact with W7AIA during the two days of the QSO party will be eligible to apply for the Mt. Saint Helens Award, a color certificate featuring a photograph of the awesome eruption of the volcano on May 18, 1980.

Look for W7AIA on the following frequencies (plus or minus QRM): SB—3895, 7230, 14280, 21360, 28505; CW—3705, 7105, 21105, 28105; VHF—various Vancouver and Portland area repeaters.

To apply for the award, send log information or QSL card and $2.00 (or 8 IRCs) to: Award Manager, W7AIA, PO Box 4124, Vancouver WA 98668. All proceeds from the award will go to the Reid Blackburn Scholarship Fund which has been established by the Columbian, a Vancouver newspaper. So far, 647 amateurs have applied for the award, which has provided for a $1,000 contribution to the scholarship fund.
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ICOM'S IC-720A TRANSCEIVER

Although the four buildings at 73 Magazine are each more than a mile apart, no telephone is needed when new equipment arrives for review. The 73 hams start forming lines the minute word gets around that equipment has arrived. Responding to that call, I was informed that the senior staff was so pleased with my previous reviews of dummy loads, power supplies, and BNC-to-garden-hose adaptors that they were going to give me a shot at a real radio.

Real radio is an understatement when it comes to Icom's newest all-mode, general-coverage transceiver, the 720A. This state-of-the-art solid-state rig should fill the bill for just about all devotees of the various modes of amateur communications available to us today on the HF bands. The first two days that the rig was available to me, it was put to use at W2NDS/1 where it was compared to several other transceivers in the station at the same time. In typical Icom fashion, the 720A's receiver outperformed all others — no mean feat when you consider that the Icom has a general-coverage receiver covering 100 kHz to 30 MHz.

The 720A arrived at my station the evening that the ARRL 10-meter contest started and I thought that I would attempt to put the rig through its paces during part of the contest. As it came from the box, 15 minutes prior to the start of the contest, those familiar words "some assembly required" echoed in my mind. The separate power supply (IC-PS15) attached to the 720A with no problem. Two of the phono jacks, on the rear panel, serve dual functions. As it comes from the box, these jacks are set up to provide an input for a low-band antenna and transverter/scope output. If you wish to use a linear amplifier, you must change the position of an internal connector, converting the function of these jacks to provide ALC and relay outputs. The conversion of these jacks required a few minutes study of the manual and less time in effecting the change.

With a few minutes left before the start of the contest, I thought I would take a look at the general-coverage frequencies. At that time of night, reception was good on the lower bands. I was surprised at the fidelity of the AM reception with only the standard filter in place. My first encounter was with a Colombian station on 5 MHz playing traditional music. Having lived in Colombia for several years, it brought back memories and made me an instant SWL nut. Other treats in the first tour around the bands were an Austrian Christmas music special, a Spanish-language discussion of solar flux, a British Broadcasting Company London Times news program, a Portuguese discussion of the economic situation in the United States, and, of course, the old standby, Radio Moscow, with an editorial on the United States' deployment of the neutron bomb in Europe. No tour would have been complete without a stop on the low end of 8 MHz where the CW maritime traffic, with its near-perfect code, is a great place to increase or maintain your code speed.

An interesting feature of the 720A was noted during this tour. While listening to one of the AM broadcasts, I noted that our old friend, the Russian woodpecker, was as prominent here as he is on the ham bands. Out of curiosity, I turned on the noise blanker and watched the interfering signal fall from 20 dB over S9 to S3. I still knew the offending signal was there, but it was much less bothersome.

Looking up at the clock, I found that the contest was already four hours old (later diagnosed as SWLer's disease). I decided to get a good night's rest and tackle the pileups in the morning. At first light I was on the bands. My first contact was W2NSD/1, S-9 New Hampshire. Not bad, but I decided to use my limited time to hunt for countries. In eight hours, I racked up 47 countries and got a feel for how the 720A performed.

**Operator's Manual**

The first thing that impresses the new owner of a 720A is the clarity of the operator's manual. It begins with a concise walk-through of all controls and external connections (more than 50). It next provides detailed explanations of the major controls. A description of the circuit operation follows, remarkably understandable for a rig of this complexity. The section on maintenance and adjustments, along with photographs, covers most problems that might be encountered. While the schematic is small, a large-scale parts layout, in four colors, will prove invaluable for repairs.

My concern for the understandability of the owner's manual is sparked by the fact that I am a rural ham, living more than seventy miles from the nearest ham store and doing most repairs at home. With the 720A's manual, I would have no qualms about undertaking most repairs in the shack.

**ICOM Pioneers Again**

The radio itself is small, measuring 4" x 9" x 12" and engineered to maximize the use of space. It appears to be most functional when placed at eye level. With the 720A, Icom introduces a pioneering method of function and mode selection, similar to the system used by many pocket calculators. Push-buttons replace many of the knobs used by old-fashioned rigs. Several of the controls are dual-function. While first impressions yield the feeling that you will never understand all of the controls, a few hours of use will convince you of the functionality of this method as you quickly jump from band to band, change modes, and select filters with this new system.

The receiver, unquestionably the hottest I have ever used, utilizes low-noise FETs in the rf amplifier to aid sensitivity and double conversion, with high side injection and steep-skirted filters for maximum selectivity. The receiver covers 0.1 to 30 MHz in 1-MHz steps. A two-position button allows you to step through the covered frequencies, stopping at ham bands only or at any 1-MHz segment. The operating frequency is determined by a microprocessor-controlled PLL. One of the most interesting features of this radio is a low-pass filter unit which employs a motor-driven rotary relay-switching circuit that selects various filter components for each band. During receive, the low-pass unit offers a high degree of adjacent channel rejection; during transmit, it removes harmonic components. The relay also delivers different control voltages to a plug on the rear panel for each band, thus allowing automatic band change for a linear amplifier and automatic antenna selection with external relays.

**Operating Controls**

The number of controls offered by the 720A provides maximum flexibility but makes description of the actual ease of operation difficult. In order that my written description does justice to the user-friendly 720A, the controls will be divided into four groups:

- **Frequency selection.** This group includes band-stepping switches, the switch to select one of the two vfo's available, main tuning knob, tuning-rate select buttons, and RIT button.
- **Mode Selection.** These include CW, SSB, AM, FM, RTTY, and a reverse-sideband select button.
Ancillary controls. These include the transmit/receive switch, af and rf gain controls, microphone and power output controls, noise blanker, pass-band tuning, and attenuator.

Display. These include operating frequency, mode, sideband (u or l) and LEDs to indicate that certain functions or filters have been selected.

**Operation**

SSB and CW operation is straightforward. The frequency selection is made easy by the use of three tuning rates. Major changes can be made with the tuning speed button at a 1-KHz rate. The two other rates are 100 Hz and 10 Hz. The tuning knob is equipped with an adjustable brake that controls the friction on the knob. As it came from the factory, mine was too loose and had to be tightened. The rig is equipped with two vfo's and operation may be on either one or both (split), removing the need for an external vfo.

In this time of crowded band conditions, three features of the 720A make it an ideal operator's rig. The attenuator not only adds a 10-dB pad to the receiver front end, but also removes the rf amplifier. This reduces interfering signals and yields more stable reception. Pass-band tuning (PBT) accomplishes with one control what it takes other rigs two or three to do. PBT narrows the bandwidth (selectivity) of the frequencies that will pass through the crystal filter. This effectively reduces interference from nearby signals. The noise blanker, as I mentioned, is effective in reducing the interference from the woodpecker as well as the usual pulse-type trash such as ignition noise. Living out in the country where automobile traffic is about as common as QSL cards from BY-land, I parked my Subaru under a wire antenna and let it idle. If you are not familiar with this car, it is the noisiest (rf-wise) that you will run into. Letting it idle at 2000 rpm, I returned to the receiver and found the blanker to be effective.

The transmitter lived up to my expectations on SSB. With the obligatory "this is with the processor on" routine, I found that the processor had an above average or acceptable rating from the listeners. The VOX worked with no adjustment and it was not necessary to go under the top access lid.

Speaking of "under the lid," in addition to the fifty some odd controls and jacks that the 720A has on the outside, a convenient top access lid houses additional controls. CW sidetone, meter-function select, and VOX control, that require seldom adjustment, are housed under this top lid.

CW operation is just as easy as SSB. The rig did not have the optional 500-Hz filter, but the 1.1-kHz filter provided proved to be adequate for casual use. Upon selecting the CW mode, an LED indicates the filter width and the PBT functions as it does on SSB, allowing the PB width to be narrowed by 800 Hz. Semi-break-in is possible using the VOX switch.

**Other Modes**

The 720A is equipped for FSK operation and narrow shift tones are available to be sent to a terminal unit. AM operation had to be tried since there is an abundance of 75-meter phone stations here in the Northeast. Reports of "broadcast quality" were heard more than once, giving me the interest to look into this mode further. During operation in this mode, the meter measures carrier power and the operator is cautioned that if he expects to operate for more than ten minutes, power should be reduced to the 70% level.

The finals are protected by a circuit that reduces power in an inverse ratio to swr. In addition, there is a cooling fan that is activated during the transmit mode by a thermal switch. The operator's manual cautions you that should the fan go to high speed, you should stop operating at once. I must admit that prior to operating this radio I was a "tube final" type and somewhat nervous about solid-state finals. As I spend most of my operating time on wire antennas, using a tuner, I approached my first 720A band change with trepidation. Relieved by the rapid response of the protection circuit, I adopted a more cavalier attitude with later changes. Since I spend a good part of my time chasing HK3DMO around the bands trying to link up for our regular sked, I can now appreciate the benefits of quick band changes offered by the 720A's solid-state finals.

In summary, the Icom 720A, in the hands of this operator, has proven to be a versatile and practical ham rig. In the course of two months' operation, no major problems were encountered. While not inexpensive, the unit's distinctive features gave me hours of enjoyment and broadened my perspective. The proof of the pudding is in the eating. Should you doubt my opinions, go to your nearest dealer and try the rig yourself. I guess the strongest case for ownership of the 720A is to ask if anyone wants to buy my old rig.

The lcom IC-720A and matching PS-15 power supply have a list price of $1498. For more information, contact Icom America, 2112 116th Ave. NE, Bellevue WA 98004.

Joe Hayes AE1K
Stoddard NH

**KB1T CONTEST CALENDAR**

There was a time, not too many years ago, when calendars were plain and ordinary. Functional, yes, but not very exciting. All that's changed. The walls of our homes and offices are now covered with calendars for cat haters and cat lovers, calendars from the Sierra Club and the oil companies, Right to Life and Playboy Philosophy calendars, even calendars devoted to pictures of polar bears (no kidding!). At long last, radio amateurs can join the calendar craze with one of their very own: the Contest Calendar from KB1T Radio Specialties.

The Contest Calendar is both functional and beautiful. On the functional side, it's a large, 18 x 18-inch, single sheet calendar, showing all 12 months at once. The center of the calendar features a great circle map of the Earth, centered on the USA, a handy aid to pointing your beam. Arrayed around the map are the individual calendars for the 12 months of the year. The weekends of major contests are highlighted in red with an abbreviated name of the contest and the mode (CW, phone). On the 1982 version, my count showed 26 contest weekends listed. The arrangement of the calendar on one sheet and the highlighting of the contest weekends make it easy to plan for upcoming oper-
The CES 635 Microdialer. (Photo by KA1LR)

**THE CES MICRODIALER**

For those who have never encountered an autodialing microphone before, it is a device designed to store several phone numbers and feed them into an FM transceiver at a predetermined speed at the press of a button. This is the basic function it must perform—but manufacturers and users alike soon discover that an autodialer must have several other features to perform adequately in the real world.

Like the Heathkit μMatic memory keyer (to be reviewed in June), the CES Microdialer is a second generation microprocessor-controlled device designed to make life a little easier for the amateur radio operator. Also like the Heathkit, the Microdialer has solved many of the problems experienced with the generation of devices that preceded it.

One of the most striking improvements incorporated into the Microdialer is found in its layout. It makes sense to have the buttons and the mike element on the same side of the microphone. Several microphones have the touchtone™ buttons on one side and the mike element on the other. These must be hung up carefully, to avoid pressing one of the buttons by accident. This is a small point, however, compared to some of the other problems the Microdialer solves.

Some owners of earlier autodialing microphones were quite chagrined to discover that their mikes occasionally suffered a glitch which locked their rig in the transmit mode. Hard luck if it happened when the rig was unattended! It was clearly injurious to the microphone, transceiver, and the blood pressure levels of others trying to use the frequency. CES cured the disease by removing the regulator chip (a source of heat) from the mike, putting in the radio instead, and tying the microprocessor's reset pin to the hangup hook. As long as the mike hanger on the vehicle's dashboard is grounded (and you use it!), there is no chance of an accidental transmission. Grounding the reset pin also lowers the mike's current drain from 120 mA off-hook to 60 mA on-hook. The dashboard in my car is plastic, so I simply ran a wire from a bolt in the firewall to one of the screws on the mike hanger. PL™ users should note that there is an extra conductor in the mike cable which can be used to enable a PL decoder when the mike is hung up and disable it when it is removed from its hanger. Nice touch!

**Programmed to Please**

The Microdialer really shines in the ease-of-use department. For example, when you dial a number in the automatic mode, the mike keys up the rig for 3 seconds before sending a tone—sort of a "look out equipment, here come some tones!" This feature alone allows me to use the Microdialer on several repeaters that won't accept my other dialer, which keys the PTT line at the same instant it sends the first tone.

Another welcome feature is the programmable pause. This allows you to program the autopatch access code (up to three digits) and a phone number into the same memory. The mike dialed the access code, switches back to receive for two or three seconds so you can make sure that the dial tone is there, and then keys the transmitter and dials the number. If your repeater has some perverse speed requirements, you can program

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The preface to *Packet Radio*, published by Tab Books, Inc., begins by asserting, "This book was written to provide an easy entry into the utterly fascinating world of packet radio." I'm not sure that any single volume could give an easy introduction to this highly complex subject, but this book comes pretty close. Actually, it is must reading for anyone even mildly interested in RTTY, networking, or computer communications in general.

There is a wealth of practical information here that authors Robert Rouleau and Ian Hodgson give merely as a background to the main subject. They offer, for example, a fairly lively review of the RS-232C interface, with lots of discussion of the vagaries of interfacing nonstandard equipment. For one was thrilled to discover that there is a pair of inexpensive chips available which convert TTL-level signals to RS-232C and back again!

The chapter on resource sharing via multiplexing should be read by everyone. It's only a basic introduction to the subject, but it is fascinating to someone who has never considered the subject before (which is to say, most hams!).

The chapters covering packet itself are solid and meaty—I won't reveal the chapter titles because they might scare off the faint-hearted. They sound more formidable than they really are.

The material on high-speed data transmission via HF radio is must reading for any ham who dreams of 9600-baud QSOs. The problems of bandwidth, SIN ratio, path loss multipath, Rayleigh fading, propagation delay distortions, and woefully unsuitable transmitters and receivers are discussed in a matter-of-fact manner. If you dream of a quick and dirty improvement to our present RTTY system, a read through this section will be a sobering experience.

The bottom line, though, is that packet techniques are being used, today, and with reasonable success. To find out more, buy this book! For information, contact: *Tab Books, Inc.*, Blue Ridge Summit PA 17714. Reader Service number 496.

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**Jeff DeTray WB8BTH**

73 Magazine Staff

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**PACKET RADIO BOOK**

Paul Grupp KA1LR/4

Casselberry FL
the mike to send the access code at one speed and the phone number itself at another. And to make all this happen, all you have to do is push "$" and one of the numeric keys. The looks of envy you'll get from other hams when you set all this in motion are worth every penny you pay for the mike! If you are motivated by more practical considerations, consider that you can easily call home, the police, or whatever with the Microdialer while your vehicle is in motion, without taking your eyes off the road for a second.

Entering numbers into memory is no easier or harder than with other autodialers we have tried. Memories 1 through 5 hold up to eleven digits, and 6 through 0 hold up to seven. Dialing speeds from one to eight digits per second can be programmed, and I am happy to report that there are several touchtone decoders in common use which can cope with the highest speed.

One repeater I use is plagued by a childish individual who frequently transmits tones while a user is trying to dial a number. With the Microdialer, I could bring up the patch and dial the number before our "friend" could find his or her mike.

Installing the Microdialer

If the Microdialer has any weakness, it lies in the simple fact that it involves some installation. Let's face it: There are a lot of guys who are too lazy to use a soldering iron. If a microphone doesn't come with the right plug for their rig attached, they aren't interested. To them I say, turn the page and read another article. Those of you who aren't afraid of a little work, read on!

The first thing you have to deal with is the regulator. CES solved a major problem by removing it from the mike case, but they created a minor one while doing it. You have to find a spot inside the rig for the tiny board which holds a 7805 regulator and a couple of filter caps. You also have to supply it with an unswitched source of 12 V dc. If you are using a rig over a year old, this doesn't present any problem, as there is usually lots of room for additions. I chose to use the Microdialer with my Kenwood TR-7730, one of the smallest rigs available. Getting the 12 V dc was easy—finding a spot big enough for the regulator board was not. There is a nice opening at the rear of the rig that Kenwood suggests is good for a CTCSS encoder. It may be OK for the encoder, but the rf from the adjacent final amplifier added an unhealthy dose of hum to our audio when the regulator board was put there. I finally ended up removing the internal speaker, which I never used anyway. This yielded plenty of room for the microphone's regulator and a Communications Specialists programmable CTCSS encoder/decoder board. I stored the speaker and its mounting hardware in a safe place, in case I wanted to restore it to its original condition. If there's a will, there's a way, and if it'll fit in a 7730, it'll fit anywhere!

In Use

I found the Microdialer an extremely helpful addition to my mobile VHF installation. Compared to the microphone supplied with the TR-7730, the microphone element itself has a wider frequency response, with a noticeable improvement in lower midrange response. On the negative side of the ledger, it also has considerably less output, requiring the mike gain control inside the TR-7730 to be set much higher than previously required. This means that I cannot easily switch back and forth between the CES and Kenwood microphones.

I also found that the transmitter goes into the transmit mode for a brief moment when my sample is hung up on the grounded hanger. When I say brief, I really mean brief; it has never been long enough to bring up a repeater. I did not try the microphone with other radios, so I cannot say if this is only a problem with my particular installation or could be expected in others as well. In any case, it is not a serious problem, but you should be aware that it is there.

I am particularly fond of the microphone's shape and size. Many microphones must be held carefully, or your hand will cover the element, yielding muffled audio. You have to really work at it to make this happen with the Microdialer. It may be of little consequence to southerners, but dwellers in the land of snow and ice will be happy to hear that the microphone cable is made of a material which stays flexible at a far lower temperature than other cables we have encountered.

Another point worth noting is that when used in the manual mode, the Microdialer behaves like a normal, run-of-the-mill touchtone pad. Certain other autodialers become rather churlish in the manual mode, beeping irritably and locking up for a second or two if you try to make it do something it thinks it shouldn't be doing. Rest assured that the Microdialer is too well-mannered to engage in such loutish behavior!

Conclusion

If you use an autopatch a lot, or frequently access your repeater's control functions, an autodialing microphone can uncomplicate your life. The CES Microdialer incorporates some much-needed improvements over previous units and is priced at $59.95 for a 500-Q model. The only feature that is missed is the ability to permanently store a series of numbers on a ROM chip. Maybe next year...
covers frequencies from 160 to 10 meters and can handle random wire or balanced feed antennas. A built-in 4:1 balun helps tame the wild impedances that are sometimes found when using tuned feeders.

When this kit arrived, my first thought was that there couldn’t be much involved in building an antenna tuner, since at the minimum only two or three components are required. Well, when Heath tells you that you build this tuner, they mean it. It’s up to you to assemble the two variable capacitors out of metal plates, ceramic insulators, and threaded rods. The roller inductor also needs assembly, although thankfully the coil itself is pre wound.

Heath says that this kit is a three-year project. That isn’t far from the truth, although I spent considerably more time because of a modification I wanted to make (more on that later).

Although the instructions put the capacitor and coil assembly about halfway through the project, I’d suggest putting them together at the beginning so that all the little parts they use are out of your way. Assembly of the capacitors is for the most part very easy and great therapy after a hard day at work. Just keep slipping those little metal plates onto the assembly. It’s a lot like threading popcorn onto a thread at Christmastime.

The rf sensing assembly for the wattmeter and the antenna switching circuitry are preassembled in a box which mounts on the back of the tuner chassis. Providing the critical wattmeter circuits already assembled and calibrated was a great move on the part of Heath. Not only did it speed up construction, but it’s nice to be able to rely on their calibration (my tests show the SA-2060’s meter to read within 5% of other meters used at W2NSD/I). The wattmeter actually uses two meters, one to show forward power on scales of 0-200 or 0-2000 Watts, and the second to read either reflected power (on scales of 0-50 or 0-500 Watts) or swr.

I found the reflected power mode to be easier to use than the swr mode when adjusting the tuner. All that’s really necessary is to adjust for 0 Watts reflected power, so there’s no need to know actual swr. Having dual meters is very convenient, since some tuning combinations can produce misleading reflected power or swr readings. By keeping an eye on both forward and reflected power, it’s easy to spot these conditions and to tune for optimum settings.

The SA-2060 antenna switch provides three positions. One route the signal through the wattmeter but bypasses the tuner, while the other two select coax-fed antennas which go through both the meter and the tuner circuitry. There’s no way, however, to switch the tuner in or out of line on a specific antenna—If you want to run the antenna through the tuner, you must do so all the time. This isn’t really such a bad thing, since the tuner does act as a low-pass filter and helps prevent TVI, but it is inconvenient to have to adjust the tuner before using that antenna even if the swr in the part of the band being used is low enough such that the tuner isn’t really needed.

There is a serious problem with this antenna-switching scheme if you want to use both coaxial and wire-fed antennas. The random wirebalanced feed terminals are connected to the tuner before the antenna switch, with the result that any antenna hooked up to these terminals is always in line and will be parallelled with a coax antenna selected by the antenna switch. This renders the switching system almost useless, since before switching to a coax antenna you have to go behind the tuner to disconnect the wire one. Fortunately, the fix for this problem is rather simple if you’re willing to drill a hole in the chassis and change around some wiring (see box and photo).

With the antenna switching changed as described, the tuner is a joy to use. It handles a full kilowatt with ease (although the tuner should be adjusted before running at the power level—no tuner is designed to handle the voltages that may appear when feeding a kW into 15:1 swr!), and it survived the toughest test I can think of. While driving a vee beam with full power on 80 meters, the open feeder arced through a supporting board. The feeder was burned in two and the board caught fire, but the tuner survived this rather severe mismatch with no more than a brief arc between capacitor plates. Never let it be said that we baby equipment at W2NSD/I!

In more normal use at my home station, the SA-2060 has easily matched every so-called radiator I’ve connected to it, including a very badly mismatched vertical, a more-than-random random wire, and a coax-fed collinear dipole that
presented a proper match at no
given frequency. This tuner
replaced another inexpensive
commercial one, and I've found
the change to be most refresh-
ing. I no longer have problems
with being able to almost, but
not quite, get a perfect match,
and the built-in metering and
switching (as modified) have
eliminated the need for two
other accessories, giving me a
little more room on the operat-
ing table.

If you're in the market for an
antenna tuner that includes
some of the convenience fea-
tures we've come to expect from
the high-priced supertuners but
still carries a reasonable price
tag, the Heathkit SA-2060 may
be your answer. The only real
flaw with the unit, the antenna
switching, won't bother those
who don't use wire feeders, and
those who do can easily cure
the problem. You'll have to invest
some of your time in building
this tuner, but the results (and
savings) can be gratifying.

For more information, con-
tact the Heath Company, Ben-
ton Harbor MI 49022. Reader
Service number 492.

John Ackermann AG9V/1
73 Magazine Staff

"Sure," said I. "Hey, what's going on here?" I inquired, asking the
obvious, as usual.

The guy in the windbreaker paused for a second, looked me over
very closely, and said: "It's okay. Go on ahead. Your clothes fit into
the period, anyway." So, with that I slipped between two wooden
barriers and continued my eastward march.

I'm about halfway along the block when a taxi comes tearing
down the street with a 1959 Chevy sedan in hot pursuit. The cab
smashes into a fire hydrant directly across from me and two rough
types jump out of the car and put the collar on the taxi driver. It was,
of course, a part of a movie—a TV movie, as it turned out. And the
Panavision camera caught me as a horrified onlooker. I later saw the
movie on ABC, but I guess my scene landed on the editing room
floor—I wasn't in the completed film.

So, that was the day broadcast television and ham radio made
almost simultaneous appearances in my life. Listen, it may not be the
greatest story ever told, but at least it gave me a lead to this month's
column.

On a wildly different note, I know someone who is writing a high-
school electronics textbook. As a plug for ham radio to a potentially
ripe audience, this chap thought he would include some information
about the OSCAR satellites in his book. My friend wrote to the ARRL
asking for a couple of black and white photographs so that his read-
ers could get an idea of what an amateur-built satellite looks like.

The upshot of his efforts, sad to say, was a letter from HQ saying
that the League's OSCAR photos are for use only in their own publi-
cations and "are not for dissemination to the general public." Won-
derful. So the League doesn't want the general public to know what
the OSCAR satellites look like. It's a great boost to our hobby when
only hams can find out about OSCAR.

All in all, another tidbit of information to remember the next time a
League official lets loose some of that babble about your dues going
toward more than just a magazine subscription. Phooey!

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**FUN!**

**HOBBY VIDEO**

Offhand, I can think of only one occasion in my life when amateur
radio and commercial video met. Since I need a justification for writ-
ing a column about hobby video in a ham magazine, let me tell you
about it.

It happened on the day I took my Extra test (the time I passed). I
had just left the Federal Building on New York's Varick Street with
my interim permit clutched firmly in my fist. As I was making my way
over to Washington Square to catch the subway back home, I sud-
denly noticed in front of me a bunch of klieg lights, cameras, and a
typical Greenwich Village street with cars and street signs of an
early-1960s vintage.

"Could you hold it a minute, fella?" a man in a light-colored wind-
breaker asked me.

---

**ELEMENT 1—CROSSWORD PUZZLE**

(Illustration 1)

**Across**

1) Curves formed by the inter-
section of a cone with a
plane parallel to its side.
6) Satellite TV preamp (abbr.)
8) TV bird
9) A TV distribution medium
10) Not color TV (abbr.)

11) Relative (abbr.)
12) Money: kilo
13) Satellite home video (abbr.)
15) Shorting buzz
17) Satellite TV "belt"
18) Our continent (abbr.)
21) User's end of satellite sys-
tem (2 words)

**Down**

1) Board type (abbr.)
2) Another TV bird (2 words)
3) LNA transistor (abbr.)
4) Antenna mount:
5) Man-made moons
6) The human work needed to
install a home satellite sys-
tem
7) Satellite motions

14) Hobby video is entering a
new
15) Rent a VCR
16) Composer you may hear on
"Bravo"
17) Broadcaster's slang for a
compact tape package
19) Antenna tuner (abbr.)
20) Yes opposite

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**ELEMENT 2—MULTIPLE CHOICE**

1) Where did Howdy Doody live?

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I) The first TV movie ever made starred Ronald Reagan.

II) Home Box Office is owned and operated by the Washington Post and Newsweek.

III) Of the estimated 3.9 million people who viewed the 1947 World Series on television, 3.5 million were situated in bars.

IV) The "Overmyer Network" was a 1960s attempt at forming a fourth TV network.

V) The first experimental TV station was W2XBS.

VI) There is no "Channel One" because the FCC forgot to allocate it.

VII) The CBS system for color television would have required a mechanical disk rotating on the front of your TV picture tube.

VIII) Wayne Green once worked as a TV cameraman at WPIX-TV, Channel 11, in New York.

IX) The first patent for a device that could send pictures by wire was granted to a German in 1919.

X) An episode of Hazel dealt with the problem of TVI. On this show, Mr. Baxter's reception of a golf telecast was ruined by a local ham.

---

**ELEMENT 3—TRUE-FALSE**

1) The first TV movie ever made starred Ronald Reagan.  ____ True    ____ False

2) Home Box Office is owned and operated by the Washington Post and Newsweek.  ____ True    ____ False

3) Of the estimated 3.9 million people who viewed the 1947 World Series on television, 3.5 million were situated in bars.  ____ True    ____ False

4) The "Overmyer Network" was a 1960s attempt at forming a fourth TV network.  ____ True    ____ False

5) The first experimental TV station was W2XBS.  ____ True    ____ False

6) There's no "Channel One" because the FCC forgot to allocate it.  ____ True    ____ False

7) The CBS system for color television would have required a mechanical disk rotating on the front of your TV picture tube.  ____ True    ____ False

8) Wayne Green once worked as a TV cameraman at WPIX-TV, Channel 11, in New York.  ____ True    ____ False

9) The first patent for a device that could send pictures by wire was granted to a German in 1919.  ____ True    ____ False

10) An episode of Hazel dealt with the problem of TVI. On this show, Mr. Baxter's reception of a golf telecast was ruined by a local ham.  ____ True    ____ False

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**ELEMENT 4—HAM ACROSSIC**

(Illustration 2)

Guess the words defined and write them over the numbered dashes. Next, place each letter in the correct square in the puzzle. The black squares show word endings. The completed puzzle will form a statement relating to this month's topic.

A) VCR format........................................... 17 34 4 32

B) Signal interfaces................................. 6 37 15 26 23

C) Goes with picture.................................. 25 44 18 9 11

D) TVRO antenna angle............................... 46 8 3 33

E) Videotape "outs"................................. 36 31 7 29

F) Satellite's job...................................... 40 5 35 42 41 21 2 2

G) What cable companies like to bring against pirates............................... 43 45 20 39 13

H) International radio-TV body.................. 30 19 2

I) Opera house seen on "Bravo"................. 1 27 10

J) TVRO setup can cost this...................... 28 12 38 14

K) Iraq prefix.......................................... 24 16

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**THE ANSWERS**

**Element 1:**
See Illustration 1A.

**Element 2:**
1—2 There's no Doody in Newington.
2—3 But his agent is.
3—4 Remember? They had those little HTs that never seemed
to be limited in range or vulnerable to jammers.

4—3 Roy Neal works for NBC, Murray Greshner is the cop on The Odd Couple and I don't know who the heck Hector Fuentes is.

5—4 Satcom III (not to be confused with its replacement, Satcom IIIA) was lost shortly after launch. Nobody knows for sure where Satcom III is, but I understand they're watching some great movies up on Pluto.

**Element 3:**
1—True The Killers, in 1963. It was his last acting job—on screen, anyway.
2—False Time-Life.
3—True And make that a double, please.
4—True It didn't work.
5—True Operated by NBC in New York.
6—False There is a Channel One, but we call it "6 meters."
7—True The FCC thought RCA's all-electronic system was somewhat better.
8—True Smile.
9—False Paul Nipkow was granted a German patent for such an instrument in 1884!
10—True And I've got a recording of the program to prove it!

**Element 4:**
See Illustration 2A.

**SCORING**

**Element 1:**
Twenty-five points for the completed puzzle, or ½ point for each question correctly answered.

**Element 2:**
Five points for each correct answer.

**Element 3:**
Two and one-half points for each correct answer.

**Element 4:**
Twenty-five points for the completed puzzle, or one point for each correct answer.

So, do you know the difference between a plate and a dish?

1-20 points—Sees only snow
21-40 points—Dish pointed at Earth
41-60 points—Fuzzy picture
61-80 points—Sharp black and white picture
81-100 + points—Closed-circuit image

**READER'S CORNER**

Last January's puzzle concerning the five stations and their DX schedules provoked a sizable flurry of mail — some of it indignant. As a few of you discovered, there were actually three solutions to this puzzle. Here they are:

Gail Graham W5MLY worked out a beautiful Pascal program to solve this problem on a North Star Horizon computer. I wish I could print the run here, but it's much too long to fit within this column's limited space. I just wish to thank Gail on a magnificently executed job. And thanks, too, to everybody who wrote in.

**Winners:**

**Found 3 solutions:** Jerry Wetzel W3DMB, Gail A. Graham W5MLY.
**Found 2 solutions:** Mark E. Zaleski KABBPY.


**Don't find a solution, but either tried or made a puzzle comment:**
N2AMS, K4ALI, W4DAH, W4ODS, W9ATJ, KA9BAI, KA9KAW, KB9RR, KL7RA.

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**FCC**

Reprinted from the Federal Register

**Expansion of the Telephony Segments of the High Frequency Amateur Radio Service Bands**

**AGENCY:** Federal Communications Commission.

**ACTION:** Notice of Inquiry and Proposed Rule.

**SUMMARY:** The Commission proposes to make additional segments of the 14 MHz amateur band available for telephony operation. The Commission is also inquiring about making additional segments available for telephony operation in the other high frequency (HF) amateur bands (those amateur bands between 3 and 30 MHz): Congestion on the frequencies currently authorized for telephony use is causing the employment of this mode to become increasingly difficult. The proposed rules revision would help alleviate this situation in the 14 MHz band. The inquiry looks towards finding a suitable set of frequencies for telephony expansion in the other HF amateur bands.

**DATES:** File comments on or before July 1, 1982, and reply comments on or before August 2, 1982.

**ADDRESS:** Federal Communications Commission, Washington, DC 20554.

**FOR FURTHER INFORMATION CONTACT:** Steve Lett, Private Radio Bureau, [202] 632-7507.

**SUPPLEMENTARY INFORMATION:**


Released: February 24, 1982.

**Introduction**

1. Notice of Inquiry and Proposed Rule Making in the above-entitled matter is hereby given.

2. The Commission has before it at this time seven petitions for rule making which request that the Amateur Radio Service Rules (Part 97) be amended to provide for the use of telephony operation (emission types A3 and F3) on additional portions of the amateur high frequency (HF) bands—the bands between 3 and 30 MHz. Six of the petitions propose some particular portion of certain bands for additional telephony authorization. Four of the petitions propose additional telephony privileges be divided among or limited to certain operator classes. The petitions are described in the following paragraphs.

3. RM-3705, submitted by Philip Calasso and received by the Commission on 18, 1980, requests that the frequencies 3750-3775 kHz, 7050-7100 kHz, 14530-14535 kHz, 21200-21250 kHz and 28000-28005 kHz be added to those authorized for telephony in the United States. It further requests that these additional telephony privileges only be granted to Amateur Extra Class operators and that power input during such operation be limited to 250 watts. The petition claims that expansion of frequencies for telephony operation is warranted due to congestion on the currently authorized telephony subbands and under-utilization by U.S. stations of the frequencies proposed for expansion. Lack of use by U.S. amateurs is attributed to incompatibility between telegraphy operation currently authorized for U.S. stations and telephony operation in common use by U.S. stations.
... growing congestion in telephone subbands as warranting only: 14175–14225 kHz. Amateur Extra segment of that band is cited as interference on the existing telephone;” (Block operation be authorized a radio telephone operation privilege requests that “Extra Class Amateur Huntley and received by the Commission on August 1, 1980, requests that the frequencies 3750–3775 kHz, 7000–7150 kHz, 14140–14200 kHz, 21200–21250 kHz and 28400–28500 kHz be authorized for telephone use by U.S. amateurs. This petition again cites overcrowding on current telephone subbands and lack of further protection for foreign stations as reasons for fees.

... 5.) 3773 MHz, submitted by Simon and William Bennett and received by the Commission on August 1, 1980, requests that the frequencies 3750–3775 kHz, 7000–7150 kHz, 14140–14200 kHz, 21200–21250 kHz and 28400–28500 kHz be authorized for telephone use by U.S. amateurs. This petition again cites overcrowding on current telephone subbands and lack of further protection for foreign stations as reasons for fees.

... 8.) 3773 MHz, submitted by the Willamette Valley DX Club by Robert Hickey and received by the Commission on October 7, 1980, requests that the frequencies 3750–3775 kHz, 7000–7150 kHz, 14140–14200 kHz, 21200–21250 kHz and 28400–28500 kHz be authorized for telephone use by U.S. amateurs. This petition contends that no longer has the dominant amateur population and there is little reason to think that the expected telephone subbands (telegraphy) privileges into previously reserved frequencies will result in undue harm to foreign communications. The expansion is necessary, it claims, to relieve congestion on currently authorized telephone subbands. 9.) 3773 MHz, submitted by Ronald Kramer and received by the Commission on October 7, 1980, requests that the Commission increase the portion of each amateur frequency band between 1.8 and 2.4 GHz, in addition to the available telephone (telegraphy) communication and correspondingly decrease the portion of each band available for other communications. The petition claims this is necessary since the telephone mode is becoming increasingly popular.

... 10.) 3773 MHz, submitted by Fred Huston and received by the Commission on January 13, 1981, requests that “Extra Class Amateur Radio licensees be granted restricted telegraphy operation privileges between 7.100 and 7.150 MHz” and that “[such operation be authorized a minimum 1.5 kHz of bandwidth.” The petition proposes that an additional operation be on a shared basis with existing service class operations. Relief of congestion and interference on the existing telephone subband of that band is cited as necessity.

... 11.) 3773 MHz, submitted by the American Radio Relay League (ARRL) and received by the Commission on March 9, 1981, requests that the frequencies 14150–14200 kHz be added to the frequencies currently authorized for telephone use, and that operator privileges on the revised telephone portions of the 14 MHz band be changed from the following 14150–14175 kHz, Amateur Extra Class only; 14175–14225 kHz, Amateur Extra and Advanced Class only. The petition cites growing congestion in the present telephone subbands as warranting expansion of the subbands. The operator privilege changes are proposed by the petition in the interest of lessening congestion in the upper portions of these bands. The petition also cites existing telephone operations on other portions of these bands. The lack of interference on the lower portions of these bands is also cited as a reason for leaving them open.

... The term “subband” is popularly used to describe any portion of a frequency band. Terms unauthorized modes of emission or subauthorized operation privileges are defined for the American Radio Relay League. The term “subband” is defined as a portion of the frequency band where subbands occupy a bandwidth roughly half the band may be used for F3 or F4 telegraphy emissions. The limitation of operation in most of the HF bands were instituted in order to prevent such operation from overlapping telegraphy operations as well as to protect international transmissions. Type F1 direct wave emissions (not modulated by telegraphy) are permitted in all portions of the HF bands where telegraphy operation is not permitted. Since this type of operation is more harmful to F3 or F4 operation than that type of operation. The only other modes permitted on the HF bands are Type A and F5 “slow-scan” television operation and emission types A4 and F4 fast wave emissions. A reasonable approximately equivalent to telegraphy operation and consequently are...

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Does anyone have information on the whereabouts of VP6LX (April, 1963) or W2PCJK/K6J (August, 1963)?

George Oster K8EDA
524 6th St.
West Des Moines IA 50265

Can anyone suggest a cure for the rf feedback coming out of my TS-130’s headphones and speaker when I use 10-meter phone?

Marvin Rosen N3BQA
20 W. Madison St.
Baltimore MD 21201
(301)-685-6308

I would like to hear from collectors of antique radios.

Ed Best AK4W
2004 University Dr.
Durham NC 27707
(919)-499-2164

I am looking for any information on changes that can be done to a Heathkit HW-101 to better its performance or add extra features.

Gary Johnson W08SDO
6616 Maplewood Ave.
Sylvania OH 43560
(419)-882-0121

I would like to have a copy of the manual, circuit diagram, and crystal information on the Standard SR-C146 two-meter handheld transceiver.

Dennis Sladen VE1BZJ
Site 16A Box 4, RR#4
Armdale B3L 4J4
Nova Scotia, Canada

I am in need of a schematic, manual, and alignment instructions for an E. H. Scott Laboratories AN/SRR-3 WWII Navy receiver.

Cal Cotner K4JSI
5324 N. 27th St.
Arlington VA 22207

"The Masher," an article in the March, 1982, issue of 73, has a capacitor incorrectly labeled. C3 in Fig. 2 and on the parts list should be a 1-uF capacitor.

Power Gain Systems’ new product announcement in the March, 1982, 73 had an incorrect phone number. Power Gain Systems can be reached at (318): 325-4754. Since publishing the prices for the coaxial dipole, 73 has learned that the antennas now list for $44.95 and $49.95.

Tim Daniel N8RK
73 Magazine Staff

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**HAM HELP**

**CORRECTIONS**

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SOCIAL EVENTS

from page 105

include door prizes every hour, indoor vendors, a flea market, and nets and group meetings. Food and drink will be available. Talk-in on 146.19/79 and 147.86/26. For further information, write Jack R. Thompson KA4RKS, 637 Wolf Road, Covington KY 41015, or call (606)-291-2153.

MUNCIE IN MAY 23

The 3rd annual Muncie Area Amateur Radio Club Hamfest will be held on May 23, 1982, from 8:00 am to 3:00 pm at the Ball State University indoor track building, Muncie IN. Tickets are $2.00 in advance or $3.00 at the door. All activities are under a roof and there will be forums, prizes, refreshments, and parking available. Flea market tables are $4.00 on a first-come basis, and setup will be from 1:00 pm to 1:00 am on Saturday and 6:00 am to 7:45 am on Sunday. Talk-in on 146.13/73, 146.52, and 223.10/24.70. For further information, contact Terry Evans WD9HQH, 522 S. Brother-ton, Muncie IN 47302, or phone (317)-282-0615.

FREETOWN MA MAY 23

The Fall River Amateur Radio Club will hold its flea market on May 23, 1982, from 10:00 am to 4:00 pm at the American Legion Hall, Freetown MA. Admission is $1.00 and flea market spaces are $7.00 in advance or $9.00 at the door (the table price includes 2 admissions). Free coffee will be available. Talk-in on 147.63/03 and .52. For space reservations, a check payable to Fall River Amateur Radio Club to Ann M. Carro KA1DNB, 652 Old Colony Terrace, Tiverton RI 02878.

GEORGETOWN IL MAY 23

The 13th annual Danville Area Hamfest will be held on May 23, 1982, at the fairgrounds in Georgetown IL. The gates will open at 6:00 am. Adult tickets are $2.50 in advance and $3.00 at the gate; children under 14 years of age will be admitted free. There will be a free outdoor flea market area (please bring your own tables, chairs, and power cords). The indoor area will be available at additional cost. Overnight camping, with or without water and electrical hook-ups, is $5.00 per vehicle per night. Activities will include door prize drawings, family entertainment, forums and much more. Refreshments, free coffee, and free parking will be available. Talk-in on 146.22/82 and 146.52. For more information on tickets and/or tables, contact Wendell Lyons K9A9YS, Hamfest Chairman, 903 Polk Street, Danville IL 61832 or phone (217)-431-2124.

PITTSBURGH PA MAY 23

The 28th annual Breeze Shooters Hamfest will be held on May 23, 1982, from noon to 5:00 pm at the White Swan Park, Rt. 60 (Parkway West), near the Greater Pittsburgh International Airport, Pittsburgh PA. Registration is $2.00 or three for $5.00. Activities are a free flea market, prizes, a CW contest, and a family amusement park. Sheltered tables for vendors are available by advance registration only. Talk-in on 146.28/88 or 29.0. For further information, contact Joe Kyler K3SJD, 4430 Everett Road, Pittsburgh PA 15214, or phone (412)-931-2756.

PARAMUS NJ MAY 23

The Bergen Amateur Radio Association will hold a Swap 'n Sell on May 23, 1982, from 8:00 am to 4:00 pm at Bergen Community College, 400 Paramus Road, Paramus NJ. Buyers will be admitted free. There will be tailgating only and spaces are $3.00 (bring your own tables). For more information, contact Jim Greer K2KU, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

FREMONT OH MAY 23

The Ohio Radio Club and the Ottawa County Amateur Radio Club will hold a hamfest on May 23, 1982, at the fairgrounds in Fremont OH. Dealers may set up at 7:00 am and gates will open at 8:00 am. Advance tickets are $2.50 and $3.00 at the door. Talk-in on .31/91 and .52. For table reservations and tickets, send an SASE to John Dickey W8CDR, 545 N. Jackson Street, Fremont OH 43420.

WEST FRIENDSHIP MD MAY 30

The Maryland FM Association will hold its annual hamfest on Sunday, May 30, 1982, from 8:00 am to 4:00 pm at the Howard County Fairgrounds, West Friendship MD (about 30 miles west of Baltimore). Admission is a $3.00 donation, tailgating is $3.00, advance reserved tables are $6.00 each, and tables at the hamfest will be $10.00. Talk-in on 146.16/76 and .52. For more information, write MFAA Hamfest Committee, Post Office, Harmans MD 21077. For table information and reservations, contact John Hallen WG3MN, 5495 Apt. 2, Harpers Farm Road, Columbia MD 21044, or phone (301)-596-3741.

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Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announce-ment: 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. Announce-ments must be received two months prior to the month in which the event takes place.
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6. RTTY LOOP — To keep you abreast of radioteletype developments, Marc Leavey WA3AJR explains the new RTTY equipment, the increasing role of computers in RTTY, and other matters of interest to digital communications fans.

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8340-42 Olive Blvd. • P.O. Box 28271 • St. Louis, MO 63132

See List of Advertisers on page 130
**Introducing**

**TVRO CIRCUIT BOARDS**

**Satellite Receiver Boards—Now in Stock**

**DUAL CONVERSION BOARD** ........................................... $25.00
This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages.

**SIX 47pF CHIP CAPACITORS**
For use with dual conversion board .................................. $6.00

**70 MHz IF BOARD** .................................................. $25.00
This circuit provides about 43dB gain with 50 ohm input and output impedance. It is designed to drive the HOWARD/COLEMAN TVRO Demodulator. The on-board bandpass filter can be tuned for bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid IC’s are used for the gain stages.

**SEVEN .01 pF CHIP CAPACITORS**
For use with the 70 MHz IF board .................................... $7.00

**DEMODULATOR BOARD** ............................................. $40.00
This circuit takes the 70 MHz center frequency satellite TV signals in the 10 to 200 millivolt range, detects them using a phase locked loop, de-emphasizes and filters the result and amplifies the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC.

**SINGLE AUDIO** .................................................... $15.00
This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8 MHz subcarrier and the Miller 9052 coil tunes for recovery of the audio.

**DUAL AUDIO** ....................................................... $25.00
Duplicate of the single audio but also covers the 6.2 range.

**DC CONTROL** ....................................................... $15.00

**SPECIAL SET OF FIVE BOARDS** .................................... $100.00
INCLUDING DUAL AUDIO (2 single audio boards)

---

**1900 to 2500 MHz MICROWAVE DOWNCONVERTER**

**MICROWAVE RECEIVER** This receiver is tunable over a range of 1900 to 2500 MHz approximately, and is intended for amateur use. The local oscillator is voltage controlled, making the I.F. range approximately 54 to 88 MHz for standard TV set channels 2 thru 7.

- **P.C. BOARD with DATA 1 to 5** ................................ $15.00
- **P.C. Board with all parts for assembly** .................. $49.99
- **P.C. Board with all parts for assembly plus 2N6603** .... $69.99

**HMR II DOWNCONVERTER with Power Supply, Antenna (Dish) & all Cables for installation. 180 Day Warranty.**

- **1 to 5** ....................................................... $150.00
- **1 to 11** ..................................................... $140.00
- **12 to 26** ................................................... $110.00
- **27 - up** .................................................... $9.00

**YAGI DOWNCONVERTER with Power Supply, Antenna (Yagi) & all Cables for installation. 90 Day Warranty.**

- **1 to 5** ....................................................... $150.00
- **1 to 11** ..................................................... $140.00
- **12 - up** .................................................... $125.00

**HMR II DOWNCONVERTER as above but Kit. (NO CABLES) With Box.**

- **1 to 5** ....................................................... $125.00
- **1 to 11** ..................................................... $115.00
- **12 - up** .................................................... $100.00

---

**SPECIAL NEW STOCK OF CARBIDE DRILL BITS—YOUR CHOICE $1.99**

```
1.25mm  13/64  36  47  55  63
1.45mm  19    37  48  56  64
3.2mm   20    38  49  57  65
3.3mm   24    39  50  58  67
1/8     26    40  51  59  68
3/16    29    44  52  60  69
5/32    30    45  53  61
7/32    31    46  54  62
```

---

**SATELLITE RECEIVER B O A R D S**

- **NOW IN STOCK**

---

**SP E C I A L  N E W  S T O C K  O F  C A R B I D E  D R I L L  B I T S**

- **YOUR CHOICE $1.99**
Start taking calls in curious places with the revolutionary, new Cordless Escort® Phone.

Special Purchase—The Escort® Cordless Telephone!

We are pleased to announce the Escort Mark III is now available at special pricing. We bought the manufacturer’s entire inventory--and we are passing the savings on to you!

The Escort Mark III was originally designed to retail for $199.95. Now, we suggest a retail price of $169.95 to $189.95. Or, you can move them out at $149.95. In any event, you’ll like the profit margins.

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DEALER PRICE</th>
<th>GROSS PROFIT AT $149.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>1—2 units</td>
<td>69.75 each</td>
<td>53%</td>
</tr>
<tr>
<td>3—5 units</td>
<td>64.50 each</td>
<td>57%</td>
</tr>
<tr>
<td>6—11 units</td>
<td>62.50 each</td>
<td>58%</td>
</tr>
<tr>
<td>12—23 units</td>
<td>60.75 each</td>
<td>59%</td>
</tr>
</tbody>
</table>

On all orders of 12 or more, we pay the freight! This is your opportunity to stock up for the Christmas buying season. These are ideal gift items, that will really move out!

ESCORT MARK III SPECIFICATIONS

VHF DUPLEXERS
This duplexer was made for RF Harris Mobile Phones and Two Way Radios. These duplexers can be used in any mobile phone or two way radio system, along with having the capabilities to be modified for UHF use. The physical dimensions are 3 3/5" Long, 4 2/5" Wide, and 1 1/10" Deep. The approximate weight is 18 oz./1lb. 2 oz.. PRICE $74.99

- Operates as a regular telephone on touch-tone or rotary dial systems
- Range up to 300 feet
- Ni-Cad rechargeable batteries included
- In telephone
- Charger built into base transmitter
- Simple plug-in installation!
- High-performance antenna
- Full duplex, answer and dial out
- Full FCC approval

HOW WE CUT THE CORD.
The new Cordless Phone works on a simple, highly sophisticated principle. A small base station plugs into your regular phone jack, and an electrical wall outlet. The base station then transmits any in- or out-going call to the handheld receiver, anywhere up to 300 feet.

Exactly As Shown

Toll Free Number 800-528-0180 (For orders only)
## FILTERS

Collins Mechanical Filter #526-9724-010 Model F455Z32F
455KHz at 3.2KHz Wide.

**Atmos Crystal Filters**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.52-2.7/8</td>
<td>5.52MHz/2.7KHz wide 8 pole</td>
</tr>
<tr>
<td>5.595-2.7/8/U</td>
<td>5.595MHz/2.7KHz wide 8 pole upper sideband</td>
</tr>
<tr>
<td>5.595-.500/4/CW</td>
<td>5.595MHz/.500KHz wide 4 pole CW</td>
</tr>
<tr>
<td>5.595-2.7/LSB</td>
<td>5.595MHz/2.7KHz wide 8 pole lower sideband</td>
</tr>
<tr>
<td>5.595-2.7/USB</td>
<td>5.595MHz/2.7KHz wide 8 pole upper sideband</td>
</tr>
<tr>
<td>5.645-2.7/8</td>
<td>5.645MHz/2.7KHz wide 8 pole</td>
</tr>
<tr>
<td>9.0SB/CW</td>
<td>9.0MHz/ 8 pole sideband and CW</td>
</tr>
</tbody>
</table>

Your Choice

Kokusai Electric Co. Mechanical Filter #MF-455-ZL-21H
455KHz at Center Frequency of 453.5Kc Carrier Frequency of 455Kc 2.36Kc Bandwidth

**Crystal Filters**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nikko</td>
<td>FX-07800C</td>
<td>7.8MHz</td>
</tr>
<tr>
<td>TEW</td>
<td>FEC-103-2</td>
<td>10.6935</td>
</tr>
<tr>
<td>Tyco/CD</td>
<td>001019880</td>
<td>10.7MHz 2 pole 15KHz Bw. Motorola #48D84396K01</td>
</tr>
<tr>
<td>Motorola</td>
<td>48B4863B01</td>
<td>11.7MHz 2 pole 15KHz Bandwidth</td>
</tr>
<tr>
<td>PTI</td>
<td>5350C</td>
<td>12MHz 2 pole 15KHz Bandwidth</td>
</tr>
<tr>
<td>PTI</td>
<td>5426C</td>
<td>21.4MHz 2 pole 15KHz Bandwidth</td>
</tr>
<tr>
<td>CD</td>
<td>A10300</td>
<td>45MHz 2 pole 15KHz Bandwidth (For Motorola Communications equipment)</td>
</tr>
</tbody>
</table>

**Ceramic Filters**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murata</td>
<td>BFB455B</td>
<td>455KHz</td>
</tr>
<tr>
<td></td>
<td>CFM455E</td>
<td>455KHz +- 5.5KHz</td>
</tr>
<tr>
<td></td>
<td>CFM455D</td>
<td>455KHz +- 7KHz</td>
</tr>
<tr>
<td></td>
<td>CFR455E</td>
<td>455KHz +- 5.5KHz</td>
</tr>
<tr>
<td></td>
<td>CFU455E</td>
<td>455KHz +- 1.5KHz</td>
</tr>
<tr>
<td></td>
<td>CFU455G</td>
<td>455KHz +- 1KHz</td>
</tr>
<tr>
<td></td>
<td>CFW455D</td>
<td>455KHz +- 1KHz</td>
</tr>
<tr>
<td></td>
<td>CFW455H</td>
<td>455KHz +- 3KHz</td>
</tr>
<tr>
<td></td>
<td>SFB455D</td>
<td>455KHz</td>
</tr>
<tr>
<td></td>
<td>SFE10.7</td>
<td>10.7MHz</td>
</tr>
<tr>
<td></td>
<td>SFG10.7MA</td>
<td>10.7MHz</td>
</tr>
<tr>
<td>Clevite</td>
<td>TO-01A</td>
<td>455KHz</td>
</tr>
<tr>
<td></td>
<td>TO-02A</td>
<td>455KHz</td>
</tr>
<tr>
<td>Nippon</td>
<td>LF-B4/CFU455I</td>
<td>455KHz +- 1KHz</td>
</tr>
<tr>
<td></td>
<td>LF-B6/CFU455H</td>
<td>455KHz +- 1KHz</td>
</tr>
<tr>
<td></td>
<td>LF-C18</td>
<td>455KHz</td>
</tr>
<tr>
<td>Tokin</td>
<td>CF455A/BFU455K</td>
<td>455KHz +- 2KHz</td>
</tr>
<tr>
<td>Matsushita</td>
<td>EFC-L455K</td>
<td>455KHz</td>
</tr>
</tbody>
</table>

**ROTROON MUFFIN FANS** Model Mark 4/MU2A1
These fans are new factory boxed 115vac at 14watts 50/60cps. Impedance Protected-F CFM is 6B at 50cps and 105 at 60cps.

**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

$15.00
$12.99
$15.00
$15.00
$15.00
$15.00
$59.99
## AVANTEK LOW NOISE AMPLIFIERS

<table>
<thead>
<tr>
<th>Models</th>
<th>Frequency Range</th>
<th>Noise Figure</th>
<th>Voltage</th>
<th>Gain</th>
<th>Power Output</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC2-102M</td>
<td>30 to 200MC</td>
<td>1.5dB</td>
<td>+15vdc</td>
<td>29dB</td>
<td>1dB Gain +7dBm</td>
<td>$49.99</td>
</tr>
<tr>
<td>AP-20-T</td>
<td>200 to 400MC</td>
<td>6.5dB</td>
<td>+24vdc</td>
<td>30dB</td>
<td>1dB Gain +20dBm</td>
<td>$49.99</td>
</tr>
<tr>
<td>AL-45-0-1</td>
<td>450 to 800MC</td>
<td>-6vdc @ +12vdc</td>
<td>30dB</td>
<td>1dB Gain -5dBm</td>
<td>$49.99</td>
<td></td>
</tr>
<tr>
<td>AK-1000M</td>
<td>500 to 1000MC</td>
<td>2.5dB</td>
<td>-12vdc @ -12vdc</td>
<td>25dB</td>
<td>1dB Gain +8dBm</td>
<td>$69.99</td>
</tr>
</tbody>
</table>

**Mini Circuits Double Balanced Mixers**

<table>
<thead>
<tr>
<th>Model RAY-3</th>
<th>Frequency Range</th>
<th>Voltage</th>
<th>Conversion Loss, dB One Octave From Band Edge</th>
<th>Isolation, dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF)</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70KHz to 200MHz</td>
<td>+23dB</td>
<td>6Typ./7.5Max. Total Range 6.5Typ./8Max.</td>
<td>40Typ./30Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF)</td>
<td>$24.99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model TSM-3</th>
<th>Frequency Range</th>
<th>Voltage</th>
<th>Conversion Loss, dB One Octave From Band Edge</th>
<th>Isolation, dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF)</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1MHz to 400MHz</td>
<td>+7dB</td>
<td>5.3Typ./7.5Max. Total Range 6.5Typ./8.5Max.</td>
<td>50Typ./35Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF)</td>
<td>$11.99</td>
</tr>
</tbody>
</table>

**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,Ice=60mA,F=1GHz/F=2GHz | 14dB typ,8dB typ |
| Price | $29.99 |

**Motorola RF Power Amplifier Modules**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
<th>Voltage</th>
<th>Output Power</th>
<th>Minimum Gain</th>
<th>Harmonics</th>
<th>RF Input Power</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHW612A</td>
<td>146 to 147MHz</td>
<td>12.5vdc</td>
<td>20watts</td>
<td>20dB</td>
<td>-30dB</td>
<td>400mW</td>
<td>$57.50</td>
</tr>
<tr>
<td>MHW613A</td>
<td>150 to 174MHz</td>
<td>12.5vdc</td>
<td>30watts</td>
<td>20dB</td>
<td>-30dB</td>
<td>500mW</td>
<td>$59.80</td>
</tr>
<tr>
<td>MHW710</td>
<td>400 to 512MHz</td>
<td>12.5vdc</td>
<td>13watts</td>
<td>19.4dB</td>
<td>250mW</td>
<td>40dB</td>
<td>$57.50</td>
</tr>
<tr>
<td>MHW720</td>
<td>400 to 470MHz</td>
<td>12.5vdc</td>
<td>20watts</td>
<td>21dB</td>
<td>40dB</td>
<td>250mW</td>
<td>$69.00</td>
</tr>
</tbody>
</table>

**Toll Free Number**

800-528-0180

(For orders only)

MHz electronics
**“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. fl DC to 1125MHz fl fr
fr 880MHz fl fr

SSB Noise Figure
4.9dB Typ. 6dB Max. fl 30 to 1125MHz fl fr
5.5dB Typ. 6.5dB Max. fl 880MHz fl fr

Isolation
fr at R 30dB Min. 40dB Typ. fl 2.8 to 5.35GHz
fr 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 0.2dB 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 0 +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
I-Port 1.5:1 Typ. 2.0:1 fl=100MHz
1.3:1 Typ. 2.0:1 fl=500MHz
1.8:1 Typ. 2.5:1 fl=1125MHz

SGS/ATES RF Transistors

<table>
<thead>
<tr>
<th>Type</th>
<th>BFQ85</th>
<th>BFQ92</th>
<th>MotoroRF Transistor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Base V</td>
<td>20v</td>
<td>25v</td>
<td>25v</td>
</tr>
<tr>
<td>Collector Emitter V</td>
<td>15v</td>
<td>15v</td>
<td>15v</td>
</tr>
<tr>
<td>Emitter Base V</td>
<td>3v</td>
<td>3v</td>
<td>3v</td>
</tr>
<tr>
<td>Collector Current</td>
<td>40ma</td>
<td>25ma</td>
<td>30ma</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>200mw</td>
<td>190mw</td>
<td>375mw</td>
</tr>
<tr>
<td>HFE</td>
<td>40min. 200max.</td>
<td>20min. 150max.</td>
<td>30min. 200max.</td>
</tr>
<tr>
<td>FT</td>
<td>4GHz min. 5GHz max. 1.6GHz Typ.</td>
<td>4.5GHz typ. 2GHz min.</td>
<td></td>
</tr>
<tr>
<td>Noise Figure</td>
<td>1GHz 3dB Max. 500MHz 4dB Typ.</td>
<td>1GHz 2dB Typ. 2GHz 2.9dB Typ.</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>$1.50</td>
<td>$1.50</td>
<td>$2.00</td>
</tr>
</tbody>
</table>

Motorola RF Transistor MRF901 2N6603

National Semiconductor Variable Voltage Regulator Sale !!!!!!!!

<table>
<thead>
<tr>
<th>Type</th>
<th>LM317K</th>
<th>LM350K</th>
<th>LM723G/L</th>
<th>LM7805/06/08/12/15/18/24</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 to 37vdc</td>
<td>1.2 to 33vdc</td>
<td>2 to 37vdc</td>
<td>5, 6, 8, 12, 15, 18, 24vdc</td>
<td></td>
</tr>
<tr>
<td>1.5Amps</td>
<td>3Amps</td>
<td>150mA.</td>
<td>1Amp</td>
<td></td>
</tr>
<tr>
<td>TO-3</td>
<td>TO-3</td>
<td>TO-100/TO-116</td>
<td>TO-220/TO-3</td>
<td></td>
</tr>
<tr>
<td>$4.50</td>
<td>$5.75</td>
<td>$1.00</td>
<td>$1.17</td>
<td></td>
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</tbody>
</table>

P & B Solid State Relays Type ECT10872

<table>
<thead>
<tr>
<th>Type</th>
<th>7Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>5VDC Turn On</td>
<td>120VAC Contact</td>
</tr>
<tr>
<td>20Amps on 10&quot;x10&quot;x.062&quot; Alum.Heatsink with</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

*May Be Other Brand Equivalent

Toll Free Number
800-528-0180
(For orders only)
## "MIXERS"

**WATKINS JOHNSON WJ-M6 Double Balanced Mixer**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO and RF 0.2 to 300MHz</td>
<td>IF DC to 300MHz</td>
<td>$21.00</td>
</tr>
<tr>
<td>Conversion Loss (SSB)</td>
<td>6.5dB Max. 1 to 50MHz</td>
<td></td>
</tr>
<tr>
<td>Noise Figure (SSB)</td>
<td>8.5dB Max. 0.2 to 300MHz</td>
<td></td>
</tr>
<tr>
<td>Conversion Compression</td>
<td>same as above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.5dB Max. 50 to 300MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.3dB Typ.</td>
<td></td>
</tr>
</tbody>
</table>

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

<table>
<thead>
<tr>
<th>Frequency</th>
<th>NF</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>F=2GHz</td>
<td>db 2.4 Typ.</td>
<td>db 12 Typ.</td>
</tr>
<tr>
<td>F=3GHz</td>
<td>db 3.4 Typ.</td>
<td>db 9 Typ.</td>
</tr>
<tr>
<td>F=4GHz</td>
<td>db 4.3 Typ.</td>
<td>db 6.5 Typ.</td>
</tr>
</tbody>
</table>

FT Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.

<table>
<thead>
<tr>
<th>Vcbo</th>
<th>Vceo</th>
<th>Vebo</th>
<th>Ic</th>
<th>Pt</th>
<th>mw</th>
</tr>
</thead>
<tbody>
<tr>
<td>25v</td>
<td>11v</td>
<td>3v</td>
<td>50ma</td>
<td>250</td>
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UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufactures and described in the Motorola RF Data Book.

<table>
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<td>13pf</td>
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NIPPON ELECTRIC COMPANY TUNNEL DIODES

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<tr>
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<td>Cap. pf.</td>
<td>1.7Typ. 2max.</td>
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FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ratio (Volts/Div Factor) 10:1, Cable Length 4ft., Frequency Range Over 100MHz.

These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

**PRICE** $45.00

MOTOROLA RF DATA BOOK

List all Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

**PRICE** $7.50

Toll Free Number 800-528-0180 (For orders only)
"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

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SK110 Socket
SK406 Chimney
SK416 Chimney
SK500 Socket
SK506 Chimney
SK600 Socket
SK602 Socket
SK606 Chimney
SK607 Socket
SK610 Socket
SK620 Socket
SK620A Socket

JOHNSON TUBE SOCKETS

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<tr>
<td>124-116/SK630A</td>
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124-111 Bypass Cap. $10.00
122-0275-011 Socket (For 4-250A, 4-400A, 3-400Z, 3-500Z) $10.00
2/$15.00

CHIP CAPACITORS

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PRICES:
1 to 10 - .99¢
11 to 50 - .90¢
51 to 100 - .80¢

* IS A SPECIAL PRICE: 10 for $7.50
   1001 & UP .35¢
   100 for $65.00
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Spurious output suppression Harmonic (nf0), 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.

Toll Free Number
800-528-0180
(For orders only)
## "TUBES"

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MHz electronics

73 Magazine • May, 1982 167
TEKTRONIX OSCILLOSCOPES

MODEL 453 Portable 50 MHz Dual Trace.
MODEL 453A Portable 60 MHz Dual Trace.
MODEL 454 Portable 150 MHz Dual Trace.
MODEL 454A Portable 150 MHz Dual Trace.
MODEL 455 Portable 50 MHz Dual Trace.
MODEL 475 Portable 200 MHz Dual Trace.
MODEL 475A Portable 250 MHz Dual Trace.
MODEL 5714 Storage Oscilloscope with a 7 A15A and a 7 A15AN-11 Amplifier and a 7 B50 Time Base.
MODEL 577D1 Storage Curve Tracer with a 177 adapter.
MODEL 577D2 Curve Tracer with a 177 adapter.
Tektronix Lab Cart Model 3.
MODEL 547 50 MHz Bench Scope.
MODEL 547A Portable 50 MHz Dual Trace.
MODEL 549 Storage Oscilloscope.
MODEL 545 30 MHz Bench Scope with a CA Dual Trace.
MODEL 545A 30 MHz Bench Scope with a CA Dual Trace.

PRICE
$1200.00
$1400.00
$1800.00
$2000.00
$1800.00
$2640.00
$2940.00
$3500.00
$3230.00
$2796.00
$316.00
$722.50
$637.50
$872.50
$722.50
$612.50
$1667.50
$412.50
$437.50

MODEL 544 50 MHz Bench Scope with a CA Dual Trace.
MODEL 543A 33 MHz Bench Scope with a CA Dual Trace.
HEWLETT PACKARD OSCILLOSCOPES
MODEL 180A Main Frame.
MODEL 180E Main Frame.
MODEL 181A Main Frame.
MODEL 182A Main Frame.
MODEL 183A Main Frame.
MODEL 180 SERIES P LUG - INS
1801A Dual Trace 50 MHz.
1801A Dual Trace 50 MHz.
1801A Dual Trace 50 MHz.
1801A Dual Trace 50 MHz.
1801A Dual Trace 50 MHz.

PRICE
$850.50
$475.50
$675.00
$750.00
$1000.00
$900.00
$1000.00

TELEQUIPMENT MODEL D83 Oscilloscope
Dual Trace Portable 50 MHz. With a 4 V and 52A Plug-In.

PRICE
$1200.00

DUMONT MODEL 1062 Oscilloscope
Dual Trace 65 MHz portable.

PRICE
$750.00

TEKTRONIX
MODEL RM565 Dual Beam Oscilloscope
10 MHz with a 3 A6 Dual Trace and a 3 A72 Dual Trace.

PRICE
$1107.50

MODEL 549 Storage Oscilloscope
Bench 50 MHz with a CA Dual Trace.

PRICE
$1000.00

MODEL 647A Oscilloscope
Bench 100 MHz with a 10 A2 Dual Trace and a 11 B2A Time Base.

PRICE
$1200.00

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PRICES: Prices are subject to change without notice.

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NO INFORMATION WILL BE GIVEN. 1-800-528-0180.
FAIRCHILD VHF AND UHF PRESCALER CHIPS

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Input Power Vdc +24 +15

GAIN FLATNESS 1 dB 1 dB

INPut Power Vdc +24 +15

Noise Figure 11 dB 2.3 dB to 3 dB

I NPUT SIGNAL TO RF POWER PORT BIAS 1 mA Nominal

VAN T EK CASCADE BINARY COUNTER

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PRESETTABLE HIGH SPEED DECADE BINARY COUNTER

11C24DC This chip is the same as a Motorola MC4024/32 Dual TTL Voltage Control Multi-vibrator

11C44DC This chip is the same as a Motorola MC4044/4444 Phase Frequency Detector

GENERAL ELECTRIC CO. GUNN DIODE MODEL Y 2167

FREQ. Gap (GHz) 12 to 18, Output (Min.) 100mW, Duty (%)

GENERAL ELECTRIC AA NICH ACADS

<table>
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PRESCALER can divide by 100.

VARIAN GALLIUM ARSENIDE GUNN DIODES MODEL VSX-9201SS

FREQ. Coverage 8 to 12 GHz, Output (Min.) 100mW, Bias Voltage (Max.) 14vdc, Bias Current (mAdc) Operating 550 Typ

VARIL Co. Inc. MODEL SS-43 AM MODULATOR

FREQ. Range 60 to 150MC, Insertion Loss 13dB Nominal, Signal Port Imp 500ohms Nominal, Signal Port RF Power +10dBm Max., Modulation Port BW DC to 1KH, Modulation Port Bias 1mA Nominal.

AVANTEK CAScadable MODULAR AMPLIFIERS

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<tr>
<td>UTO-504</td>
<td>$24.99</td>
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</tbody>
</table>

FREQ. Range 5 to 500 MHz, Gain 6dB, Noise Figure 1dB, Power Output 4dB to 3dB

MIXERS MODELS

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1051A</td>
<td></td>
</tr>
<tr>
<td>1051B</td>
<td></td>
</tr>
</tbody>
</table>

Frequency Range 2MHz to 500MC

Input/Output Frequency L & R 200KHz to 200KHz

Mixer Conversion Loss (A) 7dB

Noise Performance (SSB) (A) 7dB

PRICE $49.99 PRICE $39.99

FREQUENCY SOURCES, INC MODEL MS-74X

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This diode will replace the MBD0101, IN5711, 5082-2800, 5082-2835 etc. This will work like a chimp in all those Down Converter projects.

MOTOROLA MHB1172R LOW DISTORTION WIDEBAND AMPLIFIER MODULE

FREQ. Range: 40 to 300 MHz, Power Gain at 50MHz 16.6min. to 17.4max., Gain Flatness ±0.1 Typ ±0.2 Max dB, DC Supply Voltage ~28vdc, RF Voltage Input +70dBmV

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CREDIT CARDS: WE ACCEPT MASTERCARD VISA AND AMERICAN EXPRESS.

DATA SHEETS: When we have data sheets in stock on devices we do supply them with the order.

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RCA Cosmac 1802
Super Elf Computer $106.95
The Super Elf is a single board computer that does many things. It is an excellent choice 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, Simple stop option, address displays, Power Supply, Audio Amplifier and Speaker. Fully socketed for all IC’s, Full documentation.

Super Elf comes with a ROM monitor for program loading, editing and execution with SIMPLE. For program debugging which is not included. Equipment at the same price or less.

You can see the microprocessor chip operating with the unique Quest address and data bus displays before, during and after editing instructions. Also, CPU mode and instruction cycle decoding and display on L.E.D displays. An RCA 1861 video graphics chip allows you to connect to any TV with an inexpensive video interface between graphics and game. The speaker system is included for writing your own music or using many music programs already written. The printer may also be used to drive relays for control purposes.

A 24 key HX keyboard includes 16 HEX keys plus load, reset, new, wait, input, memory protect, monitor select and simple step. Large on board displays provide output and operating help and information. There is a 44 pin standard connector socket for PC cards and a 50 pin connector socket for the Quest Super Expansion Board.

NEW!

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 4x of low power RAM fully addressable anywhere in $0K, with built-in memory protect and a cassette interface. Provisions have been made for all other options on the same board and for those really into the hardware cabling altogether. The Super Elf board includes slots for up to 6x of EPROM (2708, 2706, 2716 or TI 273216) and has a fully socketed EPROM. This board can be used for the monitor and Tiny Basic or other purposes.

A 1K 8080 ROM Monitor $19.95 as an option in the Super Elf. The board has been preprogrammed with a program loader-aetor and a basic monitor which will run most of all software, (reclosable cassette file) another exclusive from Quest. It includes register save and restore, and most memory capability and you are driven with blinking cursor. Keystrokes can be used with the register save feature to include program bugs quickly, then follow with simple logic. If you have the Super Expansion Board and Super Monitor the monitor is up and running at the push of a button.

Other board options include Parallel Input and Output Cards with full handshake. They allow easy connection of an ASCII keyboard to the output port.

5002 220 and 20 00 Current Loop for Interface or other device are on board and if you need extra memory there are 5x-20 slots for E/O RAM or various other options. All slot locations are standard.
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We now have available a bunch of goodies too good to bypass. Items are limited so order today.

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FM Wireless Mike Kit
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der, using any type of mike. Runs on 3 to 9V.

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FM Kit - 2 $4.95

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2 for $1.00

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$99.95

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MRF-238 transistor as used in PA-1 $11.95

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- **Display:** 7 digits 0.4" LED
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- **Power:** 12 VAC @ 200 mA

**Features:**
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**Accessories:**
- **Telescopic whip antenna:** $19.95
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- CT-70 Kit: $99.95
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  - Less than 100 µV to 250 MHz
- **Resolution:**
  - 1.00 Hz (600 MHz range)
  - 20.00 Hz (500 MHz range)
- **Display:** 8 digits 0.4" LED
- **Time Base:** 1.00 ppm TCXO 7.0-204°C
- **Power:** 120 VAC @ 200 mA

**Features:**
- Sensitivity less than 25 µV to 150 MHz
- Time base 1.00 ppm TCXO 20-40°C
- Display: 8 digits 0.4" LED
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**Accessories:**
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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. S.E., Vienna VA 22180, 936-3350.

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

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FT-230R: QUITE A SIGHT! (AND EASY TO SEE, TOO!!)

Sporting an all-new Liquid Crystal Display, the FT-230R is Yaesu’s high-performance answer to your call for a very affordable 2 meter mobile rig with an easy-to-read frequency display! The FT-230R combines microprocessor convenience, a sensitive receiver, a powerful yet clean transmitter strip, and the new dimension of LCD frequency readout. See your Authorized Yaesu Dealer today — and go home with your new FT-230R!

- LCD five-digit frequency readout with night light for high visibility day or night.
- Two VFOs for quick QSY across the band.
- Ten memory slots for storage and recall of favorite channels.
- Selectable synthesizer steps (5 kHz or 10 kHz) in dial or scanning mode.
- Priority channel for checking a favorite frequency for activity while monitoring another.
- Unique VFO/Memory Split mode for covering unusual repeater splits.
- Up/Down band scan plus memory scan for busy or clear channel. Scanning microphone included in purchase price.

- Full 25 watts of RF power output from extremely compact package.
- Built-in automatic or manual tone burst.
- Optional synthesized CTCSS Encode and Encode/Decode boards available.
- Lithium memory backup battery with estimated lifetime of five years.
- Optional YM-49 Speaker/Microphone and YM-50 DTMF Encoding Microphone provide maximum operating versatility.

And don’t forget! Yaesu has a complete line of VHF and UHF handheld and battery portable transceivers using LCD display!!!

FT-208R - 2 Meters
FM Handheld
FT-708R - 70 cm
FM Handheld
FT-290R - 2 Meters
SSB/CW/FM Portable
FT-690R - 6 Meters
USB/CW/AM/FM Portable

Price and Specifications Subject To Change Without Notice or Obligation

YAESU ELECTRONICS CORP. 6851 Walthall Way, Paramount, CA 90723 • (213) 633-4007
Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246 • (513) 874-3100
Superior dynamic range, auto. antenna tuner, QSK, dual NB, 2 VFO's, general coverage receiver.

**TS-930S**

The TS-930S is a superlative, high performance, all-solid-state, HF transceiver keyed to the exacting requirements of the DX and contest operator. It covers all Amateur bands from 160 through 10 meters, and incorporates a 150 kHz to 30 MHz general coverage receiver having an excellent dynamic range.

Among its other important features are, SSB slope tuning, CW VBT, IF notch filter, CW pitch control, dual digital VFO's, CW full break-in, automatic antenna tuner, and a higher voltage operated solid state final amplifier. It is available with or without the AT-930 automatic antenna tuner built-in.

**TS-930S FEATURES:**

- 160-10 Meters, with 150 kHz - 30 MHz general coverage receiver.
- Covers all Amateur frequencies from 160-10 available with new WARC, CW, and AM. Features 150 kHz - 30 MHz general coverage receiver. Separate Amateur band access keys allow speedy band selection. UP/DOWN band switch changes in 1-MHz steps. A new, innovative, quadruple conversion, digital PLL synthesized circuit provides superior frequency accuracy and stability, plus greatly enhanced selectivity.
- Excellent receiver dynamic range. Receiver two-tone dynamic range, 100 dB typical (20 meters) 500 Hz CW bandwidth, at sensitivity of 0.25 volts. SN/10 dB, provides the ultimate in rejection of IM distortion.
- All solid state, 28 volt operated final amplifier. The final amplifier operates on 28 VDC for lowest IM distortion. Power input rated at 250 W on SSB, CW, and FSK, and at 80 W on AM. Final amplifier protection circuit with cooling fan, SWR Power meter built-in.
- Automatic antenna tuner, built-in. Available with AT-930 antenna tuner, or as an option. Covers Amateur bands 80-10 meters, including the new WARC bands. Tuning range automatically pre-selected with band selection to minimize tuning time. *AUTO-THRU* switch on front panel.
- CW full break-in. CW full break-in circuit uses CMOS logic IC plus reed relay for maximum flexibility, coupled with smooth, quiet operation. Switchable to semi-break-in.
- Dual digital VFO's. 10-Hz step dual digital VFO's include band information. Each VFO tunes continuously from band to band. A large, heavy, flywheel type knob is used for improved tuning ease. T.F. Set switch allows fast transmit frequency setting for split-frequency operations. A-B switch for equalizing one VFO frequency to the other. VFO 'Lock' switch provided. RIT control for ±9.9 kHz receive frequency shift.
- Eight memory channels. Stores both frequency and band information. VFO/MEMO switch allows use of each memory as an independent VFO. (The original memory frequency can be recalled at will), or as a fixed frequency. Internal Battery memory back-up, estimated 1 year life. (Batteries not Kenwood supplied).
- Dual mode noise blanker ("pulse" or "woodpecker"). NB-1 with threshold control, for pulse-type noise. NB-2 for longer duration "woodpecker" type noise.
- SSB IF slope tuning. Allows independent adjustment of the low and/or high frequency slopes of the IF passband, for best interference rejection.
- CW VBT and pitch controls. CW VBT (Variable Bandwidth Tuning) control tunes out interfering signals. CW pitch controls shifts IF passband and simultaneously changes the pitch of the beat frequency. A "Narrow/Wide" filter selector switch is provided.
- IF notch filter. 100-kHz IF notch circuit gives deep, sharp, notch, better than -40 dB.
- Audio filter built-in. Tunable, peak-type audio filter for CW.
- AC power supply built-in. 120, 220, or 240 VAC, switch selected (operates on AC only).
- Fluorescent tube digital display. Fluorescent tube digital display has analog type sub-scale with 20-kHz steps. Separate 2 digit display indicates RIT frequency shift.
- RF speech processor. RF clipper type processor provides higher average "talk-power," plus improved intelligibility. Separate "IN" and "OUT" front panel level controls.
- One year warranty. The TS-930S carries a one year limited warranty on parts and labor.

**Other features:**

- SSB monitor circuit, 3 step RF attenuator, VOX, and 100-kHz marker.
- Optional accessories:
  - AT-930 automatic antenna tuner.
  - SP-930 external speaker with selectable audio filters.
  - YG-455C1 (500 Hz) or YG-455CN-1 (250 Hz) plug-in filters for 455-kHz IF.
  - YK-88C-1 (500 Hz) CW plug-in filter for 8.83-MHz IF.
  - YK-88A-1 (6 kHz) AM plug-in filter for 8.83-MHz IF.
  - MC-60 (S-8) deluxe desk microphone with UP/DOWN switch.
  - TL-922A linear amplifier.
  - SM-220 station monitor.
  - HC-10 digital world clock.
  - HS-6, HS-5, HS-4 headphones.

More information on the TS-930S is available from all authorized dealers of Tri-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

KENWOOD

**Specifications and prices are subject to change without notice or obligation.**