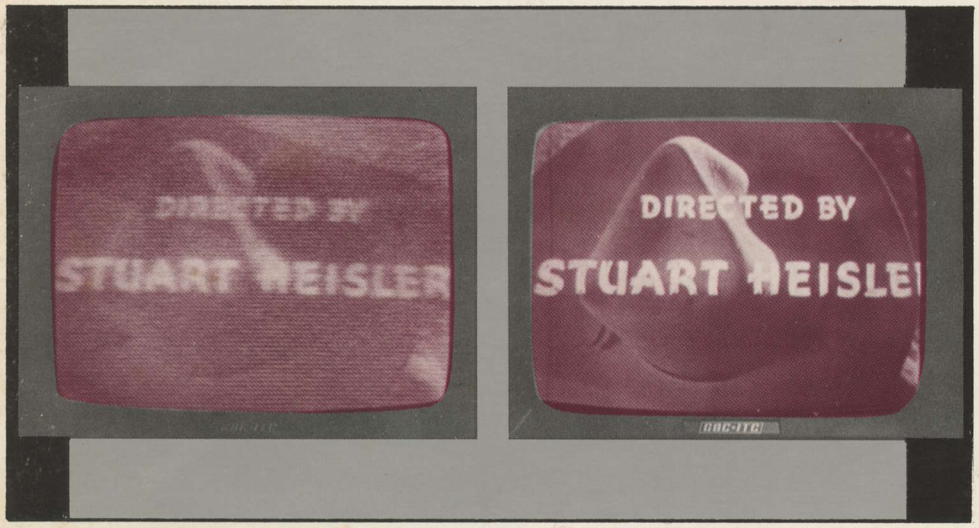
CATJ

WTCG-17 ATLANTA via two simultaneous modes



LEFT, Direct at CATJ LAB 9-22-77 at 758 miles

RIGHT, SATCOM II at CATJ LAB at 44,600 miles

October 1977

HP's CATV Spectrum Analyzer: It has the performance to measure your system's performance.

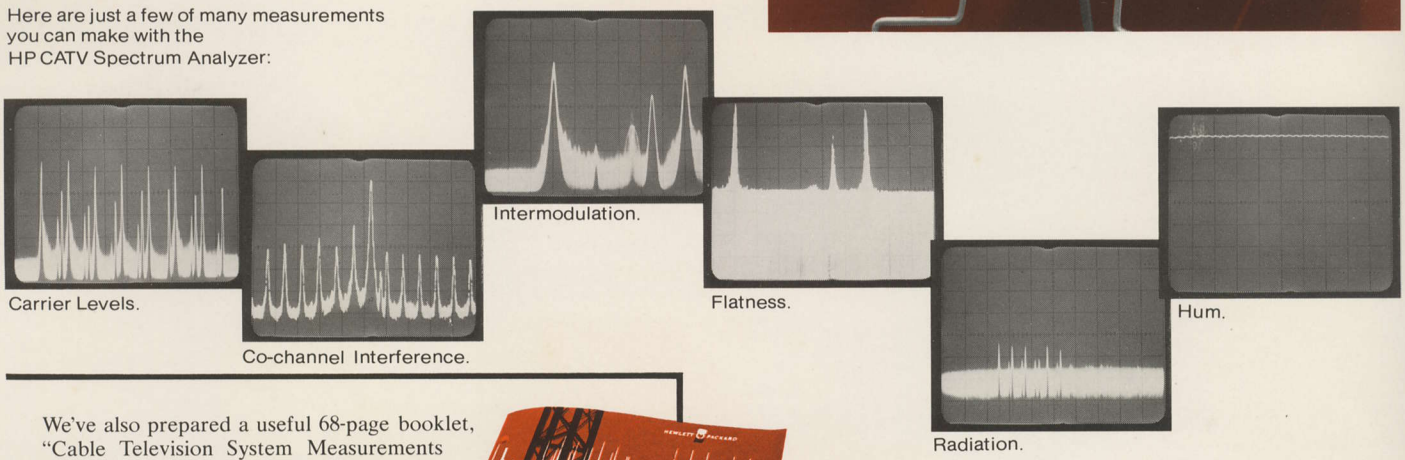
HP's 8558B Option 002 CATV Spectrum Analyzer displays the amplitude and frequency of each spectral component of the input directly on a CRT. It's ideal for system performance verification as well as providing insight into unusual signal conditions. The 8558B features ±1 dB frequency response, high sensitivity of −63 dBmV, resolution bandwidths from 1kHz to 3MHz, and 70 dB dynamic range.

It's easy to use too: convenient three-knob operation lets you make measurements faster and more accurately than you're probably used to. What's more, this field-proven instrument is economically priced. HP 8558B Option 002 plug-in is $4950; 182T Display is $1650. (A 350 MHz plug-in is available at $3950. Also offered is a variable persistence and storage CRT display unit, $2600.)

For more information, give your nearby HP field sales office a call, or write.

Domestic US prices only

Here are just a few of many measurements you can make with the HP CATV Spectrum Analyzer:



Carrier Levels.

Co-channel Interference.

Intermodulation.

Flatness.

Hum.

Radiation.

We've also prepared a useful 68-page booklet, "Cable Television System Measurements Handbook" which reviews CATV system measurement considerations and then describes in step-by-step detail what you need to know for cable system performance verification. To get your copy, just ask your HP field engineer. Or write on your company letterhead to;

CATV Measurements Handbook
Hewlett-Packard Company,
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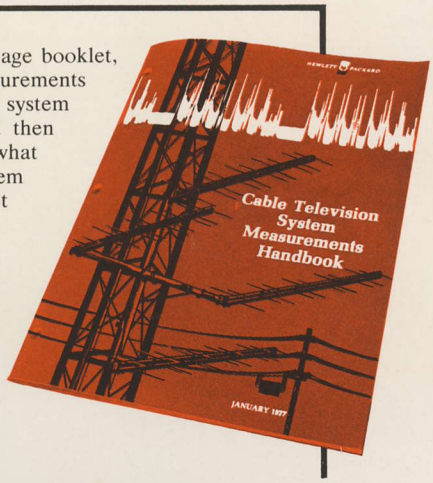
Palo Alto, CA 94304



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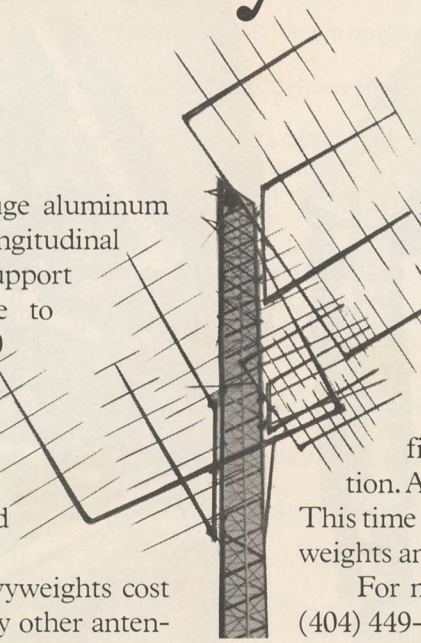

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CATJ

October 1977

VOLUME 4– NUMBER 10

PUBLISHED MONTHLY, AS ITS OFFICIAL JOURNAL, BY THE COMMUNITY ANTENNA TELEVISION ASSOCIATION, INC., OKLAHOMA CITY, OKLAHOMA, AS A SERVICE TO ITS MEMBERS AND OTHERS PROVIDING CATV/MATV SERVICE TO THE TELEVISION VIEWING PUBLIC AND BROADBAND VIDEO/AUDIO DATA COMMUNICATION SERVICE.

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—FEATURES—

—DEPARTMENTS—

OUR COVER

CAN YOU TOP THIS? On September 21st the CATJ Laboratory installed its own 6 meter TVRO. On the evening of September 22nd the Lab recorded reception from Atlanta's WTCG via two simultaneous modes; **direct** (a mere 758 miles over half of Georgia, Alabama, Mississippi, Arkansas and half of Oklahoma), **and,** via transponder six and SATCOM. And this created the 'direct' and 'bird-relayed' photos shown on our cover this month. **Ain't satellites wonderful!**

CATA-torial

KYLE D. MOORE, President of CATA, Inc.

Adjusting To The Satellites

A two-year anniversary has just passed. CATV use of satellite receive-only terminals is now twenty-four months old; and climbing.

Of all of the "blue sky" promises held out before the cable industry, satellite signal delivery stood out alone from the days of the first tests. All of the basic elements of success seemed to be present. **It has an exoticness** straight out of the space age, yet it is truthfully **a simple one-hop microwave system.** It is the "ultimate" distant signal, delivered to each and every properly equipped cable headend with excellent quality, high reliability (typically higher than all but our Grade 'A' signals off-air), and now, reasonable cost.

Two years is not a very long period of time for a concept to develop and expand, yet we are now into generation two or three of the original concept and additional mutations seem likely before year-three is upon us.

Nobody knows for sure how many CATV systems are utilizing TVRO signals; it is the nature of the service that not everyone goes through the niceties of an FCC filing. Most do, but some quanity does not. Let's assume there are at least 140 terminals in and operating. In the July issue of CATJ the Community Antenna Television Association took its annual industry survey of (among other items) planned useage of satellite delivered signals in the coming 18 month period. Our November issue will report in some detail the results of this year's study; but a few previews are worth noting at this time.

Of all systems surveyed 45.95% said they planned to have at least one 'premium' or pay channel on their system by January 1, 1979. That works out to 1,700(.15) such systems using pay-cable channels

The survey tells us the 44.58% of all systems in the United States plan to have an operating TVRO by January 1, 1979. If you select 3,700 systems nationwide as your base, that amounts to 1,649 CATV TVRO terminals some 15 months or so from now. Because of the high survey response this year we were able to separate several industry CATJ reader categories out for their own study. **Owners and Operators** was one such sub-group studies. And as a group they plan to purchase and install 47.36% of all terminals to be added before January 1, 1979; 781 terminals.

barely 15 months from now.

As a group we may well be optimists. In anybody's book that is some healthy growth in the next 15 months. It works out to 100.6 new terminals per month, every month, for the next 15 months. And because the TVRO installation business is just now starting to get up a head of steam, we are running along at around 15-25 per month as this is written. To maintain the projected numbers totaling 1,649 terminals by January first in 1979 we are going to have to have some very fancy numbers along about next spring, summer and fall!

Yet the survey does accurately reflect the honest intentions of the industry, and it is plain that our sights are set high. . .**very high**. . . for the coming near term future.

Television has always been a business of numbers. The audience or rating numbers have long dominated both directly and indirectly our FCC rules for signal carriage. Our own viability in the marketplace has long been dependent upon our ability to produce a higher number of viewable channels on our cable than the customer can receive from his own antenna system. **The broadcaster** has long recognized that **if** he can keep our cable channels **down** his own profitability is enhanced. And by in large the broadcaster-created cable signal carriage rules have worked very well. . .**for the broadcast interests.**

Satellites change the rules however and for once it is cable not broadcast television that is writing the rules. The ultimate program 'mix' off of the satellites will likely be one or two or three non-network commercial signals, one or two pay-cable or special event channels, and a handful (up to six) cable-only advertiser and endowment supported channels. Some will be full time (i.e. twenty four hours per day) while others will be available only a few hours per day. Through all of this the cable operator will finally be able to offer his viewers a service that does not simply echo the local broadcast service channels. Cable's strong suit has always been diversity of programming and the satellite signal delivery service will ultimately prove to be the most important and powerful tool in our arsenal.

Atlanta's Ted Turner and his channel 17 had the foresight to be the first 'commercial service station' available through the bird. Virtually every CATV system in the United States has the FCC-rules-elbow room to offer WTCG; if not full time, at least as an all-night signal after local signals have left the air. But **after** you have added WTCG it may well be that FCC rules will **not** allow you to add a second non-network (indie) signal to your system. The recent announcements by Southern Satellite Systems (they are planning to offer San Francisco's KTVU) and United Video (who is planning Chicago's WGN) of additional indies-via-satellite **could prove** to be difficult to pull off with the present FCC rules; it is entirely possible that after a system adds WTCG that it simply cannot get FCC permission to add either RTVU or WGN. At least not full time. Or to put it into the proper number-perspective, not at sufficient systems to make it possible for either Southern or United to pay the transponder rental tariff.

Which brings us to an interesting impasse. The FCC would like to see non-broadcast services develop for cables; formats such as that promised by Network-I seem to fit the FCC's grand design for cable better than turning a handful of indies into 'super stations' with the bird(s). If Southern and/or United find that they cannot sign up sufficient cable systems to carry KTVU and/or WGN, they'll back off of the announced start dates and try to figure out why there's a problem. **The problem,** if turns out there is one, **will of course be the FCC's signal carriage rules.** Which will create a new movement to get the signal carriage rules relaxed; at least so Southern's KTVU and United's WGN can be put into "at least as many homes as WTCG".

Meanwhile over at WTCG the cable delivery business is humming along brightly. Going into September the station had 603,039 cable homes getting WTCG via satellite. During September another 93,000 cable homes were added via satellite delivery alone, pushing the October first number to nearly 700,000 satellite-delivered-homes. Some systems are reporting WTCG's signal has been an important factor in reviving interest in basic cable connections. In Alexandria, Louisiana the CATV system reported it added 4,000 subscribers (from 13,000 to 17,000) with a sales push that ran parallel to the addition of WTCG. In Jonesboro, Arkansas one single promotion tied around the WTCG carriage of Atlanta Braves baseball netted 6% new subscribers in just a couple of weeks. Not every system can expect this kind of response but apparently a very high percentage of systems are re-learning what marketing is all about with the addition of WTCG. The excellent back-up support fielded by WTCG's cable relations staff is not an insignificant factor in the equation either.

While all of the attention for CATV satellite program delivery is largely focused here in the United States, the bird-availability of WTCG and other programming is not going unnoticed elsewhere. WTCG has formal requests for service from such far-away non-continental locations as Hawaii, Alaska, the Bahamas, Bermuda, Grand Cayman, Turks and Caicos Islands. Numerous requests have also come from Mexico. The CATV system operator in Yellowknife, NWT (Canada) tried to get his government to rule on his adding WTCG this past winter. They dodged the issue so he forced their hand by simply putting WTCG on a couple of hours a day. **They acted,** telling him to cut it out. He obliged, but now the issue is out on the table in Canada as well.

So will there be another 1,649 new CATV TVRO's by January first of 1979? Probably not, and that goes against the bottom line from our own CATJ/CATA survey, but then we have always been known as an overly optimistic industry. Still. . .it is possible, and the coming 15 months should be among the more exciting periods in this industry as the TVRO phenominon matures and grows into a medium unique to itself.

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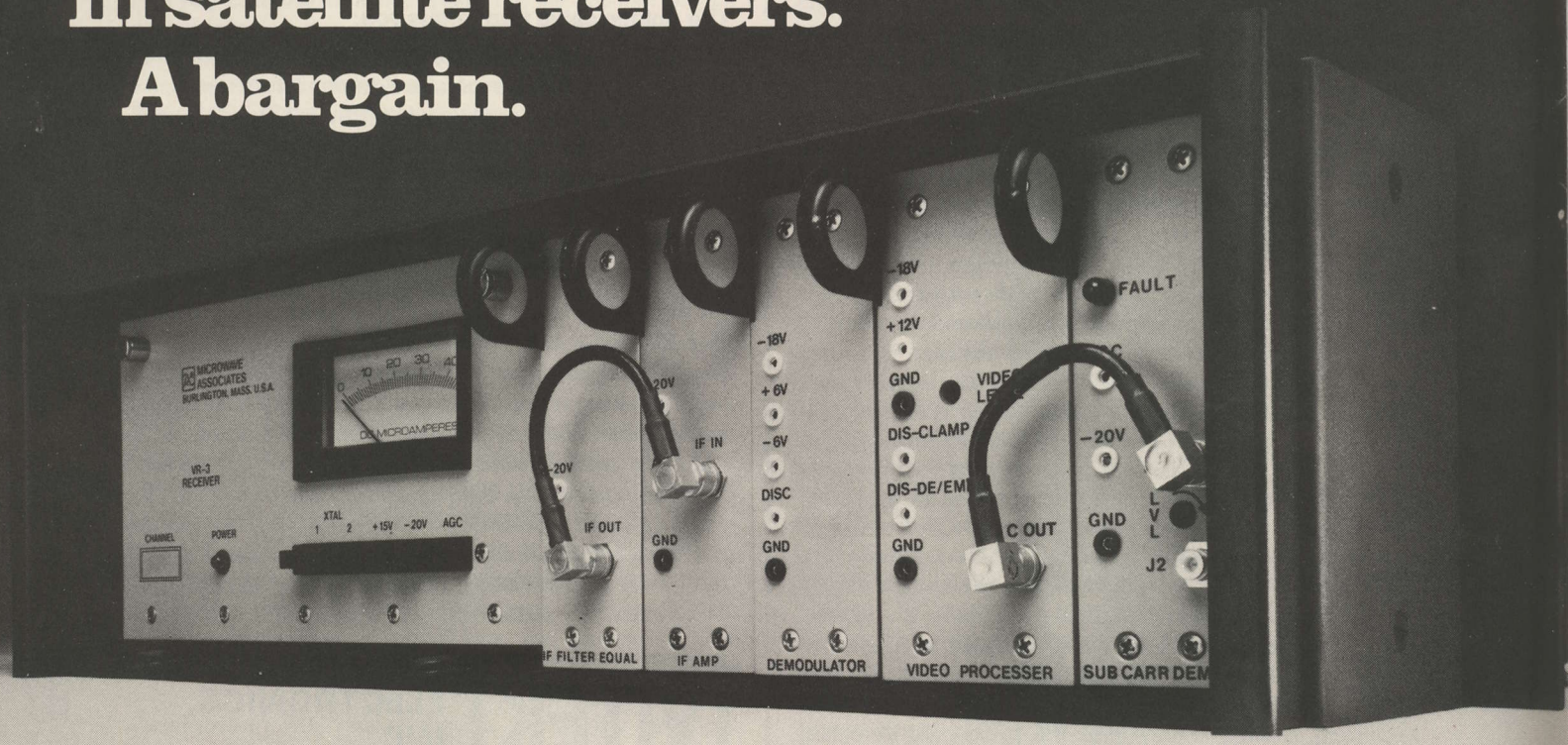

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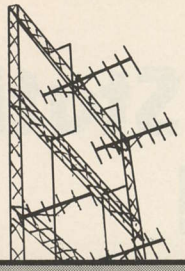

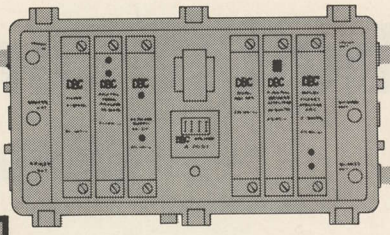

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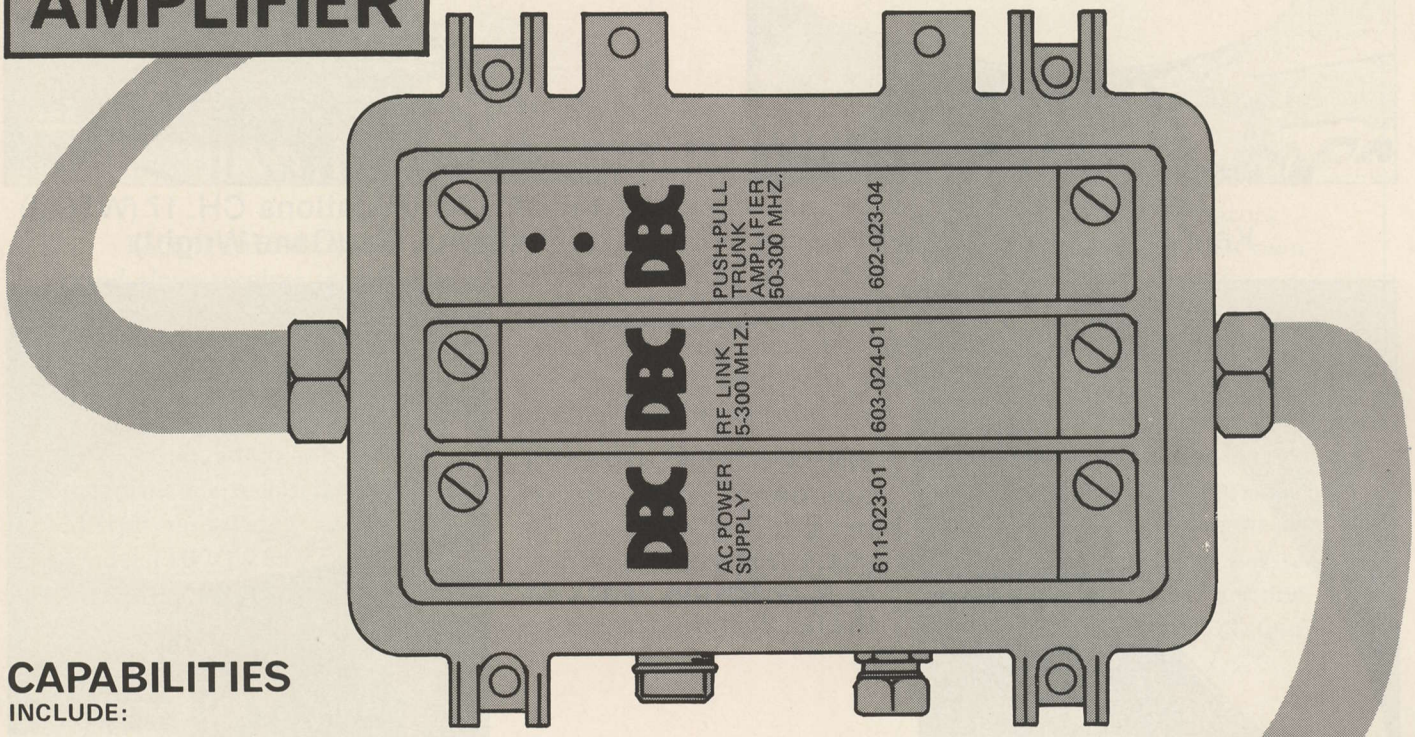

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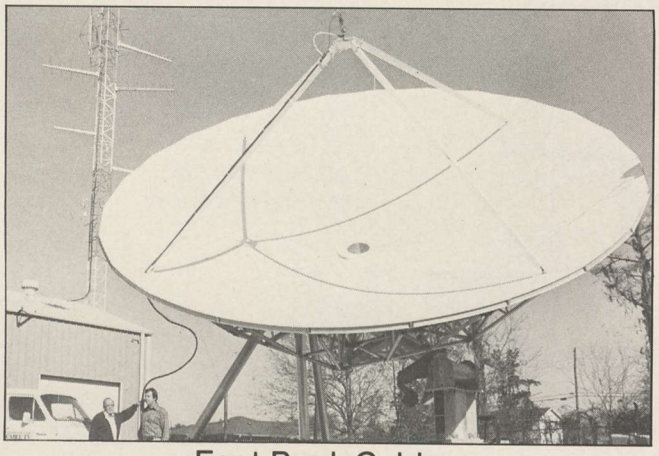

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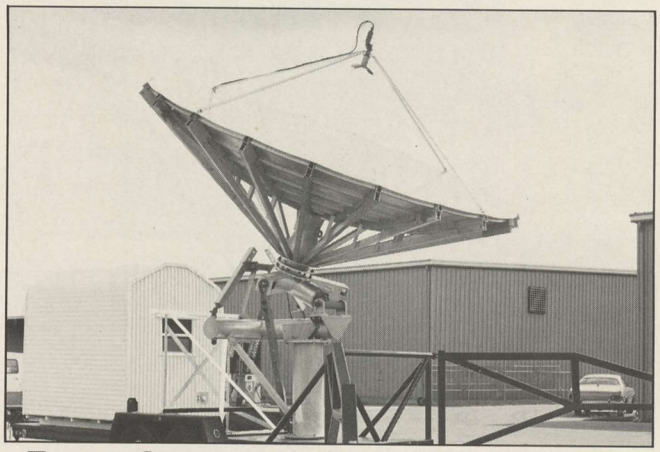

Turner Communications CH. 17 (WTCG)
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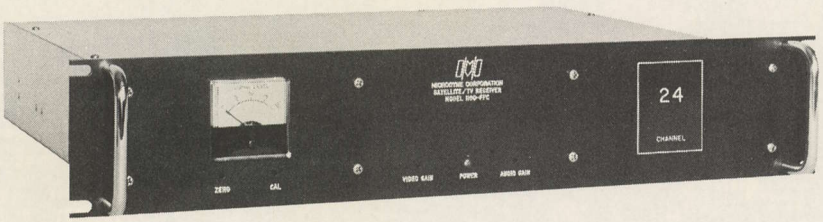

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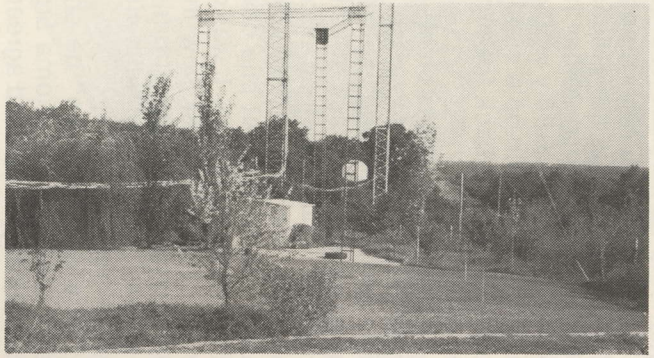
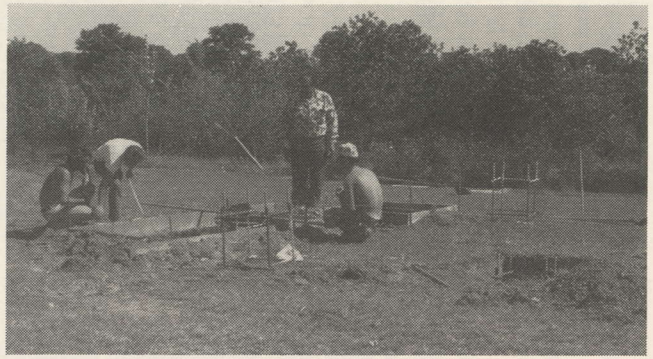
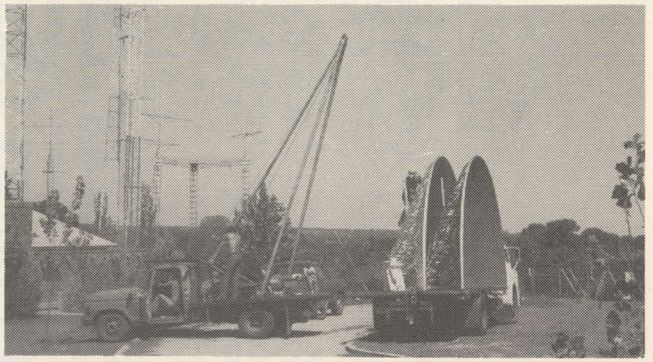


10:59 AM/THE SITE. . . Stakes in place, at 11 AM USTC will appear with a transit and locate the base center line. The terminal will go just behind the small tree left of center.



12:22 PM/READY FOR CONCRETE. . . Three concrete piers will be poured using 5.5 cubic yards of 3500 pound (2% calcium for quick-drying) concrete. 3,000 pounds of steel TVRO will sit here in six hours.

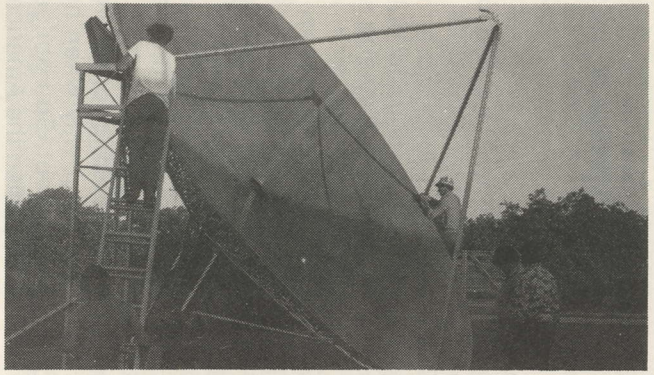


1:33 PM/OFF LOADING TVRO. . . Now the concrete is drying and the twin half-sections of the USTC SAT/FLECT I steel TVRO are off loaded from the lowboy trailer and placed into position adjacent to the poured base piers.

6:44 PM/PREPARING THE FEED. . . With 1.5 tons of terminal in place on the USTC polar mount the sun is setting as the feed-horn struts are bolted into place. Waiting for the concrete to dry has used up at least an hour at this point. **We could have been sixty minutes quicker!**

8:38 PM/INSTALLING LNA. . . The Scientific Communications 50-D 150°K low noise amplifier is mounted in place. That's a half-moon (the real moon!) just to the left of USTC President 'Stormy' Weathers, but this job will be done before the sun goes down.

8:48 PM/THE PICTURE. . . The six meter SAT/FLECT I terminal was within 0.2 dB of optimum C/N when power was applied to the LNA. And there it was, the Atlanta Braves vs. the Houston Astros in living color on 'Super-17'! A quick check revealed CBN (transponder 8), HBO (transponders 20 and 24) alive and well.



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WHALE LAMPS FOR LINE EXTENDERS?

A Visit With Professor Lipra Loof Concerning Ergs, Dynes, and Energy Use

Professor Lipra Loof was without a doubt my most unusual cable customer. Back in the 30's, or so the story went, the man was an oil field roustabout. He worked the wildcat rigs throughout Oklahoma, Louisiana and Texas and had earned a reputation as a hard working, brighter than average oil rig jockey. Then one day while on a deep well drill in the swamps of Louisiana he had conceived a new device that cut in half the time required to chain wrap a well casing. He had taken the idea to a young man in Houston and together they had devised a new form of choker that ultimately ended up on practically every drilling rig in the world. A solid patent and nearly 30 years of royalties later the man had moved into my town just as I was building my first cable system. Every couple of months when I had a few hours to spare I'd drop in under the pretext of 'checking his cable service'; just because I enjoyed the company and the free wheeling thoughts the man always seemed to have.

"My TV's just fine but come on in anyhow" he greeted me at the door of his modest frame house. I smiled and followed him inside to his study. Papers, oil field trade publications and mechanical gadgets of every size and description were stacked from ceiling to floor. There was barely room for a man to squeeze by the stacks to one of the two chairs in the room.

"I think this energy thing has gone far enough" he said to no one in particular. "The government is going to mess us up so bad we'll be back burning whale oil lamps and sending smoke signals. Don't you agree?"

I knew he was looking for an argument. He always started off that way when he was working on some new concept. So I obliged. "Oh I don't know, I think that when the American public finally decides we have a real crisis here they'll come through like they always do" I responded as I settled into his guest chair.

"Bulldung" he snorted. "By the time the public wakes up to this one the government will have shut off every option in sight and we'll be left to pay for their bureaucratic sins for two or three generations into the future!" The professor and I agreed on one thing in life; that the federal government could mess things up worse than any group ever created by man.

"Now see here" said I pulling a little newspaper out of my pocket that had come in the morning mail. "Here in my electric co-op newspaper it says that our electric co-op got through the hottest Oklahoma summer in ten years without setting any new peak current capacity demands. That proves that people are at least conserving electricity **or** during that 20 day hot spell of 95 plus temperatures we surely would have drawn more juice out of the co-op's supply than in previous years!". I leaned back feeling pretty good about my retort.

The tri-focal glasses on his forehead slid down onto the bridge of his nose as he dropped his head and spun around in his chair to dig in a tottering seven foot stack of yellowed newspapers. His hand shot out dead into the center of the tall stack and he yanked back with a tug. Neatly out of the seven foot pile came a single edition of the New York Times. It was dated only the week prior. I started to ask how in the world a week old newspaper could get buried in the **middle** of a seven foot stack of yellowing newspapers but he cut me off.

"One isolated case" he snapped back at me "and people in Oklahoma are seldom if ever in the majority". I nodded agreement; we **had** voted

for Jerry Ford in 1976. "Here. . .look at this." His gnarled finger directed my eyes at a Times report of energy use in the United States in the summer of 1977. **Petroleum products**—use up 12.2% over 1975. **Electrical energy**—up 11.7% over 1975. The list went on and on. The Times had compared every possible form of energy and many of the products of energy and our national use of each versus several years prior. **"See here—ice cream sales are up 17.7%!"** he jabbed with his bent finger at the line of type. "Can you imagine that—ice cream, one of the least energy-conscious foods in the whole world and here we are using 17.7% more in the summer of 1977 than we did just two years ago! I tell you this whole country is going to end up burning whale oil again!

I thought about a report I'd read in a magazine on an airplane a couple of weeks prior and the fact that whales are all but extinct but decided better. He'd only jab his arm into another pile of newspapers or magazines and find something to contradict my new found knowledge. Besides my curiousity was peeked by now. The Professor obviously was leading up to something and I was anxious to learn what it might be.

"OK, so we've got a national problem and you and I both agree that if we let the federal government handle it alone we'll end up with whale oil lamps. So what do we do?" I asked.

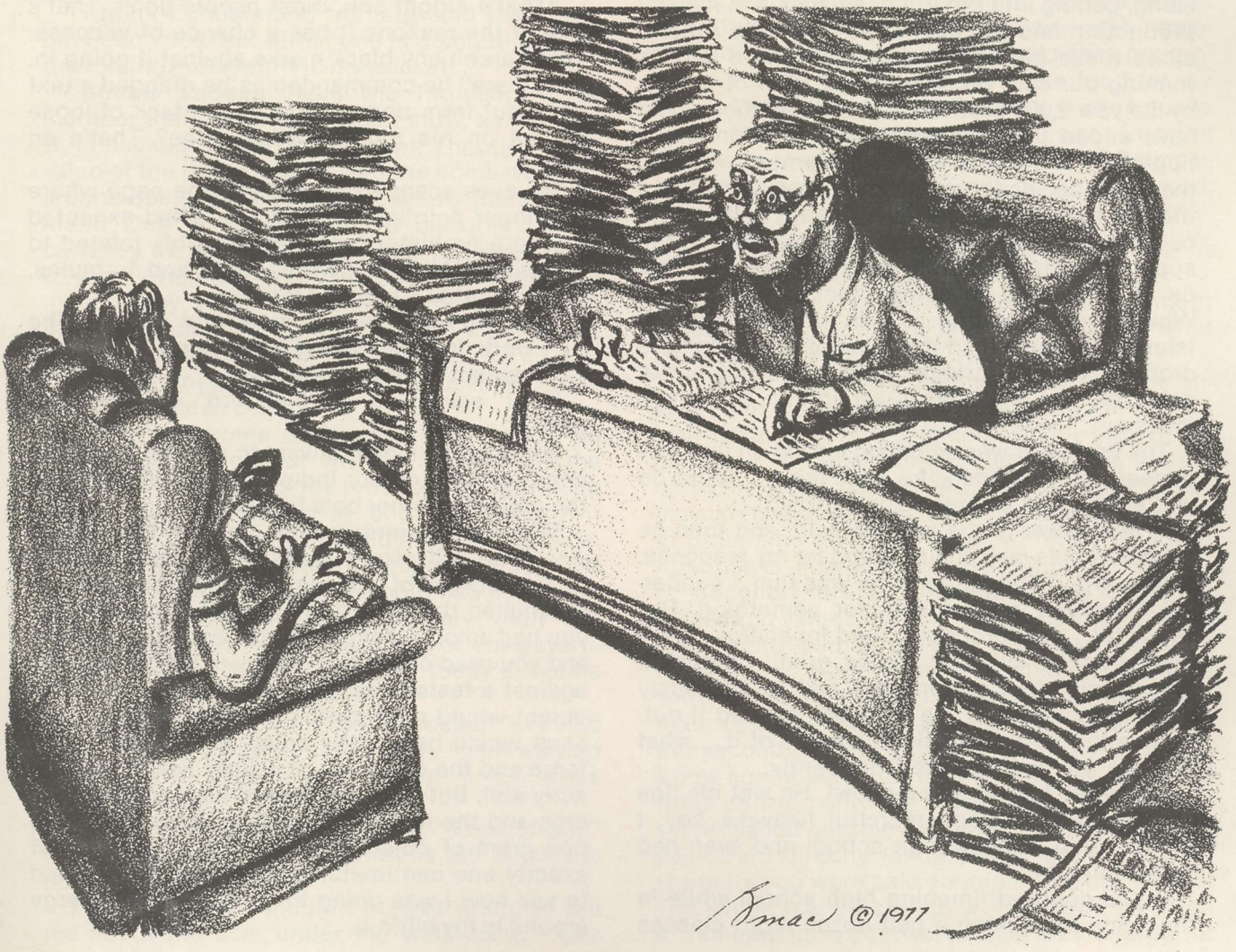
He smiled. This was the entree he had been waiting for.

"We've got to do away with money" he said softly, in a very serious tone.

"Do away with money!" I exclaimed. "How in the world would that solve the energy crisis?"

He settled back in his chair and painfully lifted his left leg on top of a half open drawer on his desk. I'd heard stories of what happened to that leg; he had gotten it caught in a chain wrap on an oil field casing just as the steam hammer had started to pound the casing into the ground. It must have been an excruciating experience. I'd been told he somehow managed to stay conscious with his leg so badly mangled that during the two hour ride to the nearest doctor the finger tips on his right hand dug into his left wrist with such fury that when they finally got him to the doc they had to take six stitches in the left wrist. I'd seen the scar on his wrist and I believed the rest of the story.

"You know that I like money" he went on "and that I've had more than my share in my lifetime. But money has outlived its usefulness and it is time for a serious re-evaluation of our whole mone-



tary system. Back when the paper money represented real gold reserve and when the coins had real-content value equal to their face value, we had a workable system. But now the paper money is only as good as the government behind it and we both know how good that is."

I smiled and thought about how my cable TV rate had only gone up one dollar in 16 years and I'd re-built the plant three times and added 8 channels of service in that period. Somehow I'd stayed in business through it all but it certainly wasn't because of the dollar value staying constant or (heaven forbid) appreciating.

"You're telling me it is time to do away with money and replace it with something else?" I asked.

"That's right. The money isn't worth much and every year it becomes worth less. The only way a person can tred water and just stay even is to keep raising the prices for the goods he sells or the services he gives. When you couple that to the scare about running out of oil in the next few decades, we end up with a system that is headed straight for disaster. Now I've been in the oil business all my life and I know how these people think. The smarter ones realized ten years ago or more that sooner or later they would run out of product to sell. They've been diversifying right along, getting into other fuel sources and mineral production and the like. If we'd left the system alone these big companies would have had us running our cars on some **other form** of energy by the year 2,000 because that is where they would have ended up themselves. But no, somebody tipped off the Arabs and in a moment of panic the Arabs decided that **if** the boat was going down they were going to get every penny they could out of every drop leaving their shores before the supply ran out; or before the oil companies got us all converted to some other energy forms. Which ever came first, it didn't make much difference, because then the value of oil would have dropped to 1890 prices. Now we've got a real panic on and it's time to straighten the whole mess out."

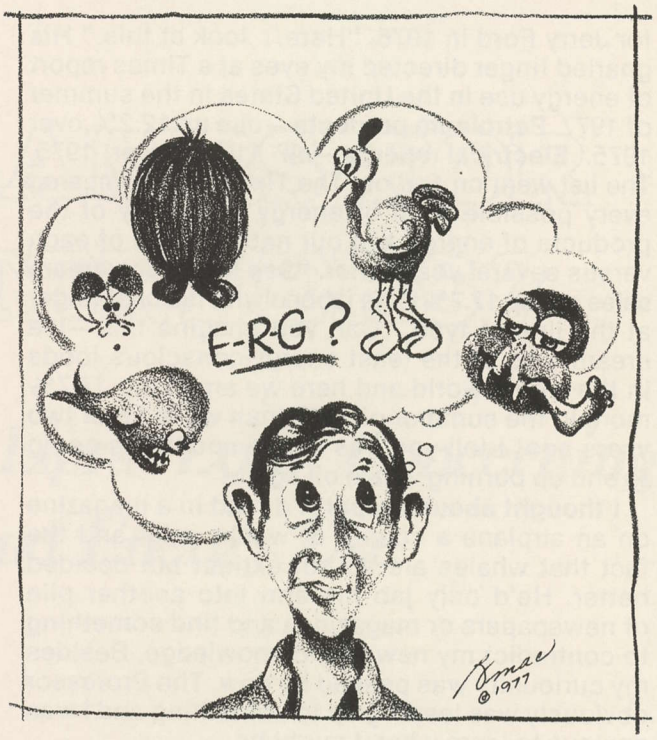
The Professor was adjusting his leg on the desk drawer and I decided the best thing I could do was settle back and take a deep breath.

"The answer is the erg" he said, and then he sat back in his own chair waiting for my response.

'The erg'. What in the world was that, I pondered. Obviously an acronym for something. But what? **'E'**. . .that probably stood for energy. **'R'**. . . revolution? re-cycling? "Good grief" thought I. The possibilities are endless and he obviously had the upper hand. He'd already figured it out. I broke the silence. "I like the name of it. . .**what does an 'erg' eat?"** I asked innocently.

His smile turned into a scowl. He wet his lips and exploded. "Good merciful heavens boy, I thought you went to high school and even had some college!"

If you counted finishing high school while in the Army and taking a half dozen night classes



at the local JC I guess he had me dead to rights. "I'm sorry but I just don't know what an 'erg' is" I offered in apology.

"That's alright son, most people don't. That's one of the reasons it has a chance of success. There aren't any black marks against it going in. Look here" he commanded as he dragged a text book out from under a foot high stack of loose papers on his roll top desk. "See? That's an 'erg'".

My eyes scanned the face of the page where his finger pointed. No pictures. I had expected to see a prehistoric animal, possibly related to the whale. All I saw were words and formulas. Then I spotted it in bold face type:

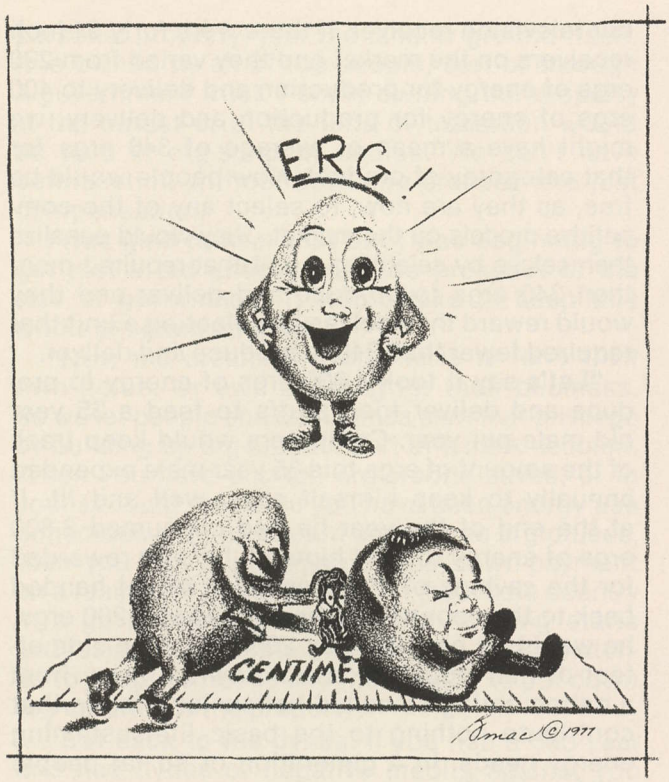
'The erg—the unit or work and energy. The work done in moving a body one centimeter against a force of one dyne'.

"Oh!" said I "so that's an 'erg'. But what is a dyne?"

His fingers flipped forward to another well worn page and the crusty index finger walked down the page to another bold face entry.

'The dyne—fundamental unit of force. One dyne will give a mass of one gram an acceleration of one centimeter per second'.

I mulled the dyne and erg over in my mind. If you had an object that weighed exactly one gram and you used one erg of energy to push that gram against a **resistance** of one dyne, the one gram object would **not** move. The one dyne of resistance would be exactly **equal to** the one erg of force and the one gram of weight would stay exactly still. But if you **increased** the energy to two ergs and the resistance **stayed at** one dyne, the one gram of object would move at a speed of exactly one centimeter per second. But I failed to see how I was going to carry 'ergs' of energy around in my billfold.



"Do you understand now?" the Professor queried.

"I think I understand the 'erg' and the 'dyne' but I don't see how either one is going to replace the folding green stuff in my pocket".

"Simple enough" said the Professor. "Remember that our folding green stuff, as you call it, is backed by the government. That is the full value of the paper money, and the coins we carry around uselessly are also backed by the government. Only the government's backing of this currency we have varies from day to day and year to year. When **they** need more money, **they** print more money. When **they** think **they** have too much in circulation **they** go out into the commercial banking system and **they** 'borrow' some of it back. The value goes up and down. . .but in the long term it just goes down.

"They encourage us to save it but when we do the interest on our savings is offset by the inflation. **They** control the inflation by controlling how much paper **they** print and how much of it **they** let in or take out of circulation at any time. The gold standard worked pretty good until FDR took us off of it because the gold had some real world value. But the paper currency today has no backing but the moral backing of our government. And you know how good today's morals are!"

I agreed with him but the discussion seemed to be getting away from the 'erg'. I still wanted to know how I was going to carry a "unit of force or work" around in my pocket.

"I'm getting there" he snorted. "Look at this" he commanded as he held up his left wrist and pointed at his watch.

For an instant I thought he was going to tell me about the scar under the watchband. "See this watch." I nodded affirmatively.

"Guess how many 'ergs' it took to make this watch?"

I didn't have the faintest idea. In fact until he asked me to guess I hadn't connected the 'erg' with **making** anything. But of course they are related. For example, the metal in the watch had to be mined, and smelted and transported and fabricated into the watch housing and the spring and gears and other parts therein. Each of these processes took energy and if you really wanted to sit down you could probably figure out how many 'ergs' of energy went into the production of that watch.

"That's right" he answered "now you are catching on! There isn't anything we use any day that hasn't some number of 'ergs' invested in it. The garden you are so proud of behind your house—you've got 'ergs' invested in the produce there. And the beautiful thing about an erg is that it is an exact unit of measurement. Oh we might have trouble getting the exact number of ergs invested in a product pinned down for the first ten years or so, but after we got used to it we'd have it down to a real science and it would prove to be a foolproof system of energy measurement."

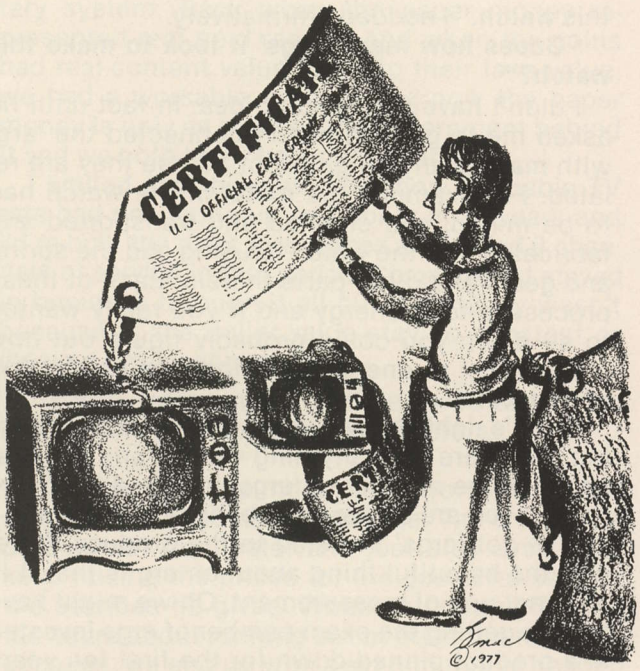
I was beginning to see the light and that was no pun. "Let's see" offered I "if I worked for a man for eight hours a day and he paid me based upon the number of ergs I put forth with something called **erg-scrip,** then I could take my erg-scrip into the market and purchase food for my family. When I looked over the grocery store goods I'd be able to see how many ergs went into the manufacture and processing of a box of Oatmeal, for example, or a gallon of milk or a loaf of bread. I'd convert my own ergs-worked into food stuffs."

He smiled broadly, "See how easy it is?" he asked.

I smiled back. And then a look of puzzlement crossed my face. "How is this better than what we now have with money" I asked?

"Let me start at the beginning for you" he answered in a sincere voice. "Because the 'erg' is well defined it is a standard which cannot be monkeyed around with. We are not dependent upon the world supply of a prescious metal nor the currency policies of the political party in power to determine our base-value. An erg of work in Australia is an erg of work in America.

"Secondly this is a high technology world. We place high value on doing things better, quicker. If you were paid in 'erg-scrip' and you were in a store buying a television set you might be faced with two sets producing identical pictures and features; only one has an 'erg-load' of 360 while the second has an 'erg-load' of 319. You'd have a new appreciation for the set that was produced while utilizing only 319 ergs of energy versus the set produced utilizing 360 ergs of energy; because you could directly identify with the number of erg-units you were paid yourself for a day's work. The whole manufacturing world would be given a tremendous incentive to use **less energy,** or



fewer ergs, to produce their products because right there on the tag would be a federal 'erg-certification' that told you how many ergs went into the TV receiver from the raw material stage to landing it on the dealer's floor for you to see. In no time at all our wasteful system of energy useage would straighten up and fly right. The whole world would become like your Oklahoma electric co-op members and they'd conserve energy because energy would become the basis against which everything they did and bought would be measured. Think of the new conscious-level of the world concerning energy!"

My head was spinning. I was obviously wasting ergs of energy with the new concept. Just thinking about it used up energy I had stored in my body. I'd probably have to eat an extra helping of supper to make up for the burned-off ergs I'd used up this afternoon! I knew there were some major problems with the concept, but what were they?

"Bet you are wondering how we'd handle the profit incentive?" volunteered the Professor. **That was it. . .**I knew there was a basic flaw in the plan! His concept might work alright in a socialist or communist society but I was born and brought up as a capitalist and I wasn't ready to trade that in just yet; whale oil lamps or no whale oil lamps!

"Remember the 'dyne'?" he asked. I did. It is the unit of force. If you stretched a point a tad you could also look at it as a unit of resistance; opposing the movement of a body or object.

"The 'dyne' becomes our tax collection system and our incentive for profit."

I knew the government was goint to get into the act someplace.

"If we do this right every task in the world will have assigned number of ergs to accomplish the work or create the product. Let's go back to our television receiver. If there were forty 21 inch receivers on the market and they varied from 290 ergs of energy for production and delivery to 400 ergs of energy for production and delivery, we might have a mean or average of 340 ergs for that categorey of product. Now people would be free, as they are now, to select any of the competitive models on the market. They would penalize themselves by selecting a unit that required more than 340 ergs to produce and deliver and they would reward themselves by selecting a unit that required fewer than 340 to produce and deliver.

"Let's say it took 4,000 ergs of energy to produce and deliver food stuffs to feed a 35 year old male **per year.** Computers would keep track of the amount of ergs this 35 year male expended annually to keep himself alive, well and fit. If at the end of the year he had consumed 3,800 ergs of energy to feed himself, he'd be rewarded for the savings of 200 ergs he in effect handed back to the economy. If he expended 4,200 ergs, he would be penalized by 200 ergs. One side effect of this would be a rapid switch away from a nation eating so-called hollow junk foods that contribute nothing to the basic life-sustaining energy needs. In a generation or so fat people will be gone!"

We chuckled at the prospect and decided that people would also once again seriously begin growing some of their own food in back yard plots.

"A company that produced products that were erg-wasteful would find itself, like the fellow who used up 4,200 ergs of energy to feed and keep himself fit for the year, penalized at the end of each year. This is where the 'dyne' comes in as a unit of tax collection. Remember there is no money, only erg-scrip. And eventually the inconvenience of the erg-scrip could be done away with as every transaction becomes a computer transaction; recording the erg-cost of the product or service against the erg-account of the purchaser and depositing same as a credit into the erg-account of the seller.

"Now at the end of the year the whole nation's erg-accounts are balanced and national averages computer-calculated for every categorey of person, family size, and product. People, products and manufacturers who were erg-wasteful during the year would be quickly identified and they would be assigned negative credits or 'dynes' for each erg they have wasted for the year. This would be done on a one for one basis; each erg wasted, one dyne assessed. Now erg-thrifty people and firms would end up the year with erg-pluses in their computer accounts and after the national averages were computer calculated they would be rewarded in proportion to their thriftiness by being allowed special land-holding privileges."

A bell went off. "Land holding privileges? we queried. "What is that? And what happened to real-property such as real estate? How do you calculate the value of a piece of land?"

"Oh yes, I forgot to mention that going into this program all land goes into an 'erg-bank'. Not

personal property, just the land or ground itself. It is owned by all of the people, sort of through a government trust. People owning the property at the outset or at the time of transition would be paid in erg-scrip of course. We can't have confiscation without both due process and just compensation."

I was glad to hear that but I was beginning to get just a tad uneasy with the prospect of the size of government it would take to keep this whole program straight.

"Now the dream of everyone is to have their own home. Or own building for their business. So we let people and companies earn that privilege by building up erg-credits. Sort of a bank account. When you have enough erg-credits saved, or in your account, because you have been energy use conscious enough to earn annualized erg-pluses, then you can apply them to the down-payment on a residence or building. With the whole country in a government land trust the housing starts and residence construction could be easily matched to people's needs and their ability to put down erg-credits for the property.

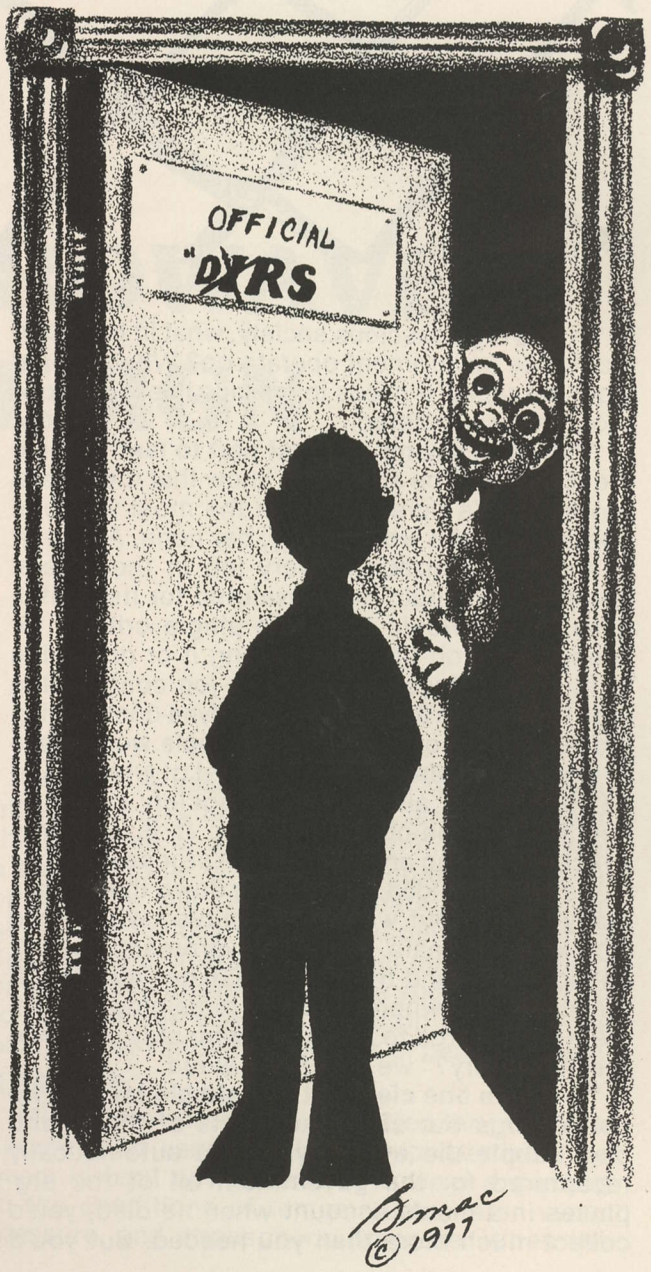
"But back to the dynes. If you had a bad year and had dynes or negative credits against you or your firm, you'd have to work off those dynes by being more energy use conscious in the following year. A company would be allowed just so many dynes against its annualized sales, as a percentage of annual sales, before it would be declared an energy wasteful company and forced by rules and regulations to close up shop."

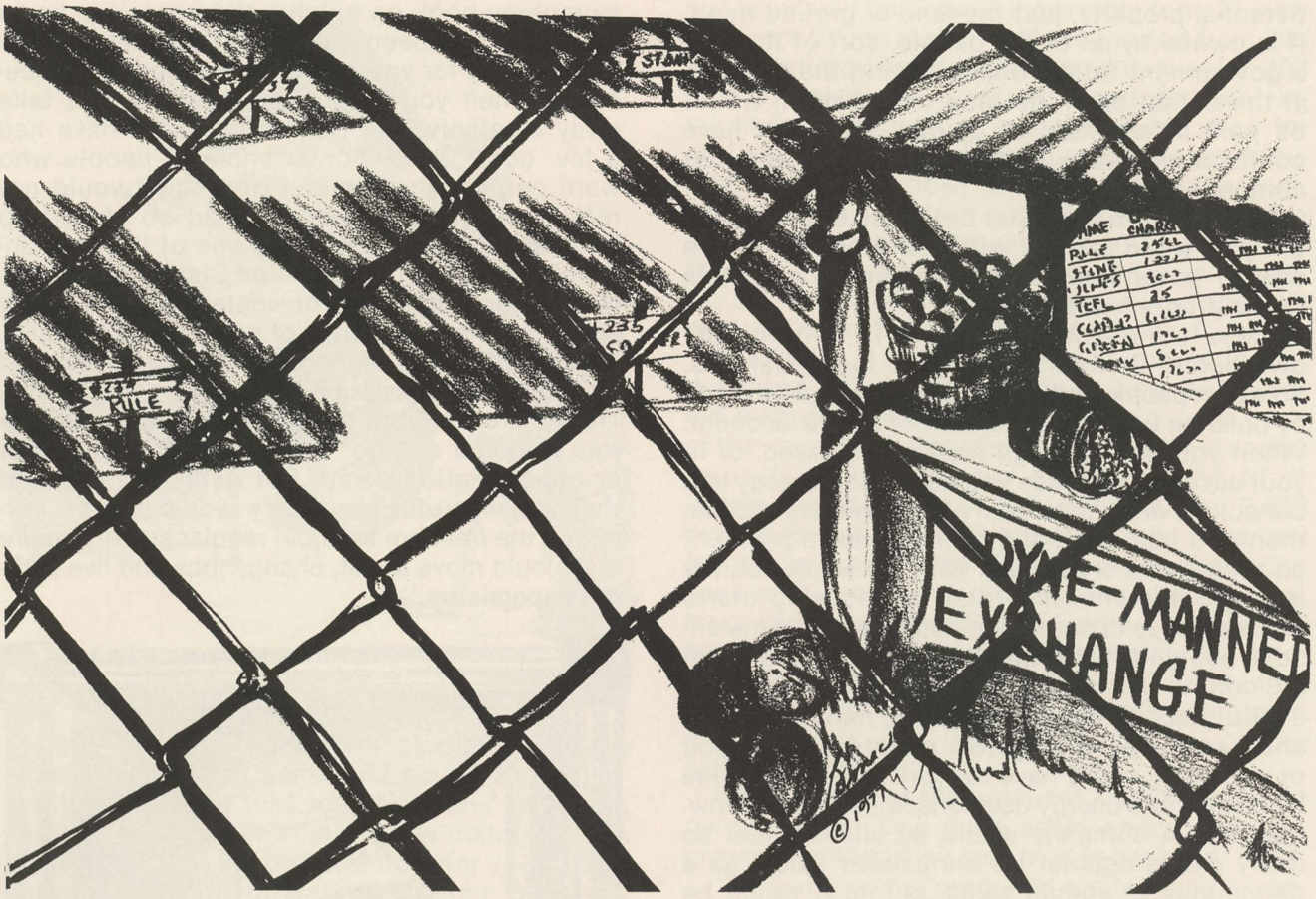
"Hold on" said we. "You might get away with closing up an energy wasteful company, but what about an energy wasteful person or family? You can't simply close them down!"

"Agreed. And that problem has cost me many sleepless nights. But I think I have a solution. First of all our whole purpose is to keep the world spinning, technology moving, and everyone on earth as reasonably comfortable as possible. We want to avoid a socialistic state and retain individual iniative and individual responsibility. But wasteful people must somehow be either denied privileges or punished. There are no other alternatives. We can't allow a wasteful minority to drag the rest down to lower standards of living. That's what happens with high taxation for the upper income brackets now, if you stop to think about it. By taxing those few who are skillful enough to be extra-efficient and extra-productive now, we lower their standard of living by depriving them of some of what is rightfully theirs... in return for which we shuffle the money down to the poor wretches who are either too lazy or too unskilled to even maintain a living. Taxing one person 80% of his income so that we can take his tax money to raise the standard of living of 80 people 1% is not very far from socialism... you'll have to admit that!".

There was some logic in his statement I had to agree.

"So I've borrowed a page from the Hubert Humphrey book on helping the poor. You know Humphrey has been wanting to establish a classless society for years. I've always opposed it because when you take away incentive you take away creativity. But Humphrey might have had a few good ideas. For example, if people who were perpetually wasteful of energy would not reform on their own, they would be picked up body and soul and moved to one of the vast undeveloped areas of the United States, such as in New Mexico or Arizona or western Kansas where we have miles and miles of non-productive land. There they would work, as a family unit if need be, under the close supervision of erg-instructors. They'd live well, but not lavishly. They would be free to come and go; this wouldn't be a prison or concentration camp. But until they mended their erg-wasteful ways they would not be permitted the freedom to rejoin regular society where they could move about, change jobs and live **without supervision**."





"In this erg-conscious society, what in the world would the government operate on? Where would it get the capital it needs to manage this monstrous program", I wondered.

"I've been saving the best part to last" smiled the old man. "You and I both know that the federal government's bureaucracy is the most wasteful operation in the world today; bar none. As a part of the re-organization, every job in the federal bureaucracy would be re-evaluted for its usefulness. There would be but a single criteria for keeping the job open, modifying it or disposing of it. And that would be 'Is the job contributing ergs or dynes to the society'? All dyne-contributing job positions would go. **These people would have to find work in the real world.** Most of what would be required in an erg-related society could be handled by computers anyhow. It is primarily a record keeping and evalutation process."

We liked the idea of trimming down the bureaucracy alright, but were still troubled with those who would remain. "If the government doesn't collect taxes, and the ergs and dynes stay in the private sector, where does the remaining government get its ergs to pay those who stay on to run the machinery?" we wondered aloud.

"We have one clear cut and simple tax and we collect ergs out of the accounts of those who pay. **People die everyday.** If you automatically recaptured for the government all of the ergpluses in a man's account when he died, you'd collect much more than you needed. But you'd also encourage him to be a crazy spender in his latter years. So you have one simple to calculate tax system; **when a man dies,** 50% of his ergpluses automatically go into the government coiffers. The balance, or the other 50%, is his estate for his family or as he saw fit to will away. That keeps the incentive alive, cuts all of the mickey mouse IRS red tape to the barest minimum and frees up Heaven knows how many IRS agents and employees for useful work."

We smiled and leaned back in the padded chair. The old man shifted his bent leg off the open drawer and back to the floor. Nobody said another word for several minutes. My mind raced with the possibilities of a whole world so conscious of energy needs and productivity that everyone actually worked together for the salvation of our planet. The prospect was bright but the road to the promised land looked more than slightly rock strewn.

Finally we spoke. "This is such a big change in the way the world functions. Why all of the petty greeds in the world, the establishment, virtually everyone would be against it. I just don't see how it could be sold to the public."

"Well, there's always whale lamps" he replied quietly. And then he too smiled. "Gave you some thing to think about, didn't I sonny" he said pulling his bent leg under the chair and pushing himself up from the desk. It was my signal to make my excuses and head for the door.

Squeezing by the last stack of magazines I

spotted the same magazine I had read on a TWA flight earlier in the summer. The one that told me that whales were all but extinct. The magazine was folded open to the whale story; so I knew he had read it. My eyes lingered on the article for just a second too long as he hobbled after me towards the door. I knew he had seen me looking at it.

"And just in case you think the whale lamps are a viable alternative" he began "come back again soon and we'll discuss that too!".

He was right of course. We couldn't turn back the pages of life several generations. We could only look ahead. But my that was a dark tunnel up there.

Returning to the office I remembered something I had been planning on doing for nearly two years. Out at the end of Summer street I still had three SKL split band tube type amplifiers running. I knew they were energy wasters, and the tube money I'd spent in the last two years alone to keep them going would have replaced them with some of the new solid state gear. It was past quitting time when I unlocked the door. The lights were out in the shop. Good. I could sit down by the front window where the afternoon sun was still brightly shining to do what I needed to do before heading home. It only took a couple of minutes to fill out the purchase order; "Three solid state, low current drain line extender amplifiers model. . ." I wrote down. And then I went back and underlined three words; **low current drain.** I'd never done that before, but I had the feeling that I would in the future.

BASIC MICROWAVE PATH DESIGN

Microwave engineering involves many complex considerations and calculations which may be beyond the realm of experience of CATV operators who are considering the installation of one or more hops of microwave. The operator who is unfamiliar with microwave technology must, therefore, rely heavily on the equipment manufacturers for recommendations and advice. It is hoped that this article will help those individuals to converse productively with persons interested in providing them with microwave services/hardware.

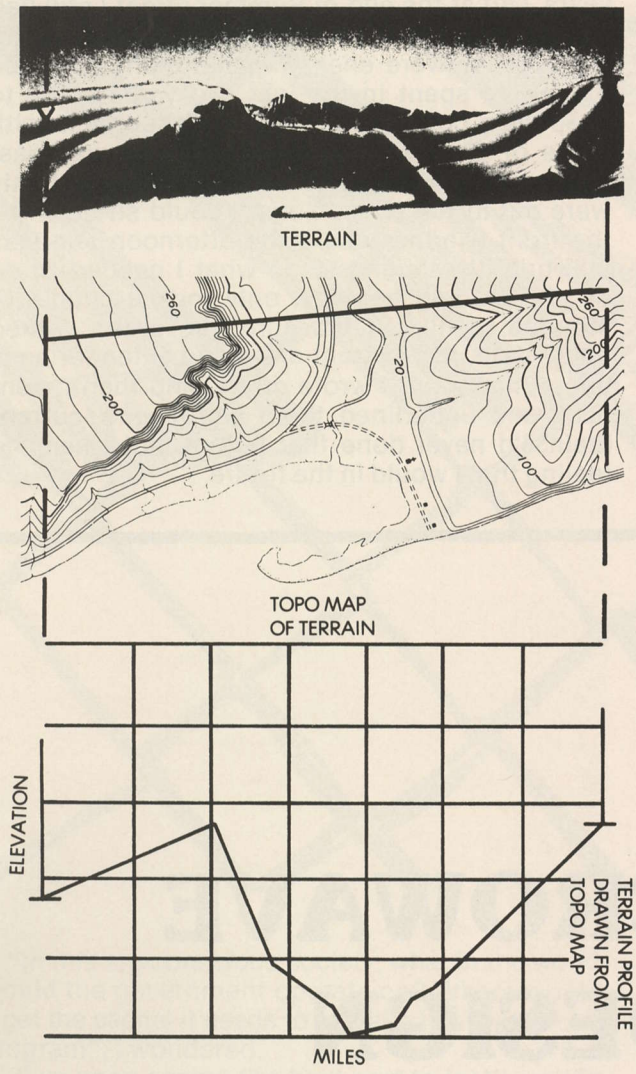
by
John Schuble
Microwave Division
Telesis Corporation
Evansville, In. 47714

Contact is usually first made with the radio manufacturer who will **supply** a terrain profile of the path **free** of charge. A simplified sample of a terrain profile is shown in **figure 1.** An actual path profile will show other data, including an allowance for beam bending/dipping (K factor). Fresnel zone clearances (F) will also be marked on the profile to allow clearance above the terrain to achieve free space attenuation values of the beam under various conditions of beam bending.

K FACTOR

Microwave energy is transmitted thru an atmosphere with varying refractive properties. The beam is bent upward and downward according to the conditions of temperature, water vapor pressure, and atmospheric pressure. When the

FIGURE ONE



beam **dips,** the condition is viewed as an equivalent earth **bulging.** When the beam is bent **downward** and tends to follow the earth's curvature, this is viewed as an equivalent earth flattening. **(See Figure 2).**

The "K factor" is 1 when the equivalent earth radius (bulge) is **equal to** the actual earth radius. The K factor is **greater than one** when the beam is bent downward an amount equal to the earth's curvature. **The K factor is less than 1** when the equivalent earth radius is less than the real earth, and the earth is therefore "bulged."

The normal daytime condition of the atmosphere is K 4/3; with the beam bent slightly downward, causing the horizon to be slightly extended. Microwave paths are commonly designed to provide terrain clearance for K 4/3 **and for** K 2/3.

To determine the clearance requirement at any point on the path at K 2/3, simply multiply the number of miles to one end of the path times the number of miles to the other end of the path. The product is the answer in feet. To determine the clearance requirement at any point on the path at K 4/3, simply divide the K 2/3 value by 2. For example, assume a 20 mile path: the clearance at the ten mile point at K 2/3 = 10 x 10 = 100'. 100 ÷ 2.50' at K 4/3.

It appears that the K 4/3 value need **not be** calculated, since it is **always less than** the K 2/3 value. **Not true,** because additional calculations of fresnel zone radii must be made and added to each of the K values.

FRESNEL ZONES

The microwave signal must be a distance **above** the earth's surface before it's transmission loss thru the atmosphere is **not** increased from effects

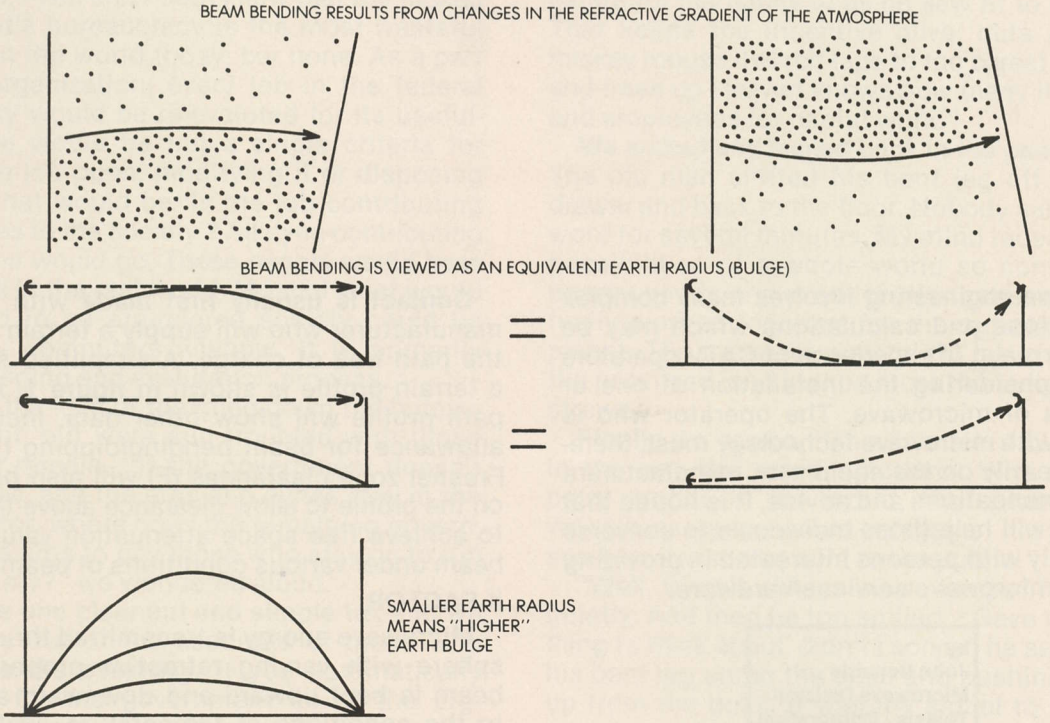


FIGURE TWO

of the earth's proximity. It has been determined that **the clearance needed is about .6 of one fresnel zone.** The design criteria to cover varying degrees of beam bending (determined empirically) is to allow for one full fresnel zone under normal conditions (K 4/3), and for high reliability systems, to allow for an additional .3 fresnel zones under conditions of K 2/3. What, then, is a fresnel zone?

Refer to figure 3. The dotted line shows the path of direct transmission. The solid lines with arrows show **some** of the paths that will reach the receive antenna one wavelength, later (delayed). The dashed line shows all points of reflection for the signal to reach the receive antenna 1-1/2 wavelengths later than the direct signal. The **first fresnel zone radius** is the **distance from the dotted line to the solid line;** the **2nd fresnel zone radius** is the **distance from the dotted line to the dashed line.**

The first fresnel zone radius can be calculated from the following formula:

$$F_1 = 72.1\sqrt{\frac{d_1 d_2}{FD}}$$

where **d_1 is the distance from the point** on the path (in miles) to one end of the path

d_2 is the distance from the same point on the path (in miles) to the other end of the path

D is the total distance of the path (in miles)

F is the frequency (in GHz)

Any other numbered fresnel zone radius can be calculated:

$$Fn = F_1\sqrt{n}$$

where **F_1** is the **first fresnel zone radius**

n is the **numbered** fresnel zone radius

A phase shift of 1/2 wavelength occurs during the reflection process. The above discussion allows for this factor.

These same clearance requirements apply to the sides of the path.

A sample calculation will clarify the K factor and fresnel zone consideration.

Assume a 20 mile path, and calculate the clearances in the middle of the path.

K 2/3 = 10 x 10 = 100'

K 4/3 = 10 x 10 ÷ 2 = 50'

$$F_1 = 72.1\sqrt{\frac{10 \times 10}{12.8 \times 20}} = 45'$$

$.3F_1 = 45 \times .3 = 13.5$

A) K 2.3 + $.3F_1$ = 100' + 13.5' = 113.5'

B) K 4/3 + F_1 = 50' + 45' = 95'

"A" (113.5') is the total clearance required, since it is greater than "B" (95').

These calculations must be done for **all** points on the path and **added to** the heights of trees/obstructions on the path. A line is then drawn between the antennas on the transmit and receive towers which clears **all** of the calculated elevations.

Prepared templates are available (or can be constructed) to eliminate the need to calculate clearances for all points on the path. A major advantage of the calculation method is that any scale of ruled paper may be used.

Figure 4 depicts total clearance requirements for path lengths of 2 to 40 miles, using the criteria discussed here, which is commonly employed

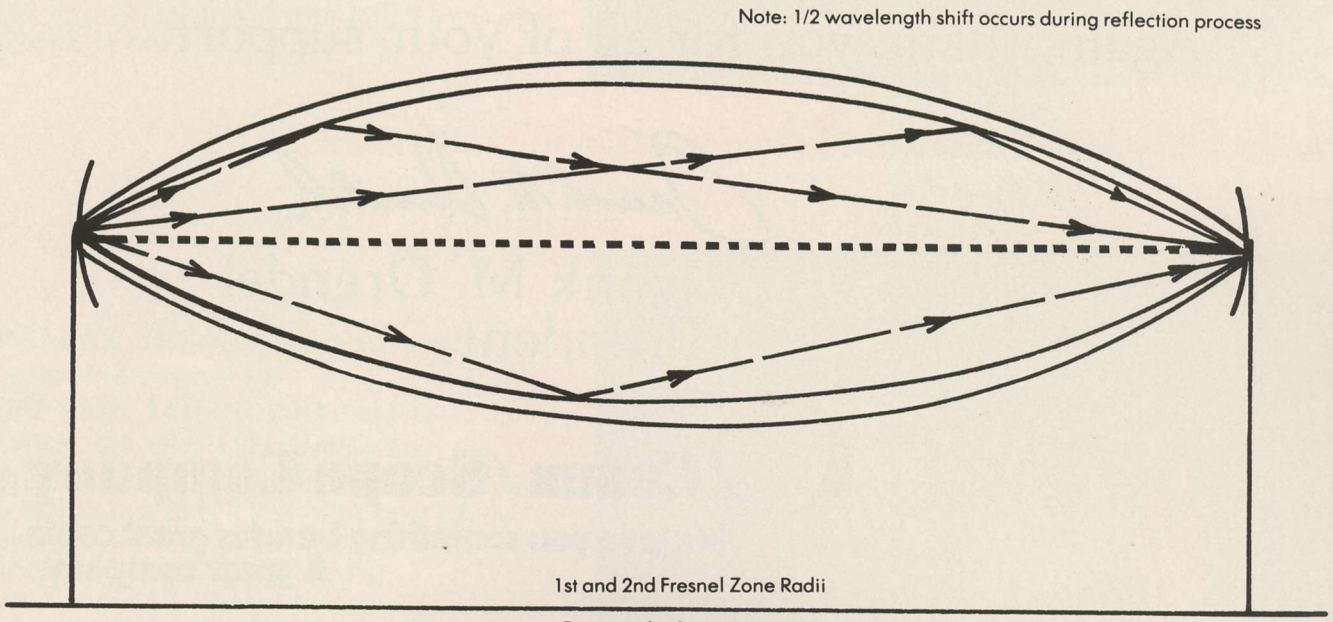


FIGURE THREE

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You* MUST *have this reference!

FIGURE FOUR
MICROWAVE PATH CLEARANCE
CARS BAND

F_1 above K 4/3
$.3F_1$ above K 2/3
80' tree/obstruction
minimum 20'

Point on Path

Path Length	1	2	3	4	5	6	7	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
2	**100**																						
4	100	102	100																				
6	**100**	**107**	**109**	**107**	**100**																		
8	103	110	115	116	115	110	103																
10	**104**	**113**	**120**	**122**	**124**	**122**	**120**	**113**															
12	105	116	124	131	132	133	132	131	116														
14	**106**	**118**	**128**	**134**	**139**	**141**	**142**	**141**	**134**	**118**													
16	107	120	131	139	146	152	155	156	152	139	108												
18	**108**	**123**	**135**	**147**	**156**	**164**	**169**	**174**	**174**	**164**	**147**	**123**											
20	110	125	141	155	167	177	184	189	193	189	176	155	125										
22	**111**	**128**	**147**	**162**	**177**	**189**	**198**	**208**	**215**	**215**	**208**	**189**	**162**	**128**									
24	112	132	153	171	187	201	212	222	235	239	235	222	201	171	132								
26	**113**	**136**	**159**	**180**	**197**	**213**	**227**	**238**	**255**	**265**	**265**	**255**	**238**	**213**	**180**	**136**							
28	114	140	165	187	207	225	241	254	275	288	292	288	275	254	225	187	140						
30	**115**	**144**	**171**	**195**	**217**	**237**	**255**	**271**	**295**	**302**	**321**	**321**	**312**	**295**	**271**	**237**	**195**	**144**					
32	117	148	177	203	227	249	269	287	316	336	349	353	349	336	316	287	249	203	148				
34	**119**	**152**	**183**	**211**	**237**	**261**	**283**	**303**	**336**	**361**	**377**	**386**	**386**	**377**	**361**	**336**	**303**	**261**	**211**	**152**			
36	121	156	189	219	248	273	297	319	356	385	406	418	422	418	406	385	356	319	273	219			
38	**123**	**164**	**195**	**227**	**257**	**285**	**311**	**335**	**376**	**409**	**434**	**450**	**459**	**459**	**450**	**434**	**409**	**376**	**335**	**285**	**227**		
40	125	165	201	235	268	397	325	351	396	433	462	483	495	499	495	483	462	433	396	351	397	235	165

for CARS band microwave. The numbers **include 80' trees and a minimum 20' clearance** regardless of calculations. Microwave paths installed with less terrain clearance than shown in figure **4 may** work, but it becomes increasingly difficult to predict the system performance as the path clearance is diminished.

Assuming adequate terrain clearance exists as verified by a field survey, (see **CATJ** article—May, 1977—**Field Surveys**) the theoretical receive-carrier-level can be determined by subtracting the total losses in the system from the total gains. **Figure 5** shows the loss values of the most common waveguides used, the gain values of common antennas, the loss values of radomes (antenna covers), and the loss value of circulators **(see figure 6).** Path loss is shown as 96.6 + 20Log D + 20 Log F (**figure 7** gives loss values for paths of 1 to 40 miles).

Next, the fade margin must be determined. Fade margin is the difference between the theoretical (normal) receive-carrier-level and the minimum usable signal. Receiver sensitivity must be determined first:

Sensitivity = KTB + NF_{dB} + BW_{dB}

where **KTB** is the noise floor which is -174 dBm

NF is the receiver noise figure in dB (11)

BW is the receiver band-width in dB (25 MHz = 74 dB)

Sensitivity = -174 + 11 + 74 = -89 dBm

A carrier/noise ratio of 10 dB is required to produce a 30 dB signal/noise ratio (because of the 20 dB FM improvement factors compared to AM). The required receive-carrier-level, therefore, is -79 dBm.

A calculated receive-carrier-level of -39 (as an example) will afford a 40dB fade margin (difference between -39 and -79). This information refers to "ideal" FM equipment, and in actual practice, fade margins may be 3 to 6 dB less due to "shot" noise in the FM receiver discriminator.

Little data is available to relate fade margin **and** path length **to reliability.** A rule of thumb (developed by the author based on unscientifically compiled empirical data on 65 paths) is to **allow 10dB plus 1 dB per mile** of path length for cascades of no more than 4 hops, **as a minimum.** Actual fade margins needed depend on the type of terrain, number of hops, reliability required, stability of towers, rainfall rates in a specific geographic area, etc.

Microwave systems tend to grow. When designing a hop of microwave, be sure to consider the feasibility of extending the system without redesigning it.

Many options are available at additional cost. Tunnel diode amplifiers (pre-amps) for the receiver, and post-amps for the transmitter will **increase** fade margins. Alarm units can alert the maintenance technician of an upcoming outage, a tower light failure, or a power failure. Standby battery power can provide time to restore com-

FIGURE FIVE
Typical Losses/Gains — 12.8125 GHz

Waveguide	
Elliptical	4.2 dB per 100'
Rigid	**4.2 dB per 100'**
3' Flexible Section	Negligible
Circular	**1.2 dB per 100' plus .6 dB for 2 connectors**
Aluminum	5.2 dB per 100'

Antennas-Standard (with typical 40-50 dB front/back ratio)

2'	35.7 dB
4'	**41.7 dB**
6'	45.2 dB
8'	**47.7 dB**
10'	49.6 dB

[dual-polarization antennas have .1 dB less gain, typically]

Radome (Loss)	
2'	**1 dB**
4'	1.2 dB
6'	**1.4 dB**
8'	1.5 dB
10'	**1.8 dB**

[Extra-strength radomes have higher losses. Add .5 dB, typically.]

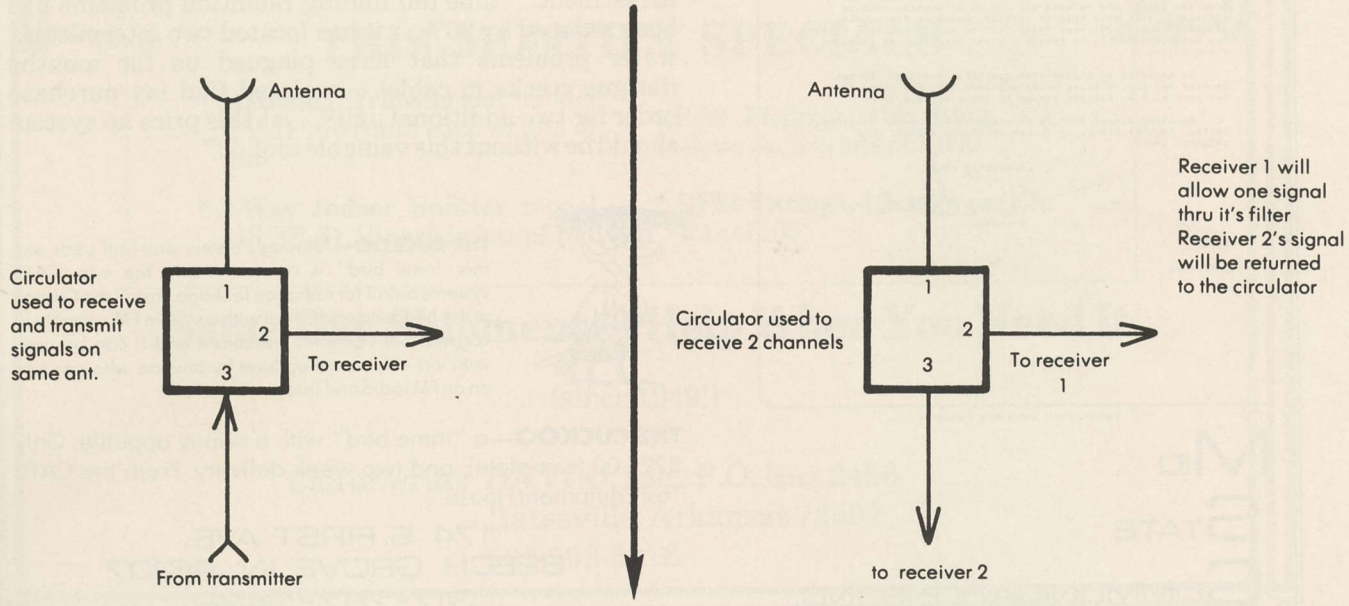
Circulators (Loss)	
Per port passed	.3 dB
General	
Splitters	3 dB
.05 Watt Transmitter	+13 (dBm)
.5 watt transmitter	+27 (dBm)
Path Loss	96.6 + 20logD + 20logF where D is distance in miles where F is frequency in Ghz.

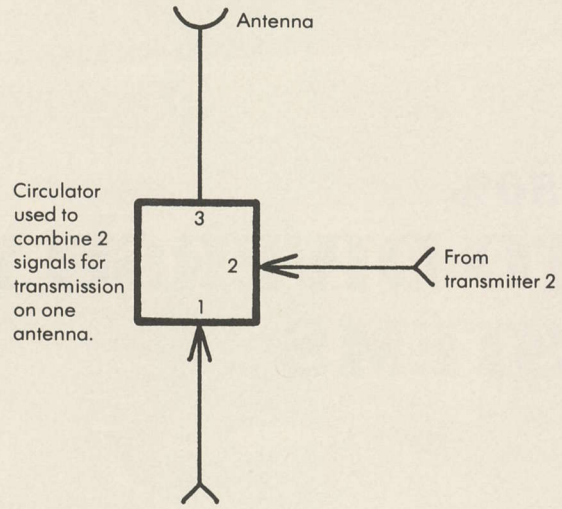
FREE SPACE PATH LOSS (12.8125 GHz)
Path Loss = 96.6 + 20 Log D + 20 Log F

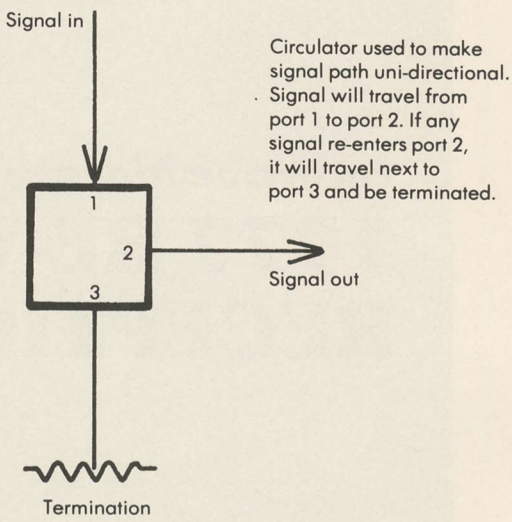
Miles	Loss	Miles	Loss
1	118.7 dB	21	145.19 dB
2	**124.7 dB**	**22**	**145.6 dB**
3	128.3 dB	23	145.98 dB
4	**130.8 dB**	**24**	**146.35 dB**
5	132.7 dB	25	146.7 dB
6	**134.3 dB**	**26**	**147.0 dB**
7	135.6 dB	27	147.38 dB
8	**136.8 dB**	**28**	**147.69 dB**
9	137.8 dB	29	148.0 dB
10	**138.7 dB**	**30**	**148.3 dB**
11	139.6 dB	31	148.58 dB
12	**140.3 dB**	**32**	**148.85 dB**
13	141.0 dB	33	149.12 dB
14	**141.6 dB**	**34**	**149.38 dB**
15	142.3 dB	35	149.63 dB
16	**142.8 dB**	**36**	**149.88 dB**
17	143.4 dB	37	150.1 dB
18	**143.9 dB**	**38**	**150.35 dB**
19	144.3 dB	39	150.57 dB
20	**144.8 dB**	**40**	**150.79 dB**

Circulators are used to combine and divide signals, and in some cases to make a signal path uni-directional. Drawings of circulator uses are shown here. The device usually has three input/output ports marked 1, 2, and 3. A signal entering any port will travel to the next numbered port; if it cannot get out, it will try the next numbered port. It will continue "circulating" until it finds a way out, **losing .3db each time it passes a port.** The devices are magnetic, about 2" square, and must be mounted at least two inches from any ferromagnetic material.

Understand that the receivers and transmitters attached to the ports of the circulators in the drawings have **channel filter.** In the upper right drawing, for example, both signals travel from port 1 out port 2, but the receiver filter passes only it's frequency. The other signal is rejected and sent back to port 2 where it re-enters the circulator, travels to port 3, and is accepted by the second receiver.







mercial power before the system experiences an outage. Clamper/distribution amplifiers can eliminate low frequency disturbances and provide a video "drop" for the CATV modulator at a repeater point.

Be sure to consider the possible expense of tower modifications and/or stabilizing starmounts, since these costs can be substantial. Maintenance personnel, spare parts and test equipment are other considerations.

Whatever microwave configuration is being considered, costs must be weighed against benefits. A careful study of each path by cost-concious individuals who seek to understand all facets of microwave operation, will result in the best possible service to your subscribers at a reasonable cost.

Improve Marginal Signals 50%

1977 RE-VISIT TO DIVERSITY RECEPTION SYSTEMS

Not Altogether

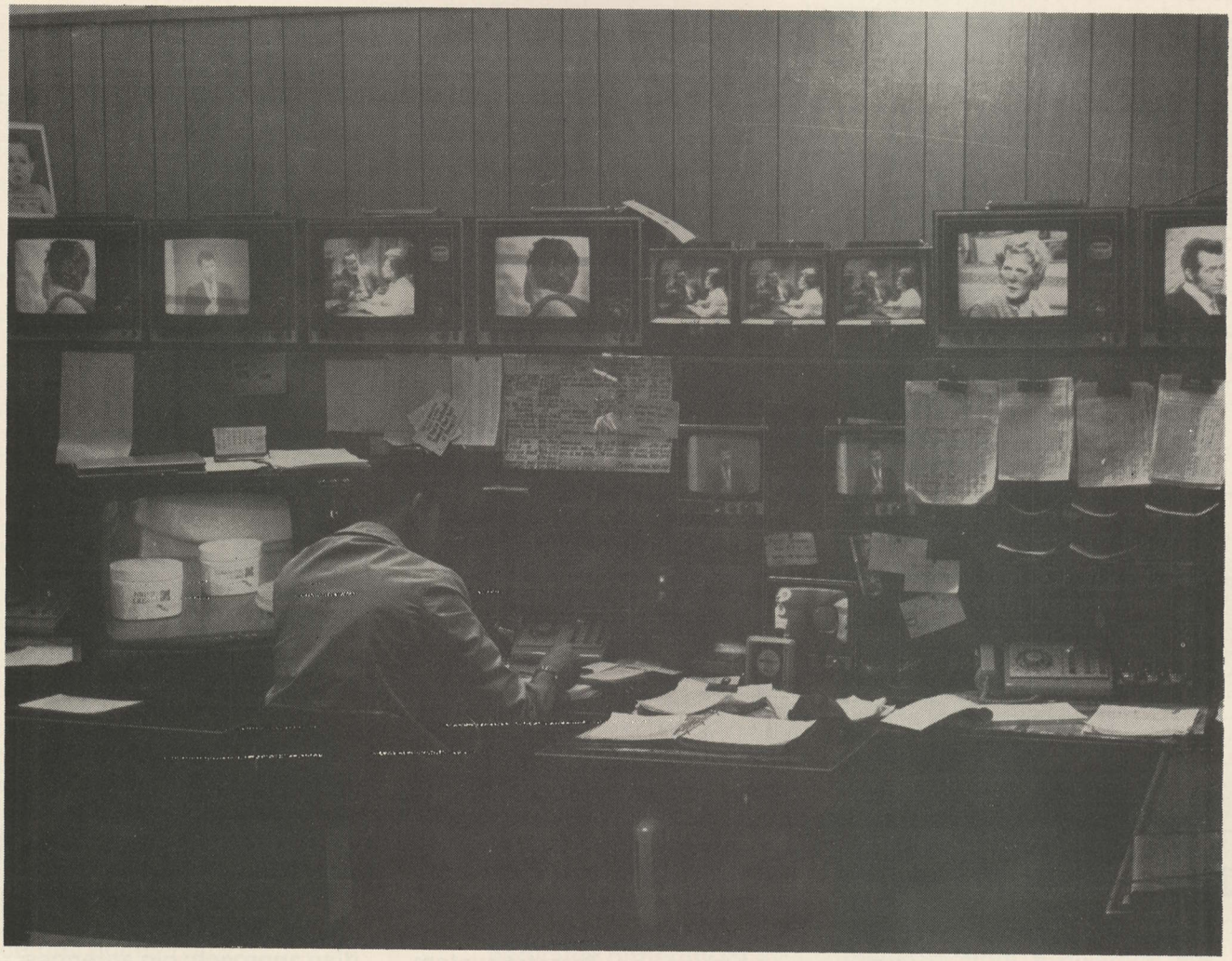
One of the most basic principles of VHF and UHF signal propagation is the fact that if you set up two identical receiving systems or locations, both "looking at" or receiving the same signal over comparable distances and similar paths, that the signal reception at the two locations will seldom be coincidental.

One illustration of how this impacts on CATV is found in the Vancouver, British Columbia CATV system; with more than 200,000 primary subscribers, reputed to be the largest CATV complex served from a single headend in the world today. The 'bread and butter' of the Vancouver system is just-out-of-reach Seattle market signals. The four VHF channels from Seattle (channels 4, 5, 7 and 9) are just weak enough arriving in the Vancouver metro-plex and the metro-plex is just noisey enough (i.e. the concentration of people and machinery generates a fair amount of interference to VHF reception) that by some careful off-air site engineering the Vancouver Cablevision system has been able to collect in excess of 200,000 of the city's 240,000 homes as subscribers. The Vancouver system began as many others in Canada also did; it grew up out of a series of non-connected apartment building system. When the decision to get out of the "block cable business" and into the "community cable business" was made in 1958, the owners and operators of the system had noticed that at various times of day and at various locations throughout the "block/apartment systems" complex they saw better signals at one location than at others. After a suitable period of monitoring it was discovered that three of the apartment building tops provided generally better signals than the others available, but for some reason there was no clearly one-best location. At some periods of the day, and year, each of the three selected sites had it all over the other two sites.

And so the decision was made to maintain all three sites, to cable the three sets of off-air signals from Seattle to a central office location, from which a hub headend would branch out to serve the whole of the community. As the system matured and the subscriber count grew the system reacted by installing a bank of permanent monitors or receivers in a "Control room" and by stationing there a "signal master"; an engineer or technician who's sole function is to sit and monitor the three sets of signals at all times, on the 12 monitors (four channels per head end, 3 headends cabled into the office hub). If he found site 'A' had a better looking picture on channel 7, for example, than sites 'B' and 'C' he switched that site's channel 7 signal into the master headend processor. At any given moment signals from all three sites, or two of the sites or on occasion only one of the sites might be in use by the systems 200,000 plus subscribers.

In this way the Vancouver system has ingeniously overcome a problem which apparently no other system in the world has solved to date; the fully attended selection of the best possible signal(s) for subscribers at all times.

The flip side of this record is that most if not in fact all other systems in operation simply select the best single



VANCOUVER CONTROL CENTRAL—constant visual monitoring of Seattle off-air channels at 'Woodwards', 'Van Horne', and 'Roof Top' sites provides measure of quality control for system's 200,000 plus subscribers. Signal source fed down line is selected manually by control operator.

site they can find and if the signals drop down or out on occasion; so be it. They hope that in the long haul the CATV system will provide sufficiently superior signals to normal home antennas to keep the subscribers on-line.

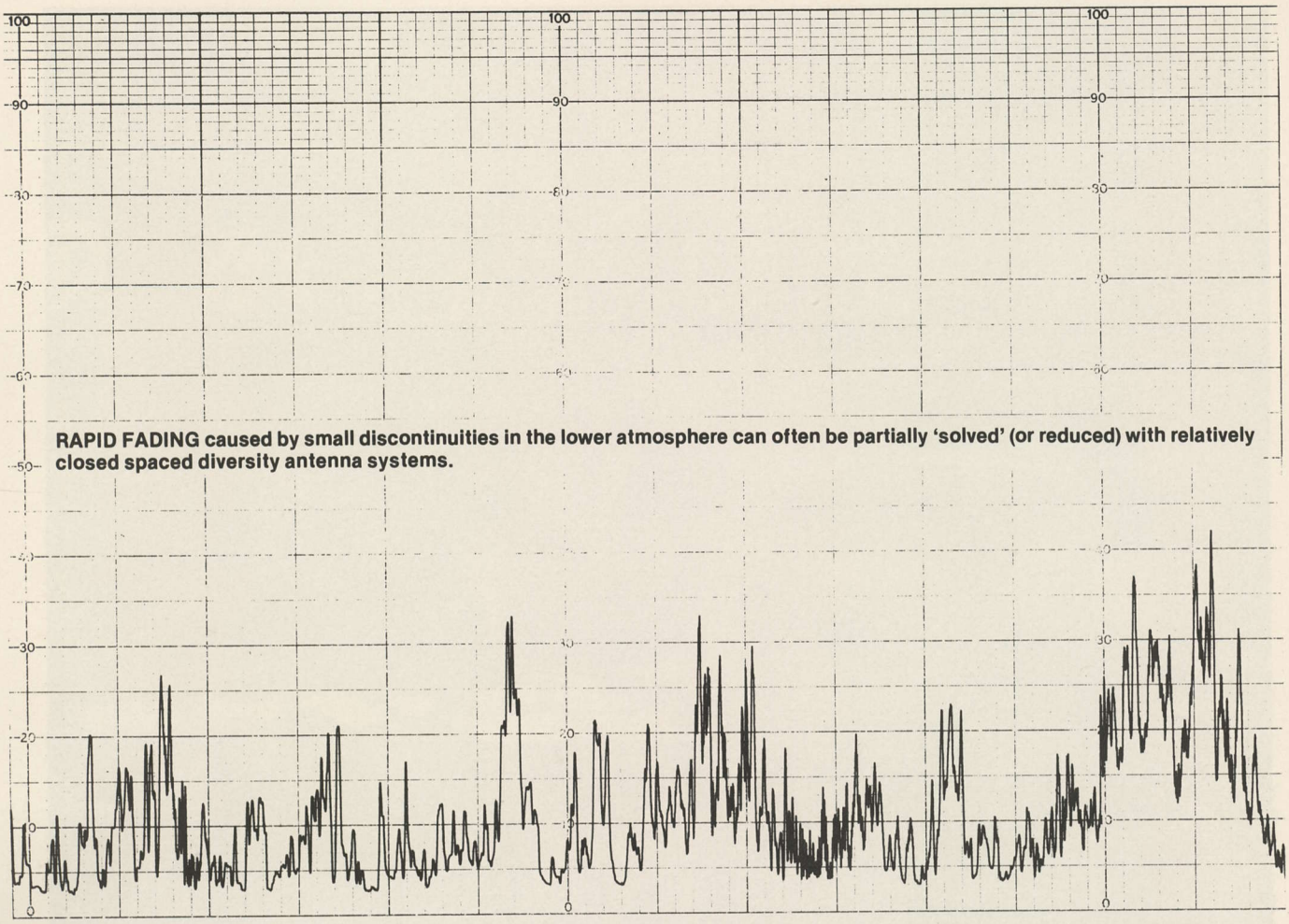
Selection of a site is at best a compromise, even if you happen to be receiving all of your signals from the same transmitter cluster in the same direction or heading. About the best the typical system can do is to employ some vertical 'diversity'; and few even bother to do that.

Some years ago the selection of a site was the single most important job to be undertaken by a new system builder or planner. Engineers, technicians and others who engaged in new system construction often spent weeks and even months "surveying" all available locations around a community seeking out the best possible signals. In those days a system often had signals from only one direction, and with the shorter transmitter towers and lower transmitter powers then employed, every dB of off-air signal level was very important to the would be operator. Then as TV transmitters discovered the value of tall sticks and maximum power transmitters the task of signal seeking became a less and less practiced art; so that today headend sites are often chosen with only minimal signal verification.

For example, how many systems do you know that put their headends on the south side of town when (for example) their most distant (and therefore the most prone to interference) signals come from north of town? Such systems look **through the town,** with all of the noise and other man-made junk that crawls into pictures, to pick up their most desireable signals. Or how many systems do you know have selected a site because the "price was right" or the "terms are good", without more than a quickie survey of the available signals and the interference present?

Other systems are forced into a compromise simply because signals come from several different, widely varying directions. Invariably, some of the signals must travel over the cable community proper which means that the headend site antennas must look through the town (or down a freeway, etc.).

The answer is of course some



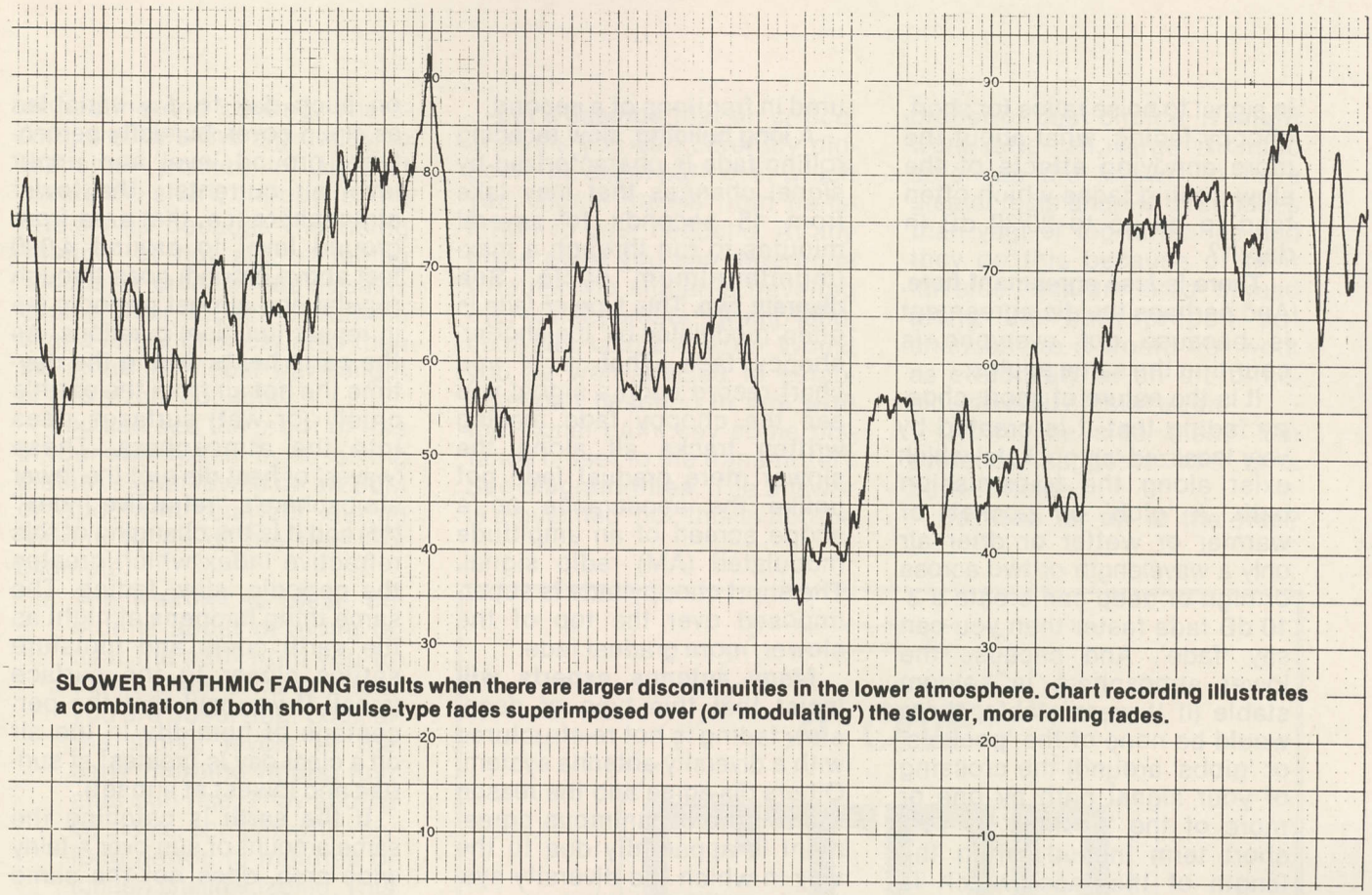
RAPID FADING caused by small discontinuities in the lower atmosphere can often be partially 'solved' (or reduced) with relatively closed spaced diversity antenna systems.

form of diveristy reception. But until now the costs for such diversity have been far too high for the typical system to consider the benefits of diversity versus the return.

Diversity reception is simply having two or more separate antenna receiving sites, properly separated so that when the law of averages catches up with you at one site (and the signal fades or otherwise garbages up) you can switch (either manually as in Vancouver or automatically as is now also feasible) to a second site. It is not a totally unknown approach. Several high Sierra communities on California's eastern slope have 'winter' and 'summer' headend sites for example, having found that there are at least two separate 'seasons' for signals in their area. The original Winnipeg, Manitoba system, designed around bringing into the Winnipeg area several North Dakota long-haul signals with huge tropo-scatter antennas, employed an automatic system that sensed which of two separate antenna systems was providing the best service at any given point in time.

If you think back to the mid 1960's in this industry you may recall the 'tropo scatter' antenna craze this industry went through. At the time the Canadian systems were well into huge 100 to 300 foot long (by half-height) wire mesh tropospheric scatter antennas. They were hauling in stateside signals over paths up to 200 miles long and for them this was the only way they could import long haul signals before they were eventually allowed to utilize microwave relay. The 'fad' swept into the United States during a period when the FCC was less than cooperative in allowing CATV systems to add additional microwave service channels (i.e. a freeze of sorts was on). Precluded from bringing in signals via microwave, the next best thing appeared to be the Canadian approach; big antennas.

At the height of the frenzy (which eventually died after the FCC **re**-opened up microwave for CATV) a smart chap figured out that if one of the big tropo-scatter antennas was good, that two tropo-scatter antennas should be better. The concept was that if you place the antennas far enough apart you could use the discontinuities in the transmission medium (the lower atmosphere) to insure that when signal levels were down at one location they would be up at another (or in the worst case, not down as badly). The concept was hardly new; it had been widely utilized in shortwave communication circles (for dissimilar reasons however) since the early 1930's. Most such diversity systems did not work very well, and today there are skeletal remains of the big antennas from Texas to Manitoba and California to Pennsylvania. If there are any still in operation within the United



SLOWER RHYTHMIC FADING results when there are larger discontinuities in the lower atmosphere. Chart recording illustrates a combination of both short pulse-type fades superimposed over (or 'modulating') the slower, more rolling fades.

States, we are not aware of their existence.

There are several schools of thought on diversity antenna systems for VHF and UHF. Most seem to agree on one central point:

a) **The effectiveness of the diversity array depends largely on the type of fading being experienced.**

For example, if the signal fade is short and choppy (**see diagram one,** a chart recording of such a fade rate), there is something to be gained with diversity (or two separate arrays) fairly tightly spaced. However, the up and down swing of such short, choppy fading is typically in the 3-10 dB **maximum** range, and the brevity of each cycle is such that if there are two antennas being sampled by the 'A' / 'B' switching network (the network that determines which signal to send on down to the processor or trunk), the switch spends a great deal of time chattering back and forth between the two. The bottom line on this specific type of short-term, choppy fading is that:

1) **Diversity can be effective** in cutting down the fade rate, but,

2) **The fade range is within such limits** (again, typically 3-10 dB range) that the headend AGC system should be able to handle the fades without any particular difficulty **(*)**.

Most 'A' / 'B' switching systems developed for CATV diversity antenna sites in the 60's and early 70's were simple voltage level switching circuits. If array 'A' had a higher signal voltage level present than array 'B' the switch simply favored 'A'. Such systems lacked the sophistication to determine whether the voltage level was in fact a pure carrier (i.e. not being degraded by noise or co-channel). The truth is, as Vancouver has discovered through the years, that "strongest is not always best-est!". Obviously something more sophisticated than a mere carrier-operated-relay (COR) is required if the system is to realize maximum benefits from a diversity system.

If most antenna experts agree on the ability of a diversity array to produce **some** improvement

***-As long as the signal fade is shallow, such as 3-10 dB, the processor AGC system should be able to handle the fading without causing dis-ruptions in the customer picture which the eye can see. This will not be true if the short fades take the signal level down below the threshold point on the AGC system; which simply means that if the 'average' level is close to the bottom of the AGC 'window' for the processor, the short, choppy fade could in fact drop the level below the AGC threshold point for brief fractions of a second or so.**

in signal to noise ratios for short, choppy fading, what about the more annoying affects of the slow, rolling fades which often tend to be up to 20/30 dB in depth?

There is less agreement here. And perhaps the dis-agreement is because not everyone is counting the same apples.

It is the nature of short, choppy fading that it is created by very localized 'air pockets' which exist along the transmission path. A 'glob' or 'pocket' of warmer or wetter or drier air only a wavelength or two across or high or deep can create a 3-10 dB fade faster than you can say 'fade'. And because the lower atmosphere is seldom stable (if it were stable, there would be none of the 'pockets' or 'globs' around) the crossing of your signal path by one or more of the 'pockets' is very short term indeed, often the length of the fade (which is measurement of the period of time the 'pocket' or 'glob' stays in line between the transmitter and receiving antenna) is measured in fractions of a second.

A long building, slow receding rolling fade is characterized by signal changes that may take from 15 seconds to several minutes to run through a maximum/minimum cycle. **See diagram two.** This type of fade is often 'modulated by' the shorter, choppy fade. That is, if you chart record such a signal you see the choppy fade making written tracks all along the slower more gradual fade not unlike the appearance on a scope screen of an amplitude modulated (AM) radio signal. The short choppy fade is superimposed over the top of the slower, more gradual fade.

Many antenna experts will insist that this type of deep, slow fading is not re-structured with a diversity antenna system. Others dis-agree and the reason there is not unanimous agreement is apparently due to the way in which the diversity system has been established.

This slower, deep fading is largely the result of the earth's heating and cooling. Depending on such day to day variables as cloud cover, humidity percentage, ground level and upper level air currents. . .the lower atmosphere (i.e. that area from ground level to around 4,000 feet above ground) goes through regular and almost periodic (as in repeat function) gyrations. As the earth heats during the daytime the hot air from the earth's crusty (or wet) surfaces rises into the atmosphere. These 'waves' of heat dis-rupt the lower atmosphere's "refractive index" **(**)** and it is the changing of this refractive index which creates the periodic, slow fading. The same thing happens at night as the earth cools and moisture settles closer to the surface (recall if you will that the percentage of humidity in the air on a clear day is greatest at sunrise and lowest at sunset).

If the earth is catching the same amount of sun over a fairly wide area, does not the same amount of heat waves rise (or moisture drop) over the whole of the region? The answer is in the negative because of the varying types of material on the earth's surface. Green, grassy meadows heat and give rise to updrafts at different rates than does water or plowed sod. Forests are different than fields of wheat. The end result is that the lower atmosphere, while it heats in the daytime and cools off at night, is a homogenious mix. Acres of corn heat the atmosphere above at one rate while acres of lake surface area next door have a different rate

****-The refractive index is the measurement tool utilized by meteorologists to determine the amount of 'signal bending' which is taking place within the atmosphere. VHF and UHF range signals do not travel straight through the atmosphere; rather they are bent, although typically very slightly, downward as they travel forward. For this reason there is some signal 'lumination' beyond the visual or line-of-sight horizon as a small portion of the signal front travels beyond the visual horizon because of the bending in the lower atmosphere. In practical CATV-land, this additional area served beyond line of sight by 'bending' typically makes up the more distant 50% or half of the predicted contour 'B' grade coverage area for a television station.**

of heating and cooling. Therefore, we have the big daddy to the small pockets of air that create the short, choppy fading rates. And because the rising 'clouds' of hot air, or falling 'clouds' of moist air are sizeable in size, their impact is likewise over a larger or wider area than the small individual wavelength or two sized 'pockets'.

You can see the proof of this in your own system by observing distant signal levels on an SLM or spectrum analyzer during various times of the day. For example:

a) **The weather is clear**, no storms about or along or near the path from you to the TV channel transmitters you are observing. Look at the signal levels in **the early morning hours,** just after sun rise. They should be stable, perhaps with very long period (3 minutes or longer) **shallow** fading. This is before the sun has begun to heat the earth and neither the small 'pockets' of air nor the large 'columns' of rising hot air have begun to move through the lower atmosphere.

b) **Look at the same signals** in the period 1 to 4 hours **before sunset.** If the weather has no storms along the transmission / reception path, the signals will exhibit both choppy fades **and** the slower, drawn out fades (on paths of mid Grade B contours and beyond into the so-called 'C' or 'scatter region').

Diversity arrays properly separated in space can and do overcome the slow, rolling fading. The key phrase is 'properly separated'.

How Much Separation?

One of the reasons there may be a lack of agreement between people who practice in this field is that there is no one, single answer to the question **"How far apart must the antennas be to create a true diversity effect?".** The reason for this should be quite evident; there are no two identical paths from transmitter to receiver in the world.

Let's assume that on critical analysis you can carefully pinpoint the **exact** path over which your signal travels from transmitter to your headend. At any given point you can determine whether the signal is traveling over water, forests, swamp land, cultivated land and so on. Would you be well advised to estab a second headend **in line with** the signal path, say some distance closer to the transmitter? **See diagram three.** The answer is a qualified 'no'; this is not the proper or best choice. It **might** work (after all, large rhombic antennas are known to have greater resistance to deep fades than yagi or log antennas and they do this because of their 'diverse' capture area spread **along** the path proper) but chances are it would not work **as effectively as** an off-to-the-side diversity installation.

Off to the side then? The evidence suggests this is a better choice.

But how far off to the side?

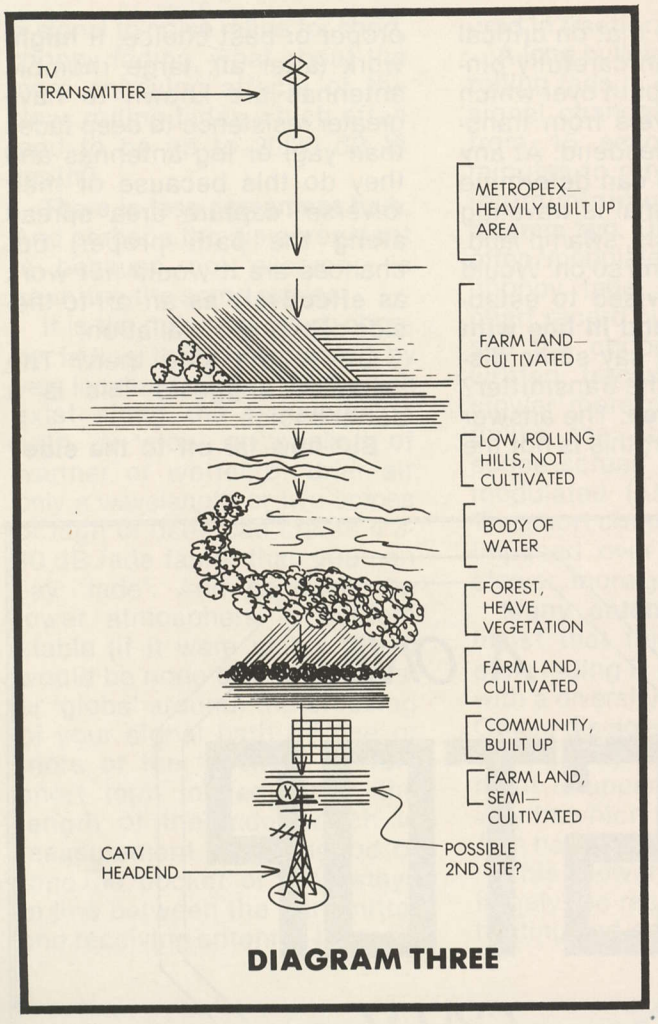


DIAGRAM THREE

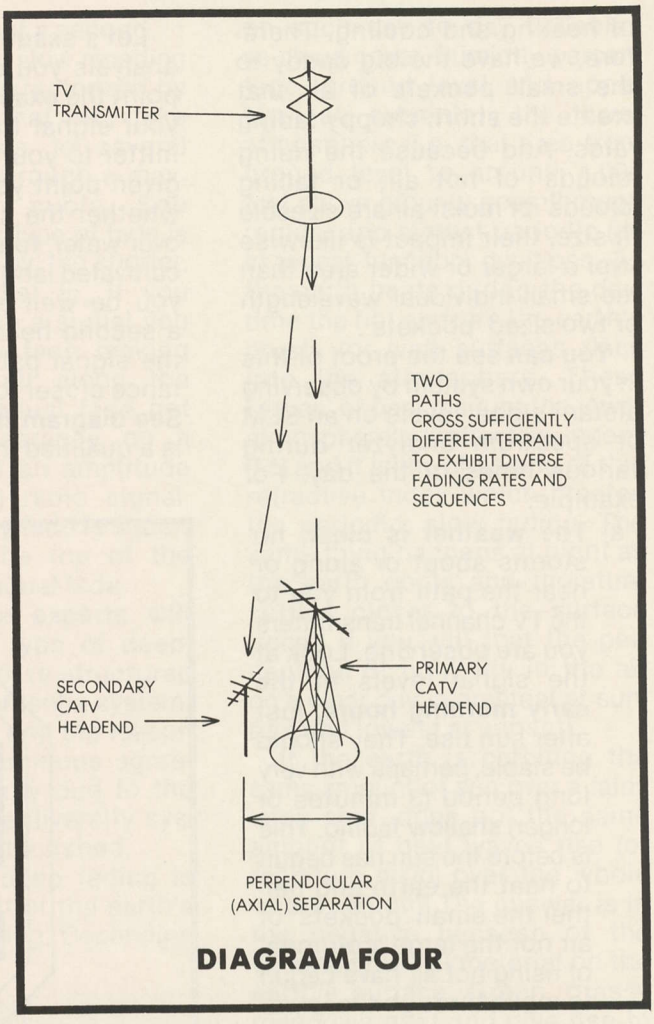


DIAGRAM FOUR

That's the sixty-four dollar question. And the answer depends entirely upon the physical make-up of the path itself; from the transmitter end to the receiving point at both sites.

If the terrain topography is essentially similar or identical along **both** paths **(diagram four)**, you are probably not going to gain much, if anything, with a diversity site. But if the paths can be dis-similar, so that you have different heating and cooling rates along the two respective paths from transmitter site to receiving sites. . .then you may have something.

Most of the large tropo scatter diversity arrays of the 60's were within "cabling distance" of the headend. That is, perhaps separated by a few hundred feet; seldom if ever by more than 1,000 feet. A 1,000 foot separation (side to side) on a 90 or 100 mile path is a very inconsequential **increment of** the total path length. If there is a rule of thumb in this business (and there probably is **not**), separations along the perpendicular path axis of **less than** 1 to 1.5% of the total path length are almost guaranteed to be unsatisfactory.

If this starts to sound like a 1 to 1.5 mile minimum separation between the respective arrays, you are dead on. But don't turn off yet. . .it may be much easier to accomplish (thanks to the march of technology) than you think.

Vertical Diversity

Some systems have found that by varying the height above ground of two arrays for the same station, they have been able to cut down on the amounting of signal variation present. This seems to be an especially effective technique along coastal areas where signal outages (or fades) sometimes last hours or even days due to local "inversion" conditions. The technique has less application for essentially over-flat-land paths and is perhaps useless in the mid-west except under some very unusual and quite rare weather conditions.

Recall that some of the eastern slope California Sierra systems have found that separate 'winter' and 'summer' sites are desireable. Los Angeles signals that travel up the back of the Sierras to the north have been found to vary 15-20 dB between the seasons at different sites; sites which produce useable signals in the winter are not satisfactory in the summer, and vice versa. Such sites are operated 100% of the time, when switched on, but there is seldom any effort to manually or automatically switch between the two **for short term** variations. Similar experiences have been reported in sections of New Zealand and Australia and it is likely as VHF and UHF range use increases world wide there

will be additional seasonal 'sites' found and installed. The explanation for this is not incomprehensible; coastal areas with mountains on or near the coast often experience almost stationary 'inversions'. The 'inversion layer' creates a kind of atmospheric 'wave guide' trapping signals between two different air boundaries or along a sharply divided temperature or moisture gradient. The VHF and UHF signals get caught within the inversion layer, or 'duct' as they are sometimes known, and this carries the signals far beyond the distance where they normally become too weak to be useful. By selecting between two separate sites as the seasons change the cable operator is simply compensating for either the height above mean sea level of the inversion layer, or, the path along which the inversion or duct forms. Sometimes it is straight vertical (meaning up and down height above sea level) diversity he is experiencing, other times it is a combination of vertical (height) diversity plus some horizontal (lateral or side to side) diversity he is taking advantage of.

The bottom line is that the signal is where you find it, and if you can't move it to where you are, you go after it where it is.

The Site Survey

Which brings us to how you go about, on a cheap and not very expensive scale, comparing signal levels at two different sites; your present headend site and one you have selected after some rudimentary signal searching work with a test antenna, a short mast, an SLM and a portable receiver.

Your goal is simple enough; you want to know, as a function of real time, whether when the signal fades at the master site it is **also fading** at the optional second site. First of all, you will need to acquaint the people involved with the differences between short, choppy fading and the more disastrous deep fades of 15 seconds or more duration. It is a little like calling a little league baseball game; there need to be some hard and fast rules going in.

The exercise can be done with chart recorders (which means you need two identical recorders, one at each site and both connected to SLM's before any processing AGC is encountered). Or, it can be done quickly and simply with one man stationed at the headend with an SLM watching the fading while a second man is stationed at the prospective second site with a similar rig. The two communicate with a telephone (if available), or with a two-way radio.

One man would ideally have a chart recorder connected to his SLM, but manual notes can be taken. While one observer stays quiet **and writes down** both his observed signal levels **and** the levels coming to him via telephone or two-way radio (in two separate columns) the second man simply reads out over the communication system the level changes. Here is where the hardest part comes in; separating the short, chopping fades from the more regular but slower fading. Let's say you see the signal swinging between -10 and -14 dBmV. It is moving pretty fast, too fast to really track out-loud. So you **average** the two and write down (if you are the logger) **-12 dBmV.** At the same time the second location man is doing the same thing; **averaging mentally** what he sees, and then sending you

only the 'purged' data.

The exercise can later be translated to some simple linear or log graph paper from the written columns and the fading compared directly visually. The parallel measuring process should be repeated at staggered periods of time through the morning, early afternoon and late afternoon hours. In short, it should fill the span, say in 15 minute increments each, of the majority of the daytime hours (when the fading is typically at its worst).

A few words of caution. Don't expect anything like 100% opposition-correlation. In other words, don't expect to find location 'A' **up** everytime local 'B' is **down.** That's a text book kind of diversity and it is seldom going to happen. By just the most pure odds of chance, if you have sufficient axial separation between the sites, you should see around 50% parity; that is, 50% of the time when one is up, the opposite site will be down. Therefore on a long term average anything as good as 50% or better is probably worth pursuing. **Wouldn't you settle for a 50% improvement in your more distant signals?** That's what we are talking about when all is said and done. Anything better than that is frosting on the cake. Anything less than that suggests you are still too close together for your particular path.

Getting Together

Assuming you find a second site that would, when worked against the primary site, produce improved customer pictures, how do you get the two sets of signals back to a common point, say the main headend?

Let's dispose of the obvious first. If you happen to have cable between the two locations, the answer should be obvious. Perhaps you have the making of a diversity link-back system already in place and you simply haven't thought of using the cable for this purpose previously! Those two-way capable cable amplifiers you bought some years ago might have a use for a sub-band return band plug-in amplifier afterall.

Now the not so obvious. **Low cost microwave.**

What is an improved picture worth to you? Let's say your one and only independent signal is often degraded by heavy fading. It is the **one signal** you receive which sets the cable service apart from the ho-hum network signals that filter into the community off-the-air. You've given considerable thought to taking a microwave feed for the channel, even to going up the road 25-30 miles and taking the signal off the air there and bringing it back yourself on CARS band. But the bucks have stopped you.

If diversity reception tests prove the signal can be measureably improved, why not look at tieing the diversity site back to the main head end with some two foot dishes and the new low cost microwave? A path only a few miles long will have bunches of margin, you can probably do it from almost ground level without getting all wrapped up in expensive waveguide, fittings and other parts that may slow down a serious low cost microwave effort for a longer path. You might even get by with some simple tripod mounts right on the roof of your headend building!

Automatic Selection

The Vancouver system employs a live person to make qualitative judgements on the signals present largely because they feel that when all is said and done there are picture degradation factors which electronic equipment alone cannot totally measure, and compare. They may be correct is this assumption.

Signal level is simple enough to measure, and compare; provided both signals are at RF at the same site at the same time. Separated sites, on the order where they must be microwave-linked complicates the simple signal level comparison approach. But signal level alone is not an adequate judgement; not as long as the signal level present may be the **sum** of real signal voltage (desired), plus, co-channel **non**-desired signal level, plus, **man made** noise sources. With the exception of co-channel, a signal to noise comparison system would be a better system, but it is not yet adequate. And it should properly be done at baseband (which is fine for the incoming microwave linked channel but not fine for the locally picked-up signal at the main tower which presumably stays at RF). Co-channel presents some additional problems, but they too could be solved with automatic comparison techniques.

The bottom line is that however the system is put together, it needs to be done inexpensively. Until the low cost microwave came along, there was no need to look for solutions to the automatic comparison and selection system problem; without a signal to compare, what was the necessity? But now that problem appears well on the way to resolving, some emphasis should be placed on designing the remaining missing ingredient to the system. Given our present day knowledge of diversity, the availability of low cost microwave, and the apparent ability to improve our marginal off-air signals by 50% or better, the impetus is present to add yet one more trick to our CATV kitbag.

IN THE NOVEMBER CATJ—

A special issue for a special reason. A hard look at the practical problems which have come about as a result of the industry's interest in low-cost (GunnPlexer) microwave. How far will it go, **really?** How do you get signals into and out of the GunnPlexer equipment, without spending more money on the peripheral gear than you spend on the microwave system?

A very operations-oriented treatment of FCC signal carriage rules versus Significant Viewing surveys.

State of the Industry-78. Nearly 4% of all CATJ readers responded to our 80 page industry survey form in the July issue. There are big changes coming if the survey results are 'on mark' and we'll look at what they are and how they are expected to mature.

Big antennas. Large 60 foot high by 120 foot wide half-bolics are producing outstanding results (+10/15 dBmV level signals) for one operator over 130 mile paths.

TECHNICAL TOPICS

Coop's Cable Column/September

"I fully agree with your September column.

The (TVRO) antenna prices have eroded to a level where an experienced manufacturer cannot afford to compete. The marketing expenses to sell the systems have increased as a direct result of the small aperture ruling and profits, if any, have decreased. I think you will see more major antenna companies, such as ourselves, no longer actively pursuing the TVRO market.

Since our corporate formation as Radio Mechanical Structures, Inc. in 1973, our primary goal has been to become the foremost supplier of earth station antennas. To date we have produced and delivered over seventy (70) In TelSat, DomSat and TVRO antennas. There are high quality earth stations ranging in size from 6-meter to 105 feet in diameter. We will continue to produce these antennas now that we are a part of the Harris Corporation and will maintain the high quality of our products which has made us one of the largest producers of satellite earth station antennas in the United States."

Rod Hurlburt
Marketing Manager
Harris Corporation/Antenna Operations
Kilgore, Texas 75662

I was glad to see your Coop's Cable Column in the September, 1977, issue. It brings up several very valid points in earth terminal pricing. Reasonable profit or return on investment on a product is absolutely necessary for a manufacturer if he is to produce, sell and service the equipment. Selling the earth terminal at the lowest possible price will gain a few sales initially, but no manufacturer can afford to maintain a service and engineering staff for free. And customers will not remain with suppliers who cannot support their product. These factors have almost become cliches, but are often overlooked when price is the only consideration.

As far as the "kit of parts" offered by the Texas group, the potential buyer should ask, as you suggest, "Who can I call for help on the overall system?" No doubt each individual component manufacturer (i.e. receiver, LNA, antenna) will honor its own warranties, but there will be a number of unanswered questions regarding overall system set-up, calibration and performance. The purchase of an earth terminal is a serious commitment by the cable operator and he expects to receive a prompt return on his investment. I am sure that the responsible system owner will want to choose a supplier who can design, manufacture, engineer, sell, warrant and service the **entire** package. Further, he would want to choose a supplier who is also firmly committed to the CATV market.

Again, Bob, your editorial was excellent and we hope those considering an earth station will look at both price and aftersale support before he buys.

Paul R. Beavin
Sales Manager
Cable Communications Division
Scientific-Atlanta, Inc.
Atlanta, Ga. 30340

I read your "Coop's Cable Column" in the September issue with great interest. The message is an important one, and I hope all your readers thinking about satellite service have seen it.

At least two of the points discussed require comment. One is the low profit margin currently "enjoyed" by suppliers. The other is the do-it-yourself engineering trend.

On the first point, have no fear, we are not pricing our radios so low that we will drive ourselves out of the business. We shall continue designing and introducing new low cost products like our 12XC Microplexer and VR-3 satellite receiver. We feel that by offering the cable operators inovative new products that lead to new profit opportunities for him, a continuing market for our equipment and services will exist.

On the second point, I am concerned about the potential problems that can develop from the do-it-yourself engineering trend. Little margin for error exists in the design of an earth station and selection of components. Without a contractor with overall responsibility, the operator may find himself holding the bag on a system with less than acceptable performance and nowhere to go but back to the drawing board. I hope anyone contemplating equipment purchases will seek and receive advice from people who have a strong microwave engineering design background and a reputation at stake.

J. 'Duke' Brown
Microwave Associates, Inc.
Burlington, MA. 01803

To All—

These responses to the September 'Coop's Cable Column' pretty well reflect the 'typical' reaction of suppliers to the TVRO portion of the industry. A couple of not-so-typical reactions are being developed into a November 'Coop's Cable Column' report. The bottom line remains the same. . .when you pay too little for something, you often find that the sweetness of the deal turns sour when you need help after **the sale.**

Youngest Analyzer Builder?

"I purchased one of your CATJ/Laufer spectrum analyzer kits with the intention of allowing my son Paul to build it. Paul does know how to use a soldering iron but this is about

the extent of his prior experience. I gave him no help except to finalize the test set-up with the scope and field strength meter. The assembly works well and he is very proud of his success. I know that all of the credit should go to Mr. Laufer and CATJ.

I enclose a photo of Paul with the CATJ/Laufer spectrum analyzer. Paul was 12 in September. Would he be the youngest participant in the industry wide project? We are looking forward to your next 'invention'!"

Jan Spisar
Triple Crown Electronics Inc.
Rexdale, Ontario
Canada M9W 2Z3

Jan—

An our congratulations to Paul! We suspect that Paul is the youngest to build the elementary analyzer, and we suspect that Barbara Herbert of GTE-Sylvania (see CATJ for August 1977, page 13) **is the only dis-staff builder. This particular project went exceptionally well with 225 CATJ kits now out in the field. Now you fellows who are having trouble making yours work... perhaps 12 year old Paul, or Barbara, can help you out!**

July Contest Winner

Our July issue of CATJ included our annual industry marketing study and survey; and the opportunity for some fortunate reader to win his very own low cost (GunnPlexer) microwave system.

In years past our survey participation has averaged between 2.5 and 3% response from readers. Not bad, certainly high enough to produce statistically accurate survey results, but not outstanding. This year we broke all of the records; **perhaps** because there was a 'premium' attached to the survey.

Over 4% of all readers responded to the survey and on August 26th, after our cut-off deadline had passed, we asked our Janet Stone to randomly select a survey card from the pile. Out came the card of Mr. **Gene Warner, Longhorn Communications, Jetmore, Kansas.** Gene is relatively new in the cable business in western Kansas, serving a small community that now receives five channels of television thanks to the miracle of cable.

Gene is receiving from CATA, CATJ and Microwave Associates one of the low-cost GunnPlexer **systems.** This is the non-commercial version of the low-cost microwave, starting with the basic Microwave Associates GunnPlexer modules and building from there with the latest (current) version of the modulator and demodulator package developed in the CATJ Lab. Now Gene will be studying for his amateur radio license so he too can use this system **legally!**

Congratulations to Gene for being selected as the contest winner, and our thanks to the several hundred other industry members who took the time to complete this year's marketing survey. We'll have a report on the results of that study in the November issue of CATJ.

Permission Granted

"I enjoy CATJ and find it both interesting and informative. While going through the past issues I find that I am missing several which I would like to obtain. These are the August 1974, January, February, August and September of 1975. I would also like your permission to copy articles that pertain to subjects that we are now teaching our men in an effort to improve their abilities in our field. Please keep up the good work."

Alan Baumgartner
TelePrompTer Cable TV
Largo, Fl.

Permission granted for copying of CATJ material for this type of purpose, of course. In fact people who are using CATJ articles for training can feel free to go right ahead and copy at will... we are not the stinkers that others might be over the copyright business, perhaps because we understand the user's side as well as the creator's side! As for back issues...our supplies ran out some time ago. Anyone wanting to help Alan complete his 'priceless set' of CATJ can contact him at 1176 East Bay Drive in Largo (zip code 33540).

More TVRO Surplus

"I have some older tube type Motorola 6 GHz video receivers available for swap and some surplus dishes that are somewhat banged up (an auto body man could bang them back out again). I am also building a TVRO and need an LNA and a feed for a 10 foot dish. Additionally, I need a 4 GHz mixer assembly. I can obtain an HP generator (HP 616) which covers up to 4.05 GHz and can be modified to cover the full 3.7 to 4.2 GHz region. At the present time it looks like it will be next spring before I am up and running with my own backyard project. If CATJ wants to act as a clearing house for spare or needed TVRO parts, that's great!"

Walt Pfiester (W2TQK)
1 Skadden Terrace
Tully, New York 13159

Walt—

We are glad to provide a 'forum' for people building their own terminals and hopefully through these pages the self-doer TVRO enthusiast will be able to find what he needs to complete his system. The LNA looks like it may end up being the toughest hill to scale; the low noise GaAs FET amplifiers are so new they have not made it to the surplus market yet (it may be years before they do). Anyone have any suggestions? We've seen some surplus 3-4 dB noise figure traveling wave tube amplifiers (with 50 dB of gain) around in the surplus channels, but that is far too high a Nf for a ten foot dish.

Mis-Leading Spec

"In the Showcase section of the June CATJ, our Channel Notcher (model 3271 A) is listed. However the specs listed are mis-leading in that it describes the notcher as attenuating the entire 4.5 MHz channel-band-width. Actually, it attenuates each of the three critical carriers (video, color, audio)."

Bill Zajac
Asst. Chief Engineer
Microwave Associates, Inc.
East Syracuse, N.Y.

Bill—

Correction noted. What we meant to say was that by employing your Channel Notcher the user 'cleans up' the affected channel such that he can then re-use all **of the channel with a new signal inputed at the point where the Channel Notcher cleans up the previous on-channel signal. By chopping out the three carriers noted a person should have a clean channel remaining. We feared saying that you simply chop the three carriers, concerned that people would wonder how eliminating them left the channel clear.** Trust us guys...**it does. (Or should!)**

Crud Cleverly Explained

"I would like to reply to the "Crud" letter on page 40-41 of the July 1977 issue, just in case nobody else does. The source of interference on the Channel 30 picture is in all likelihood due to the San Francisco Channel 44 listed in my book of channels versus places, since the Channel 44 signal is probably quite strong. Since the receiver is tuned to Channel 30, and the mixing is a function of the intensity of both signals, it would appear as if the crud comes from the same direction, which in fact it doesn't.

It works like this: Channel 30 has pix carrier on 567.25 and sound on 571.75. To get a 41.25 sound/43.75 pix in the IF, a local oscillator of 613 MHz is used. Channel 44 has its pix carrier on 651.25, and sound on 655.75. Now, the selectivity of the UHF preselector on a tuner is not very good, and a strong 44 will make it through even with the tuner set to 30. When the 44 pix carrier gets into the mixer, (the pix carrier being the strongest signal Channel 44 puts out, and therefore the most obvious crud generator), the resulting frequency is 42.75 MHz, which is 3 MHz (exactly, if the oscillators were all dead on) above the Channel 30 carrier in the IF (well, below, actually, but the IF is inverted). Since 3 MHz isn't an integer multiple of 15,750 or 15,734. . ., the pattern appears to move. This motion in the picture is further aggravated by oscillator drift especially in the LO.

The solution? Don't use a standard IF! If you convert Channel 30 to Channel 3 first, the problem is gone. Pick the intermediate channel so as not to cause crud somewhere else in the system, of course, and preferably the blank channel you're going to use. If you insist on using a standard IF, amplify the Channel 30 signal a lot before going into the IF—this will swamp out most of the Channel 44 signal with the AGC action in the tuner and IF.

The FCC forbids channels that are 14 or 15 channels apart from being within 60 or 75 miles of each other, respectively, because of this problem, but only because TV sets all use the same IF. Thank goodness for that, at least, or the problems would be random."

Jim Rieger
Rieger JL
Ridgecrest, Ca.

Jim—

Well done! A clever bit of sleuthing and hopefully now reader John Phillips in Pleasanton, California can effectuate your cure as outlined.

Unreasonable FCC

"I thought the industry might be interested in a recent FCC decision effecting my 80 subscriber system here in southern California. The following letter explains the 'problem'; and their solution. The bottom line is I have another impossible task brought on by their dumb rules.

Dear Sir:

I received by mail, Saturday, August 6th, a copy of Memorandum Opinion and Order, dated July 1, 1977, and released July 28, 1977, granting my application for a Certificate of Compliance for my existing Cable System in Trabuco Canyon, California.

I note with interest, that I am ordered to add the signal of KOCE TV to the existing system.

In checking the maps, I find that Huntington Beach is within 35 miles of Trabuco Canyon, the transmitter site of KOCE is within 35 miles of Trabuco Canyon, and therefore according to the well intentioned Rules and Regulations set forth by your Commission, KOCE TV should be on the Cable. One small point has been overlooked however; reception of a UHF station is dependent on line of sight wave propagation and this does not exist between KOCE and the receiving location for the Cable System. I have made several tests using a new Sony TV set, several different antennas, and a 30 dB gain pre-amp, and the picture and sound received is not usable, and it is my belief there is no way the signal can be improved to provide a usable signal for the cable. I estimate it to be -40 to -50 dBmV.

To add KOCE the existing system would require a new receiving location (Head End) and/or a several hop microwave system. I estimate the cost from $50,000 to $150,000.

The cost to add KOCE to the existing cable system is prohibitive and I cannot and will not do it. The costs would have to be passed along to the customer and would make his monthly rate in the neighborhood of $75.00 per month. This is not in the public interest.

May I suggest that your Commission order KOCE to move its transmitter to a more suitable location where it can fully serve this area. In addition to the 80 homes I serve, the other 30 homes in the Canyon would also be able to receive KOCE.

The above facts considered, I respectfully request your Commission issue a waiver of the appropriate rules allowing the Cable System in Trabuco Canyon to continue operation without being required to add KOCE.

By copy of this letter the Chief, Cable Television Bureau is informed I cannot comply with the order to add KOCE to Trabuco Canyon Cable System. If I cannot receive a waiver, I would appreciate any suggestions you may have.

Respectfully submitted,
Orange County Cable TV
Ray Torian, Owner

Ray—

Your situation is hardly unique, KOCE is a channel 50 station licensed to the 'Coast Community College District' of Huntington Beach. It's success or failure depends upon the funds provided by the school district and viewing in your canyon area has no bearing on

that funding. The Commission's failure to recognize the non-availability of a signal such as this, plus the financial limitations of an 80 subscriber system is a gross example of bureaucracy run amuck. The Commission establishes procedures for obtaining waivers of the rules and will undoubtedly 'allow' you to proceed in that direction. But the waiver route is expensive; it requires both time and money. A system with 80 subscribers should not be harassed by the rules in this fashion nor forced to go through the expensive waiver process. CATJ/CATA would like to hear similar reports from other 'under 500 subscriber' systems, now operating or planned, facing this type of problem. Perhaps if there are sufficient systems involved some type of 'class or group action' can be brought against the Commission in the form of a rule making petition. Let's have the facts fellows and see where it leads us!

Trends In Future TVs

If the wave of the future in American television set styles is set by design innovations first appearing in Europe this year, there may be a great deal of change coming. The recent Berlin International Radio-TV Exhibition marked the first gathering of world wide television receiver manufacturers in several years and the air of change was everywhere evident.

For trivia buffs. . .what was the largest U.S. manufactured direct view screen size ever offered? If you said 30 inch (first offered by Dumont in 1950), you are correct. Now Sony is showing a 30 CRT Trinitron proto-type with delivery expected in early 1979; the price tag to be in the $4,400 "range". But size was not the main feature of the Berlin show, rather the sophistication of the receiver itself, turning it into a modern home 'video center' seemed to have caught the attention of receiver manufacturers.

For example, Saba displayed a receiver that is actually two receivers in one. In addition to the normal color CRT display the viewer has the option of 'inserting' on the screen a smaller black and white picture from another TV channel or video source. Saba noted that a viewer could in effect watch 'two channels at once', or, 'using a local black and white camera keep an eye on the kids in another room while still enjoying their regular television channel'.

Digital displays were very big. Virtually all of the 49 brands on display had wide selections of receivers that automatically display (1) the channel number the receiver is tuned to, and (2) the correct time. Some of the digital clocks that display are positively over-engineered. One has a DC back up supply that will keep the clock set to the proper time (for screen display) for 'up to a year with the power disconnected'. This particular receiver comes direct from the factory with the time already set; when the viewer first turns on the receiver fresh from the crate, there is the time correctly displayed.

Another major theme of the show was 'text on the screen'. The British have been experimenting with the transmission of digital 'text' interleaved with their normal video program material and the German Post Office is scheduled to begin wide spread use of a similar system in 1980. Receivers were already available to call up for screen display the digitally derived 'text' and the German system will allow viewers to 'call up on command' via a two-way telephone hookup 'millions of pages of computer stored text'.

LOW COST PRESSURIZING FOR MICROWAVE WAVEGUIDES

Microwave equipment and hardware is expensive. Thsoe who are planning to build a system will find that the cost of some items can be reduced. One such item is a dry air pump used to purge the waveguide of moisture.

A device similar to that shown here can be constructed in a few hours for approximately $60. (Similar units sell for $300.) No skill is needed for construction and most of the parts can be obtained locally. A complete parts list is shown in Figure 2.

The dry air pump consists of three basic sections; (a) a pump to bring air into the waveguide, (b) a drying agent to remove moisture from the air, and (c) a pressure switch to control the pump motor.

Air is pumped through a canister containing silica gel (desicant). The desicant absorbs the moisture from the air. The dry air enters the waveguide. A pressure switch controls the pump to keep pressure in the waveguide at approximately 3 psi (adjustable).

The absortion of moisture will cause the desicant to turn pink. Pink desicant can be reactivated by placing it on a cookie sheet and heating in an oven at approximately 200°F. When the desicant has returned to it's normal color (blue), place it in a sealed container for future use.

When constructing the dry air pump, use Teflon® tape on all threaded joints and remove the valve stems from the schrader (item 14) and gas inlet valves.

by
Tom Scharf
Microwave Division
Telesis Corporation
Evansville, In. 47714

Automatic Dehydrator Pump

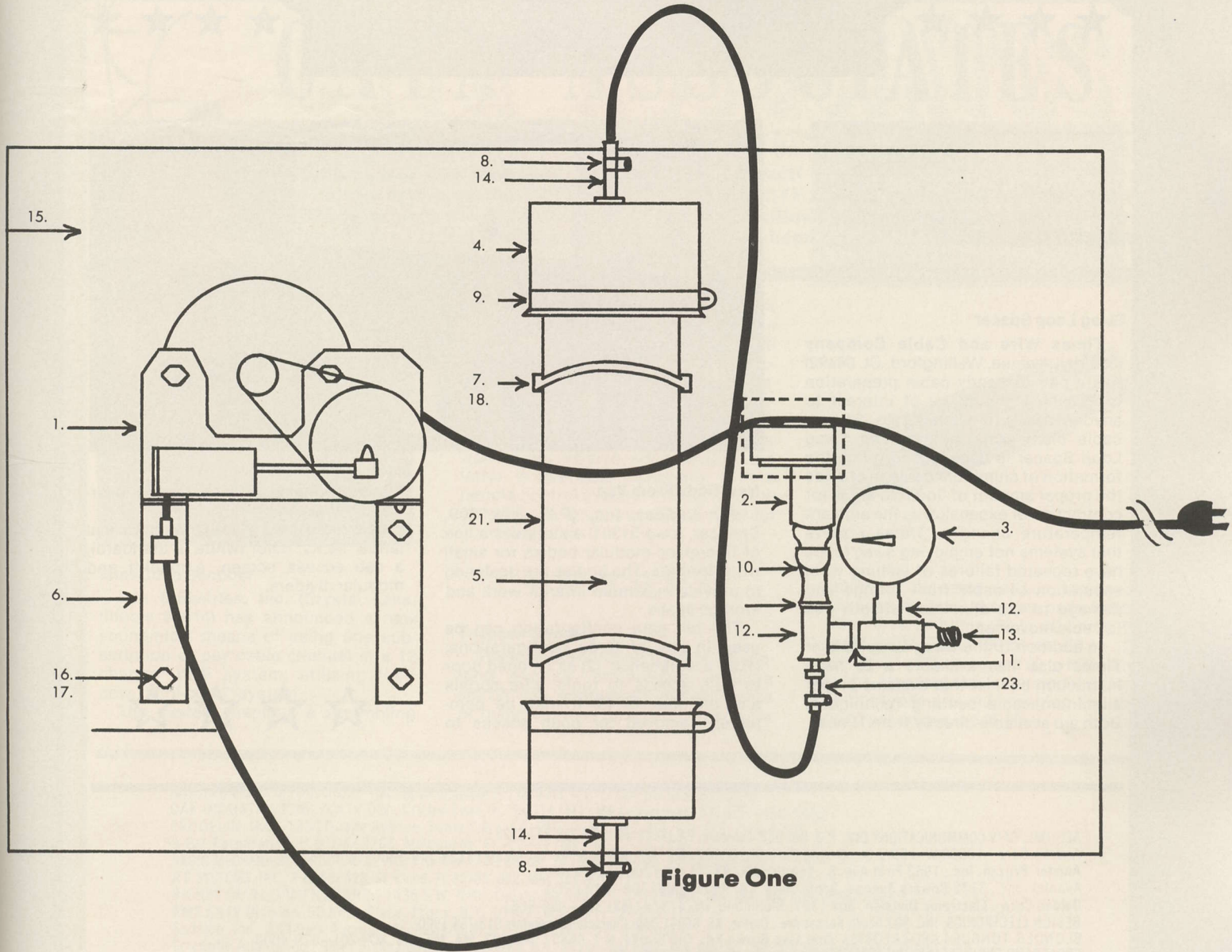


Figure One

1 Cosmic Piston Pump
w/motor bracket, ballcheck,
belt & felt pads $12.75

New Rochelle Manufacturing Co.
55 Webster Avenue
New Rochelle, NY 10801

2 Air Switch 3-30 pounds
Model #J54S-24-9711
& dust cover $13.75

B & B Instruments
P.O. Box 4038
Hammond, IN 46324

3 Pressure Gauge 0-15 lbs.
Part #3400A $4.00
Gas Inlet Valve
Part #3017 $1.20

Andrew Corporation
10500 W. 153rd Street
Orland Park, IL 60462

4 Rubber Stoppers
3" diameter x 2" deep
Model #7

Kelly Supply Co.
1004 W. Oklahoma Street
Grand Island, NE 68801

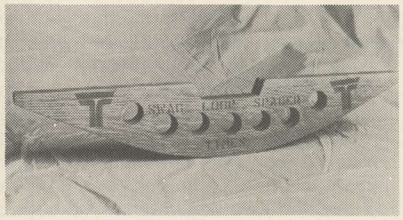
5 Silica Gel Desiccant
Grade 42 1 1/2 lb. can
Code #42-08-15-243 $3.50

Grace Davison Chemical
Baltimore, MD 21203

Items 6 thru 23 can be procurred from local hardware/automotive stores.

6	2	4" Shelf Bracket	.90 ea
7	2	2 1/2" U Bolt set 5/16 18Thd	.95 ea
8	4	Stainless Clamps Ideal 6202 3/8"	.40 ea
9	2	Stainless Clamps #48 1 1/2 - 3 1/2"	.75 ea
10	1	1/4" to 1/8" Pipe Reducer	1.00 ea
11	2	1/8" x 1" Threaded Pipe	.70 ea
12	2	1/8" Pipe "T"	1.20 ea
13	1	1/8" Pipe to 1/4" Copper Flare	1.00 ea
14	2	Schrader Tubeless Tire Valve P.N.3640-K2	1.03 ea
15	1	12" x 20" x 1/4" Masonite Board	1.00 ea
16	6	1/4" x 1/2" Coarse x 20 Thd Bolts	.05 ea
17	6	1/4 - 20 Hex Nuts	.05 ea
18	8	5/16 - 18 Thd Hex Nuts	.05 ea
19	1	15" x 1/8" Rubber Hose	.12 per ft.
20	1	24" x 1/8" Rubber Hose	.12 per ft.
21	1	2 1/2" x 7 1/2" Lexan Tube	4.00 per ft.
22	1	Teflon® Tape	.90 per roll
23	1	Gas Inlet Valve	

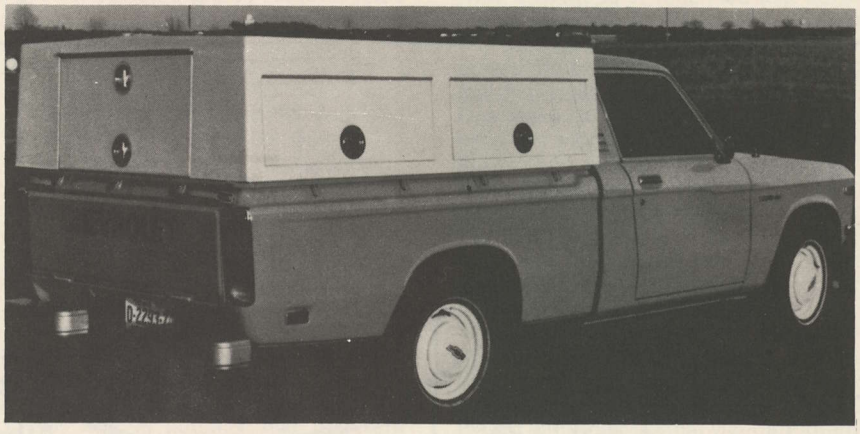
SHOWCASE



Swag Loop Spacer

Times Wire and Cable Company (358 Hall Avenue, Wallingford, Ct. 06492) has a pair of handy cable preparation tools which should be of interest to anyone doing or planning to do new cable plant construction. The Swag Loop Spacer is designed to guide the formation of aluminum cable to provide the proper amount of 'loop' to allow for contraction or expansion as the ambient temperature changes. Times reports that systems not employing swag loops have repeated failures of lashing wire, separation of cable from fittings and damage to the aluminum sheath due to cable movement.

In addition to the Swag Loop Spacer Times also has available a 20 page instruction booklet that explains proper aluminum cable bending techniques. Both are available directly from Times.



New Body From Van

Van Ladder, Inc. (P.O. Box 709, Spencer, Iowa 51301) announces a line of fiberglass modular bodies for small truck formats. The bodies are designed to provide maximum interior work and storage space.

The tail gate configuration can be used in any of three configurations; (1) as a workbench, (2) as an open door to gain access to tools, wire spools and the like, or (3) it may be completely removed for open access to materials inside and hauling of oversized items.

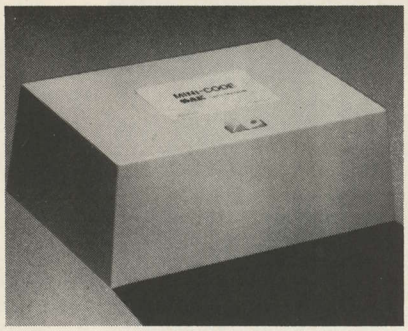
Two models are available with optional ladder racks, color (white is standard), a cab access screen, a manlift and modular dividers.

☆ ☆ ☆ ☆

AEL, INC., CATV COMMUNICATIONS DIV., P.O. Box 552, Lansdale, PA 19446, **(M1, S2)** 215-822-2929
Andrew Corp., 10500 W. 153rd St., Orland Park, IL. 60462 (**M2, M3, M9** Satellite Terminals) 312—349-3300
Anixter-Pruzan, Inc., 1963 First Ave. S., Seattle, WA. 98134 (**D1**) 206—624-0505
Avantek, Inc., 3175 Bowers Avenue, Santa Clara, CA. 95051 (**M8**) 408—249-0700
Belden Corp., Electronic Division, Box 1327, Richmond, IN. 47374 (**M3**) 317—966-6661
BESTON ELECTRONICS, INC. 903 South Kansas Ave., Olathe, KS. 66061 (**M9**) Character Generators-913-764-1900
BLONDER-TONGUE LABORATORIES, One Jake Brown Rd., Old Bridge, N.J. 08857 (**M1, M2, M4, M5, M6, M7**) 201—679-4000
BROADBAND ENGINEERING, INC., 535 E. Indiantown Rd., Jupiter, FL. 33458 (**D9, replacement parts**) 305-747-5000
CALIFORNIA MICROWAVE, INC., 455 West Maude Ave., Sunnyvale, CA. 94086 (**M9 Satellite Terminals**) 408—732-4000
CATEL, 1400-D Stierlin Rd., Mt. View, CA 95043, **(M4, M9)** 415-969-9400
CCS HATFIELD/CATV DIV. 5707 W. Buckeye Rd., Phoenix, AZ. 85063 (**M3**) 201—272-3850
C-COR ELECTRONICS, Inc., 60 Decibel Rd., State College, PA. 16801 (**M1, M4, M5, S1, S2, S8**) 814—238-2461
COLLINS COMMERCIAL TELECOMMUNICATIONS, MP-402-101, Dallas, TX 75207, **(M9, Microwave)** 214-690-5954
COMMUNICATIONS EQUITY ASSOCIATES, 651 Lincoln Center, 5401 W. Kennedy Blvd., Tampa, FL 33609 **(S3)** 813-877-8844
COMM/SCOPE COMPANY, Rt. 1 Box 199A, Catawba, NC 28609, (**M3**) 704-241-3142
ComSonics, Inc., P.O. Box 1106, Harrisonburg, VA. 22801 (**M8, M9, S8, S9**) 703—434-5965
C R C ELECTRONICS, INC., P.O. Box 855, Waianae, HI 96792, (**M9** Videotape Automation Equipment) 808-668-1227
DAVCO, INC., P.O. Box 861, Batesville, AR. 72501 (**D1, S1, S2, S8**) 501—793-3816
EAGLE COM-TRONICS, INC., 8016 Chatham Dr., Manlius, N.Y. 13104 (**M9 Pay TV Delivery systems & products**) 315—682-2650
EALES COMM, & ANTENNA SERV., 2904 N.W. 23rd, Oklahoma City, OK 73107, **(D1,2,3,4,5,6,7, S1,2, S7,8)** 405-946-3788
FARINON ELECTRIC, 1691 Bayport, San Carlos, CA. 94070 (**M9, S9**) 415—592-4120
FEDERAL BROADCASTING CO. 600 Fire Rd. Box 679 Pleasantville, N.J. 08232 **(D9, S9)**
FERGUSON COMMUNICATIONS CORP., P.O. Drawer 871, Henderson, TX. 75652 **(S1, S2, S7, S8, S9)** 214—854-2405
FRANK L. CROSS & ASSOCIATES, INC., 5134 Melboune Dr., Cypress, CA 90630, **(M9)** 714-827-0868
GILBERT ENGINEERING CO., P.O. Box 14149, Phoenix, AZ. 85063 (**M7**) 602—272-6871
G T E SYLVANIA, 3046 Covington Rd., Marietta, GA 30062 (**M1,D1**) 404-003-1510
HUGHES MICROWAVE COMMUNICATIONS PRODUCTS, 3060 W. Lomita Blvd., Torrance, CA. 90505, (M9) 213-534-2146.
HOME BOX OFFICE, INC., 7839 Churchill Way—Suite 133, Box 63, Dallas, TX 75251 (**S4**) 214—387-8557
ITT SPACE COMMUNICATIONS. INC., 69 Spring St., Ramsey, N.J. 07446 (**M9**) 201—825-1600
JERROLD Electronics Corp., P.O. BOX 487, Byberry Rd. & PA. Turnpike, Hatboro, PA 19040, **(M1, M2, M4, M5, M6, M7, D3, D8, S1, S2, S3, S8)** 215-674-4800
JERRY CONN ASSOCIATES, INC., P. O. Box 444, Chambersburg, PA 17201 (**D3, D4, D5, D6, D7, D8**) 717-263-8258
LARSON ELECTRONICS, 311 S. Locust St., Denton, TX. 76201 (**M9 Standby Power**) 817—387-0002
LRC Electronics, Inc., 901 South Ave., Horseheads, N.Y. 14845 (**M7**) 607—739-3844
Magnavox CATV Division, 133 West Seneca St., Manlius, N.Y. 13104 (**M1**) 315—682-9105
MICROWAVE ASSOCIATES, INC. 10920 Ambassador Drive-Suite 119 Kansas City, MO. 64153 (**M9**) Microwave Radio Systems-816-891-8895
MICRODYNE CORPORATION, P.O. Box 1527, 627 Lofstrand La, Rockville, MD 20850, (**M9 Satellite TV Recs.**) 301-762-8500
Microwave Filter Co., 6743 Kinne St., Box 103, E. Syracuse, N.Y. 13057 (**M5, bandpass filters**) 315—437-4529
MID STATE Communication, Inc. P.O. Box 203, Beech Grove, IN. 46107 (**M8**) 317-787-9426
MSI TELEVISION, 4788 South State St., Salt Lake City, UT 84107 (**M9 Digital Video Equip.**) 801—262-8475

CATA ASSOCIATES

In recognition of the untiring support given to the nation's CATV operators, and their never-ending quest for advancement of the CATV art, the COMMUNITY ANTENNA TELEVISION ASSOCIATION recognizes with gratitude the efforts of the following equipment and service suppliers to the cable television industry, who have been accorded ASSOCIATE MEMBER STATUS in CATA, INC.



Mini-Code Decoder

Oak Industries, Inc. (Crystal Lake, Illinois 60014) has announced a new economical means of using one subscription or pay cable channel in a 12 channel VHF system; utilizing their new "Mini-code" system.

The system employs a scrambling technology which Oak reports "cannot be decoded by any competitive premium system". A two position rocker-switch selects the operating mode (i.e. decoding the premium channel, or, allowing normal service to pass). A parental-control keylock system is optional with the decoder. Either a set mounted or wall mount version are available; the latter is available optionally with a remote control system. Pricing is in the $20-22 price range per unit in 1,000 lot quanities.

☆ ☆ ☆ ☆ ☆ ☆

Texscan Goodies

Texscan Corporation (2446 N. Shadeland Avenue, Indianpolis, Indiana 46219) has announced a new series of minimum loss coaxial "L" pads for matching between various values of impedance. The ZM series pads match from 50 to 75 ohms, 50 to 60 ohms, 50 to 90 ohms, 50 to 100 ohms, 50 to 125 ohms, 50 to 135 ohms and 50 to 600 ohms in the standard-available models. Connector types are wide ranging and the price per device is $15.00.

NORTHERN CATV DISTRIBUTORS, INC., 8016 Chatham Dr., Manlius, N.Y. 13104 (**D1**) 315—682-2670
OAK INDUSTRIES INC./CATV DIV., Crystal Lake, IL. 60014 (**M1, M9 Converters, S3**) 815—459-5000
PRODELIN, INC., 1350 Duane Avenue, Santa Clara, CA. 95050 (**M2, M3, M7, S2**) 408—244-4720
Q-BIT Corporation, P.O. Box 2208, Melbourne, FL. 32901 (**M4**) 305—727-1838
RADIO MECHANICAL STRUCTURES, INC., P.O. Box 1277, Kilgore, TX 75662 (**M2, M9, S2**) 214-984-0555
R F SYSTEMS, INC., P.O. Box 428, St. Cloud, FL 32769, (**M2, M6**), 305-892-6111
RICHEY DEVELOPMENT CORP., 1436 S.W. 44th, Oklahoma City, OK. 73119 (**M1, M4, M8, S8**) 405—681-5343
RMS CATV Division, 50 Antin Place, Bronx, N.Y. 10462 (**M5, M7**) 212—892-1000
Sadelco, Inc., 299 Park Avenue, Weehawken, N.J. 07087 (**M8**) 201—866-0912
Scientific Atlanta Inc., 3845 Pleasantdale Rd., Atlanta, GA. 30340 (**M1, M2, M4, M8, S1, S2, S3, S8**) 404—449-2000
SCIENTIFIC COMMUNICATIONS, INC., 3425 Kingsley Rd., Garland, TX 75041, (**M4 Low Noise & Parametric**) 214-271-3685
SITCO Antennas, P.O. Box 20456, Portland, OR. 97220 (**D2, D3, D4, D5, D6, D7, D9, M2, M4, M5, M6, M9**) 503—253-2000
Systems Wire and Cable, Inc., P.O. Box 21007, Phoenix, AZ. 85036 (**M3**) 602—268-8744
TERRACOM, 9020 Balboa Ave., San Diego, CA 92123, (**M9 Microwave Earth Stations**) 714-278-4100
TEXSCAN Corp., 2446 N. Shadeland Ave., Indianapolis, IN. 46219 (**M8, bandpass filters**) 317—357-8781
Theta-Com, P.O. Box 9728, Phoenix, AZ. 85068 (**M1, M4, M5, M7, M8, S1, S2, S3, S8, AML MICROWAVE**) 602—944-4411
TIMES WIRE & CABLE CO., 358 Hall Avenue, Wallingford, CT. 06492 (**M3**) 203—265-2361
Titsch Publishing, Inc., P.O. Box 4305, Denver, CO. 80204 (**S6**) 303--573-1433
Tocom, Inc., P.O. Box 47066, Dallas, TX. 75247 (**M1, M4, M5, Converters**) 214—438-7691
TOMCO COMMUNICATIONS, INC., 1077 Independence Ave., Mtn. View, CA 94043 (**M4, M5, M9**) 415-969-3042
Toner Cable Equipment, Inc., 418 Caredean Drive, Horsham, PA. 19044 (**D2, D3, D4, D5, D6, D7**) 215—675-2053
Triple Crown Electronics Inc., 42 Racine Rd., Rexdale, Ontario, Canada M9W2Z3 (**M4,M8**) 416 743-1481
UNITED PRESS INTERNATIONAL, 220 East 42nd St., New York, N.Y. 10017, (**S9**) (Automated News Svc.) 212-682-0400
UNITED STATES TOWER & FAB. CO. P.O. Drawer "S", Afton, OK 74331 (**M2,M9**) 918-257-4257
Van Ladder, Inc., P.O. Box 709, Spencer, Iowa 51301 (**M9, automated ladder equipment**) 712—262-5810
VIDEO DATA SYSTEMS, 40 Oser Avenue, Hauppauge, N.Y. 11787 (**M9**) 516-231-4400
VITEK ELECTRONICS, INC., 200 Wood Ave., Middlesex, N.J. 201—469-9400
WAVETEK Indiana, 66 N. First Ave., Beech Grove, IN. 46107 (**M8**) 317—783-3221
WEATHERSCAN, Loop 132 - Throckmorton Hwy., Olney, TX. 76374 (**D9, Sony Equip. Dist., M9 Weather Channel Displays**) 817—564-5688
Western Communication Service, Box 347, San Angelo, TX. 76901 (**M2, Towers**) 915—655-6262/653-3363

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D6—CATV hardware
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D8—CATV test equipment

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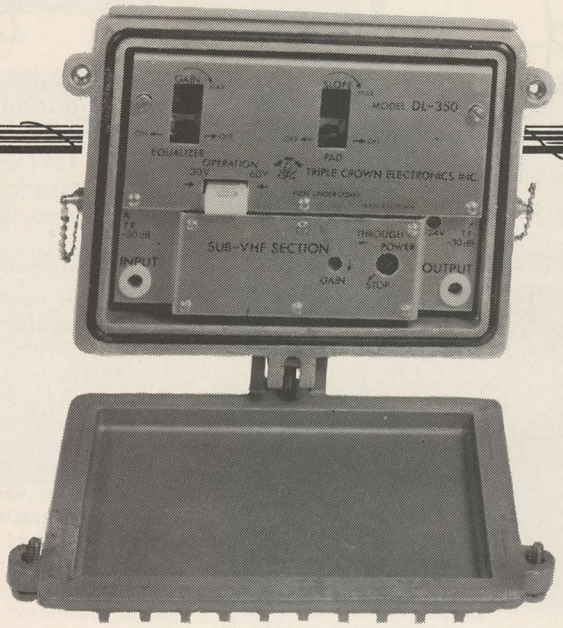
TRUNK—QUALITY
LINE EXTENDERS



- **Versatile** - 14 to 40 dB of gain, with thermal or AGC level compensation control
- **Performance** - critical signal to noise controlled with inter-stage controls
- **Quality** - highest line-extender quality in the industry with low distortion hybrids for 50-300 MHz operation
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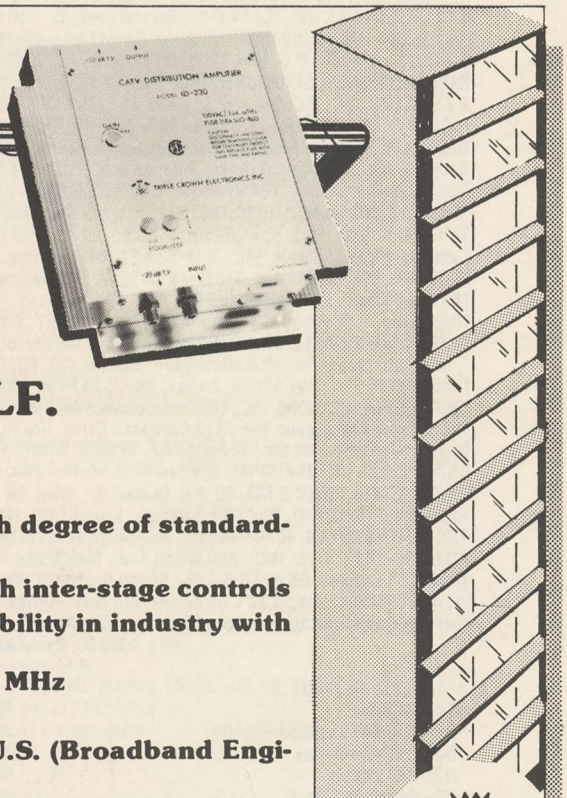
- **Convenient** - 30 or 60 VAC operation
- **Service** - high quality product backed by Canadian and U.S. (Broadband Engineering, Jupiter, Fl.) service depots.

TRIPLE CROWN ELECTRONICS, INC.

Write or call: 42 Racine Road, Rexdale, Ontario M9W 2Z3
Telephone (416) 743-1481

GETTING CABLE *INTO*



AN APARTMENT BUILDING IS ONLY HALF THE ANSWER

GETTING IT *AROUND* THE BUILDING IS THE OTHER HALF.

Triple Crown Apartment Amplifiers Offer:

- **Verasatile Gain** - from 14 to 56 dB of gain with high degree of standardization
- **Performance** - critical signal to noise controlled with inter-stage controls
- **Capability** — highest signal (carrier) handling capability in industry with optional feed-forward techniques
- **Expandable** - optional two-way from 5-30 or 50-300 MHz
- **Multi-Powered** - 117 VAC, 30 or 60 VAC operation
- **Service** - high quality backed with Canadian and U.S. (Broadband Engineering, Jupiter, Fl.) service depots.

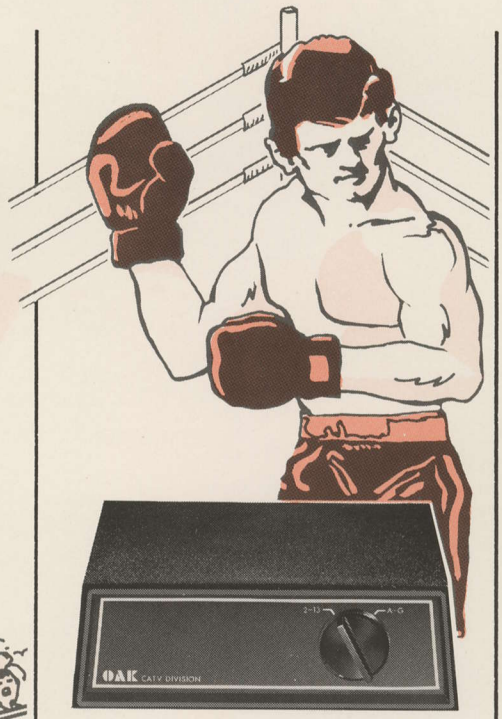
TRIPLE CROWN ELECTRONICS, INC.

42 Racine Road, Rexdale, Ontario, M9W 2Z3 Telephone (416) 743-1481

The Oak one-two punch... a knockout for profits!

This is the Trimline II— a champion 35-channel AFC converter.

It's a high quality unit with the toughness and versatility to meet the varying operational parameters of cable systems. It has wide dynamic range and high selectivity to defend against such opponents as cross-modulation and adjacent-channel interference—even at high input levels.

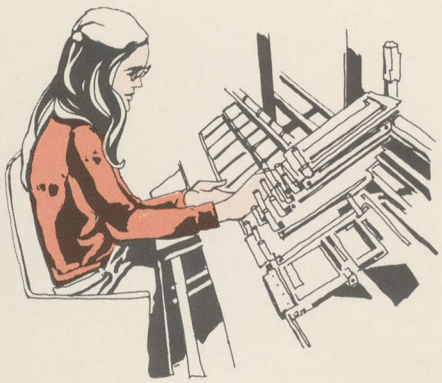


For the twelve rounders, Econobloc adds seven more. Oak ranks the Econobloc as the most economical way to expand your 12-channel system. Mid-band channels A to G convert to channels 7 to 13. Econobloc converters live up to their name by giving you a block of seven mid-band channels at an economical price.

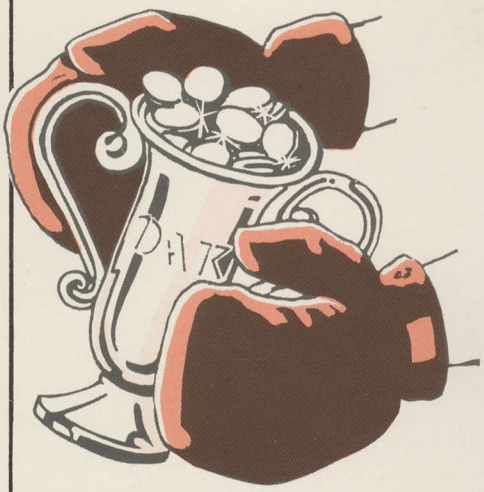
Great seats for the fans. You can offer your fans the convenience of set-top or remote "Jewel Case" operation. In either event, a built-in Automatic Frequency Control eliminates the fine tuning shuffle. The Trimline II is also available with an optional self-contained descrambler for premium programming with unbeatable security.

The initial cost of a converter is only round one. Before you score the totals, ask yourself where and how the product is made, and by whom. Remember, reliability counts. The reliability of the Oak product stems from our control over the total production process.

We build them in our plants. All Oak CATV products are made in company-owned facilities. We have a commitment to our customers and we back it up with prompt delivery and rapid service turnaround.



The winner...Oak!



Compare Oak converters with all other contenders...but remember that there's more to the comparison than just the "black box." Market leadership and technological expertise are your assurance that the Oak Trimline II and Econobloc converters will go the distance. Oak converters are winners and your profit-wise choice.

OAK Industries Inc.

CATV DIVISION / CRYSTAL LAKE, ILLINOIS 60014

TELEPHONE: 815-459-5000 TWX: 910-634-3353

Coming through...

with performance — where it counts

Time is money. And installation time adds up fast. At Belden, we're coming through with ways to save you time and money on every job.

DUOBOND®

The drop cable that makes fast, profitable connections, time after time. Its aluminum foil shield is bonded directly to the core—doesn't push back when "F" connectors are installed. Cuts way down on signal leakage, call-backs and troubleshooting problems.

UNREEL®

Dramatically slashes installation time—up to 50%! It feeds wire freely, right from the carton with no kinks, backlash or reels.

We've got a lot more going for you, from fast delivery to complete technical information.

SEED® (Shielding Effectiveness Evaluation Device), for instance. This revolutionary testing system makes cable selection easier and far more accurate than previously possible.

Our new comprehensive guide to CATV coax cable makes selection easy, too. Has answers to a wide range of needs. Send for your copy today!

Make sure you contact Belden for all your CATV drop cable needs. We'll come through with answers that insure optimum performance. Where it counts. Belden Corporation, Electronic Division, P.O. Box 1327, Richmond, IN 47374; 317-966-6661. 8-3-7

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