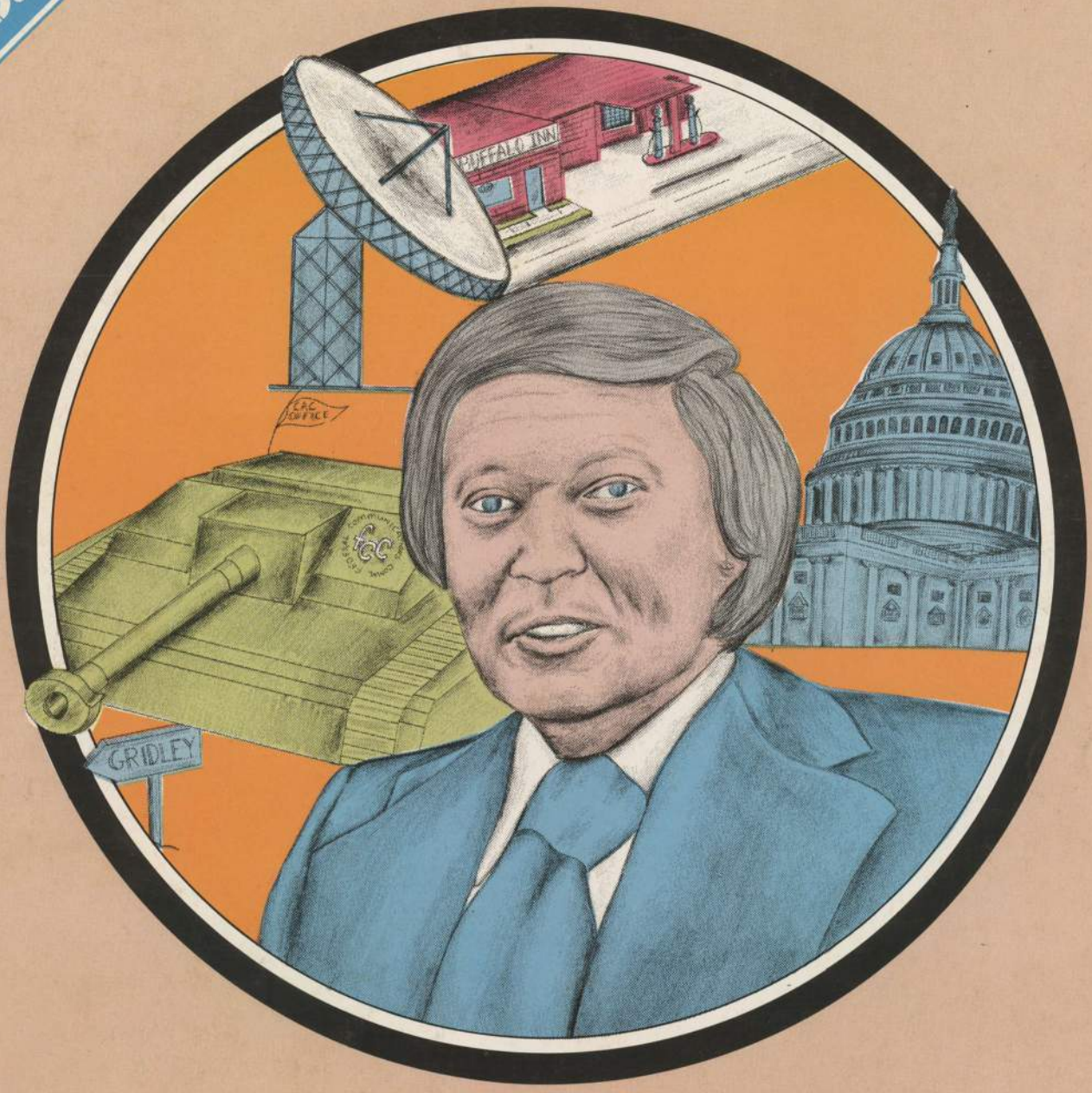
Kyle D. Moore



KYLE D. MOORE
CATA's founder and first President (1973—1978). His influence on the cable industry has been profound and the successes he leaves behind will undoubtedly never be matched.

July 1978

CATJ

OFFICIAL JOURNAL
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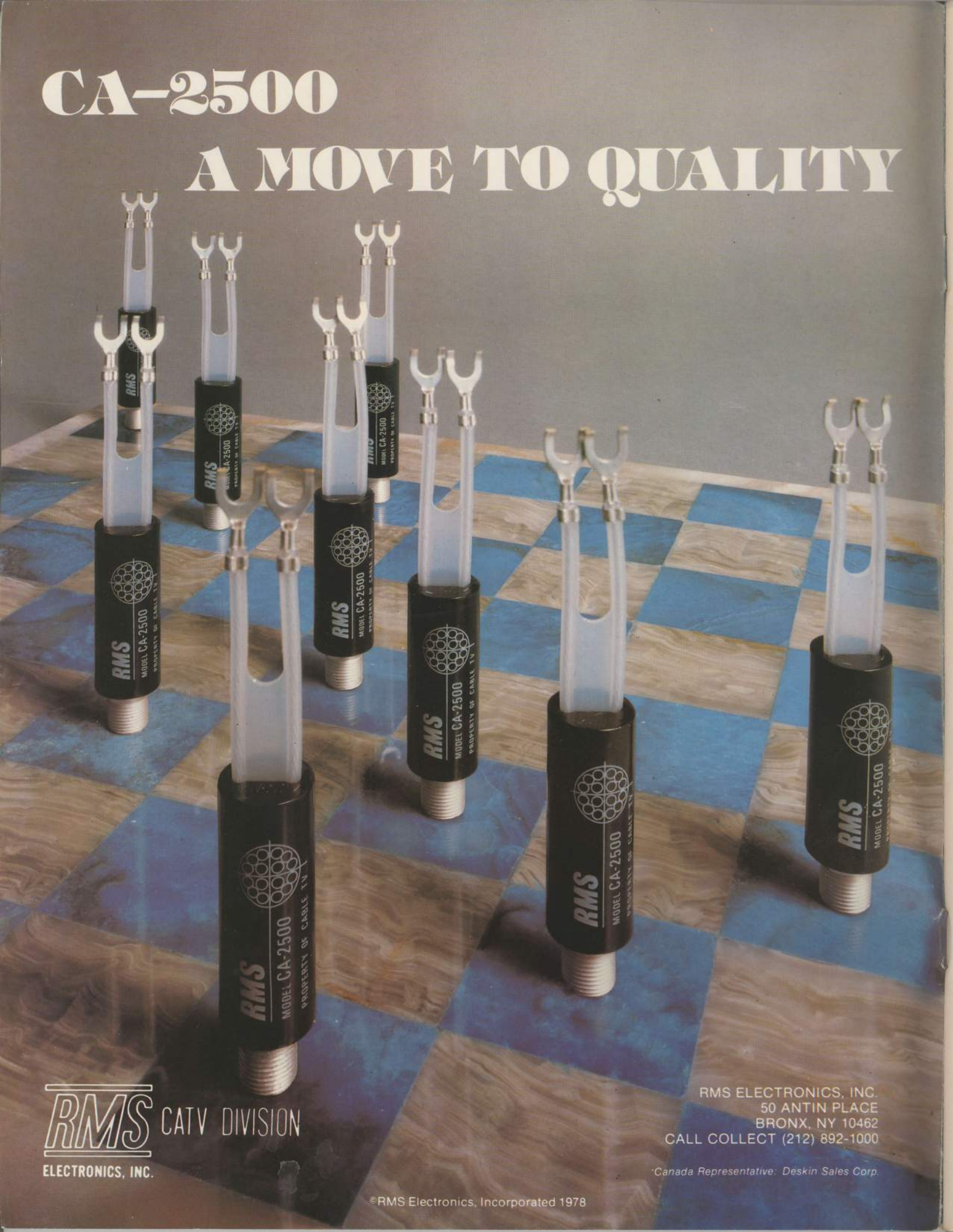
CA-2500

A MOVE TO QUALITY



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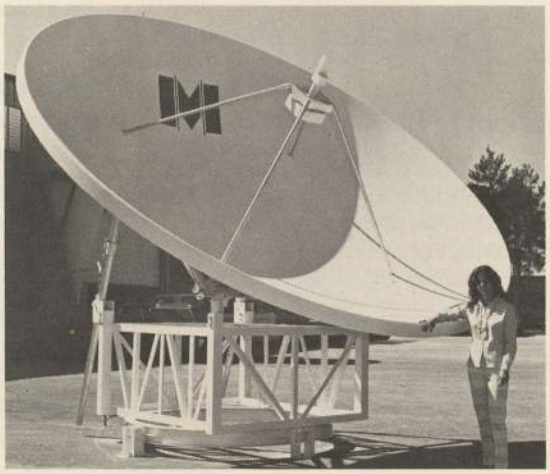

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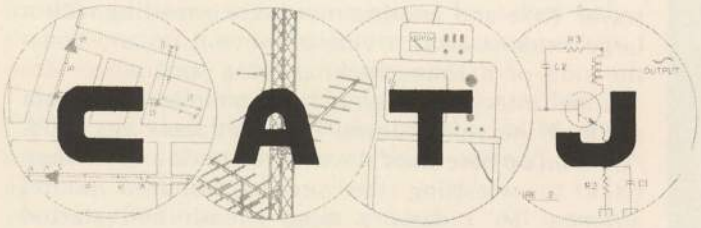

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OFFICES

CATA/CATJ
4209 NW 23rd, Suite 106
Oklahoma City, Oklahoma 73107
(405) 947-7664

CATA (Washington Office)
Steve Effros, Executive Director
1100 17th St. NW (Suite 506)
Washington, D.C. 20036
(202) 659-2612

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OUR COVER

Kyle Dean Moore. A man to whom you never say no. A man who asks questions that you may not want asked; or wish to answer. A man who, when he wants something 'done right', does it himself. A pioneer in the industry, an operator of small rural systems in four southwestern states. The founder of CATA, retiring this month from active day to day involvement in CATA and now CATA's new Chairman of the Board. One heck of a guy.

CATA-torial

BEN CAMPBELL, President of CATA, Inc.

Kyle D. Moore

This month marks the end of an era in CATA and perhaps in cable. Kyle Dean Moore, the spark plug behind the formation of the Community Antenna Television Association, CATA's first President (1973 through 1978) and now its Chairman of the Board of Directors is retiring from **active** day to day participation in the affairs of the industry he knows so well and loves so much.

Kyle Moore is a pioneer in cable. Not the first, certainly, to build and operate a cable system in the southwest but his 1955 entry makes him one of the first. And his 23 year history in the industry has been certainly one of the most colorful. Unlike Kyle, who at 43 years of age is a veteran of cable, I am second-generation cable. From my earliest remembrances my whole life has revolved, one way or another, around cable. From my father's pioneer system in Mineral Wells, Texas to his founding of CAS (which subsequently has become TOCOM) everything of importance in my life has somehow been related to cable.

From my father I learned two lessons well. **Number one** was that a person has to **finish** what he starts, no matter how difficult that may turn out to be. **Number two** is that in any transaction **all parties** involved must benefit or there is no foundation for the transaction.

Kyle, although barely enough older than I to be an older brother, has had almost as much influence on me as my own father. From Kyle I learned, early, a third lesson in life which I shall always carry with me. That being, if you want something done right, you need to do it yourself.

In my teens I began my commercial life in CATV as a telephone salesman for CAS; I was given a handful of accounts to keep tabs on via the telephone, to handle their needs and coordinate the shipments of the CAS parts they needed. Kyle was one of my accounts. After a stint of the telephone I was given a box of CAS CATV devices, a set of catalog sheets and summarily packed off in my car for my first 'field sales trip'. Kyle Moore was one of my first stops. He was in La Grange, Texas at the time, where his La Grange system was in the final stages of shake down. His office said I'd find him out at the tower site. When I arrived, wet behind the ears and nervous about my first in-field confrontation with a real CATV person, I was told he was 'up there'. That turned out to be 400 feet above ground on the tower. Kyle and another man were wrestling with a large antenna array, trying to move it up and down the side of a tower looking for a spot where co-channel interference would be minimized. **"Wanta see me?"** he yelled down. I shouted back yes I did. **"Com'on up here then"** he shouted back and he went back to wrestling the several hundred pound antenna. So I drew a deep breath and started climbing. I climbed and I climbed. At about the 200 foot level I suddenly realized that I had never climbed a tower before in my life and I'd never been higher off the ground than a step ladder! But I was half way to where Kyle was working so I drew another deep breath and headed on.

I spent three hours on the tower with Kyle that day. Kyle was never one to spend 'needless' dollars on something a man could do by hand so we hand winched the big array up and down for three hours, looking for a null in the co-channel. As we finally came down a car was driving off. Someone commented that there goes so-and-so, a salesman for Jerrold. Days later I ran into the Jerrold salesman in another CATV town. **"Were you really up there on the tower with Kyle?"** he asked. When I said yes his older face broke into a smile and he put his hand on my shoulder. **"Son"** he said, **"I've got to hand it to you. . .I guess Jerrold just doesn't need the business that bad though".** The Jerrold man was right. They didn't but CAS did. And I later learned that was one of the reasons Kyle did business with us. He knew what it was to be an underdog and he liked to give the underdog a chance.

Nearly twenty years later, in a motel room in Dallas, Texas I saw the same self-help streak that sent Kyle up the tower for a day at a time to chase a co-channel problem. The scene was this. CATA's organizational meeting, some 100 'delegates' had traveled from both coasts and points between to discuss in an open forum the formation of the Community Antenna Television Association. Then NCTA President David Foster, not invited by the group but on hand none the less, had finally gotten Kyle off into a private room. There, I later learned, Kyle had been offered the chairmanship of something Foster called the 'Independent Operators Board'. For several hours Foster had talked and Kyle had listened. When Kyle finally came out, his face drawn, shirt unbuttoned and his tie loosened, he looked at me with the same piercing eyes that later would set back Congressmen, Senators and FCC officials and he summed up his decision. **"There's just no way. If it is going to work, we are going to have to do it ourselves."**

And so we did. Or rather "he" did with thousands of hours and tens of thousands of dollars of his own money and a little help from a few hundred fellow Community Antenna Television system operators.

Kyle, perhaps more than any other individual operator on hand in Dallas in July of 1973 recognized that the CATV industry was in truth then (as it remains today) two quite distinct industries. We share in common many important operating procedures and much of the equipment but where the two industries differ they differ a great deal. Kyle saw

that and he saw it clearly. He understood the operating position of those who wished to operate as broadband communication systems; he asked only that they try to see as clearly the operating posture of the community antenna system operator.

Looking back to the first formation meeting of CATA, and then the dark days of the six to nine months thereafter when everything seemed to be against CATA, I recall as vividly as if it were only yesterday Kyle saying again and again **"All I really want is a fair shake for community antenna operators in the copyright settlement, and the FCC to recognize that there are two different industries here that must have two different sets of regulations."** Later he would watch the gradual dis-mantling of the FCC's ill-conceived 1972 rules, rule by rule, word by word, and he would remark **"when they get rid of the rules for the systems under 1,000 subscribers I will feel then that we have accomplished something."**

Neither Copyright nor the dis-mantling of the rules happened overnight. Copyright happened first of course and while for all practical purposes most of the smaller systems ended up paying only a token flat fee per year Kyle was never satisfied with the 'victory' he devoted thousands of personal hours to attaining. **"It's not the $30 per year that bothers me"** he would say. **"It's having those damn bureaucrats swamping you with forms and reports to fill out that rests like a burr under my saddle. There's no way they can even handle the paperwork for the small, flat fees we are paying!".** To lose money doing something. . .even shuffling paper in Washington, has always been a 'capital crime' to Kyle. **"And to think we are actually supporting this idiocy with our tax money!!!"** he would exclaim.

When the FCC moved the 'exemptions' from 50 subscribers to 500 subscribers in March of 1977 Kyle took me and Coop aside one day and sat us down. **"They** (the FCC) **said in writing that this would be a 1,000 subscriber exemption soon. That's my cue to retire. You fellows better tell the board to find a replacement."** Well, it 'soon' took more than a year but Kyle was deadly serious about retiring. **"I'm no public speaker and I've played my hand. No smart man sits in a game with a pair of treys and the pot getting bigger every minute. Deal me out."**

History books are filled with giant figures who have influenced the destiny of mankind. I am very fortunate to have been associated with such a man who has insured the positive climate of our industry for many years to come. But more especially I am proud to call that man my friend.

Kyle, while you may believe yourself to be a man who like the marathon runner mid-judged the length of the race and 'ran too hard too early' I assure you that there is no way this industry can now or ever will 'deal you out'. Years from now millions of small town American families will be sitting around watching some of the nation's best television offerings oblivious to the tenacity of one man who more than any other man in the history of our industry made it all possible. Few men have started with so little and have accomplished so much in 43 years. I for one will follow closely what you do with the next 43 years of your life and I shall continue to call you my friend.

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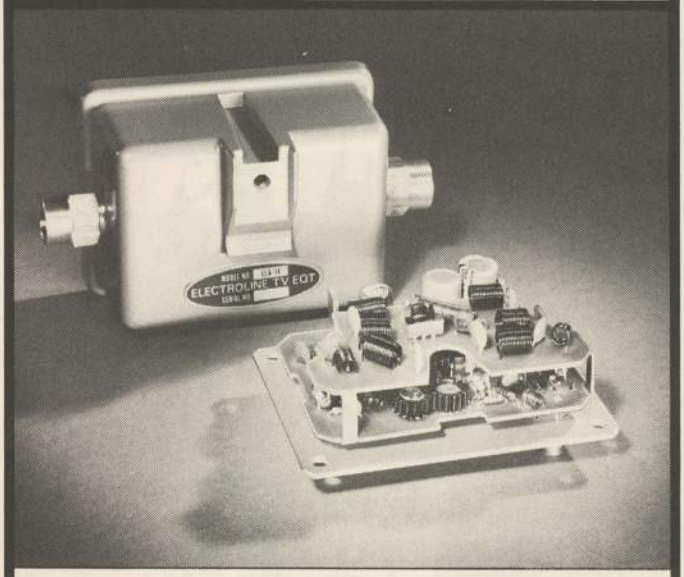

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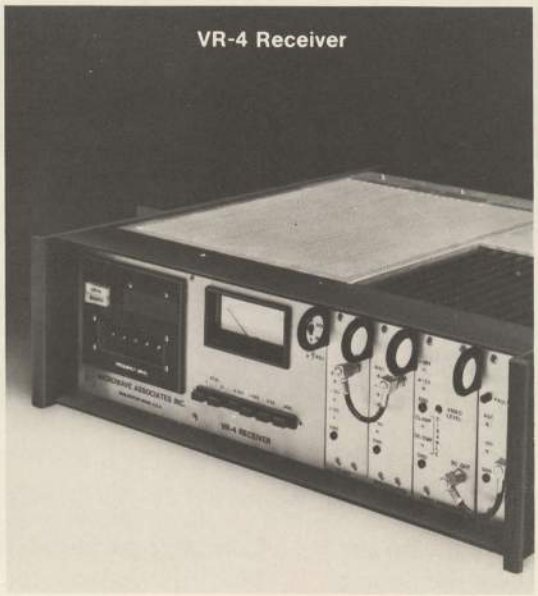
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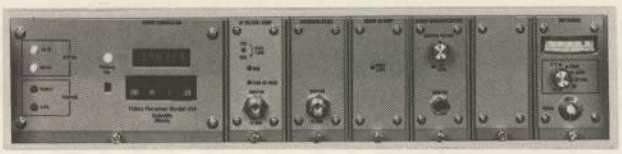

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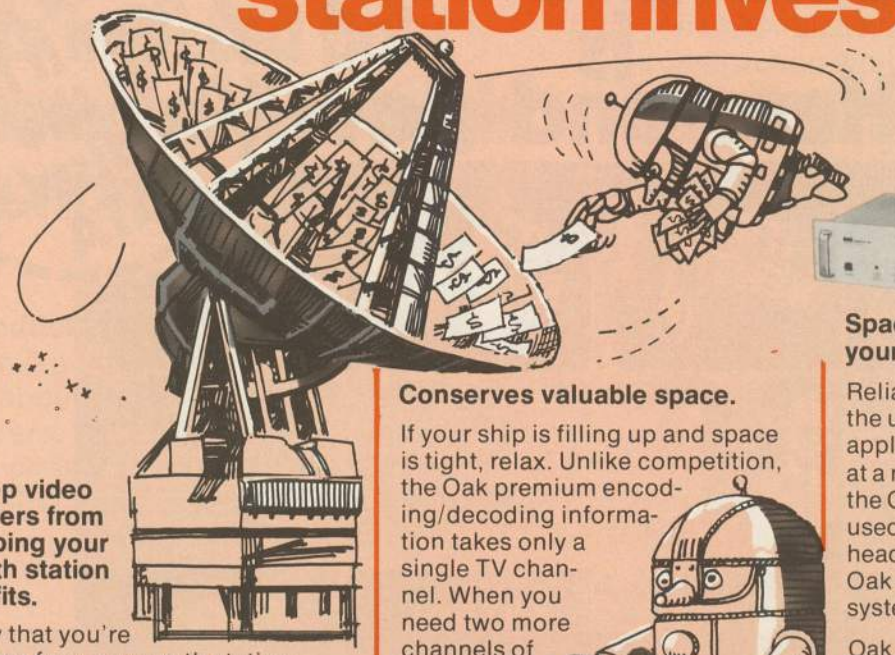

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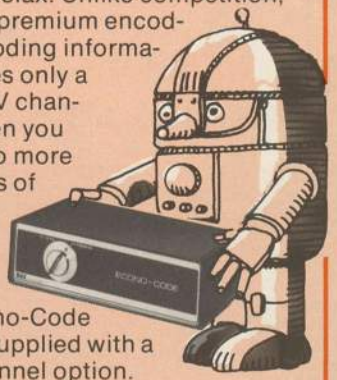

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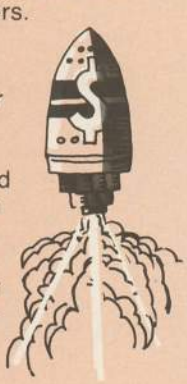

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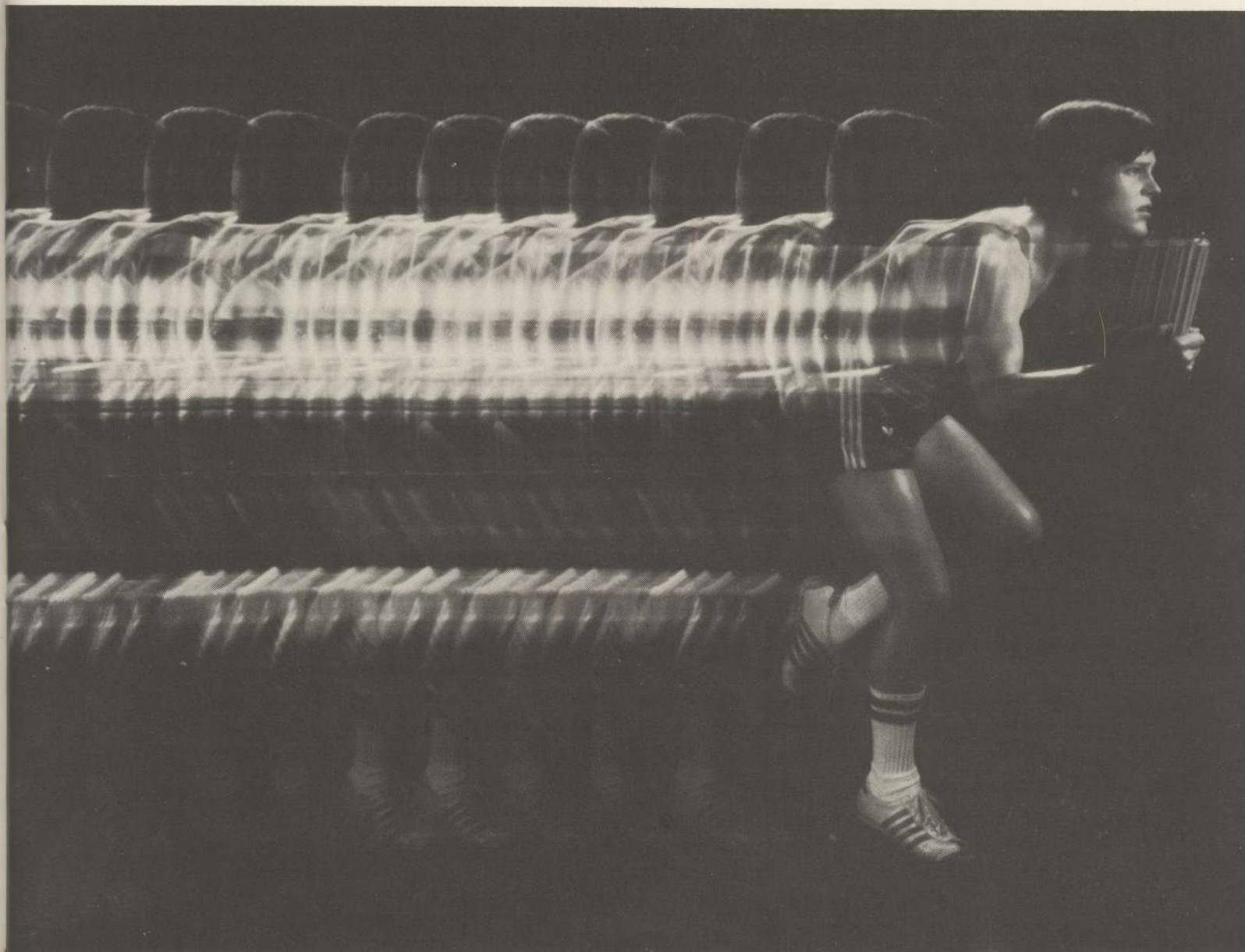

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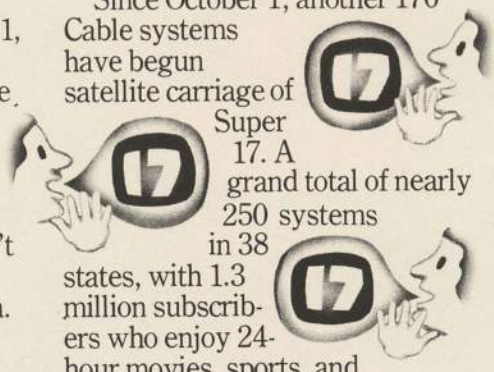

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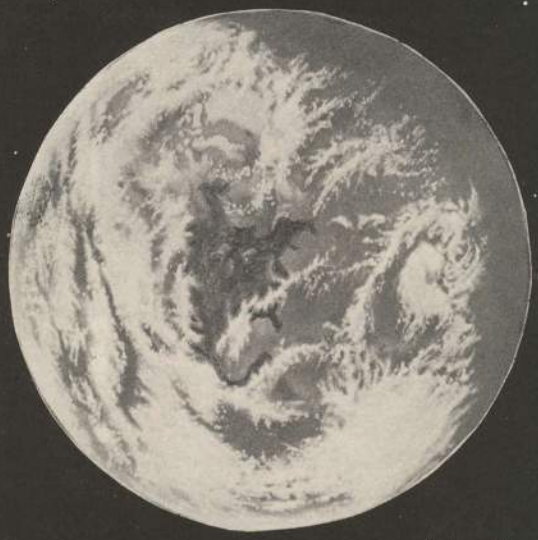

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Pure Family Entertainment. Front Row delivers 4 to 5 current movies a month, rated G or PG. These features are lifted from the Showtime schedule.

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3—In Existing Pay Systems. Even if you have another full pay service, Front Row will help you sign on and trade-up resistant cable subscribers.

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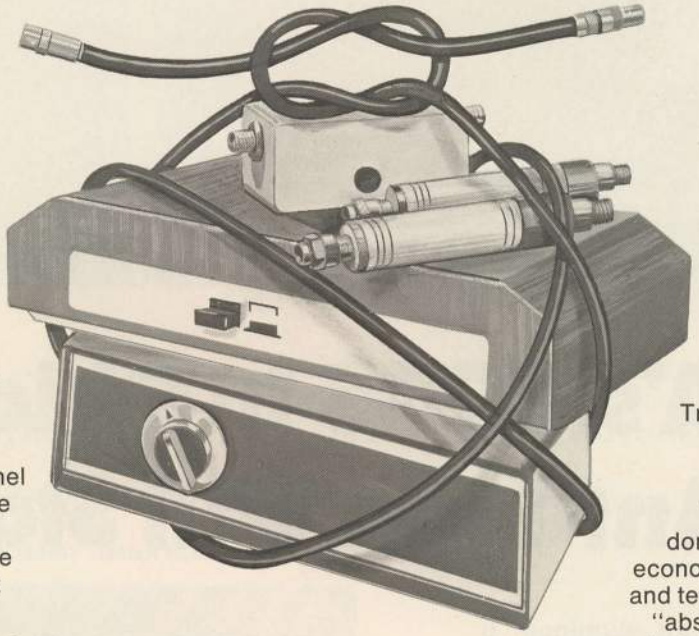
Negative vs Positive Systems
Audited vs Unaudited Systems
Cable Traps vs Descramblers
Lowest Overall Costs vs
Lowest Front End Costs
Single Channel or Multi-channel



Negative vs Positive System

There's no doubt about it . . . the Negs have it over the Pos. The greatest deterrent against theft of service is to not allow the premium channel into the home where it can be reconstituted . . . to trap the signal of all non-payers at the pole where it is least subject to tampering.

VITEK Cable Traps ***look like drop cable***, provide deep-notch depth (typically greater than 70dB), superior environmental stability and durability, are maintenance-free — and are ***on the pole!***

Audited vs Unaudited Systems

Auditing is easy with VITEK Cable Traps. Simply count your traps and compare with your current subscriber list. No contact with the subscriber is necessary. Since (Pos) descramblers are located in the home, installation records are your only clue as to who your "customers" really are. Gaining access to the residence can be difficult and may require numerous visits.

Cable Traps vs Descramblers

If "they" don't pay . . . reconnect the cable trap . . . on the pole! Recovery and replacement of descramblers is time consuming, costly and may require legal action.

Any way you look at it... VITEK is the answer for PAY TV Security!

VITEK

Descramblers can also be "loaned out" depriving you of additional income . . . but VITEK Cable Traps stay put . . . ***on the pole!***

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If you're successful, you'll outgrow the short-term economics and inadequacies of descramblers as others have and change over to VITEK's Cable Traps.

It's simply a matter of . . . Pay us Now . . . or Pay us Later.

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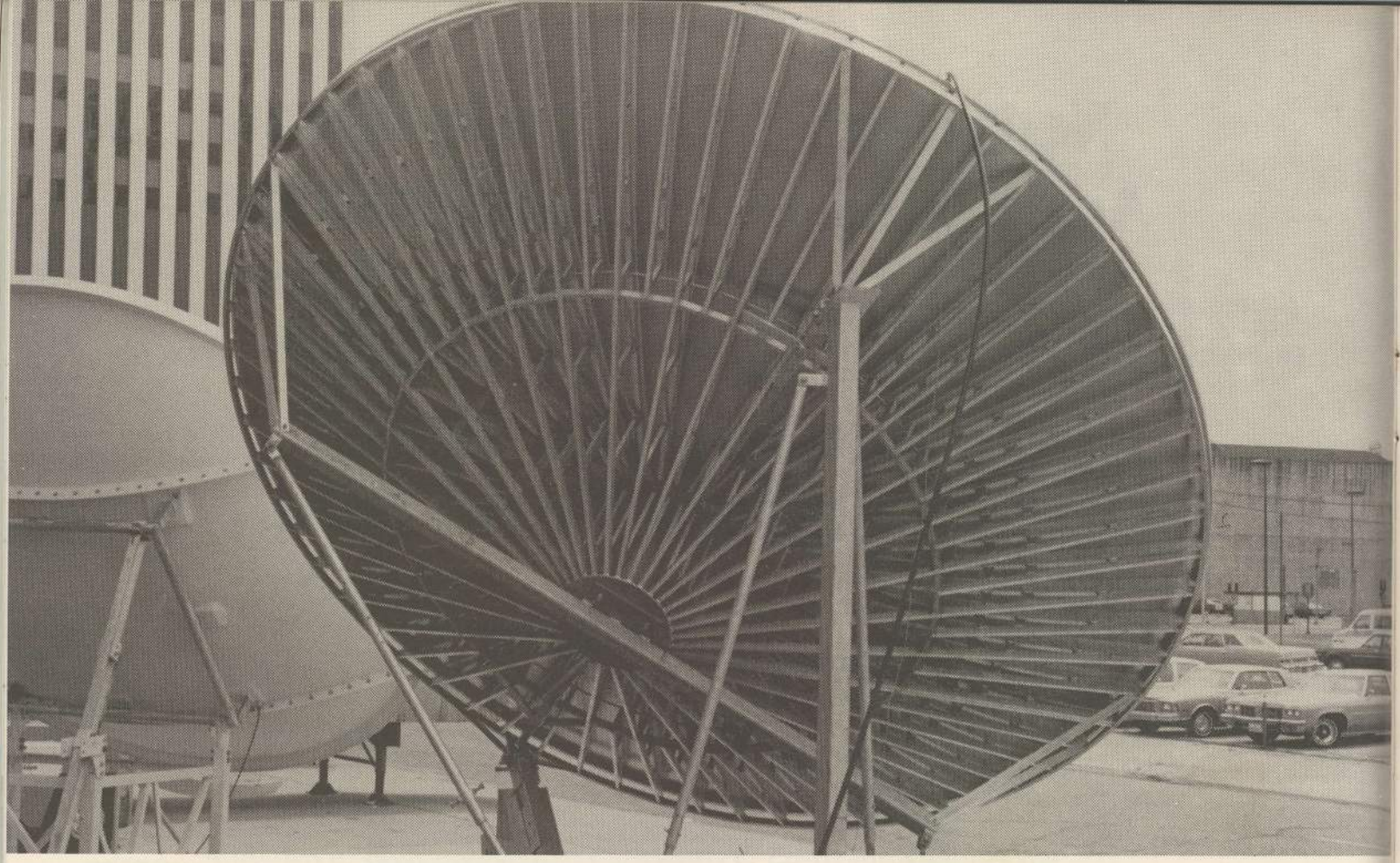

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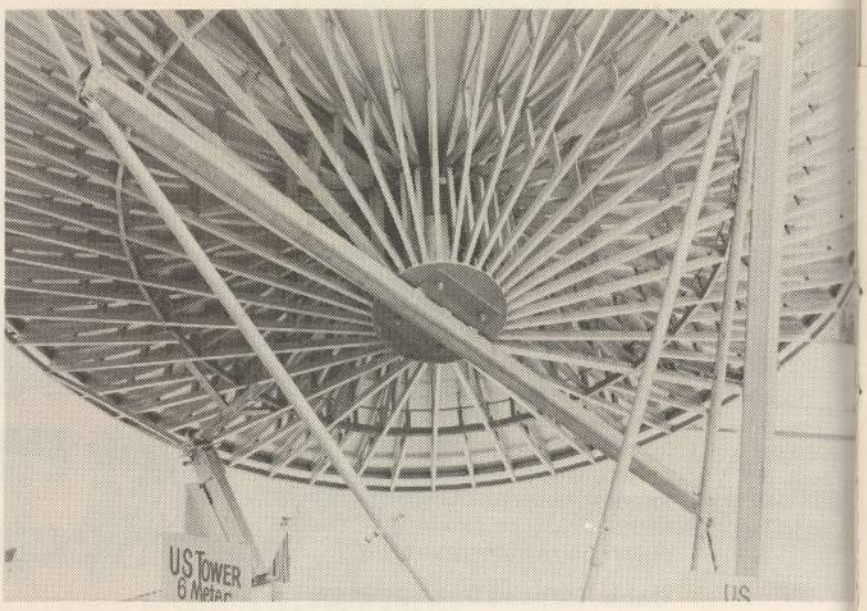

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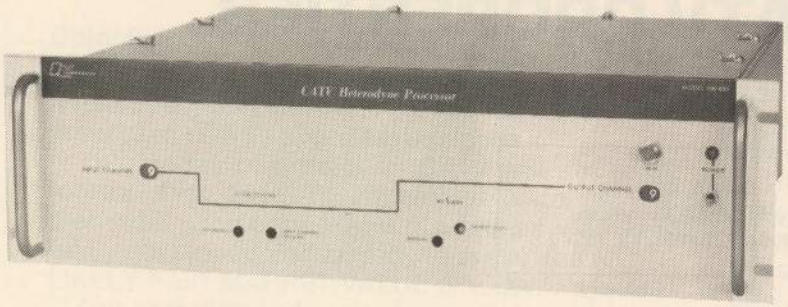

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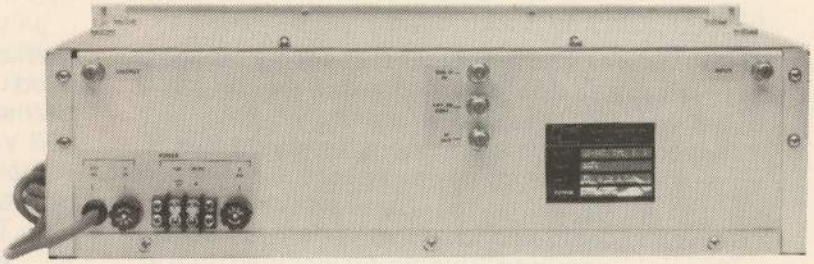

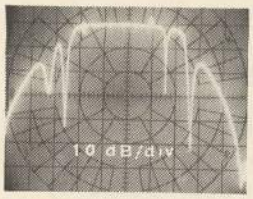

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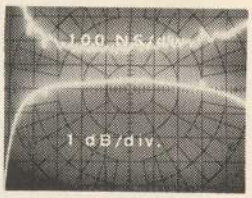

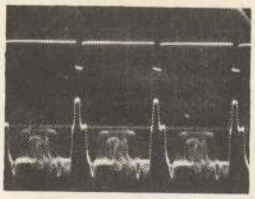

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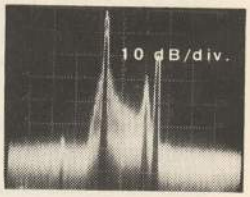

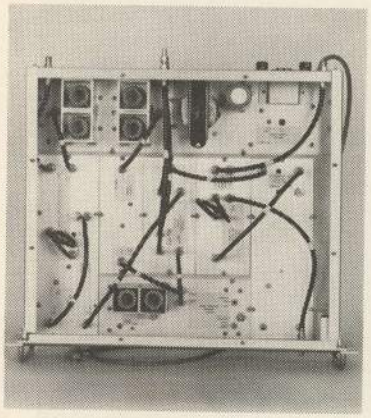

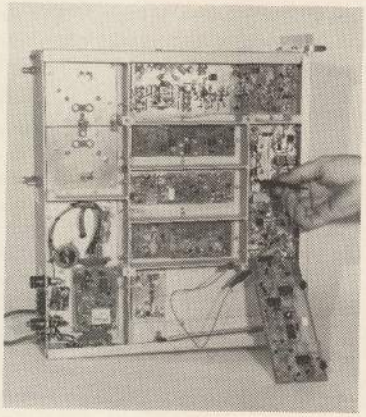

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How Much Money Is It Worth?

APPRAISING THE VALUE OF YOUR CATV PROPERTIES

Gary A. Dent,
Gary A. Dent & Associates,
Box 400467, Dallas, Tx. 75240

Introduction And Background

If there was ever a subject that seems clouded in mystery and contradictions, it is the question of the **VALUE** (?) of a CATV system.

Anyone who owns a system, or would like to someday, or lends money to a system, or taxes a system at sometime or other, eventually asks **"How can I determine what this system is worth?"**

Several years ago, this writer decided that it would, indeed, be nice to have a consistant and reliable process of determining the value of a system. Like many of our **CATJ** readers, I had spent a number of years building, managing, buying and selling, financing, etc. CATV systems, but if someone asked me "How do you evaluate a system?" I found it rather difficult to explain.

For years, we all have employed one or two predominent approaches to setting a price (Value) on a system. We kicked around **subscriber-multipliers** ("It's worth $250 per subscriber."). . .or we **multiplied the cash flow by some number**. . . ("We will pay only six (6) times cash flow.").

But. . .who determined what per subscriber multiple or cash flow multiplier should be used?

What was cash flow, as the CATV industry defined it?

What was meant by FAIR VALUE, or FAIR MARKET VALUE, TRUE VALUE, etc.?

We studied twenty one (21) CATV systems transactions (sales) and discovered that:

1. The **per-subscriber multiplier** ranged from a **low of $186** to a **high of $580!**
2. The **cash flow multipliers** ranged from a **low of 5.2** to a **high of 13!!!**

Something was very wrong here.

We also discovered that:

3. **Cash flow** meant different things to different people. It depended upon who you were talking to as to what was called cash flow.
4. **The traditional** Financial-Ratio Analysis (as usually applied to other businesses by lenders or financial analysists) just didn't apply to CATV.

Our initial conclusion, therefore, was. . .

a. No wonder lenders are confused and reluctant to deal with us in CATV.

b. While some "average" multiplier might be

Mr. Dent has twenty-five (25) years of professional experience in the fields of broadcasting, cable-tv, electronics manufacturing, and finance/appraisal.

As early as 1953 he participated in the development of some of the nation's pioneering CATV Systems, in West Virginia and Pennsylvania.

As a General Manager and MSO-Director of Operations he has been involved with more than 40 individual systems in 17 states, and involving plants as large as 600 miles.

He served as Chief Engineer/General Manager of many of the larger systems, during their construction phases, as diversified as Lancaster, Pa. to Des Moines, Iowa.

He also was associated with Scientific-Atlanta and GTE-Sylvania as an Application/Sales Engineer and in System Financing in the early 70's, involving several hundred systems.

Since 1975, Mr. Dent, has conducted an Appraisal business based in Dallas, Texas. The firm does **not** broker systems or financing packages, but is associated with firms in that function.

In the three-and-one-half years of the firms activity it has appraised, conducted feasibility studies, or rate-increase analysis for Sixty-Four (64) separate systems, with a total value of more than $53-Million Dollars!

In the past year the firm has expanded its appraisal practice to include general business evaluations as well as CATV enterprises.

Recent evaluations included major-market studies involving such markets as New Orleans, Houston, and Baltimore/Washington, among others.

Gary Dent's system appraisal process and a related subject, leverage of your existing CATV property are important ingredients in the CCOS '78 seminar schedule this month. If you are planning to attend CCOS '78, and are interested in understanding more about 'CATV financial discipline' we encourage you to study this article carefully to prepare for the CCOS seminars on related topics.

applied to a CATV system's CASH FLOW (?) the likelihood of it being a true representation of it's value was rather risky.

c. If you wanted to convince a lender of the accuracy of the stated value of a system, you'd better come up with some rationalization of that multiplier or find some other method of evaluation that did support your opinion of value.

Objective Of This CATJ Series

Our work in determining some answers to these questions and conclusions led to development of our CATV appraisal business.

This series of articles in **CATJ** will set forth **for the first time,** in considerable detail, the methods, approaches, and disciplines we eventually developed and employ to arrive at a MOST LIKELY FAIR MARKET VALUE of a CATV system.

Our ambition is to enable you to apply all or part of the appraisal process to your own systems, or those you may be interested in buying.

It doesn't require some financial or mathematical genius to apply the process. But, it does require some patience and a real desire to gain confidence in the evaluation of a system. . .and . . .some reasonable knowledge of engineering, management, and marketing realities encountered in our CATV industry.

Free Fall Outs

Later, these appraisal methods (or disciplines as they are called) will be employed to demonstrate to you how they may be applied to gain CONSIDERABLE INSIGHT into many important extra financial conclusions which will be of considerable use to you whether or not you ever actually buy or sell a CATV system.

In this, and subsequent articles, we will use the appraisal disciplines to determine:

. . .**Not only Fair Market Value**. . .

but also

. . .**How to use your system as leverage on other investments**. . .

and

. . .**When to expand your system,** rebuild it, re-finance it, sell it, raise rates, how much to raise rates, how to prepare a loan proposal, when to invest more capital, when NOT to invest, whether or not a new community or extension should be built, and a host of other vital **financial understandings** are yours **if** you will apply the appraisal process with care and an objective attitude.

The Appraisal Process

Before we begin, and in order for this process to be of more interest to you, we recommend you obtain a few simple tools and have them at hand.

1. **A good calculator.** Preferably, one which has a few basic financial formulas built in (the NOVUS 6020 is probably the least expensive and will be invaluable in your future CATV applications). We will supply some basic formulas later, however if they are already programmed into your calculator, it will save time.
2. **An accounting columnar pad.** Select one at your office supply with at least 13 vertical columns. . .and about 40 horizontal lines.
3. **Plenty of note paper** for calculations, notes, data, etc.

What Is Fair Value?

Fair Value is often defined in a wordy, fancy manner (willing seller, willing buyer, both informed, etc.) but what it merely boils down to is "what **someone** is willing to pay".

That "someone" could be you. However, you may have **unique** needs such as your demand for a certain yield on your investments, the interest you pay (due to your good credit experience) on your loans may be lower than average, or you may have certain tax-liabilities which could be offset somewhat by purchase of a specific system.

Later, we will demonstrate in these articles how you may determine what "you" as an individual might pay for a system. It is the VALUE TO YOU AS A SPECIFIC BUYER.

But, right now we want to know instead, "What will a TYPICAL BUYER in the open market place pay for a system?" In other words, we will start at the very beginning of our appraisal process by assuming we are looking at the system **through the eyes of** the average, typical, CATV investor.

Therefore, FAIR MARKET VALUE is what that typical buyer might pay.

A Range Of Values

Understand this from the outset. . .we are not going to arrive at a definite VALUE that can**not** vary. To be accurate, we must develop an INDICATION OF VALUE from several different approaches, then finally determine what is the MOST LIKELY VALUE going to be from those various VALUE INDICATORS.

At the conclusion of the appraisal process, when you have done all your calculations, made TYPICAL MARKET assumptions about the subject system, and arrived at several figures which represent possible values, you will have to take your experience and knowledge in hand and SELECT THE MOST LIKELY VALUE by some reasonable reconciliation.

If you are interested in the HIGHEST likely VALUE, then select that highest figure. If you are interested in the LOWEST likely VALUE, then select that one from the range.

But realize that except where we envision **you,** and your qualifications as a **specific buyer,** we **must** be satisfied with the MOST likely VALUE of a TYPICAL MARKET buyer.

A Case Study

To clarify the appraisal process, we are going to select an actual system, without identifying it,

and take you through the steps we employed to arrive at its **apparent** VALUE.

The system was appraised in 1976. The owner employed the appraisal report to effect a sale of the system.

After taking you through the process on this case study, we will update the system a bit and look at it as if **current** factors were effecting it and see if the **value** would have changed **if** those factors (such as pay-cable) had been given consideration in 1976.

Insert Your Own System Factors

As we proceed through the process, you may want to insert system parameters of your own system, or one you are contemplating and arrive at a VALUE for your own situation.

There may be vital factors which effect your specific system that are not present in our case study, therefore, if you do employ another system's profile and work along with us and our case study, always ask yourself if any important consideration unique to your system has been left out since our case study did not have that condition.

The "missing factor" may effect your own system in either a positive or negative manner in final reconciliation of value, however, if you are alert you will recognize where it needs to be inserted, and account for it in the approach to value.

Gathering The Data

There are many factors (data) that you need to know about the system you are appraising.

Some data is available from the system operator/owner, some he may not have (but should have?) accumulated for you as a prospective buyer (or appraiser).

Obviously, there is financial data, subscriber data, and plant data which will be needed, and we'll get to those later, but first take a look at the system from a broader viewpoint (as the TYPICAL BUYER would view it).

National Industry Analysis

It may sound elementary, but if you don't know what's happening in CATV nation-wide, and how it may effect the system you are evaluating, then you can't make a valid evaluation.

In 1976, our case study revealed for the subject system that:

a. The industry had available to it financing at terms of approximately 80/20 to 75/25 DEBT/EQUITY; interest rates ranged from 2% to 5% over prime (some fixed rates of about 11% to 12% occured); terms of loans were generally 8 years with some running 10 years with a 1 to 2 year interest-only period. These financial conditions were available to the TYPICAL BUYER who had no special borrowing advantages.

b. **In 1976,** CATV faced a "potential" pay-cable development that was very promising... but, not every system at that time was equiped with pay, nor planning it specifically (the case study was not).

c. **Copyright expenses** were ahead, but not a current expense item in 1976.

d. **Monthly rates** were averaging about $6.00 to $6.50 for first sets, added outlets were $1.00 to $1.50 generally. Rate increases were destined to raise those averages to $6.75 by the end of 1978. . .**but that was not apparent in 1976.**

e. A review of typical financial demands of most investors and lenders in the market place revealed that **a dividend on equity** of 15% to 20% was demanded (we'll explain that later), an after-tax-yield of about 12% was minimum to attract investor capital, an **internal rate of return** demand ranged from about 10% to 15%.

   You may not have known about these without considerable study of the sales transactions in the industry, however, a broker, appraiser, lender, or active CATV investor might have shared them with you.

f. There were **no apparent FCC moves** pending that would cripple the system under study. No other government bureaucracy had any disasters planned.

g. **In general,** CATV was growing, plant construction costs weren't increasing at fantastic rates, technological development was not about to make CATV obsolete with satellite roof-top antennas, and overall there were prospects of stable, dependable business and regulatory environments existing that would influence the value of the system in a generally positive manner.

The point here is that if you don't **know** and keep in touch with general factors nationally that might effect the system you can't apply any reasonable appraisal with validity. As always, lack of knowledge and understanding can hurt you.

Area Analysis

What about the **state** in which the system is located?

Is the state PUC regulating CATV? Is it likely to do so soon? What bills effecting CATV are pending? What is the corporate tax structure in the state? How about Ad-Valorem Taxes? How's the labor market?

In other words, are there any adverse or positive factors that may occur on a broad plane at state wide levels that would effect the current and future value of the system? If so, you need to know about them.

Find out by talking with operators in that state, if you don't already have a feel for the circumstances. Check every positive or negative factor you encounter carefully. Make certain you "feel" the likelihood of any condition that is in a mood of change or trend that would effect the system as on-going business in any way.

Look for trends, up or down, in economic factors as well as regulatory factors within the state.

CASE STUDY: Our system was located in a state with no regulation at the state level and none envisioned in the foreseeable future. Tax and other factors were normal and typical. No adverse conditions were uncovered and none were anticipated that could effect the **value decision** in any great manner.

Community Analysis

Ahhh! Finally, we are going to look at the system itself. . .right?. . .wrong! Before you can determine anything about the value of the system you MUST know a whale of a lot about the community it serves.

You must establish a familiarity with the community that borders on that possessed by a lifelong resident if you REALLY want to trust the validity of your final appraisal.

You may not be able to reveal to the people you talk with who you are and why you are there (this might create a problem for the system's owners). If you are using your own system along with our case study, then go after the data we are about to describe.

Talk to the obvious people and keep your eyes open and listen. (Chamber of Commerce, City Staff, Utilities, Merchants, TV Dealers, Bankers, Real Estate Developers and Brokers, School Officials, local Newspapers, Radio Stations, TV Stations, and typical residents [both subscribers and non-subscribers].)

Build a Community Profile of current and **future** prospects for that city. Dig in.. .and dig out the data.

CASE STUDY: In 1976, we found that our community had been laid out as a County Seat in the late 1800's (outside 35 mile zones and all Grade A signal areas) was in the center of a geographical complex of highways, and railroads, was within one of the state's two best growth centers, had a strong healthy business district, had built some new schools recently **(kid growth = CATV growth),** trended toward a profile of middle class wage earners with two or more children (it wasn't a retired or dying town), had stable population growth at a moderate rate (15%) over the past census and recent years (5%), had a sound economic base not dependent upon the welfare of a single industry; banks had a 13% increase in deposits, and there were no derogatory conditions found in the community overall.

Town growth was to the north, but little system expansion was needed to keep up with it, and only about 25 to 30 new homes were being built annually.

There was some reluctance on the part of the City Council to agree to past rate increases. Future increase requests might be rejected or trimmed sharply.

However, no adverse reactions were noted (to CATV, the service, or the company) in general, and while the town presented no growth explosion it was a stable and highly reliable economic community, with a good "mix" of residents who, most likely, would continue to subscribe to cable TV **IF** the package was attractive versus roof-top antenna reception.

SUMMARY OF IMPORTANT DATA AND CONCLUSIONS

National CATV Conditions	Good; stabilized; steady growth
System's State "	No state controls-none expected
Systems Community "	Good; stable; slowly growing
Miles of Plant	51-Miles / 90% aerial.
Plant Expansion	2 to 3 miles, next 10 years.
Plant Condition	Fair to good. Rebuild 80% complete Mixture of Ameco/SKL/Jerrold-Starline-20
Headend	Jerrold Com-II's
Age of System	3 to 12-years.
Remaining Functional	2 to 25-years with rebuild finished.
Homes Passed by Plant	3,400-Growth = 25 yearly-average.
Primary Subscribers	2,746-Added outlets = 600/22%
Saturation	80%-Growth to 94%-10 years.
Home-Antenna	3-Networks (2-VHF, 1-UHF).
Reception	Typical. "Best" antenna = Cable offering, but with fair to poor quality.
Cable TV Offers	3-NBC; 3-CBS; 2-ABC; 1-Ind.; 1-ETV 1-Weather; 1-News; 14-FM Stations.
Monthly Rates	$6.50-1st Outlet; $1.50 added outlets. $15.00-Installation.
Average Subscriber Rate	$7.46-Monthly/$89.52-Yearly.
Franchise Fee	3% up to $40,000, 5%-all over $40-K.
FCC Permits	Requires update March, 1977.
STABILIZED:	Gross Rev. = $235,000 (Rounded) (Expenses) = $132,000 (Rounded) N.O.I. = $103,000 (Rounded) ($102,868)
Pole Rents	$3.50 & $3.00 = Avg. 1900 poles @ $3.37.
Rate Increases:	55¢/25¢ (1st/added respectively) -1972 50¢/25¢-1973 50¢/— -1975. 50¢ = Anticipated 2nd. and 4th Years future.

Figure One

System Analysis

Finally, the nitty-gritty. Your inspection of the system and accumulation of data will generally fall within the following categories:

1. **Financial Data**
2. Subscriber Data
3. **Plant and Technical Data**
4. Management/Operational Data (policies, etc.)
5. **Marketing Data** (previous promotions, retention, etc.)
6. Documents (franchise, FCC Permits, leases, etc.)

Figure 1 displays a summary of the case study system as it was observed.

Taking the six (6) data categories above from the bottom to the top, these are the primary factors you will be looking for:

Documents

Naturally, you will want to examine the franchise and FCC Permits, etc., to see that all is in order to assure a continuing business.

ANTICIPATED CAPITAL EXPENDITURES

Item:	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Plant Rebuild (Completion)	$70-K									
Plant Expansion			$4,000			$4,000			$4,000	
Tools/Test/Misc.	$1,000	'	'	'	'	'	'	'	'	'
Vehicles		4,600	8,600	4,600		4,500				
Subscriber-Addtns.	$4,750	3,750	2,625	1,750	1,625	1,500	1,500	1,250	1,250	1,125
TOTAL:	$75,750	9,350	16,225	7,350	2,625	11,000	2,500	2,250	6,250	2,125

Figure Two

If the franchise has onerous terms and conditions, or is due to expire before a period of, say, eight (8) years, you may have problems with financing, **or want to make a franchise renewal a requirement** before closing on the system.

In most documentation, you are interested in the cost or expense obligations (such as office and tower site leases) and what **future** effect or changes will be imposed upon the system through those documents.

The effect of variations in problems in documentation items is too complex to cover here, however, you may want to consider any difficulty from the viewpoint of it's "cost to cure" and adjust your appraisal accordingly.

Marketing

You are interested mainly in what kind of sales and marketing programs, media, and results the system **has demonstrated.**

If you believe the typical market buyer (operator) would behave in a different manner, with better or worse results, it will be reflected in your future anticipations of sales expenses and subscriber growth rates used later in the appraisal process.

Otherwise, you are concerned about the reactions of the system as a community of subscribers, non-subscribers, and prospective subscribers to the system's sales programs historically.

In short, **how tough is this town to sell** on Cable TV?

Management

This is a broad category. Your interviews and observations are aimed at discovering if the system was operated in a "typical" manner.

You'll be interested in staff and organization, work-flow in billing, policies in handling delinquent accounts, personnel relations (labor contracts), maintenance and technical efficiency and a host of tangible and intangible operational considerations and costs.

Where you think something would be "adjusted" as viewed by the typical market, you will make those adjustments. Some may appear in your **adjusted income statement,** which we will address later. Others may be less direct in their consideration to income or expense but just as important to consider.

Competence of management and staff, as well as their current status (and your adjusted opinions) as to number, positions, organization, wages and salaries will come into view.

(If you have gotten the message that appraisal of a system **includes** "adjusting" it from what it **IS** to what it **SHOULD BE** to meet typical market anticipations and conditions then you have been paying excellent attention. This **"adjusting"** depends upon your personal skills, knowledge, and understanding. **RECOGNITION and adjustment for either profitable or unprofitable conditions** [which the typical market can and would react to] **is the guts of appraising a system.)**

Irregular or unusual conditions CANNOT remain hidden from an experienced observer (operator) who takes the time to inform himself and **account** for what he observes. And, if it's your own system you are appraising along with our case study, take off your rose-colored glasses.

Plant And Technical Data

An inventory of the plant and other fixes assets is dandy to have. So are recent FCC test results. And "engineering proof of performance" of the system is also nice.

BUT. . .NONE OF THESE **OF THEMSELVES** REFLECT ON THE VALUE OF A SYSTEM.

Surprised? Read on. . .

You don't evaluate systems by the miles of plant, or number of amplifiers, or cost of the headend, EXCEPT, in one approach to value (THE COST APPROACH) which we will discuss later.

HISTORIC SUBSCRIBER GROWTH

	1974	1975	1976
January	2,397	2,483	2,658
February	2,400	2,492	2,663
March	2,423	2,505	2,684
April	2,423	2,515	2,696
May	2,397	2,525	2,715
June	2,403	2,568	2,746
July	2,387	2,578	
August	2,411	2,585	
September	2,420	2,604	
October	2,443	2,606	
November	2,452	2,625	
December	2,469	2,632	

Ave. % Growth Yearly 6.9%

Figure Three

USUALLY, the replacement cost of a system will not resemble the FAIR MARKET VALUE. (There are exceptions which we'll illuminate later.)

FCC tests? Given a little time, and not too much money, any good engineer can make a system pass FCC specs, or even industry imposed standards. That's no value-indicator. So it meets specs, so what! What you need to know is stuff like:

"How does it react when it storms, blows, and lightening strikes?"

"How long and how often has the system been down recently?"

"How many service calls (ratio to subscribers) are there?"

"HOW HAPPY ARE THE SUBSCRIBERS WITH THEIR PICTURES AND SERVICE?"

That latter question and other considerations are the main factors about the plant and technical categories.

Of utmost importance is your observation and opinion about replacement of plant at **what time** in the future will this be required, and what cost (at a later date) is likely to be involved.

(Consider also what equipment additions or replacements would be "typically valid" which would either REDUCE the service and repair costs and expenses, DELAY rebuild, IMPROVE picture quality, REDUCE disconnects, ADD channels or services, and have an effect on the system's bottom line as either an income PRODUCER or expense REDUCER.)

Expansion of the plant, rebuild, and other adjustments will all be part of your appraisal at this point.

What you will produce from your efforts will be something like our case study's **figure 2,** anticipated capital expenditures.

Note that ALL future capital expenditures (except day to day repairs which are covered in the income statement) are included and the most likely year of their demand is determined.

Remember when arriving at anticipated capital expenditures, react as the typical market would react. Don't phase out pressure-taps the first year just because you know their inherent problems. If their rather immediate replacement would not contribute directly to service call reductions on a major scale, postpone them a year or two.

The critical items (and pressure taps may indeed be critical **if** of sufficient number, or improperly installed, etc.) get first attention. Usually the major item is that which most dramatically effects the system's quality and service efficiency, OR ADDS a channel or service attraction.

If you are an "engineering purist" then **your appraisal** will produce a value lower than that of a more "reasonable" appraiser (buyer) and you might be out bid for the system in a competitive purchase.

If, on the other hand, you can look at an inventory of a system, note the amplifiers, manufacturer, model, and age in the system and already know about what technical bugs that particular

TYPICAL ACCOUNT BREAKDOWN (March, 1976)

#Outlets	#-Accts:	$-Rate	= Gross Billing Revenue
1	2123	$6.50	$13,799.50
2	416	8.00	3,328.00
3	81	9.50	769.50
4	29	11.00	319.00
5	9	12.50	112.50
6	2	14.00	28.00
7	2	15.50	31.00
10	1	20.00	20.00
11	1	21.50	21.50
12	1	23.00	23.00
13	1	24.50	24.50
17	2	30.50	61.00
59	1	93.50	93.50
Special Cnt.	1	117.50	117.50
	2670		$18,748.50

Figure Four

equipment has, how long it can be "retained" and fussed with, and when it becomes impractical to do so. . .THEN you are really working in engineering **economics.** If **you** don't know, call someone who has that gear, tap, headend processor, cable, fittings, etc. in his system, and ask him. He'll tell you.

Also, remember a typical market buyer is **not** (except in very small mom and pop systems) likely to be a hands-on manager-engineer type. Don't leave equipment in the system (in your capital expenditure preparation) just because YOU can handle it and make it work. Visualize **reasonable** competence and technical ability of the "future" staff running the system's plant, not a technical whiz-kid, **or** a dum-dum.

Another plant and technical category factor you will observe is whether current technical personnel should be:

a. Retained
b. Replaced (at what cost?)
c. Trained up (I like that, usually)
d. Stolen (they're too good for that system. . . don't laugh, it happens)

FCC Tests? Proof of Performance? Make note of them for validity, detectable problems, and as they may reveal future needs and money demands . . .then put them aside.

Subscriber Data

Again, in this category as in the others, you are interested in the HISTORICAL evidence as a foundation to indicate the most likely FUTURE.

Get weekly or monthly subscriber activity reports for several years back and subscriber account records.

From this prepare two analysis sheets:

1. History of subscriber growth **(figure 3** case study)
2. Breakdown of accounts **(figure 4** case study)

Also get details on the dates and amounts of previous rate increases, special rates to commercial accounts, free subscriber hookups (schools, etc.).

SUBSCRIBER DATA SUMMARY

Primary Subscribers	2,746 (Actual count-not equivalents).
Added Outlets	600
Basic Rates	$6.50-1st outlet; $1.50 added.
Average Subscriber Rate	$7.46-Monthly; $89.52 Yearly (Actually collected in Revenue).
Apparent Churn Rate	33%
Average Growth	Monthly = 6 in 1974 " = 13.58 in 1975 " = 19 in 1976 (thru June) Yearly = Avg. recently of 6.9, say 7%.
Saturation & Trend	80%-forseen 91%-year 5; 94% year 9.
Rate Increases	1972 = 55¢-1st outlet; 25¢-added outlets 1973 = 50¢-1st outlet; 25¢-added outlets 1975 = 50¢-1st outlet;----------0---------- Rates gained on adding channels. No "pure economic" rate-increase success. Projected = 50¢ in 2nd & 4th Years.
Free Subscribers	No excessive amount observed, typical.
Annual Payment Profile	No significant or non-typical amount.
Installation Fee Income	No unusual amounts.-Typical.
Elasticity of Demand	$8.00 to $9.00 (estimated maximums).
Seasonal Turnovers?	No significant amount; stable.
Subscriber Mix	Added Outlets @ 22% roughly. Might be improved to 25% to 30% with marketing.
Illegal Taps	System 75% "tagged". Needs completion.
Subscriber Billing	Office work-flow inefficient. Changed from monthly-billing to coupon-booklets earlier.36-day lag on dlqnt. disconnect. Scored well on delinquent-balance $$$.
Additional Income	Insignificant to value.
Marketing?	1972-door-to-door. Results-"fair". Local media available. Typical one-promotion yearly. Channels listed in local paper, weekly.
Disconnects VS Rate Increase?	No apparent hard reactions.

Figure Five

Note disconnect totals from the reports, and reasons for disconnects, measure churn (annual **turnover** of subscribers = churn).

Determine how many subscribers pay annually, or otherwise in advance, the fees charged for installation, reconnect, relocation, etc.

Note the number of added outlets versus basic subscribers. REMEMBER TO DETERMINE HOW THE SUBSCRIBERS ARE COUNTED. What you need is an ACTUAL count, NOT equivalents.

All the primary data we gathered, and conclusions we reached are displayed in **figure 5** (subscriber data summary).

In conjunction with our earlier home count effort in the community analysis (you did one didn't you?) we can begin to visualize the subscriber penetration, historically.

It is amazing how casually we treat home counts in our industry. **This is the only inventory we have to sell** (potential homes) and we seldom know how many we have in stock. **Incredible!**

Home count and subscriber data are vital and inseparable.

If in doubt. . .drive out the system and count noses. Usually, however, a composite of utility and postal figures, plus a bit of driving for reference and verification will suffice.

Here are the questions and conclusions that we are looking for in the subscriber data:

a. **Historic trends in growth**
   1. What happened when rates jumped?
   2. **Average subscriber revenue** (divide gross revenue by subs.)
   3. Churn (How many folks had to be hooked up to RETAIN one net/new subscriber monthly, yearly).
   4. **Seasonal adjustments in subscriber flow.** (Population turnover, seasonal exodus, etc.)
   5. Mix of subscribers tells us where to apply rate increases (i.e., the efficiency of money flow/subscriber flow)
   6. **How are the delinquent accounts?** Collectable assumptions? Charge them off? Billing policy show?
   7. Average time from first reminder to disconnect?
   8. **Effect of sales and marketing on subscriber numbers.**

From all of this you will establish your opinions of the future subscriber growth of the system; changes in rate structure, adjustments in installation fees, billing process, changes, etc.

Don't forget to question ELASTICITY OF DEMAND?

What the blazes is that?

Well. . .wouldn't it be nice to know at what **rate ceiling** the typical subscriber would say, "You blasted cable costs too much, I'm going back to my antenna!"

It can be determined in several ways, some are rather complex.

For your purposes it is sufficient to simply interview subscribers (in a random sampling) and determine at what point they seem to believe the rates, monthly, would become unbearable.

Talk to some disconnects (not too financially strapped) and get their reactions to this and other questions as mentioned earlier.

If you don't have this opportunity to interview . . .don't worry about it, use your good judgement. Sometimes you cannot reveal your interest by visiting in homes in the community.

If disconnects, or sluggish sales followed a rate increase in a very outstanding manner, maybe the system's current rate structure is nearing the break point for **that** particular community.

By whatever means, get some feel of this category.

Application of trend analysis, predictibility curves, etc., are nice, and we use them, but common sense and experience in CATV will often get the same results.

Financial Data

Obtain balance sheets and income statements (monthly if possible) for a period of the last 12 months, latest balance sheet at end of a year, and go back at least 3 to 5 years with this data if you can.

Go over the income statements in an interview with management or accounting personnel to determine:

1. What expenses are allocated to each account category on the income statement (P & L sheet, some call it)?
2. **Take each account and determine how it was, or is normally accumulated.** For instance, in RENTS-does that include the microwave "rent", etc.
3. Make certain ALL expenses which you feel would be present are accounted for and that you understand the chart of accounts employed for the system. (**Until** a standardized accounting procedure is adopted in our industry, be prepared to see almost any form of accounting and ask questions until you are satisfied.)

Other than verification and "understanding" for the moment, do nothing with the income statements but make notes and clear up questionable items.

Balance sheet analysis is another matter.

Frankly, we do NOT pay a great deal of attention to the balance sheet of a CATV system. (That will shock some accounting friends of ours.) In fact, (and this will shock them even more) balance sheets and income statements are seldom really accurate representations of the past performance of the system/business! What's worse is that accountants are concerned with the PAST, and you, as an appraiser of a system, are concerned with the **present** and **future.**

However, in order to find out how things got the way they did, and what they might be in the future, we study the past, recognizing a perhaps inaccurate record. Actually, **inappropriate** (record) is a better word.

If you are given an audited financial statement, note the wording. . ."in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year" . . .This statement means that the financial statements fairly present the financial position and past operations of the system IF one is willing to agree with the PREMISES set forth by **G**enerally **A**ccepted **A**ccounting **P**rinciples, or GAAP as it is also known.

Right now in CATV there is an effort to get a GAAP ruling and standardization for accounting. That is a worthy task and sorely needed. But. . . by and large. . .you must **still** dig out the financial details you need to know to evaluate the system. Just remember that a balance sheet represents a company's financial position **as of a certain date** in the past, the income statement records the **result** of its operations for a period **preceeding** the date of the balance sheet. To understand, then, all the artificial results that even GAAP produces requires in-depth training in accounting and years of experience in analysis of financial statements.

Fortunately, you don't need more than a basic knowledge of accounting to appraise your system. And, except to look for irregular changes and unusual variances of the net worth of the system as reported by the balance sheet, you will mainly work with the income statements.

An Alternative Appraisal Approach

To satisfy our accounting friends (if we have any left), we will admit that **many businesses** can be appraised by approaches which involve to some degree, applications from the balance sheets and income statements. **We are** familiar with financial statement analysis, use of analytical ratios for comparison to other, similar systems (businesses) and analysis to find key unusual, misvalued, or omitted items.

However, in seeking an efficient and accurate appraisal approach for application to CATV systems, we found some years back that the market place of buyers and sellers, etc., did NOT employ those procedures in the main. The process they did employ was more akin to that which we are about to detail.

The Approach(s) To CATV "Value"

We have completed our preliminary analysis of the system, gathered abundant and sufficient data, and are now ready to begin to apply our data and knowledge to arriving at an indication of the **Fair Market Value** of the system.

We employ THREE classic, and recognized (in other business worlds) **Approaches to Value.** Within those three approaches are several methods or sub-disciplines.

Use of **all** the different approaches and disciplines gives greater creditibility and confidence in the final **opinion of value.** However, most often,

REPLACEMENT COST: CASE STUDY (1976).

Management/Franchising	$ 10,000
Strand Maps—Pre Construction Engineering.	3,000
Pole Clearance	15,000
Tower: (Includes Building, Fence, Winch, Etc.)	32,300
Headend: (Includes Antennas, Spares, Labor, etc.)	44,178
Amplifiers & Spares (Old and new-replaced)	58,548
Cable	30,822
Taps	15,708
Subscriber Drops	67,500
Hardware/Labor	106,839
Vehicles/Tools/Misc.	30,325
Office Equipment	10,000
Total Replacement Cost:	$424,220.

Figure Six

only one or perhaps two of the approaches produce a final indication of value.

The three approaches to value (familiar to lenders and investors in real estate and other commercial property fields) are:

1. **The Cost Approach**-examination of present day costs to replace, or reproduce a system.
2. **The Market Approach**-use of comparisons, if any can be found and adjusted, of similar systems that have transacted.
3. **The Income Approach**-this approach is our main contender and the one we will work with in our case study.

The Cost Approach

This is merely the calculation, from your data you gathered, as to what it costs to TOTALLY replace the system, with modern, similar equipment.

Remember, you must consider the costs not only of building the plant, but those entailed in obtaining a franchise, licensing, FCC permits, strand mapping, pole clearance, design and engineering, as well as turn over of subscriber drops through the years to arrive at a figure that reflects a total replacement.

Glance at **figure 6** for our case study's replacement cost. Later you will find this is below the final **value** of the system, (and it usually is) however for those that are serious about appraisal we suggest you still do the task. The reasoning is that by doing a replacement cost analysis you have been **forced to think** seriously about the components and condition of the system. This would be done BEFORE you prepared that capital expenditure we discussed earlier, and it would make your capital expenditure preparation easier and more accurate.

Use current costs as you gather them from the industry's manufacturers, suppliers, and contractors. Do NOT assume bargain basement pricing, or a shelf built construction effort. Usually, the typical market will turnkey a large portion (perhaps all) of the system. Employ the costs that are MOST LIKELY to be paid.

Some systems, (newly built perhaps) will have a value approximating the cost approach value. In several instances of our experience systems have been evaluated at LESS than replacement cost! Why? They were **over-engineered** for the community, or built in portions of the community which should NOT have been constructed among other reasons.

The Market Approach

You probably will not find system sales that are fully comparable in the market place of transactions. Use of directly comparable system turnovers is not usually possible. However, you must learn certain factors FROM YOUR OBSERVATIONS of the market's transactions. (Glance at **figure 7,** typical economic factors). By watching trade press reports of sales, talking with buyers, sellers, brokers, and lenders, you would have accumulated certain market data as we did in our case study in 1976. Most of the economic factors demonstrated are still viable in 1978.

One of the major factors which can be employed to arrive at a value is that illusive **and misleading** cash flow multiplier. IF you can find system transactions with somewhat similar subscriber numbers as our case study, similar saturation and potential figures, which transacted with a debt/equity of about 80/20 or 75/25. . .with similar monthly rates and prospects for future rate increases. . .**then**. . .you **might** arrive at a multiplier which would be later employed (in the income approach to value) to arrive at an indicated value.

Therefore, your market research, while it may not produce comparable system transactions and indicated values of systems similar to yours (or our case study), is still valuable for the OTHER data of typical market conditions and demands which it does produce.

"We declared no reliable comparable existed for our case study, therefore, no statement of indicated value was made using the market approach to value."

The Income Approach To Value

Now we put your calculator and accounting pads to use.

We are going to develop a host of computations and later apply their results to arrive at a range of indicated values using several methods within the income approach to value. During all that period in which we accumulated data about the system, calculated the replacement cost of it, and delved into the market place for typical market conditions, similar systems, etc., we began to form some obvious opinions about the system AS IT WOULD BE VIEWED BY A TYPICAL MARKET BUYER.

Stabilized Income Statement And Proforma

We are going to prepare two important displays of figures. The stabilized income statement is a

matter of "freezing" the system into a PRESENT display of net operating income; the proforma takes off from there to calculate and display the FUTURE (in this case 10 years of it.)

Using The System's Actual Income Statements

NOW take out the system income statements (profit and loss statements) and prepare, on your columnar pad a copy of what is reflected in each statement in previous years. . .and perhaps in the past 12 months.

You want to deal only, for a moment, with **direct operating expenses**. . .therefore, take out your chart of accounts any categories and dollars that pertain to:

a. **home office expenses**-overhead charged back to the system by an MSO, etc.
b. **debt service interest**
c. **depreciation**
d. **income taxes** (corporate)
e. any other expenses that do NOT reflect actual **direct** operating expense of the system (necessary to do business as an independent operating system).

From each income statement copy down the appropriate figures on your pad. Leave a blank column between each year or month. (Our case study had categories which looked something like **figure 8**. . .ignore the numbers for a moment. . .)

The last column on your pad should be the latest (current month, hopefully) income statement.

Historical Analysis

In the blank columns between each yearly or monthly income statement display **calculate the percentage of change in each item.** (If you have a calculator with a percent change key it's quicker; otherwise, calculate the difference between month/year number 1 and number 2, etc., and divide that difference [plus/minus] by month/year number 1).

Do that for each item, miles of plant, subscribers, gross revenue, each expense category, net operating income, etc. NOW. . .SIT BACK AND STUDY THE PERCENTAGE RESULTS.

(Among other things. . .)

a. Note the **growth of the plant,** on the average, each year.
b. Note net **subscriber** and average subscriber **gains.**
c. See how the gross **revenue tracks** with rate increases and subscriber growth reactions.
d. Note each **expense category**. . .what's happening in each period of time, how much change is occuring, does this agree with your understanding of staff, general expense, and other data you've gathered.

What you are looking for are TRENDS in the experience of the system historically. The first step, now, is to prepare an income statement on the same columnar pad that reflects ONE YEAR of operations brought up to the present date in time, or as near to this date as reasonable. For instance, if your last data and income statement was for November 1976 and the BUSINESS YEAR

TYPICAL ECONOMIC FACTORS (1976).

Subscriber Rates:

Average Sub. Rate (Basic 1-outlet) 1976 = $6.15
Average '76 Increase = 10%
Apparent Typical '77 Basic 1-outlet Rate = $6.50
Apparent Typical '77 Basic-added outlet = $1.50

Typical SATURATION Average of All Systems = 49%

Typical HOMES PER MILE Average 1,000 Sub System = 64 H/P/M
Average 20,000 Sub System = 110 H/P/M

System Sizes: 85% of all systems fall below 3,000 subscribers.
6% fall between 5,000 and 15,000 subscribers.
1% fall above 15,000 subscribers.

Typical Lending Practices:

A. Interest rates 2% to 5% over prime (fixed & float).
B. Equity demanded by lenders from 10% to 30%.
C. One to two year moratorium on principal.
D. Terms from 7 to 10 years, most often.

Other Indicators from the CATV Market.

A. After tax cash flow most often demanded by clients as proof of economic feasibility = 12% +/− 1%
B. After tax range of periodic internal rate of return = 10% to 15%.
C. Dividend on equity (N.O.I. less capital expenditures and debt service allowance, prior to depreciation). Most often = 20% to 25%.
D. Range of encountered capitalization rates: = .1300 to .1563. I.E. multipliers of 6.40 to 7.69.

Range of transactions in the market most similar to subject system were insufficient for direct comparables. . .however, a multiplier of 6.49 most often occured.

Figure Seven

STABILIZED INCOME STATEMENT (May, 1976).

Miles of Plant	51	
Homes Passed	3,400	
Subscribers End Year	2,715	
Subscribers Average.	2,620	
GROSS REVENUE	**$234,542**	
(Less Plant Expenses)		
Maint. Salaries		26,580
Pole Rental		6,360
Power-System		3,612
Tower Site Rental		100
Franchise Fee		11,352
Vehicle Expenses		3,420
Repair/Maint.		9,300
Insurance		2,880
Payroll Tax		2,148
UPI-Service		2,340
Total Plant Expenses	=	**(68,092)**
(G & A. Office Expense)		
Office Salaries		30,192
Office Exp.		2,400
Advertising		2,640
Rent		2,700
Payroll Tax		2,940
Property Tax		1,680
Other Tax		300
Telephone		1,500
Travel		3,000
Bus. Entertainment		30
Utilities		1,020
Subscriptions/Dues		2,316
Prof. Fees		1,200
Contributions		300
Profit Sharing		6,720
Group Insurance		4,440
Bad Debt Allowance		132
Misc. Expenses		72
Total G & A. Expenses	=	**(63,582)**
TOTAL EXPENSES	=	($131,674)
NET OPERATING INCOME (NOI)	=	$102,868

Chart of accounts employed was largely as company used them. A better format, for appraisal purposes, might have been used which broke-out fixed expenses such as franchise fees, insurance, etc.

However, this display demonstrates that any format is acceptable if fully understood and carefully adjusted by the appraiser.

Figure Eight

of the system ended December 31, 1976. . .you might PROJECT what the last month is likely to be in each category (subscribers, gross revenue, expenses, etc.) and prepare a statement STABILIZED at the date of December 31, 1976. Or. . . as in our case study where the latest income statement was for May 1976. . .we looked at the system in July and decided to "treat" the system as if our stabilized income statement was for a business year which ended in May 1976, since little had changed to measurably effect value in June and early July. (This system's actual fiscal business year ended in April.)

Our year end stabilized income statement, then, looked like **figure 8.** It produced a Stabilized Net Operating Income (NOI) of $102,868.

In addition to those items we mentioned earlier (depreciation, interest, etc.) we "adjusted" several expense items to reflect what a 12 month NOI would occur as viewed by the typical market buyer.

Adjusted Expenses

First there was an owner's salary (of $13,000) which we **removed** entirely, since the system had a manager capable of operating the system and our **typical market** would elect to ignore **that** expense (although later it would take earnings, or salaries, etc., perhaps).

We found that there was a bit more travel expense than typical and reduced that. We adjusted a rent category to reflect some office space that, while convenient, wasn't really necessary. We reduced the "management and technical" salaries a bit since they reflected some monies for management of a companion owned (but not for sale) system. A new owner wouldn't have **that** expense, he would only be interested in **this** system's operations. (The expenses should have actually been charged to the other system, but they weren't . . .this is the kind of item you look for in studying your income statements versus your interviews with management/ownership, etc.) We dropped some life insurance expense (for ownership) which wasn't necessary to new, typical ownership needs. And, we made minor adjustments in pole rental to reflect a new increased rate that was only partially reflected in the 12 month period. Vehicle expense went up a bit as our trend analysis indicated an irregular decrease actually occured which we attributed more to good luck than anything else.

I'm sure you get the picture. You are studying **the trends,** allocating slight changes to each category to reflect a stable year with NO irregularities up or down in revenue or expense items, and taking out of the income stream/expense picture those subjects that would NOT be required of a **future,** typical market **owner.**

Now, you have a picture of a year of quite typical and highly accurate conditions that produced our $102,868 NOI. Put this aside for the moment and continue with your opinions and conclusions to build your proforma.

Proforma—(A 10 Year Budget and Anticipation Display)

Now it's time to build the future (as you and the typical market owner would forsee it). Using another columnar pad repeat your items from the historical display in **figure 8** with some important additions. Glace at **figure 9,** "Proforma" of our case study. **You will work with each year,** we've skipped a few in our display for convenience in demonstration only.

Decisions. . .Decisions. . .Decisions

You've determined the conditions of the PRESENT profile of the system already for end of May 1976. What will it look like in one year from then? In two? In three?, etc.

Step 1. Start with homes passed by plant and from your earlier study of the community you

have determined how many new homes **within** the present plant area and **outside** (requiring extensions) you envisioned for the system in future years. (Note what we said in our case study about that for this system. . .do you agree with our "projection"??)

Step 2. For those homes outside the current plant area, add miles to be built. (Again, see the case study, we only saw a few miles of plant required in the future.)

Step 3. Subscribers added. Based upon the historice performance of the system, or comparable systems if history is brief, or depending upon your conclusions as to what would happen if you added a channel or other services. . .or ALL of those and other considerations, "How many subscribers will occur at the end of each year?" "Will saturation increase yearly? If so, how much?" Again record your figures and produce the display similar to ours in the case study.

Note that you **don't add** 100% of the **new** subscribers time subscriber rates to produce revenue . . .figure the "average" or about 50% of the added subscribers will contribute to revenue as they come on the system **periodically during each year.** That "average subscriber" figure is the one multiplied by. . ."average subscriber rates".

Average Subscriber Rates

Remember when you compiled a history of the subscriber growth of the system, compared it to gross revenue, and developed an average subscriber rate? Also recall how you examined the "mix of subscribers" (back on **figure 4**). Now. . . what kind of rate increases do you foresee practical, and likely to be needed in the system in the future? Look at your subscriber/account breakdown and determine what that projected increase would do to the "average subscriber rate".

Calculate what you believe the average subscriber rate would be, yearly and apply your rate increase accordingly, as we did in the case study. Using that annual average subscriber rate. . . multiply by the average subscriber numbers at the **end** of each year to get the gross revenue for the year.

Proforma Expenses

Taking each expense category, think carefully about what is likely to happen **each year to each category. Don't use** an overall percentage for expense increases as a total of all expenses.

Regardless of what SEEMS to be an annual rate of increase for expenses, certain items that you KNOW might be pending (such as pole rental increases, fuel increases, power increases, etc.) may greatly increase for future expense total, yearly, far faster than the most recent past experience. **Break down each item and consider it alone. . .carefully.**

Now, admittedly, we all know we can't look very far into the future with any confidence. . . but. . .for two to three years ahead you may be very accurate. Beyond that. . .who knows? But, **trends** are usually stable in CATV and if you **start** with "good" numbers and logically increase rates in expenses and revenue, etc., chances are the long range future will hold up.

(How good can you be? We've hit as close as within 1% after two years have actually passed from one of our projections in an appraisal.) Some systems we studied 8 years ago are still running within about 5% of what we "projected" they would in revenue, etc. Therefore, careful thought and precise, meticulous breakdowns **instead of** summary calculations can make you a fairly accurate fortune teller.

PROFORMA (end of)		Year #1	Year 5	Year 10
Miles of Plant		51	52	54
Homes Passed		3,425	3,529	3,659
Subscribers End Yr.		2,905	3,195	3,455
Subscribers Average		2,810	3,163	3,455
GROSS REVENUE		**$251,551**	**321,108**	**348,518**
(Less Plant Expense)				
Maint. Salaries		27,112	29,346	32,400
Pole Rental		6,423	7,599	7,987
Power-System		3,648	4,134	4,346
Tower Site Rent		100	100	100
Franchise Fee		11,777	15,255	16,626
Vehicle Expense		3,488	4,986	6,364
Repair/Maint.		10,004	7,430	8,203
Insurance		2,880	2,891	2,483
Payroll Tax		2,169	2,348	2,592
UPI-Service		2,340	2,574	2,832
Total Plant Expenses	=	**69,941**	**76,663**	**83,933**
(G & A Expenses)				
Office Salaries		30,796	33,334	36,804
Office Exp.		2,448	2,650	2,926
Advertising		2,904	3,873	4,300
Rent		2,700	3,000	3,600
Payroll Tax		3,079	3,333	3,680
Property Tax		1,700	1,800	2,200
Other Tax		300	350	375
Telephone		1,575	1,915	2,443
Travel		3,000	3,000	3,000
Bus. Entertainment		30	50	50
Utilities		1,122	1,642	2,645
Subscriptions/Dues		2,400	2,500	2,500
Prof. Fees		1,200	1,400	1,500
Contributions		300	300	300
Profit Sharing		7,056	7,408	8,170
Group Insurance		4,662	5,140	5,670
Bad Debt Allownce.		251	321	348
Misc. Expenses		75	92	117
Total G & A. Expenses	=	**65,598**	**72,108**	**80,628**
TOTAL ALL EXPENSES		**(135,539)**	**(148,771)**	**(164,561)**
NET OPERATING INCOME		$116,012	172,337	183,957

NET OPERATING INCOME =

Note: Expenses should be calculated for **each** year of proforma.
Display above is merely for convenience.

Figure Nine

Net Operating Income Proforma—Plus Capital Expenditures

Finally, going item by item and year by year, you've produced a 10 year NOI proforma like our case study in **figure 9.** Part of the income stream

CASE STUDY—INCOME STREAM ANALYSIS

YEAR	GROSS REVENUE	Less Expenses	Net Oper. Income	Less Capital Expend.	Avail. to Debt/Eq.	Trial Debt Service	Dividend to Equity
1	$251,551	(135,539)	116,012	(75,750)	40,262	(126,543)	86,281
2	275,575	(136,695)	138,880	(9,350)	129,350	"	2,987
3	287,706	(140,222)	147,484	(16,225)	131,259	"	4,716
4	314,712	(144,995)	169,717	(7,350)	162.367	"	35,824
5	321,108	(148,771)	172,337	(2,525)	169,712	"	43,169
6	327,402	(152,789)	174,613	(11,000)	163,613	"	37,070
7	333,493	(155,573)	177,920	(2,500)	175,420	"	48,877
8	339,077	(158,570)	180,507	(2,250)	178,257[2*]	"	51,714
9	343,645	(161,902)	181,743	(6,250)	175,493	---0---	175,493
10	348,518	(164,561)	183,957	(2,125)	181,832	---0---	181,832
Sum	$3,142,787	(1,499,617)	1,643,170	135,425	1,507,705[1*]	(1,012,344)	667,963

Notes: 1* 10-Year amount available to Debt/Equity.
2* Sum of this column to here produces average of $144,000 (rounded) and employed in test in Indicated Value Via Anticipated Cash Flow.

Figure Ten

you need to appraise the system is complete . . .but **not** all. Using the knowledge and conclusions you gained from your earlier plant data and interviews. . .prepare that capital expenditure analysis just as we did for our case study **(figure 2)**. Plant rebuild, we decided, would be heavily invested in the very first year of a new ownership period. Expansion would continue thereafter. If you foresee a TVRO station. . .and pay cable. . .figure that capital expense. . .but, back in '76 we did not conclude that addition (it was too early to do so). **Now** we **would** assume that, as well as other added features for the same system, used in this case study.

AN APPRAISAL WORKS WITH TRENDS. . . NEVER GET AHEAD OF THEM. NEVER GET BEHIND THEM. STAY EVEN. If the industry is reluctant, you should be reluctant. . .if the industry is aggressive. . . be aggressive in your conclusions.

Income Steam Analysis

You now are ready for one last display in your calculations.

On another columnar pad arrange your calculations (proforma) to look like that of our case study in **figure 10.** You've got everything to do that **except the last columns** (we'll get to them later).

Deducting the capital expenditures, yearly, produces the amount of cash flow you believe the system will have available to:

a. **Pay Income Taxes**
b. **Pay off Debt**
c. **Pay a return** on the equity (cash down payment = 20%) that the new owners will have invested in the system if they buy it.

Indications of Value-Income (Stream) Approach

Finally, we are ready to apply various methods of evaluation to those income stream figures we've produced.

Remember we told you in the very beginning that a valid appraisal discipline produces a **range of values.** We are about to do that. Back in 1976, from the market study we did, we found that systems that were sold similar to this one seemed to transact at a figure that was roughly **6.49 times** the apparent (as best we could dig out of industry sources) Net Operating Income (NOI).

Since it is recognized that: Value = Income Dividend by a Capitalization Rate or multiplied by a Multiplier then. . .in this case study our system's stabilized Net Operating Income was $102,868 x 6.49—a value of $667,613.

Is the system value say $670,000???? We aren't sure yet.

Band of Investment Method

Let's test another accepted method and see what happens. We breakdown the typical debt/equity costs and demands into a "weighted profile".

We said that the CATV TYPICAL MARKET told us (back in 1976) that (see **figure 7** again). . .

Debt is usually 75 to 80% of price (when a system is bought and sold);

Equity (cash down payment) is usually 25% to 20%.

And. . .that by studying transactions and talking with buyers, sellers, etc., the demand for a yield on equity (return on equity invested) annually should average about 20 to 25%.

Therefore: 80% (Debt) x 12% (interest usually charged) = .096 or 9.6%

20% (Equity) x 20% (yield needed) = .04% or 4%

Total of the Two = 9.6% + 4% = 13.6

Remember Value = Income/Rate

For simplicity, let's change that 13.6% into a Multiplier by dividing it into "1" (reciprocal) (1/.136 = 7.3259).

Therefore. . . $NOI ($102,868) x 7.3529 = $756,382.

Is the system value then $756,382?

CONTINUED ON PAGE 36.

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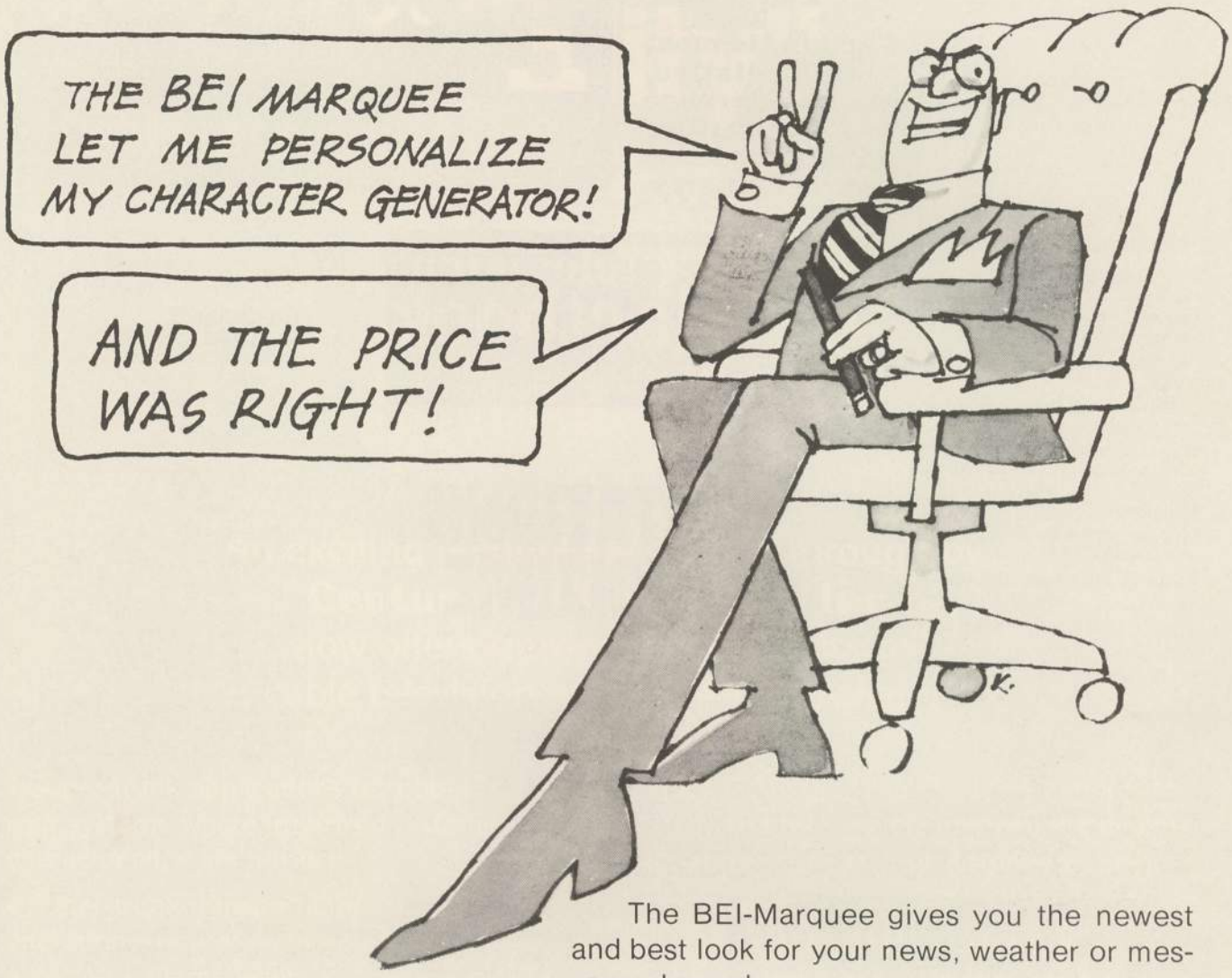

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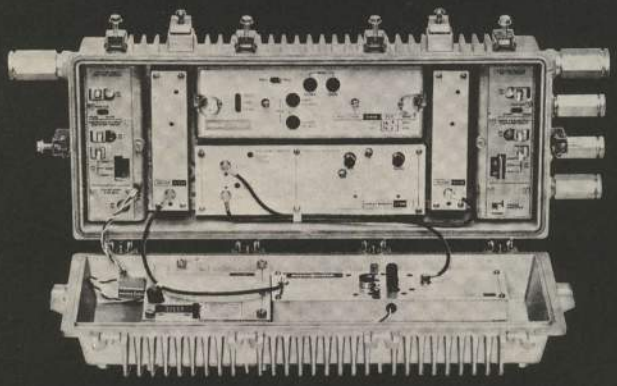

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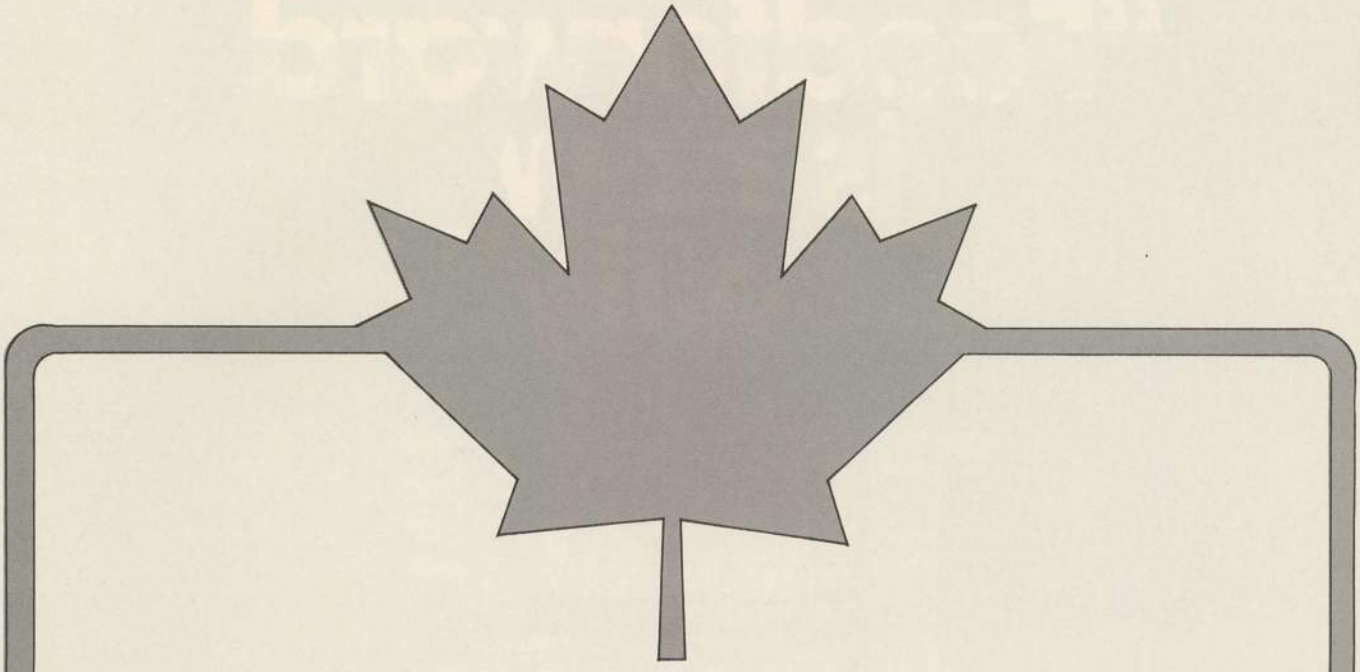

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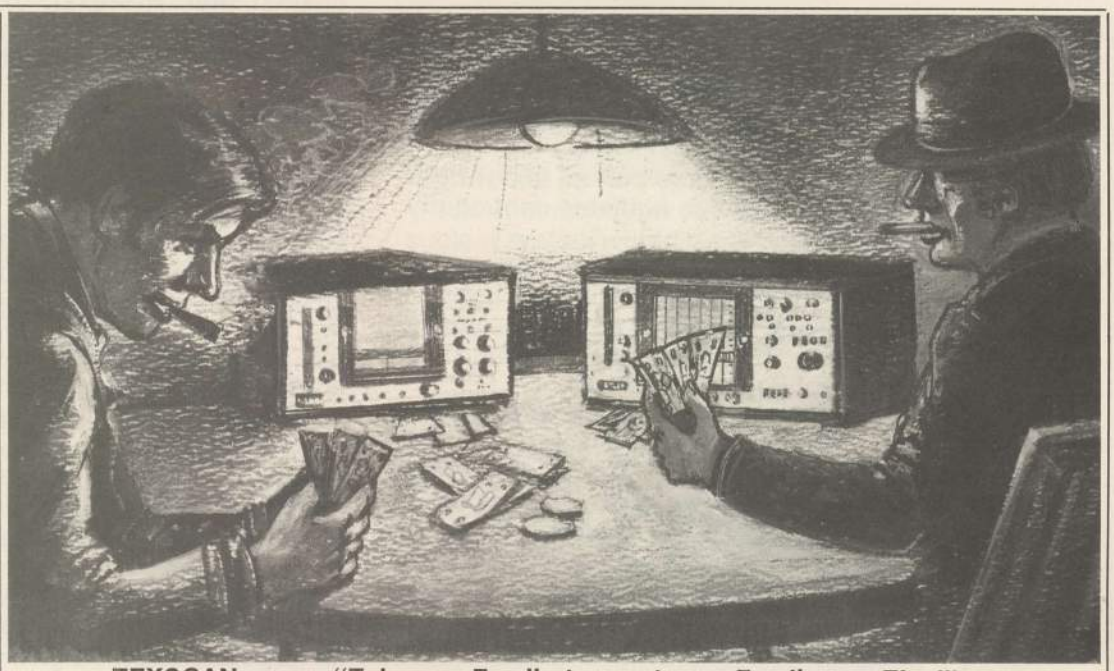

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CONTINUED FROM PAGE 30.

Maybe. We still aren't certain but the RANGE of value is **beginning to** develop. So far it appears the system may have a value of $670,000 to $760,000. Let's go a bit further in our appraisal process. We have capitalized the NOI but there are other considerations in the income stream displayed on **figure 10,** after NOI.

Indicated Value via Anticipated Cash Flow

Our case study proforma, **after** capital expenditures are deducted, produces an **amount** available to debt and equity of about $1.5 million in the 10 year projection.

Over an eight (8) year time period, about right for debt payoff, the average available debt/equity amount is, say $144,000.

If we pictured the DEMANDS on that annual amount, here's what it might look like. . .

$144,000 = 100% of Cash Available, yearly average.

(– $???) = Debt Payments

= $??? = Left over amount, dividend-on-equity.

If we knew the typical debt package might be as we have previously stated it (75% to 80% debt/ 20% to 25% equity) and we made an allowance above of some amount for a reasonable equity yield (20% to 25% annually) we could then take the remainder, apply it to principle/interest payments annually and produce at a figure that would indicate 75% to 80% of the **apparent** system value.

Trial And Error Calculations

This is where a financial calculator, with built in formula keys to determine payments for various sets of debt, interest, and time will save you longer calculations.

The formula otherwise used is:

debt amount $= \frac{1-(1+i)^{-n}}{i} \times$ **payment amount**

i = interest rate and n = length of debt payoff period.

Using the formula you will "try" various payment amounts at typical interest rates (i) then prevailing in the market, and for terms (n) that are typical. We finally came up with a debt package which saw an amount of about $126,000 as payment to debt, annually. This (at 12% interest over 8 years) would retire an amount of $648,825 in debt.

If that amount ($648,825) was considered to, say 80% of "value" then the system would be valued at $811,000 ($648,825/.80).

Equity or cash down payment would then be about $162,000.

As a further test of our best-trial debt/equity approach to value, we determined that **if we paid interest only** for the **first year** and produced the last column in **figure 10,** the "average" dividend to equity over **nine** years was about 16%. If we considered **10** years when debt service was no longer a major cash flow factor, the average was about 26%.

These figures are about right for our previously determined DEMAND of the market of an equity yield before tax (of 20 to 25%). **Therefore, we have another indication of value of $811,000!**

Actually, we might have gone a bit further and calculated the **apparent interest** in dollars, annually, and a straight-line depreciation for the fixed assets of the system, and came up with an average **after tax equity yield** and tested the value against that. However, experience told us we were "in the range" of the market's demands and we did not take the calculations further.

Present Value of Future Dollar Approach-(Discounted Cash Flow)

Another income stream evaluation which is often applied by investors in the market is that employing discounted cash flow principles. You may have heard this "discounted cash flow" discussed and wondered about it. It simply means that money received at some **future** date is worth something **less** than the dollar amount indicated in **today's** dollar. Inflation, or some rate to equal or exceed inflation, is the requirement. If you put $1.00 in savings account next week, and received NO interest on it, and left it for 10 years, it wouldn't purchase the same amount of goods (assuming the inflation rate continues about as it has in 10 years).

So. . .if you went to a friend, and offered to sell him that $1.00, but he couldn't actually spend it for 10 years, would he give you $1.00 for it? No. . . he'd want to gve you **some amount less than that** to account for the "discount" created by the inflation rate, annually, which depreciated the buying power of the $1.00.

Let's say we don't know what the inflation rate will be for the next 10 years, but, to keep ahead of it we would like our investment to earn at least 12%, giving us some profit motive.

So. . .what would this case study system of ours earn in the next 10 years? And. . .if we were buying all those future dollars today, what would we pay for them (present value)? Look again at **figure 10.**

Let's Sell The System In The Eighth Year

If someone came along and tried to buy our system in the 8th year, he would see a figure of $178,257 **that year** as cash available to debt/equity (assuming our projections held up).

Let's use a very modest **multiplier** of that "cash flow" of about "6".

$178,257 x 6 = **$1,069,542** (8th year value of system).

(In effect, as we appraised the system, we were actually saying that it might be worth that amount some 8 years out. . .) So we are "buying" that much, at least, if we bought the system today. We might anticipate about $1 million back when it sold. **But. . .we also are buying** the use and pleasure of the surplus cash the system produced each year, aren't we?

Again, in **figure 10** we had determined that might be as much as a total of $1,150,420!

Therefore: $1,150,420 = annual cash available before tax

+ $1,069,542 = gross from sale (theoretical) of system

$2,219,962 = Total "future" dollars.

If our assumptions about the system are reasonable we are thinking of buying (therefore appraising) a future amount of about $2.2 million.

The formula, which will tell us what that $2.2 million is worth in **today's** dollars is:

$$\text{PRESENT VALUE} = \frac{\$2{,}219{,}962}{(1 + i)^n} = \$854{,}070$$

i = Discount rate of say, 12%

n = Number of years system is projected (held) say 8 years.

This formula for present value of future dollars received gives us a value indication of $854,070!

Reconciliation Of All 'Values'

Let's review what we have learned about the apparent value of the system.

		INDICATED VALUES
By the COST APPROACH		
By the MARKET APPROACH		No acceptable comparable
By the INCOME APPROACH		
a. Using a comparable cap rate from the market	=	**$670,000**
b. Band of investment	=	**$760,000**
c. Debt/equity analysis	=	**$811,000**
d. Present value analysis	=	**$854,000**

Since we know, in this instance, no one would sell a system like this one solely based upon what it cost to replace it. . .we can **eliminate** the cost approach value.

Let's think about the income approach range of values.

a. **The comparable capitalization rate** was taken from our examination of the market of some rather nebulous "comparable" sales which **really** had **little** relationship to our case study system. Also, it represented a presumed "cash purchase" with no leverage of the acquisition through a debt structure. It had no consideration in it for the future cash flow increase from the system to speak of. . .nor realization of future capital needs.

b. **Band of investment** had leverage considered with a debt-cost but also dealt with a **current** NOI, no allowance for system growth and future capital expenditures was made.

c. **(Debt/equity analysis)** looked at the system rather completely. Future anticipations were taken considered.

d. **(Present value analysis)** considered not only a cash flow as "c" did but also some future asking price and sale of the system.

"d" at $854,000 is our highest likely value that the market might see for this system (under the conditions we set forth), **but,** it did **not** consider tax along the cash flow stream each year, nor a capital gains tax from sale of the system.

Conclusion Number 1

The **M**ost **L**ikely **F**air **M**arket **V**alue (MLFMV) is probably going to be somewhat **less than** "d" at $854,000.

Conclusion Number 2

Except for a strictly cash sale to the owner, the MLFMV is probably going to be somewhat more than "a", $670,000.

Conclusion Number 3

"c", $811,000 seems closer to the figure that will probably be paid.

Conclusion Number 4

We concluded (in 1976) that our case study subject system would most likely sell somewhere between $811,000 and $854,000. . .and offered an opinion that a leveraged sale might produce a most likely fair market value of $835,000 (highest and best value indication).

What Actually Happened?

The case study system sold for about $690,000 in what was (to the seller), in effect, **a cash sale,** after some months of exposure in the market by him, with no broker involved. There was a small debt included that was assumed by the new owners. Apparently, according to the seller, they (the new owners) "saw" some reluctance to the prospect of rate increases. The seller also, in retrospect, indicated that the "market" was down a bit (interest rates were up, capital was a bit tight) and that if he had gone to the market about six months later, he thought he might have gotten more for the system. But he was happy with the transaction.

Conclusions

How did we do as Appraisers? How did you do with your own system (if you worked along with us and our case study)?

Well. . .we all know now that appraisal of a system doesn't produce an absolute, carved in stone single figure.

But. . .the actual system transaction was only 3% off from one of our value indicators (the cash weighted market cap. rate approach) and only about 9% below our second indicator using a band of investment approach. In today's changing economic climates, with unkowns in future regulations, rate increases, services, debt costs, inflation rates to expenses, etc., **if** you can arrive at indications of value that **are within 3% to 9%** of a later transaction. . .**you ain't too shabby** as an appraiser.

You Are An Appraiser!

If you contemplate selling, buying, lending to, building a new system, or any other financial transaction, **you are,** every time you consider any of those actions, an appraiser.

Whether or not you employ a disciplined process to really define the apparent value(s) of a system from your own unique criteria or not. . . you "appraise" the minute you set a price, make an offer, agree to make a loan, go after a franchise, or plan an extension. **So. . .MAKE YOUR VALUE DECISION FROM RECONCILIATION OF A RANGE OF INDICATED VALUES. . .and you will profit from it.**

For instance, if you were the contemplated buyer for our case study system you would bargain for that lower value range that effectively was a cash sale to the seller, wouldn't you? (The buyer apparently actually did that.)

For instance, **what if** the seller had taken back a note from the buyer for, say $600,000 at 11% for 8 years and $200,000 in cash? In 8 years he would have, by then received a total of $1.1 million from his sale of the system, **including** interest! (Think about it gentlemen, if you don't **need** $600,000 **in cash** on which you will pay a capital gains tax of say 25%, why let the lenders take that interest?)

In CATV, we may need to begin to think of selling with notes carried by the seller more often. There aren't that many new systems to build or buy. We (as owners) are getting older and this sort of sales approach can make retirement and taxes a bit more comfortable.

In a later article, we will delve into those subjects that are FALL OUTS from employing a disciplined appraisal process. **Leverage** of the system, **freeing** of equity in the system, **better** financial management, **tax** savings that might be contemplated once value in various time periods is known, **the impact** of pay-cable services (to the income stream), **when** to sell, **when** to buy a system, **when** to re-finance. . .

. . .All these subjects are valid when present and anticipated-**future** values of our cable systems are known to us by employment of a reasonable appraisal process and some future contemplation of possible income stream effects.

But, before you can examine and analyze some future financial condition and plan for events and business decisions. . .you must know present values and learn how economic, or other conditions, effect them.

PART TWO—

LOW/LOW COST MICROWAVE SYSTEM RECEIVER FEATURES GUNNPLEXER TECHNOLOGY YOU CAN DUPLICATE

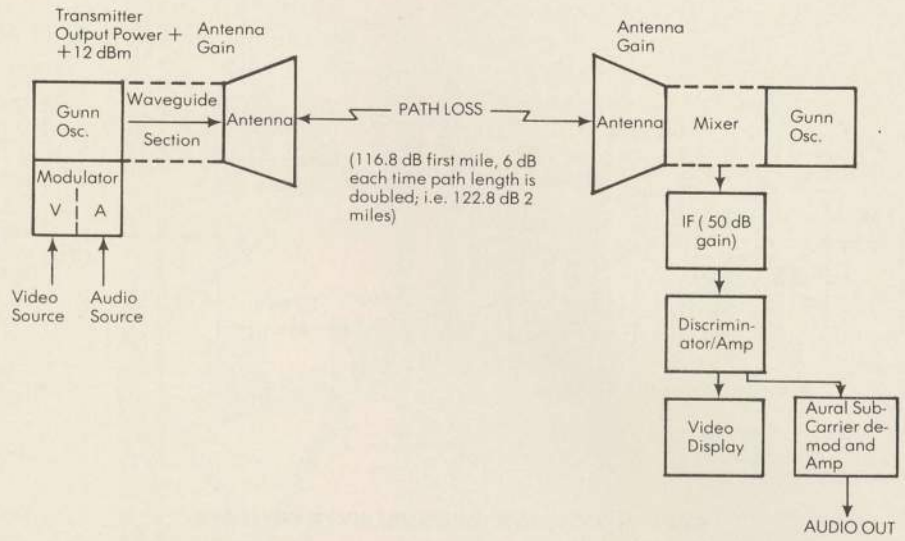
A 'Simple' Receiver

In the **June** issue of **CATJ** the CATJ Lab reported on an operating Gunnplexer microwave transmitter system which will accept baseband video and audio and create an FM/FM transmission system capable of spanning distances to 20 miles with good reliability. The video is FM modulated over approximately a 9 MHz passband and the audio is FM/FM as a subcarrier offset from the video by 4.5 MHz.

The receiver to be described is a version developed by Steve Richey for the CATJ Lab this past winter. It is not the ultimate receiver by any means, but it makes an ideal high-quality 'first serious system' for the microwave 'experimenter' who will, having made this fly, be ready to move on to more exotic transmission and reception systems.

The primary reason this receiver is designed and constructed as you will shortly see described is that it follows along with widely held practices in the TV receiver design area. First of all, we use a 40-50 MHz IF range resulting in a **10 MHz wide IF.** By selecting this region for the IF we felt that most people would be able to perform the alignment and tune up without any special equipment. For the purists, this discussion however.

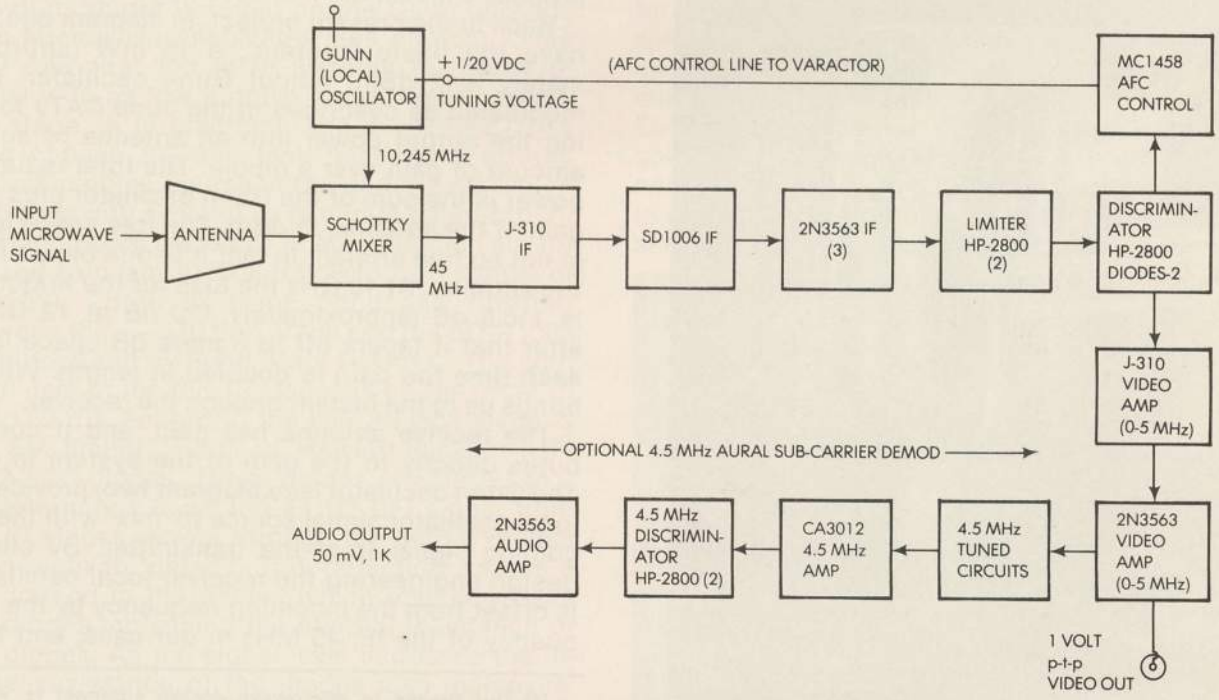
The narrow IF (10 MHz passband) is not an ideal use of FM. As Armstrong set out to prove in the 1930's, the advantage of FM is directly related to its bandwidth. Up to a reasonable limit if you deviate the signal over a wider and wider passband you end up with more signal to noise at the receiver. A perfect example of this is our fairly common use of a 36 MHz wide passband for the TVRO service we have come to accept (if not yet love) in the 3.7 to 4.2 GHz region. Armstrong, the developer of FM, proved beyond most reasonable doubt that the signal to noise advantage for FM signals into full limiting is most dramatic



THE CATJ LOW COST MICROWAVE SYSTEM FOR TRANSPORTING VIDEO AND AUDIO OVER DISTANCES TO 20 MILES

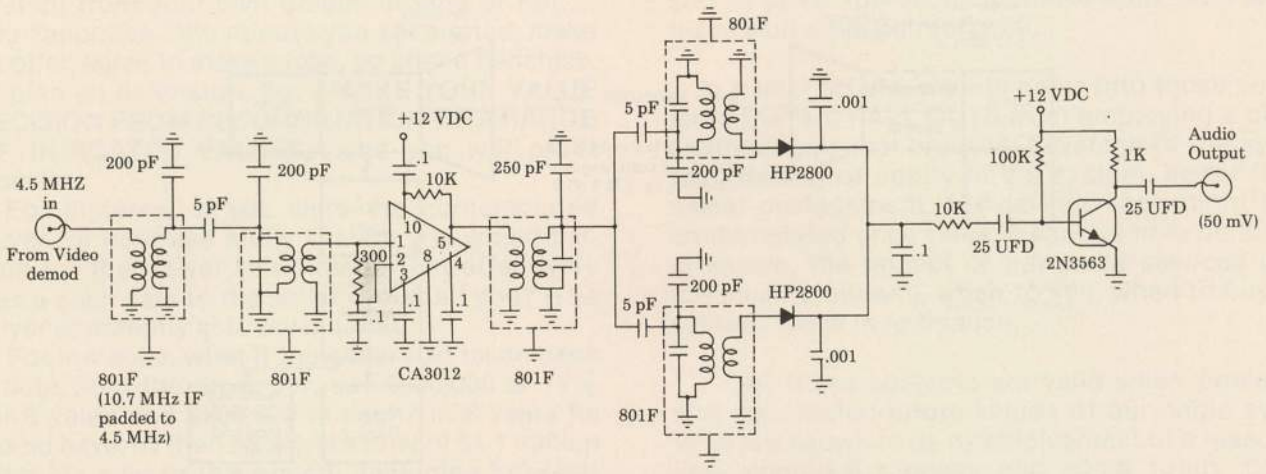
DIAGRAM ONE

when there was a relatively high modulation index. **In video work** the FM advantage is significant **when the modulation index exceeds unity.** Since the modulation index equals **peak deviation divided by the modulation frequency,** and because the highest modulation frequency for real time video is on the order of 4.5 MHz, the perhaps ideal or best deviation for attaining a real world 'FM advantage' would be on the order of 5 MHz (or more). **The radiated power bandwidth** for 99% of the modulation power spectrum is roughly equal to **twice the peak deviation** (4.5 to 5 MHz) **plus twice the highest modulation frequency** present and this suggests the ideal receiver band-



CATJ LOW COST MICROWAVE RECEIVER WITH OPTIONAL 4.5 MHz AURAL SUB-CARRIER DEMOD

DIAGRAM TWO



CATJ MICROWAVE VIDEO RECEIVER WITH AFC

DIAGRAM THREE

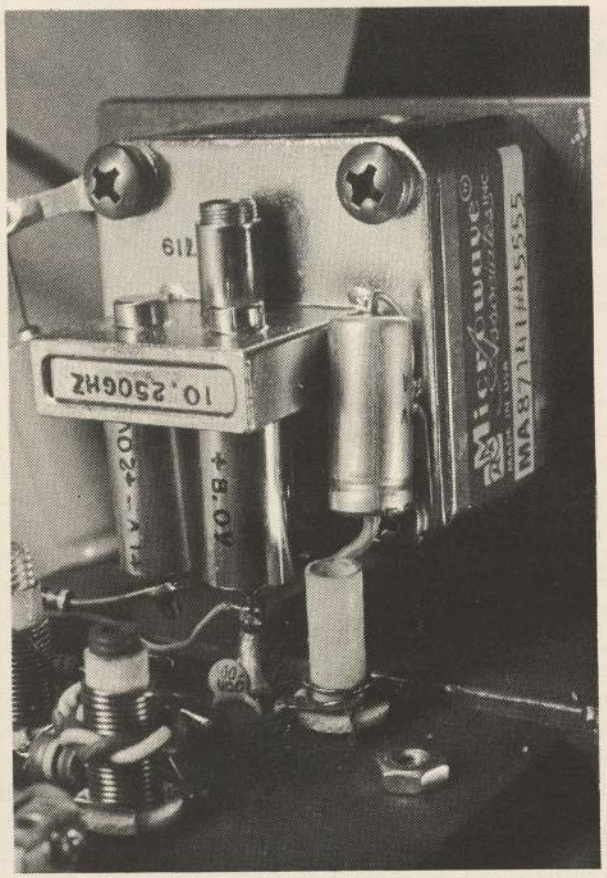
width for FM video with a modulation index of unity would be on the order of 18 or so MHz.

In the TVRO world (it always creeps in these days) the 99% power spectrum for a 4.5 MHz video signal deviated 10.25 MHz peak would be roughly 30 MHz. When you then add an aural subcarrier (say 6.8 MHz since that fits the TVRO format) which is deviated 1 MHz peak deviation you end up with a 99% power spectrum requiring a 36 MHz passband; and receiver IF.

Therefore to really attain the maximum 'FM advantage' with any microwave FM system you need to keep your deviations up and passbands quite broad **(1).** Which is another way of saying that the system presented here will get your feet very wet, produce suitable paths for reasonable local work, but you will not yet be into the FM microwave field with the proper parameters to produce a **maximum** 'FM advantage' system.

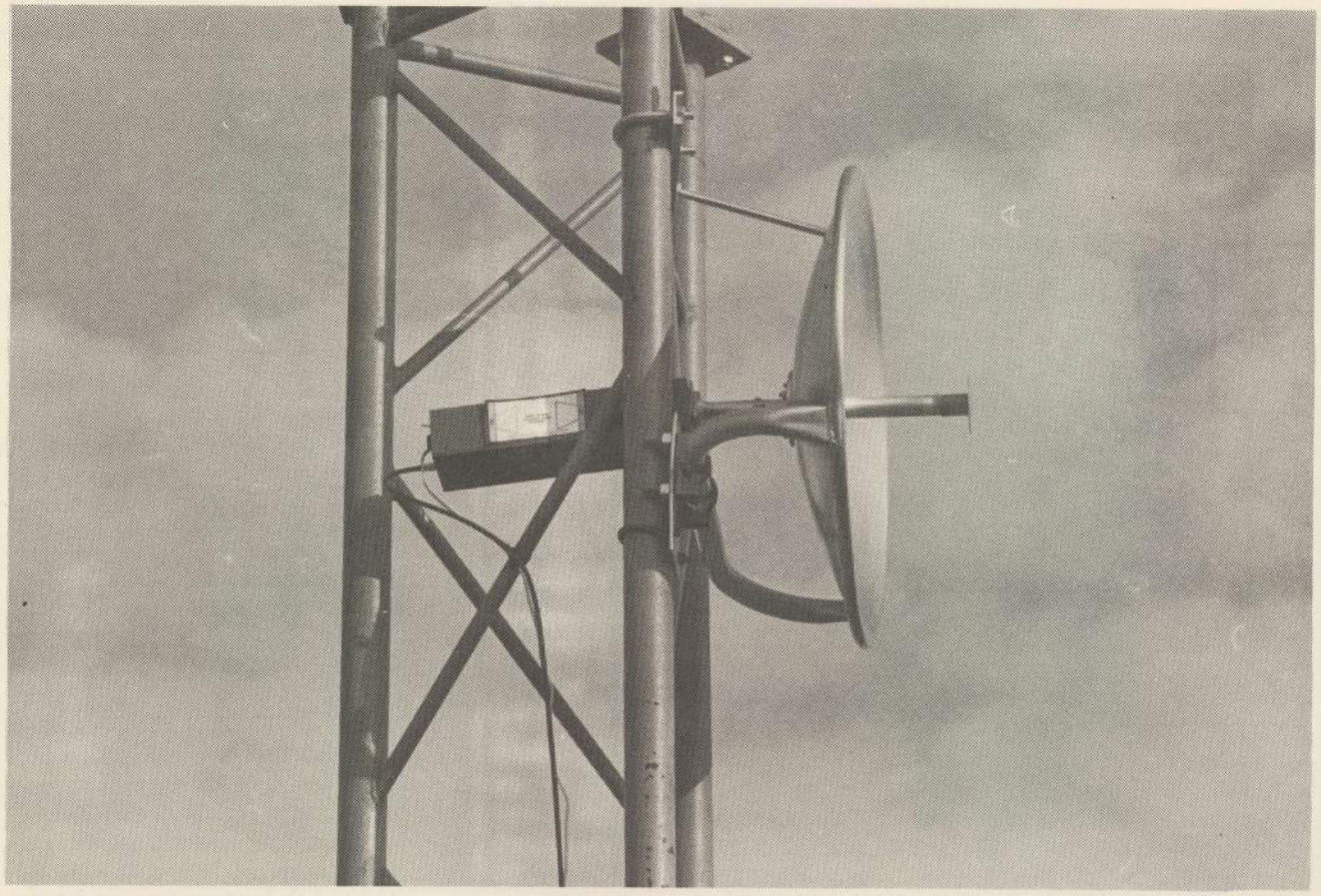
Back to the present project. In **diagram one** we have the basic 'system'; a 15 mW (approximately +12 dBm) output Gunn oscillator, FM modulated as described in the June CATJ loading the output power into an antenna of some amount of gain over a dipole. The total radiated power is the sum of the Gunn oscillator plus the gain of the antenna; in dBm. The free space loss is not so free afterall. In fact it is one big pain in the antenna. At 10 GHz the loss for the first mile is 116.8 dB (approximately 120 dB at 12 GHz); after that it tapers off to 6 **more** dB space loss **each time** the path is **doubled** in length. Which brings us to the instant project; the receiver.

The receive antenna has gain, and it contributes directly to the gain of the system in dB. The Gunn oscillator (see **diagram two**) provides a local oscillator signal source to 'mix' with the incoming signal from the transmitter. By clever design engineering the receiver local oscillator is offset from the incoming frequency by the frequency of the IF; 45 MHz in our case, and that



GUNNPLEXER OUTPUT at 40-50 MHz IF range; see schematic diagram for output coupling system from Gunnplexer mixer diode (2 turn and 1/2 turn coils on slug tuned form).

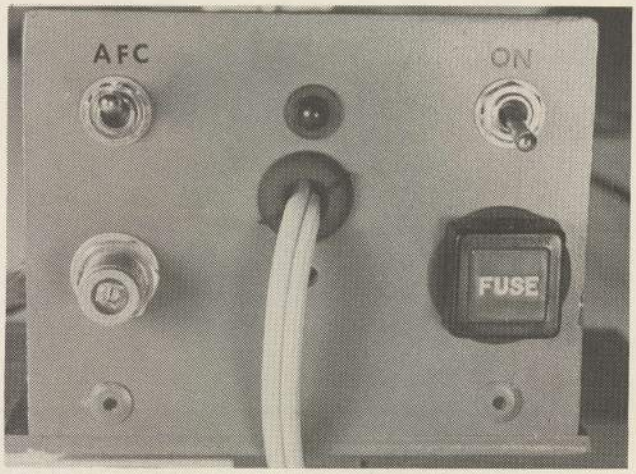
(1) Our thanks to microwave design engineer H. Paul Shuch for making it imperative that we bring this out in the discussion of the low cost microwave equipment. Mr. Shuch is a well published designer of innovative microwave circuits and the founder of MICROCOMM, a California company.



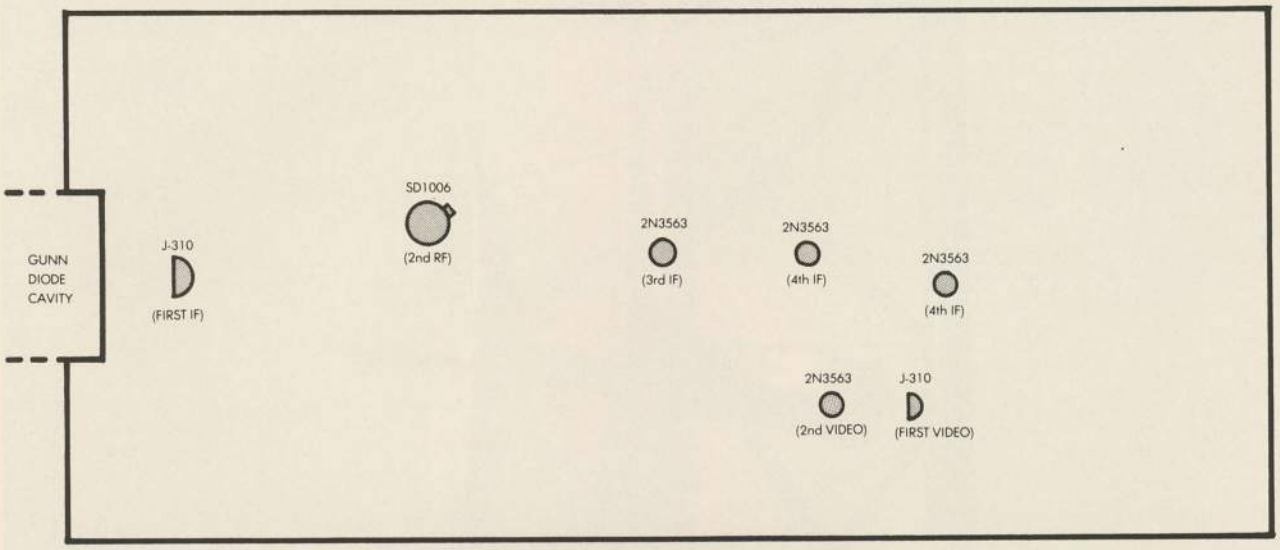
TWO FOOT RECEIVE TERMINAL with outdoor mounting low-low cost receiver mounted at parabolic antenna; output is at baseband.

provides us in the mixer output the IF signal (incoming signal minus local oscillator signal = 's IF). The mixer, part of the Microwave Associates Gunn oscillator head, is a Schotty diode. Your IF output spigot is found on the Gunn package from Microwave Associates (see photos). Once at IF our first job is to amplifiy the weak IF signal with as low a noise figure first IF amplifier stage as is practical. The J—310 FET has been chosen for this task because it affords realizable noise figures in the under 2 dB region at 45 MHz with a minimum of circuit optimization. Four additional stages of IF amplification are for voltage gain (an SD1006 followed by 3 stages of 2N3563). There is some bandpass filtering between the J—310 first stage and the SD—1006 (manufactured by Solid State Devices). The sum of all gain of the five IF stages is on the order of 50 to 52 dB. Following the last 2N3563 stage is the FM limiter; a pair of Hewlett-Packard (HP) 5082-2800 diodes. These diodes are biased to a predetermined level and as RF (IF) signal from the IF stages moves through the limiter diodes they begin to 'detect'. This detection causes a DC voltage in the diodes which reverse biases the diodes increasing the internal resistance of the diodes. As the signal level increases the internal resistance of the diodes also increases; producing a relatively constant output voltage from the diodes. This 'limiting of the output' is what comprises the limiter action, and in the process of limiting we reduce (if not eliminate) a fair amount of the circuit noise in the system (and kill any 'AM' that may be present as a degrading signal).

After the limiting the signal (still at IF) is ready for detection. In our circuit we utilize a signal splitting technique (two 51 ohm resistors making up a splitter) feeding half of the signal voltage down each of two identical legs of a detector. Each detector leg has a tuned network (18 turn coils; see schematic and parts list) with a fixed ceramic capacitor. The 18 turn/10 or 5 pF circuit is resonated so that one leg is tuned to 40 MHz and the other leg is tuned to 50 MHz. These two



OUTPUT AND CONTROLS—end of housing holds output video fitting, AC on/off switch, and AFC on/off switch plus LED to indicate when power is applied.



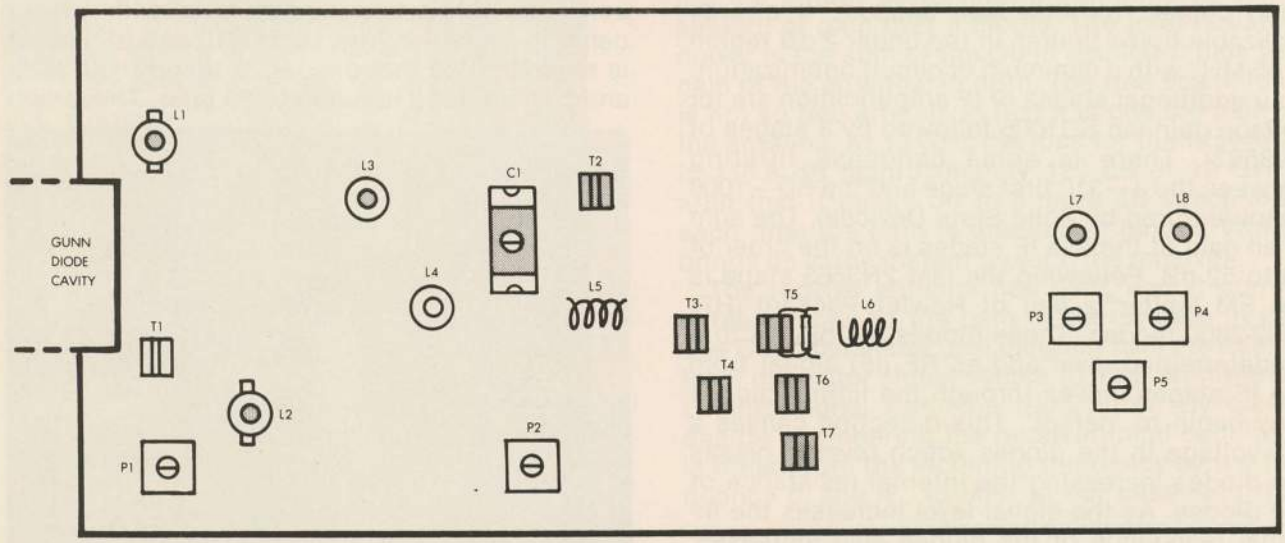
CATJ MICROWAVE RECEIVER IF/VIDEO BOARD
ACTIVE PARTS LOCATIONS

DIAGRAM FOUR

frequencies represent the two extreme edges of the 10 MHz passband of the IF. At the end of the two legs are HP-2800 diodes that serve as detectors; discriminating as it were at 40 and 50 MHz respectively. The detected energy is balanced with the 10 K pots (P3 and P4) and then a 500 ohm pot balances **between** the two legs of the discriminator/detector to insure that **equal** voltage comes from both legs. By inserting an unmodulated signal at 45 MHz through the IF you can adjust P3 and P4 for exactly '0 volts', using a VOM, and then adjust the 500 ohm pot (P5) so that you have equal positive and negative swing on the two legs of the discriminator.

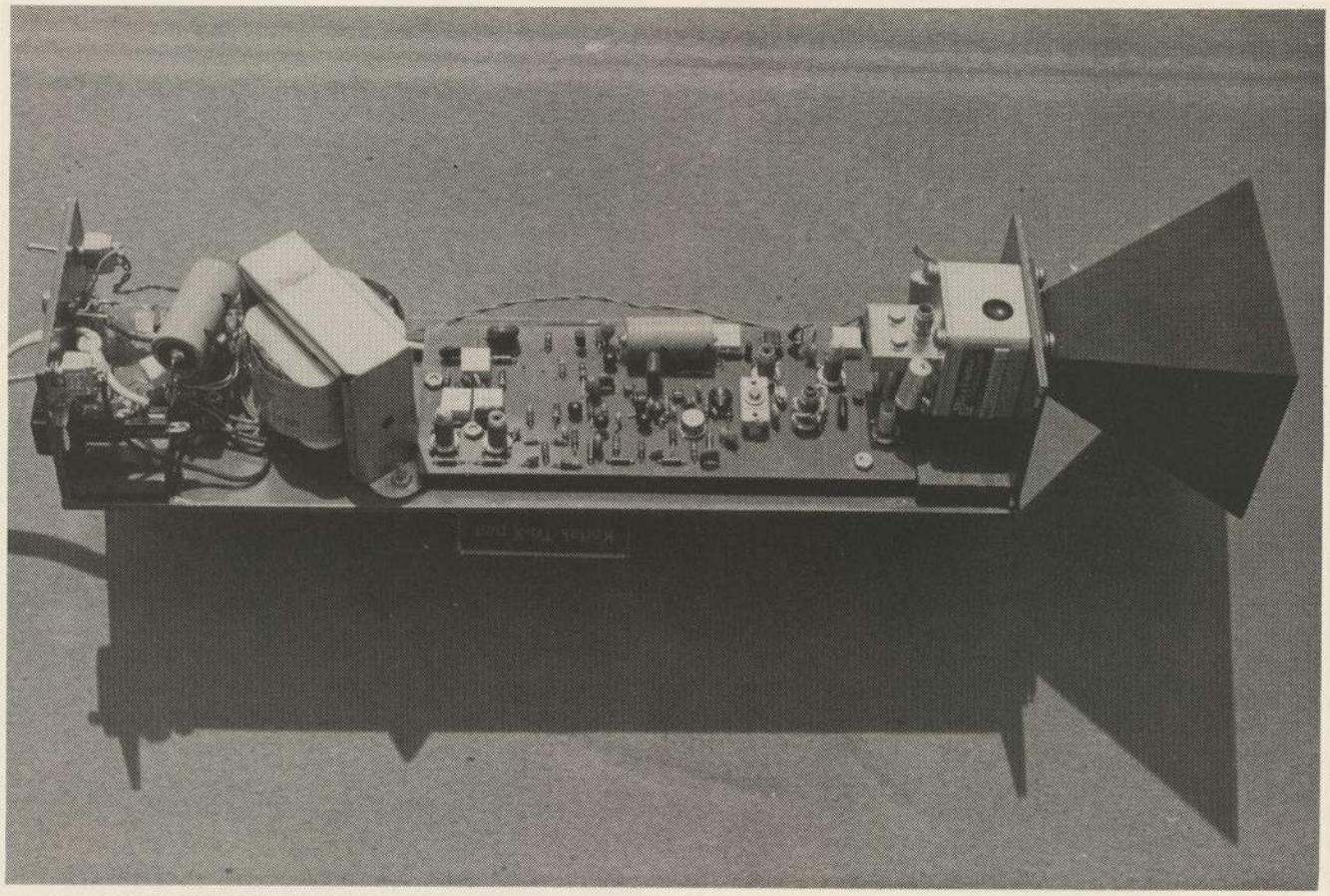
Following the detection this system utilizes a pair of baseband (0-5 MHz) amplifiers for the video (and the 4.5 MHz audio if it is present as a sub-carrier). The first video amplifier is another J-310 FET, again chosen because it is a low noise device and noise at video is just as bad as noise at IF. After the J-310 video amp stage is a 2N3563 bi-polar video amplifier stage. When the limiter is into full limiting you will have just over 1 volt peak to peak video out of the system.

Recall that temperature drift is a design problem with a Gunn oscillator. The solution, as we suggested last month, is to AFC the system. There are several possible ways to do this includ-

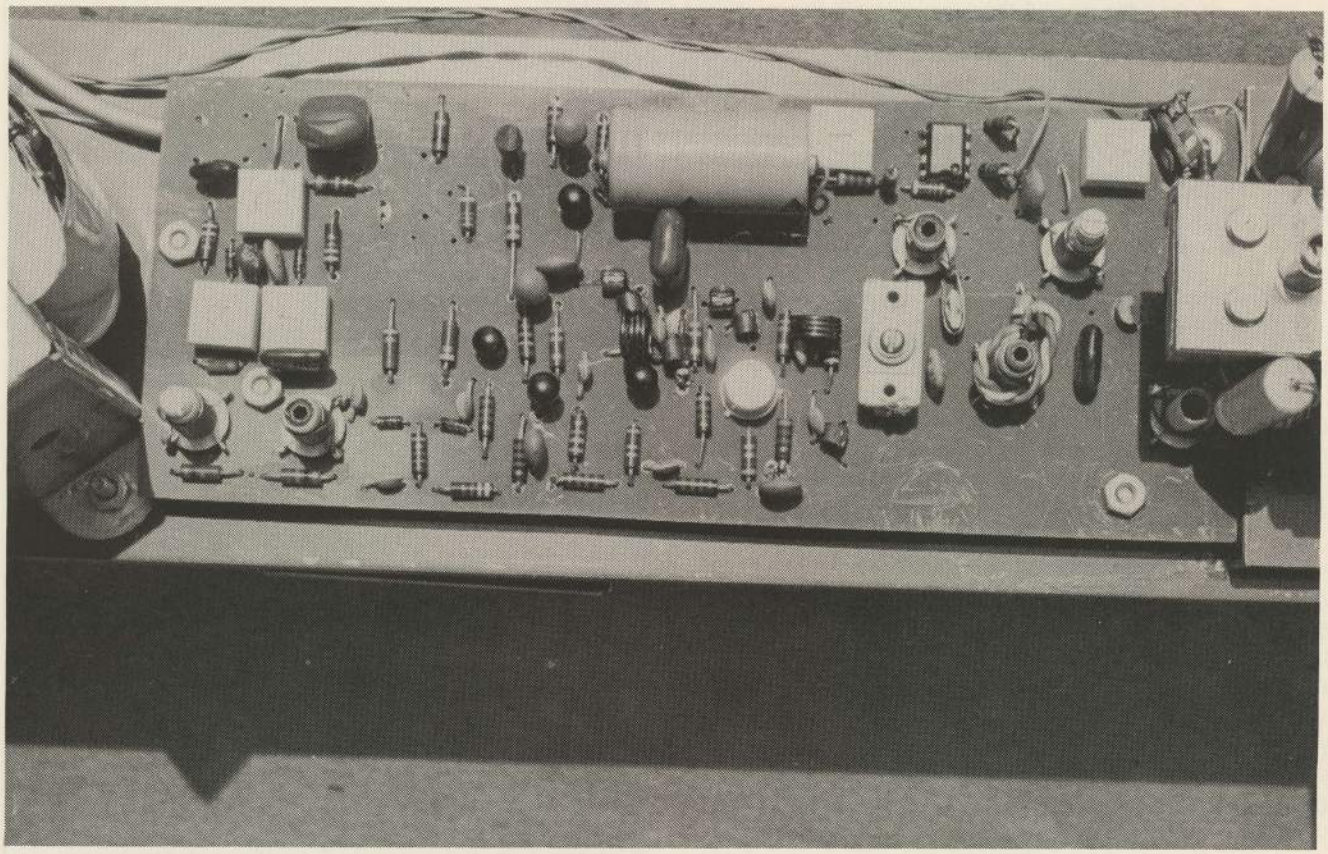


CATJ MICROWAVE RECEIVER IF/VIDEO BOARD
NON-FIXED VALUE PART LOCATIONS

DIAGRAM FIVE

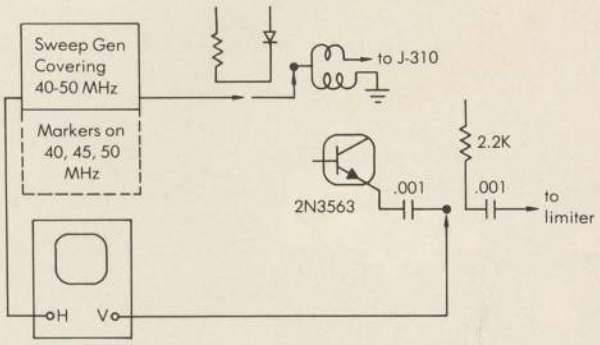


LOW-LOW COST MICROWAVE SYSTEM RECEIVER—power supply circuits to left, circuit board has (left to right) discriminator/limiter, 40-50 MHz IF amplifier.

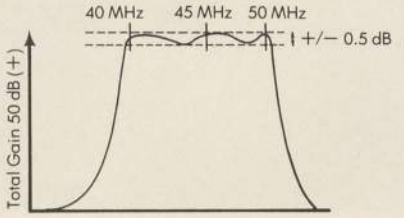


CIRCUIT BOARD layout for low-low cost receiver; discriminator and limiter circuits to far left, IF amplifier middle and to right with output from Gunnplexer mixer diode to far right.

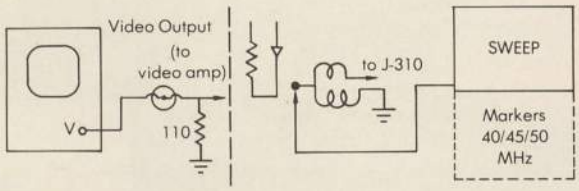
SWEEP ALIGNMENT OF MICROWAVE RECEIVER



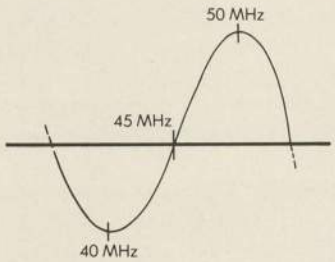
STEP ONE—Connect 40-50 MHz (range) broadband sweep source at relatively low input level (0 dBmV) to input of L1 (2.5 turn load on output of Gunnplexer; dis-connect Gunnplexer output source for IF alignment) with 100 pF coupling capacitor. Insert markers on 40, 45 and 50 MHz. Go to emitter of last 2N3563 IF amplifier (just ahead of limiter) and couple out through .001 coupling capacitor to input of scope vertical. Tie sweep horizontal to display scope horizontal.



STEP TWO—Align using L2, L3, L4 and C1 for 50 (+) dB of voltage gain (backing down from the sweep output as gain is alignment-increased), flat within +/− 0.5 dB between 40 and 50 MHz as shown above.



STEP THREE—Leave input sweep and markers in place and remove detector output from last 2N3563 IF stage emitter, changing it to the output of the receiver at the video output spigot (coaxial 'F' series fitting).



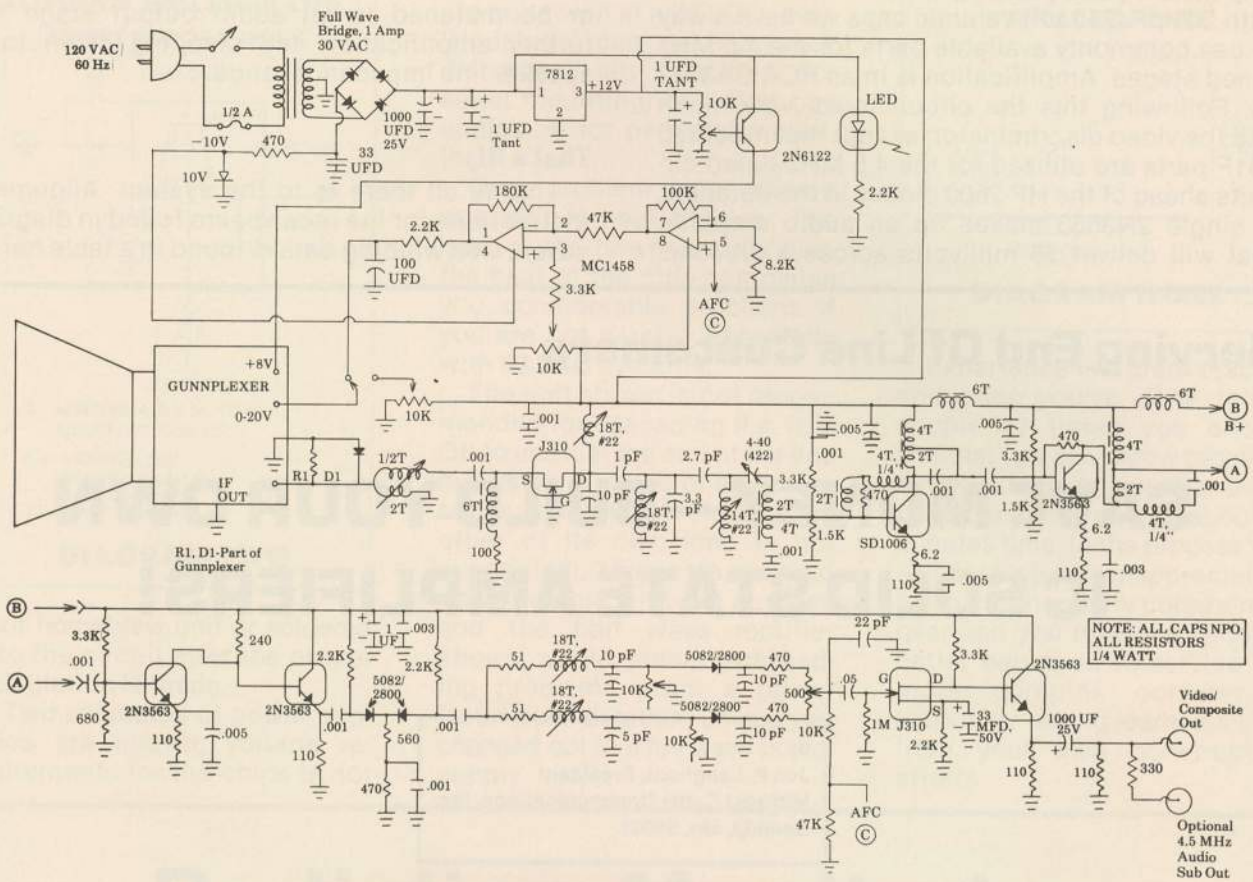
STEP FOUR—This alignment step adjusts the discriminator for proper detection across the 10 MHz wide IF passband. Adjusting L7, L8, and, P3, P4 and P5 should produce near-perfect linearity as shown in the scope diagram with 40 MHz marker at the bottom of the 'S' curve, 45 MHz exactly on the 0 volt line and 50 MHz at the top of the 'S' curve on the positive side.

DIAGRAM SEVEN

Non-Fixed Value Parts

This table explains the make-up and the function of the various 'field-adjustable' components found in the video receiver IF and demodulator.

Part Number	What It Is and Does
L1	2.5 turns # 20 on 1/4" air wound form, tapped 2 turns above ground. With high output capacity of Gunnplexer IF (100 pF), resonates output at 45 MHz IF center frequency.
L2	18 turns # 22 on Gowanda Electronics 71525 form (brass slug). Inductance for J-310 drain (output) tuned circuit.
L3	18 turns #22 on 71528 form (ferrite slug). Part of bandpass filter network for IF.
L4	14 turns #22 on 71528 form (ferrite slug). Part of bandpass filter network for IF.
L5	4 turns # 20 on 1/4" air wound form. Part of neutralizing network on SD1006 IF amplifier.
L6	4 turns # 20 on 1/4" air wound form. Input inductance for 2nd 2N3563 gain stage.
L7	18 turns # 22 71528 form (ferrite slug). 40 MHz tuned network inductance for discriminator.
L8	18 turns # 22 71528 form (ferrite slug). 50 MHz tuned network for discriminator.
T1	6 turns on Ferroxcube 56590654B core, #30. Inductance for tuned input circuit on J-3180 first IF amp.
T2	2 turns by 4 turns (2 turns towards 422 trimmer) on same core. Part of bandpass filter circuit.
T3	2 turns by 4 turns (2 turns towards SD1006) on same core. Part of output resonate network on SD1006.
T4	6 turns on same core. B+ isolation inductor.
T5	2 turns on same core, parallels 470 ohm resistor on SD1006 input circuit.
T6	2 turns by 4 turns (4 turns towards B+ line) on same core. Part of 2N3563 output tuning, first 2N3563 amplifier stage.
T7	6 turns on same core. B+ isolation inductor.
C1	Elmenco (ARCO) type 422 (mica) trimmer (4-40 pF). Part of bandpass filter circuit between J-310 output and SD1006 input.
P1	Beckman 72PMR10K helitrim pot. Adjust for 8 volts to Gunnplexer (+8 vdc) terminal.
P2	Beckman 72PMR10K helitrim pot. Adjust for +4 volts to varactor bias +1 to +20 vdc) terminal with no input signal present.
P3	Beckman 72PMR10K helitrim pot. Adjust for maximum voltage amplitude on negative (minus) side of discriminator when sweep aligning (adjusting 40 MHz side of discriminator).
P4	Beckman 72PMR10K helitrim pot. Adjust for maximum voltage amplitude on positive (voltage) side of discriminator when sweep aligning (adjusting 50 MHz portion of discriminator).
P5	Beckman 72PMR500 helitrim pot. Adjust for equal negative and positive voltage output (to input to J-310 first video amplifier) from both halves of the discriminator.



MICROWAVE RECEIVER 4.5 MHz AUDIO SUB-CARRIER DEMODULATOR

DIAGRAM SIX

ing the commercial approach by Microwave Associates wherein the transmitter uses digital divide techniques to take the output signal source down to a reference oscillator operating in the relatively low frequency VHF range. Because of the cost and adjustments required with this approach we have taken a relatively simple direction; we AFC the receiver only by making it look constantly at the **incoming signal** through an AFC loop. The loop consists of taking a sample of the received signal voltage out of the receiver immediately after the 500 ohm discriminator balance pot (P5) through a 10K resistor. This voltage is fed back to an MC1458 op amp where the first half of the device acts as a buffer amplifier and the second half further amplifies the signal and voltage-offsets the signal voltage by plus 4 volts for a **no input signal condition.** By setting the 10K pot in the op amp to a plus 4 volts under a **no signal** condition we match the plus 4 volts normally supplied to the varactor bias line of the Gunn oscillator. Now when a signal is present the plus 4 volts from the offset op amp will respond to a new voltage which is determined by the sampled voltage fed to the op amp from the 10K sampling loop. If the incoming signal moves up or down in frequency, the 10K sampling loop sends a correction voltage to the op amp which in turn plays with the plus 4 volts supplied to the tuning varactor on the Gunn Oscillator. A change in the incoming signal changes the sampling voltage which in turn changes the op amp voltage; which then retunes the varactor tuning of the receiver's Gunn local oscillator to bring everything back into focus again. This system will follow transmitter varitaions of +/– 10 MHz which translates to a temperature **differential** of 51 degrees F or so **between** the transmitter Gunn oscillator and the receiver Gunn oscillator. For most applications of attended operation this should prove adequate.

Then there is the receiver 4.5 MHz sub-carrier demodulation system. Up to and through the last video (baseband) amplifier, your aural sub-carrier is carried along with the detected video because it falls within the 0-5 MHz passband of the system. At the output of the last video amplifier stage is a 330 ohm resistor that allows you to 'split off' the output for audio detection in a separate demodulator. The aural demodulator (see **diagram six**) is another approach at keeping the system within the affordable parts range and simplified tuning procedures. By using JW Miller 801F IF cans designed to operate on the popular

10.7 MHz IF, and padding them down to 4.5 MHz with 200 pF (250 pF) ceramic caps we have a way to use commonly available parts for the 4.5 MHz tuned stages. Amplification is in an RCA CA3012 IC. Following this the circuit looks very much like the video discriminator; except that modified 801F parts are utilized for the 4.5 MHz tuned circuits ahead of the HP-2800 diodes in the detector. A single 2N3563 makes up an audio amplifier that will deliver 50 millivolts across a 1K load. This audio output is adequate to drive earphones or be matched to an audio output stage for further amplification and stepping down to a speaker line impedance range.

That's It!

That is all there is to the system. Alignment instructions for the receiver are found in diagram seven. Coil winding data is found in a table here.

Serving End Of Line Customers

SAVE MONEY—BUILD YOUR OWN IC SOLID STATE AMPLIFIERS!

by
Jon P. Langhout, President
Midwest Cable Communications, Inc.
Bemidji, Mn. 56601

Good Learning Exercise

There are many things the smaller operator can do on his own to not only improve his understanding of what makes his system tick, but to actually reduce the cost outlay of reaching a few extra homes. For several years this system has been building and using small 'extension' (as opposed to extender) amplifiers utilizing the TRW CA series of IC gain blocks.

I am not suggesting that systems utilize home built amplifiers in lieu of the high quality line amplifiers available today at quite reasonable pricing. However there are situations where you need to add a home or two at the tag end of a line where the economics of the situation simply does not allow you to tie up a full blown 'extender' amplifier for just a home or two.

Catalog number 501 (available from **TRW RF Semiconductors,** 14520 Aviation Blvd., Lawndale, California 90206) lists complete specifications for the CA series of IC amplifier devices. These are 16 to 24 dB gain 'blocks' that operate from 24 volts DC. An alternate and reliable source for the same gain blocks is **Broadband Engineering, Inc.** (535 Indiantown Road, Jupiter, Fl. 33458).

These units have been in use here in 'home brew' extension amplifiers for many years and I've experienced only a pair of failures; one of which was my fault for neglecting to place a blocking capacitor on the output (lightning got it). The units have flat gain and require some method of adding tilted response to approximate the slope of other amplifiers in the system. Perhaps the easiest way to provide such tilt is to add an equalizer pad to the input leg of the IC chip. This is no place for a long discourse on cable spacing versus equalizer requirements (versus the proper gain block to use), however most amplifier data sheets provide you with what you need to know to make your own selection. A good source for equalizers is the pads provided by amplifier manufacturers; many are plug-in type and they can be either plugged into an appropriate socket in

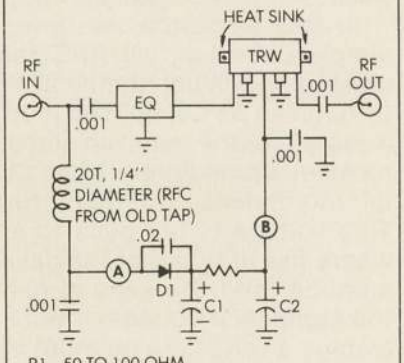
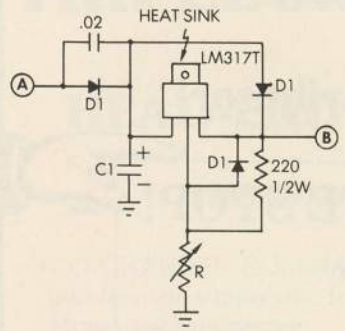


DIAGRAM ONE

ALTERNATE, WELL REGULATED, SHORT PROOF SUPPLY



R—APPROXIMATELY 5K, 1/2 W
ADJUST FOR 20/24 VDC
C1—1000 MFD, 50V
SPRAGUE (TVA 1316)
D1—1 AMP DIODE(S)

DIAGRAM TWO

your homebrew unit or soldered into the circuit after the proper calculation is made.

Two examples of power supplies are shown; voltage requirements for the chips is not critical and the chips will operate quite well at a 20 VDC level. 'Housings' can be old (often discarded) tap housings (for aerial mounting) or a Bud box enclosure for pedestal mounting.

One problem you should consider is heat buildup. The heat of the power supply plus the heat of the chip can cause you considerable problems if you are not careful; especially with 60 VAC systems.

The unit shown is not recommended for cascading (i.e. it is OK to use it at the end of the line but using it ahead of any other active amplifier, including another of its own kind is not suggested). The costs are held down in this unit on purpose and the half wave rectifier shown would present cascading problems (from a power factor consideration) unless you changed out to a full wave power supply.

TYPICAL RESPONSE

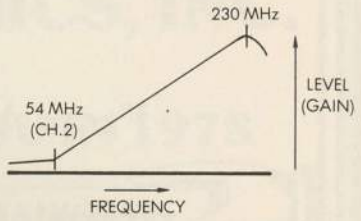


DIAGRAM THREE

Experience is a great teacher and once you've done this a couple of times you should find that you can 'throw together' a new extension amplifier using the technique shown in about 30 minutes time. In the process you will develop a new appreciation for the high quality commercial gear and you may even end up better equipped to service the more complex commercial units after having learned a little from your own construction efforts.

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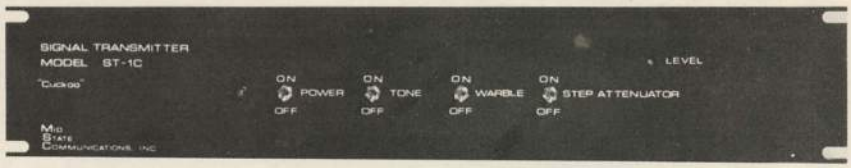

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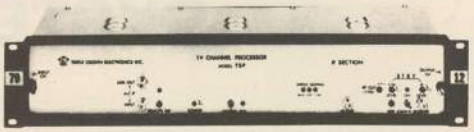

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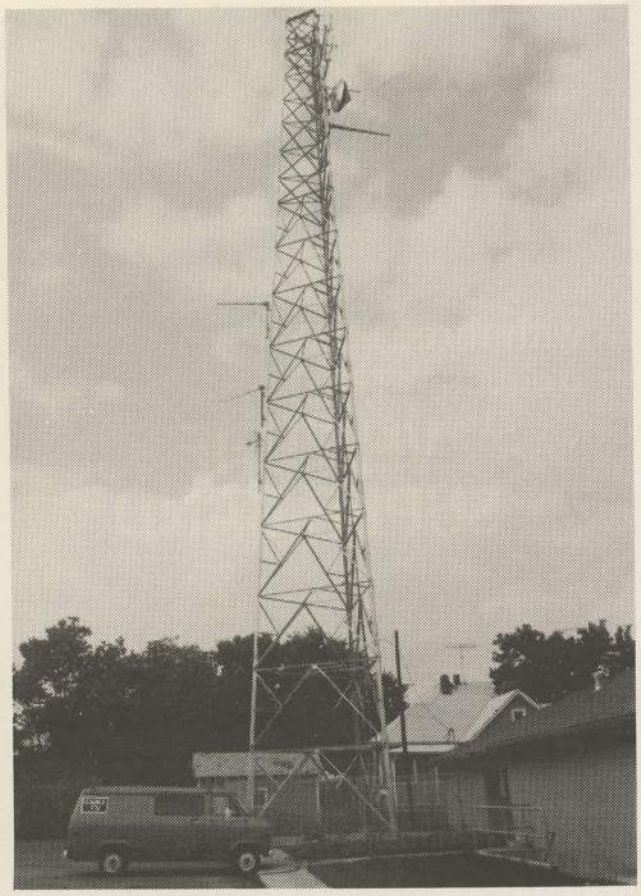
Dish? Curved Reflector? Flat Reflector?

COST-CONSCIOUS APPROACHES TO MICROWAVE ANTENNA SYSTEM DESIGNS

by
John Schuble
Microwave Division
TELESIS CORPORATION
Evansville, Indiana
47714

An article appearing in the October, 1977 issue of **CATJ** (Basic Microwave Path Design) states that radio manufacturers will usually supply a terrain profile free of charge. In fact, they will usually go a step farther, and supply a tentative path design, recommending specific antenna systems, etc. This article will explore the factors to consider when selecting antenna systems and waveguides.



DIRECTOR RADIATOR—six foot dish with radome is mounted atop 150 foot self supporting tower (dish just above VHF log).

Preliminary recommendations are usually the result of attempting to obtain the highest receive-signal-level possible. This is certainly one design objective, but it may not consider the practical aspects of the installation, which are known only to the system owner/operator. The ideal "paper" design supplied by the radio manufacturer should be scrutinized by the purchaser, to insure an optimum design for the particular situation. If the purchaser is not versed somewhat, in antenna design, the preliminary "paper" design will automatically evolve into the final design.

The **basic choices** to be made are;

1. Should **direct radiators** or **reflectors** be used?
2. Should **circular** or **elliptical** waveguides be used?
3. **What size** reflectors and/or dishes should be used?
4. Should "**curved**" reflectors be used?
5. Should transmitter **post-amps** and/or receiver **pre-amps** be used?

Let's analyze the choices by looking at a hypothetical design. First, the preliminary engineering of a one hop system as shown in **figure 1,** between 2 existing CATV towers. No other information is known at this point, so the design seems to be a good one, as shown below. (see October, 1977 CATJ—Microwave Design)

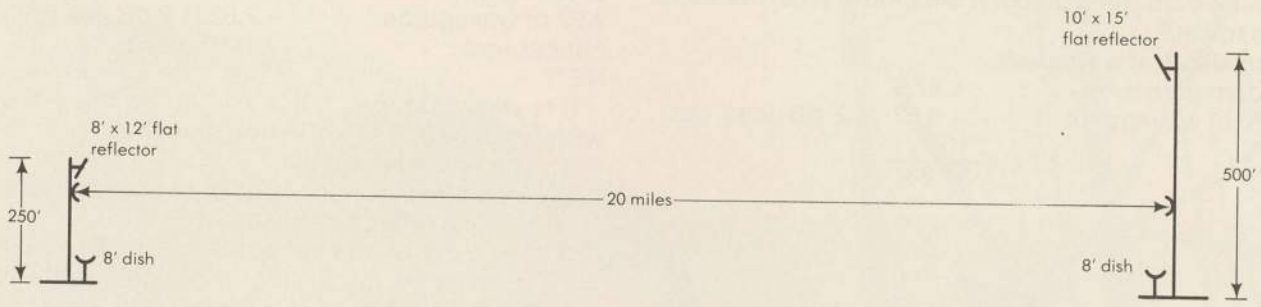


FIGURE 1

Transmit power	**+ 27 dBm** (.5 watt)
Transmit antenna gain	+ 46.5
Transmit waveguide loss	– .84
Transmit radome loss	– 1.5
Path loss	– 144.8
Receive antenna gain	+ 47.5
Receive waveguide loss	– .84 (20' of elliptical)
Receive radome loss	– 1.5
NET	**+ 28.48 receive-carrier level**

On closer examination, however, some changes were made in the design. **Figure 2** shows that it's possible to achieve a greater antenna system gain using a curved reflector and a 4' dish. The new gain for the transmit antenna system is 46.95 dB using a 4' dish, compared with the old gain of 46.5 using an 8' dish. Figure 2 demonstrates that this new gain number is valid only for a separation of 235' between the reflector centerline and the dish, which is 10' above ground level.

The design change was possible only after the system owner determined that the tower was capable of being stabilized to prevent twist and sway, by having a professional engineer analyze the design to insure it meets twist and sway standards of RS-222A published by EIA (Electronic Industrial Association). This is important because of the narrow beam width of the transmitted signal. Any movement of the transmit antenna or the tower will cause a reduction or loss of the received signal.

An analysis of tower strength and stability should be performed, **whether using passive reflectors or dishes,** although the requirements for reflectors are more stringent due to the greater wind loading. The windload felt by a 8' tower-mounted dish will be about **1/2** the windload of an 8' x 12' reflector. The windload of an 8' tower mounted dish **with a radome** will be about **1/4** the windload of an 8' x 12' reflector.

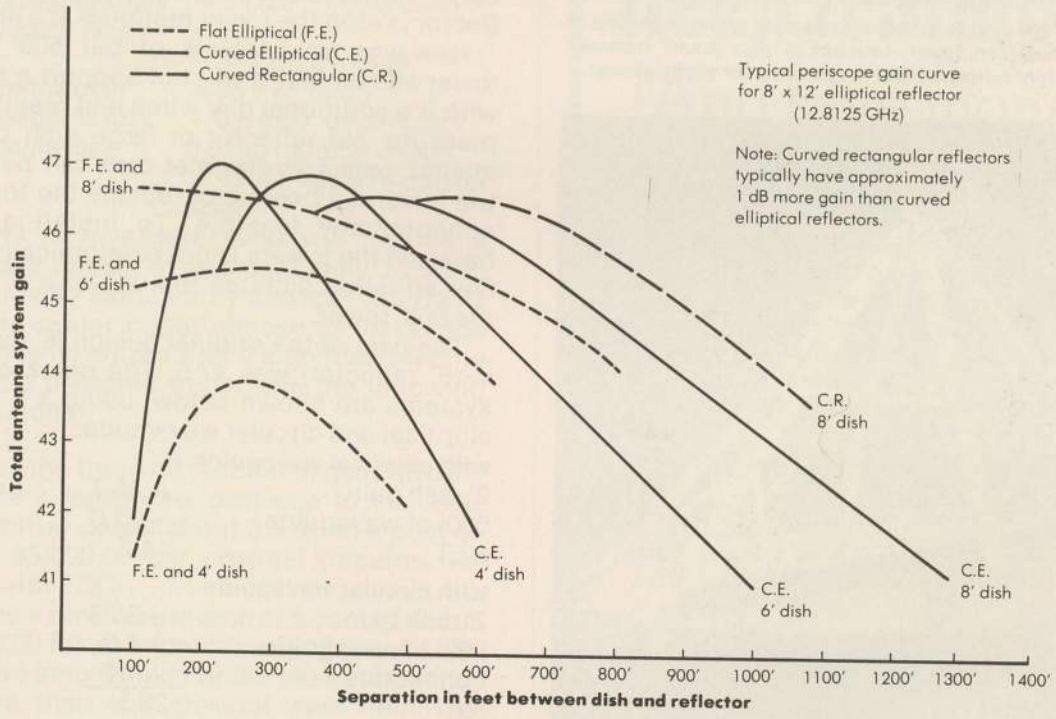
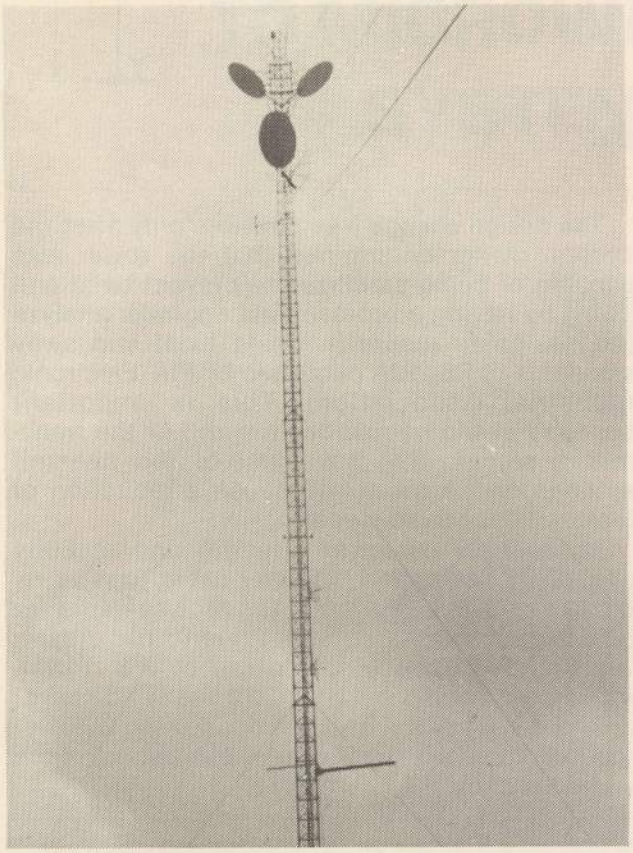


FIGURE 2

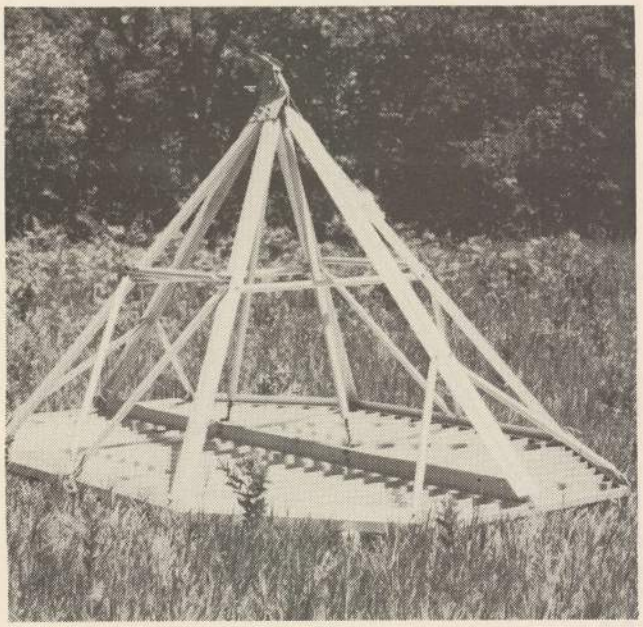
Still looking at the transmit antenna system, what would the gain be, if we mount an 8' dish on the tower?

with elliptical waveguide

8' dish gain	+47.7
235' of waveguide	−9.87 (4.2 dB loss per 100')
NET	37.83



HEAVY LOADING—three elliptical reflectors placed near top of 300 foot, 40 inch face, tower; note use of 'star mount' between uppermost pair of reflectors and single reflector slightly lower.



8 x 12 FOOT REFLECTOR—has two adjustable rods extending to center area of reflector to curve surface if desired.

with circular waveguide

8' dish gain	+47.7
235' of waveguide	−2.82 (1.2 dB per 100')
connectors	−1.2 (2 each)
NET	43.68

It is clear that the choice should be the 4' dish with a **curved** 8' x 12' reflector, since:

1. The tower **is capable.**
2. A stabilizing starmount **is required** whether or not a reflector is used.
3. The **cost** of the reflector (about $1,200.00) **is offset** by the saving in waveguide (about $1,400.00 for 235' of elliptical or about $3,000.00 for 235' of circular).
4. CATV antennas do not block the signal between the dish and reflector. (If 50% of the reflector is blocked from the dish's view, a loss of approximately 3 dB will result)

Some disadvantages of choosing the reflectors:

1. The dish at 10' above ground level must have a radome to prevent damage from ice which may fall from the tower. If the dish were located atop the tower, no damage from falling ice could occur, and therefore no radome would be needed (this assumes that the wind-loading is tolerable without a radome). The cost of the radome **and** 1.5 dB would be saved.

2. **The FCC could** conceivably **outlaw** reflectors **some**day. In that event, the antenna system would have to be replaced. The FCC's reason: reflectors tend to scatter energy from their edges, thereby interfering with other stations. As the CARS band becomes more congested, FCC intervention **is a possibility.**

3. If a TVRO earth station is to be located at the head-end site, it seems that **potentially interfering terrestrial signals** could find a path to the earth station antenna more easily, when a reflector is atop the tower mounted at a 45° angle.

However, an analysis of our 500' receiving tower shows that it will not support a starmount with it's additional guy wires and resulting down pressure. No reflector or large dish can be installed; **only a 2' diameter dish** can be added to the tower. To beef-up or replace the tower is not economically feasible. To install a repeater between the towers is not economically feasible. Our situation dictates the use of a 2' dish atop the 500' tower.

The gain of the original design (8' dish and 10' x 15' reflector) was 47.5. The gains of antenna systems are shown below, using a 2' dish with elliptical and circular waveguide:

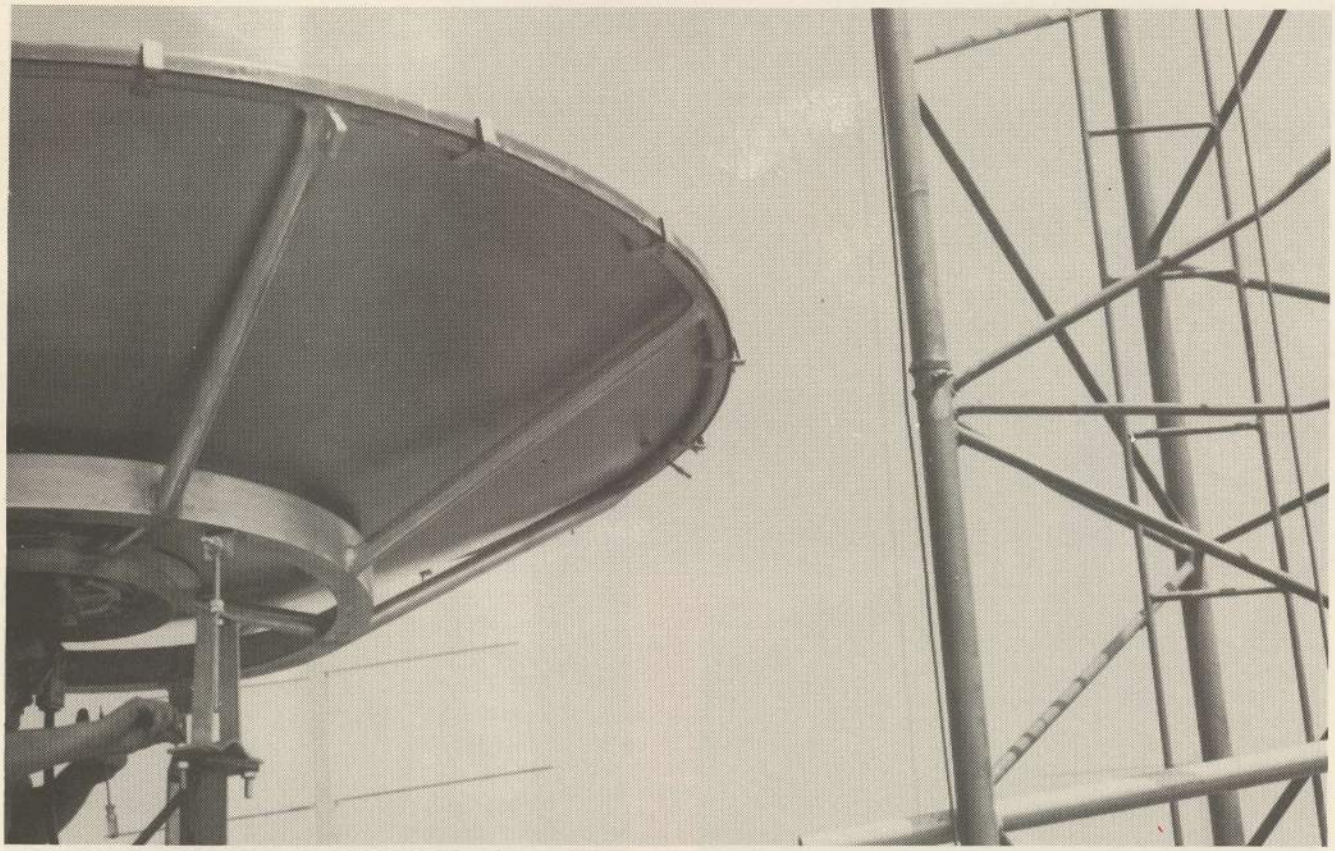
with elliptical waveguide

2' dish gain	+35.7
500' of waveguide	−21.0
NET	14.7

with circular waveguide

2' dish gain	+35.7
500' of waveguide	−6.0
connectors	−1.2
NET	28.5

It is apparent that we **must choose** the circular waveguide. Let's re-calculate our receive-carrier



ADJUSTING DISH FOR REFLECTOR SHOT—what could be an 'elevation' adjustment on a TVRO antenna is adjusted for proper alignment to reflector above. Note waveguide going to center (rear) of dish, and lead conduit 'sheating' the waveguide (lower right) to prevent falling ice from damaging line. Dish has radome, waveguide is Andrew EW-122 elliptical.

level, so far. (The original "paper" design provided a receive-carrier level of – 28.48).

Transmit power	+ 27 dBm (0.5 watt)
Transmit antenna gain	+ 46.95 (4' dish and reflector)
Transmit waveguide loss	– .84 (20' of elliptical)
Transmit radome loss	– 1.5
Path loss	– 144.8 (20 miles)
Receive antenna gain	+ 35.7 (2' dish)
Receive waveguide loss	– 6.0 (500' of circular)
Receive radome loss	0.0 (no radome used)
NET	**– 43.49 receive-carrier level**

A – 43.49 receive-carrer-level will provide a practical **fade margin** of approximately 28.5 dB. This **may** provide satisfactory service for a CATV system. The owner might choose to install the system, since he knows that **if** significant fading results, he is prepared to perform the following remedial actions:

1. **Remove** the transmit radome to gain 1.5 dB.
2. Provide a **transmitter post-amp** to increase transmitter power about 3.5 dB at a cost of about $3,000.00 per channel (requires **re**-filing with FCC)
3. Provide a **receiver pre-amp** at a cost of about $1,000.00 for an improvement of about 4 dB. This pre-amp would handle the entire band, if more than one channel were being received, although the thing to watch is overloading of the device.

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WAVEGUIDE TRANSITION—from top to bottom shows circular waveguide, mode filter, transition from circular to elliptical waveguide, elliptical connector and on bottom elliptical waveguide.

(**Gain compression** will occur for the typical pre-amp at about −39 dBm. If we choose to remove the transmit radome and add the transmitter post-amp, our receive-carrier-level becomes −38.49. [If two channels were being received, the overload point would be −42; for 4 channels, −45]. It isn't certain, then, that **both** the post-amp **and** the pre-amp could be used.)

If the signal level at the top of the 500' tower were **less than** −39, the receiver pre-amp could be located at that point to provide an improvement of about 4 dB plus the receive-end waveguide loss of 6 dB; but in our case, the level at that point is −37.49 (−43.49 less dB waveguide loss).

To summarize, our hypothetical system with it's potential remedial actions is a plausible project, since **a reasonable criteria for fade margins is 10 dB plus 1 dB per mile of path length,** for microwave systems of no great cascade. (Path lengths should be kept under 25 miles, with 30 miles as an absolute maximum). Some consideration must be given to the systems possible future expansion. Single hop systems tend to grow into multi-hop systems, where the outage at the last station will include the outages of all preceding hops.

8 FOOT PARABOLIC on pylon support, 10 feet above ground, aimed at reflector on tower 100 feet up. Note use of radome cover to protect dish from falling ice.

If future expansion plans might include the use (or addition) of a large number of channels, this should be considered in the design (potential pre-amp overloading). If it is desireable to transmit channels on **separate** polarizations, our design has a built-in advantage with the circular waveguide, since the circular will accommodate **both** horizontally and vertically polarized signals **simultaneously,** while the **elliptical will not.** Circular waveguide can be used only in situations where no bends/turns are necessary, since unlike elliptical, it is very rigid.

Concern is sometime expressed about moding problems with circular waveguides; however, with modern mode filters an integral part of the waveguide, this problem has probably been overemphasized or non-existent with video transmissions for CATV systems.

One other distinct advantage of direct radiators over reflectors in a multi-channel system is the fact that channels can be transmitted which are adjacent to channels being received. This is not advisable using reflector, since the discrimination between the transmit and receive antennas on the tower effect interference levels between transmitters and receivers at the same site. The discrimination between dishes is much better than between reflectors.

July Stats

The number of TVRO applications arriving at the FCC during the month of May tied the previous one month high of 53; set in January of this year. Significantly the number of terminal applications specifying 6 (or 6.1) meter aperture antennas set an all time high mark in May as well (18 applications) as did applications for 4.5 (and 4.3) meter terminal antennas (19 applications).

Again we remind readers that because FCC rules no longer require that an applicant list every satellite signal it plans to utilize the portion of our monthly tabulation reflecting both the "average number of channels per terminal" and the individual listings of satellite signals requested by terminal operators continues to be less than reflective of the actual signals being utilizes. Applicants must list "at least one" satellite signal they intend to utilize on their application as a matter of qualifying the terminal for licensing; although once a terminal is licensed for a single satellite service signal the licensee is now free to add additional CATV-qualified-signals at will and without further FCC authority.

After The Move

Officially, the moving day exercises which saw all CATV services users switching from RCA SATCOM II (119 degrees west) to SATCOM I (135.0 degrees west) began at 6 AM EDT on June the 1st. In actual fact the moving day exercises really began late in March when HBO programming was carried on an intermittent basis an both satellites, and then in May it began full time service on both birds.

By 7 AM on the first of June 'late risers' would have found only Atlanta's WTCG still **programming** on SATCOM II; although there was still some video on HBO transponders (20, 22, and 24) which was (as the photos here show) giving you step by step instructions on making the transition at your own system. The **up**link sites that had the most to worry about were those that have only a single uplink antenna which meant they had to terminate service on one bird, turn off the transmitter and then go through the antenna adjustment exercise to relocate on SATCOM I. CBN, Trinity, PTL and Atlanta's WTCG fell into this category and most (other than the Atlanta uplink site) managed to make the move to the F1 bird during the wee hours of the first. Atlanta's WTCG began testing on F1 around 1000 hours on the 1st with fulltime 'adjusted' service starting about an hour later.

If there was a single contiguous thread of direction through the moving day exercise, HBO provided it. HBO provided all affiliates with a comprehensive set of instructions, forecasts of signal levels from SATCOM I, sun outage tables and then backed this up with a very cleverly prepared and well executed moving day exercise. The 'slide show' appearing on the HBO transponders on the F2 bird left very little in question and apparently the months of preparation paid off; HBO reports the day went pretty much as planned.

Not everyone was that fortunate however. CATJ logged 18 calls from terminal operators who had (or were) experiencing various problems. One fellow called to ask if "the bird had been shotdown. . ."; he awoke to find his WTCG and CBN programming 'missing' and after checking for signal on WESTAR II (at 123.5 degrees) **he decided** SATCOM II had dropped out of orbit (!). How anyone could have gotten all the way through to June 1 and missed the knowledge that the F2 to F1 swap was going to take place really mystified us. The most common problem we heard was from people who had installed dishes with 'polar mounts'. For the inexperienced, a polar mount is installed so that the elevated and ground portions of the polar mount axle rests on a true north-south line. If the foot or bottom of the axle pad is properly positioned, you can swing a polar mounted antenna left and right (azimuth) and move from bird to bird in the equatorial arc with**out** having to **re**adjust the elevation. Alas, not everyone was successful (when installing the antennas) in getting the axle on a true north-south line. When you make this 'mistake' the antenna **cuts** through a **portion** of the geo-stationary arc or belt; for perhaps 15 to 20 degrees of azimuth play you get reasonably good tracking of the elevation with the azimuth change. But not for the full arc. For such installations the big jump from 119 to 135 degrees was simply too much and the elevation portion of the polar mount needed to be readjusted for the new resting place of the dish. We had seven telephone calls from system operators who, after lowering the nose of their antenna, found signal where it was supposed to be. In effect, sloppy installation of the dish's north-south line had turned their polar mount into an az-el mount!

CATV TVRO STATISTICS—JULY, 1978

Applications Filed/FCC	**Mar. 1978**	**April 1978**	**May 1978**
1) 11 meter	0	0	0
2) 10 meter	0	2	4
3) 6 meter	12	10	18
4) 5 meter	14	17	12
5) 4.5 meter	8	17	19
Total Apps	**34**	**46**	**53**
Cost Max.	$56,500	$145,000	$106,412
Cost Min.	19,935	20,250	5,000
Avg. Cost	**36,901**	**37,942**	**$37,120**
Channels Requested	88	132	124
Average Channels	2.6	2.93	2.3
Requesting WTCG	23	29	36
Requesting CBN	26	37	31
Requesting HBO	21	33	36
Requesting MSGE	7	19	10
Requesting SHOWTIME	7	5	6
Avg. Cost Per Channel	**$14,192**	**$12,949**	**$16,139**
TVRO's Licensed/FCC	**48**	**39**	**38**

Note: Data compiled from FCC sources, adjusts forward one month with each issue.

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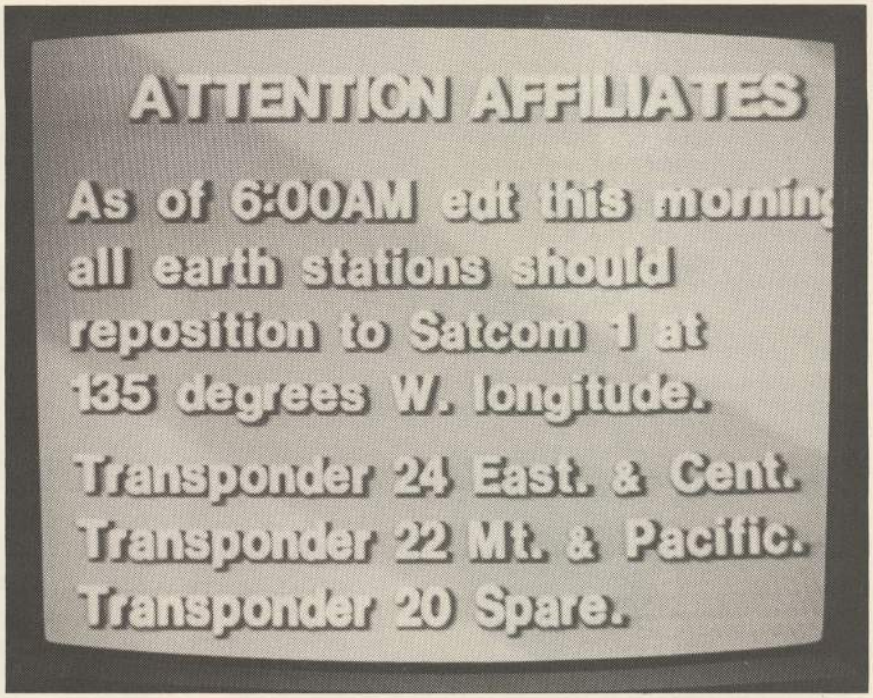
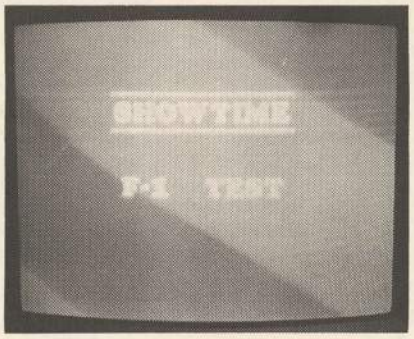
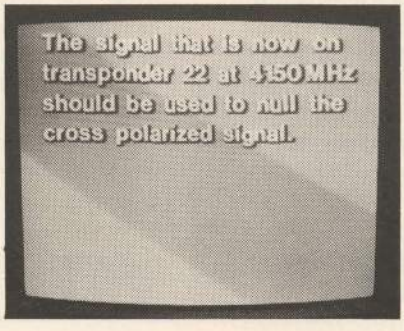


At least one installation reported their polar mount tracked 'perfectly' from WESTAR I (99 degrees) to COMSTAR (128 degrees), or over a 29 degree arc; but they had to lower the nose of the antenna (elevation mount) several inches to catch F1. "Can it be possible for F1 to have either slid further right (west) or for it to be south of the equator?" he wondered. Nope on both counts.



Several operators in the southeast report 'unusual' signal outage conditions which they associated with the F1 signal. One Alabama operator had perfect service until 10 PM at night, then it went into sparklies. Night after night mind you. At last report he still hadn't figured that one out. A terminal operator in the Yukon (that's in northern Canada) reported to us he was expecting to have 1.5 dB **more** signal on one set of transponder channels; he ended up with from .2 to .3 dB **less** signal than he had on F2. Others (the CATJ Lab site terminal included) found the F1 levels superior to F2; as had been anticipated.



All in all the moving day exercise went well and everyone involved in the planning, from RCA to HBO (in particular) deserve the credit for bringing it off with as few hitches as possible. Another hurdle is now past!

Well—almost No Problems

Perhaps the most 'amusing' story to come out of the move occurred over at the CBN uplink terminal site in Virginia. Trinity, CBN and PTL determined they would move at the end of the 'programming day', or starting at 3 AM EDT on the 1st. This meant that the RCA uplink people had to be available a little earlier than normal but cooperative RCA agreed. Trinity and PTL made the move without major incident but CBN had a problem.

CBN first made the azimuth move with their big uplink antenna, and then they went to the elevation jack. Down it came and then it stopped. Opps. It was short by a very significant amount. Frantic calls to RCA (for advice) and the uplink antenna terminal supplier followed. After several additional checks everyone agreed the elevation jack was in fact about 18 inches out of kilter. A plane was readied to fly off into the night to locate another elevation jack.

Then it occurred to the CBN personnel that they were in the process of building yet another terminal (this one to uplink to WESTAR) and there on the ground was an elevation jack that could be pressed

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into service. And so, by mid-morning CBN was operational on F1 after retrofitting the uplink terminal with a new elevation jack.

135.8 vs. 135.0

In the satellite trivia department. . .the location of RCA's F1 bird has variously been reported as being 135.8 degrees west and 135.0 degrees west. To someone looking for the bird the **correct** location is of some importance.

The location of F1 **had been** 135.8 degrees west **until** late in April, when the bird was moved back to 135.0 degrees west. The 135.0 location was the permanent home which F1 was assigned to for the long haul.

Moving F1 back to 135.0 degrees took about two weeks time. On board the satellite are small rockets which are fired periodically to keep the bird in its proper parking spot. If these positioning rockets are not fired on a regular schedule, F1 will drift (on its own) back to the east. By **not** firing those rockets over a two week period F1 gradually was allowed to drift backwards to 135.0 degrees during the later part of April and the first part of May so that when the F2 to F1 CATV service move took place F1 **was** in its permanent location at 135.0 degrees west.

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Satellites located so as to serve North America are clustered either side of a so-called 'zero-pull' zone located at approximately 104.5 degrees west. A satellite located in that position (ANIK I comes closest at 104 degrees) will pretty much stay in place on its own. Satellites west of that point drift backwards towards the east while satellites east of that spot drift westward. Absent the small on board propulsion systems there would be a heck of a parking lot at 104.5 degrees west!

First Vertical and Ortho-Couplers

Madison Square Garden Events, the UA Columbia sponsored sports and special events satellite package that has been seen on transponder 22 on SATCOM II and is currently on an abbreviated summer schedule on transponder 20 of SATCOM I will be the **first user** of the odd-numbered **vertically polarized** transponders. MSGE will be utilizing approximately 1,000 hours per year of SATCOM I time on vertical transponder 9 effective with the inaugeration of their fall time schedule (late in September). Informed sources at RCA advise that within the next 60-90 days they expect additional announcements covering other new users of transponders on the vertical antenna set for SATCOM I. The present home for MSGE, transponder 20, is being vacated so that HBO can expand their operation with additional entertainment packages.

Use of the vertical transponders presents some special 'problems' to those systems presently equipped for MSGE carriage. Basically what happens is that your present TVRO antenna reflector surface will function just as well on vertically polarized signals as it will on horizontally polarized signals.However the two cross-polarized signals must be 'seperated' into a pair of down (transmission) lines so that the horizontal signals can be sped on their way to a receive system that tunes the even numbered (horizontal) channels while the vertical signals go to their own receiver(s). To 'split' the two polarizations into a pair of polarizations requires a bit of electro-mechanics at the antenna feed system. The device that splits the pair of polarizations apart into seperate sets of signals is called an ortho-coupler. This device installs typically **immediately after** your focal or feed point antenna (horn or other type feed) but **ahead of** your LNA. The ortho-coupler is really a polarizing filter, not unlike similar filters used in photogaphy or light beam systems. When multiple-polarization signals go into the ortho-coupler it splits or divides the signals by the polarizations into a pair (2) output spigots. One output line has all of the vertically polarized signals while the other output line has all of the horizontally polarized signals.

At this point the two polarizations go into a **pair** of LNA (low noise amplifier) devices, one each for vertical and horizontal, and then respectively into their own down (transmission) lines and onto the respective receiver(s).

Transponder 9 is within the 6 transponder-set on SATCOM I which provides coverage to not only the mainland (U.S.A.) or Conus, but it also provides spot beam coverage to Hawaii (see page 62, CATJ for May, footprint map for transponders 1,5,9,13,17 and 21). Selected comparisons between transponder 20 (horizontal) and transponder 9 (vertical) indicates the following:

City	Trans-ponder 20	Trans-ponder 9
Los Angeles	33 dBw	33.5 dBw
Seattle	35 dBw	35.4 dBw
Denver	36 dBw	36 dBw
Houston	34.3 dBw	33.4 dBw
Atlanta	34.8 dBw	34.1 dBw
Miami	32.6 dBw	31.0 dBw
New York City	36 dBw	35.5 dBw
Boston	36 dBw	35.5 dBw

LNA Powering—An Option

One of the most perplexing problems facing the designer and operator of any TVRO system is the proper selection of an LNA powering source. Most systems power the LNA (at the antenna) with a DC voltage (AC versions are available but wisely are seldom chosen). However the LNA DC power sources need to be extremely free of switching transients and spikes since the vulnerable GaAs-FETs tend to act like fuses and 'fry' when their operating voltage rises above 26-30 volts DC.

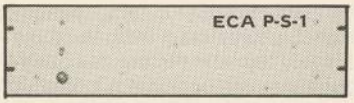
Inside of the LNA there are regulators to hold the operating voltage down to the required GaAs-FET operating voltage (typically 8-9 volts DC). After the front end GaAs-FET stages are several stages of bi-polar 'bulk-gain' which operate either in the 8-9 volt region or perhaps in the slightly higher range of 10-11 volts DC.

Many TVRO receivers provide an LNA powering jack where (it is **suggested**) you plug in your LNA powering line to obtain (variously) from 12 to 25 volts DC to run the LNA. Other TVRO suppliers offer to sell you a 'regulated' DC supply (in the 12-15 volt DC range) to power the LNA.

Because LNAs are so terribly susceptible to line spikes, surges and switching transients it follows that the best possible DC supply for an LNA is a supply that is very well isolated from the AC power mains; one that has plenty of 'capacity' (like a farad or so) built in to 'swamp' or 'dampen' any line variations that might otherwise drive (even if only momentarily) the LNA power voltage up beyond the point where the regulator will keep the voltage to the GaAs-FET within safe (for the GaAs-FET) operating limits.

Tony Bickel, formerly with USTC, has (he says) seen "perhaps $15,000 in LNAs go bad in less than a year" and so he set out to do something about the powering problem for the LNAs. We kind of like his answer and we felt that anyone who has experienced LNA failures (and if you haven't yet. . .the odds are against you) would be interested in that answer. The **Electron Consulting Associates** (ECA) model LNA/PS-1 is a solid state supply designed just for LNA powering. And it provides not only a very high degree of protection against AC line mis-haps but it also offers a standby powering feature which is important.

The LNA/P-S-1 is the very essence of simplicity. It powers your LNA through a 5 Ah Gel cell which is constantly trickle charged by a regulated supply. The output voltage to the



LNA shifts less than 20 mV from a no load to a 500 mA load condition. The whole concept is to have a very low impedance (in milliohms) on the LNA side of the supply and a very high impedance on the AC line side. The power supply presents more than a farad of capacitance to the circuit which smooths out all of the nasty bumps and grinds of the AC line side. The battery LNA source is important also because it insures that should your TVRO site lose power the LNA stays powered up (an LNA drawing 200 mA would stay operating at full voltage for more than 25 hours with

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the battery supply). **Why would that help if power was off?** Because the LNA will 'suck' moisture if it goes from a heated (i.e. operating) condition to a cooled off condition, and/or moisture will condense in the interior of the LNA if the heated operating condition cools off. There is something very nasty about moisture condensing inside of your LNA (ask someone who has had this happen to them!).

Price on the LNA/P-S-1 is $175.00 in single lot quantities and delivery is one to three weeks for the rack mounting unit. The primary is fused, there is an operating light on the primary and two (black and red) jacks on the rear for LNA power connection. CATJ installed one at our lab TVRO site and highly recommends it to others; it is far less expensive than keeping a spare LNA around (most LNA failures are power supply related). **Electron Consulting Associates is at P.O. Box 2029, Grove, Ok. 74344** (918-786-5349).

LNA Cooling - Revisited

The April issue of CATJ contained a report on the current state of the art of satellite terminal low noise amplifier designs (pages 48-60). One of the subjects covered in some detail was the status of something called TEC or thermo-electric cooling.

TEC enthusiasts seem to be coming into their own at several fronts. At least one manufacturer (Amplica) now has a 95 degree K(elvin) TEC unit available as a regular line 'item' although the price may stop many would be users. The unit is rated a scant 5 degrees K below the non-cooled units from SCI although the pricing seems to be comparable.

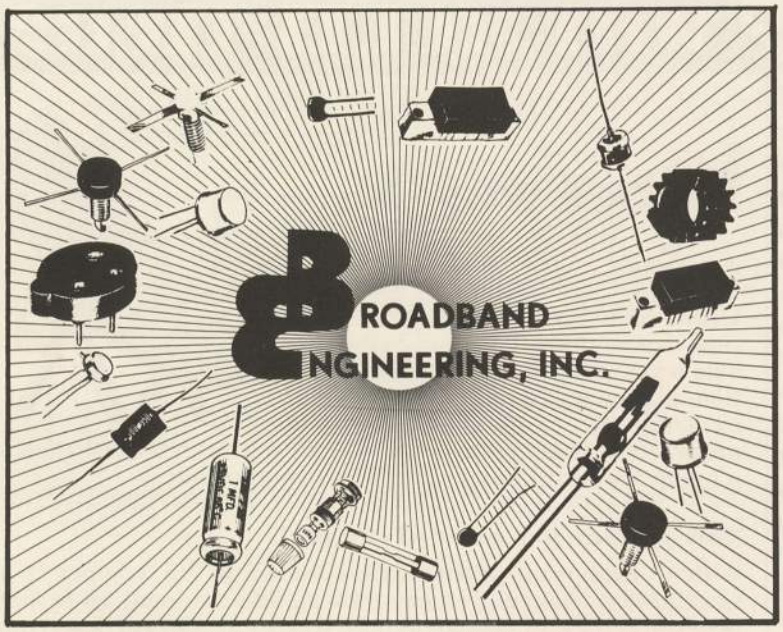
Several readers wrote or called to report that TEC cooling units, designed for camping trips and the like, operating on 12 or 6 volt supplies, were available in the "under $300" price range from several sources. One unit we are investigating will cool a fiberglass container up to approximately 1 cubic foot in size to around 0 degrees F (or minus 18 C approximately). This unit could be designed to cool an LNA housed in a custom fiberglass container when the LNA mounts **behind** the dish; and as pointed out in the April report **at 0 degrees** F you would have the **equivalent of 97 degree K unit performance** when you started out with a 120 degree Kelvin LNA.

Most TEC cooling are current hungry devices. The Amplica unit, for example, eats up 30 watts of power at the 6 volt operating level (5 amps). If you have the current and watts to spare, it is not a bad trade although not everyone would see it this way. SCI is one company working on the problem along different lines. The general concensus seems to be that the TEC system should 'spot cool' just the stage or stages in the front end of the LNA (i.e. the one or two GaAs-FET stages) and not utilize more than 2-5 watts of power in doing the cooling job. As the CATJ April report noted, cooling requires liberating considerable amounts of heat which must have someplace to go. Getting the heat out of the LNA is a tricky problem if you are going to be sure that in the process you don't allow a path for moisture to get back into the unit.

As SCI's Bob Goodrich notes to us **"The ideal TEC system should not only use very little power, and dis-charge the heat in such a way that the enclosure is not made penetrateable with outside moisture, but the system should also be designed so that if the TEC system fails for any reason the noise temperature of the LNA never exceeds what the LNA would be were the TEC system not included in the first place."**

What Goodrich is saying is that the TEC system should be an integrated package, using the 'reactance' of the TEC circuit as a part of the tuning system reactance for the GaAs-FET devices. If this approach is taken, the TEC unit could quit and you'd still have acceptable performance from the LNA. This says you start off with a high quality LNA in the 100 degree K range, design the TEC cooling just into the first stage or two making the TEC circuit part of the tuning circuit of the GaAs-FET(s) involved. Then with the TEC system 'spot cooling' the stage or two stages involved, you lower the Kelvin noise temperature of the LNA to levels such as 70-80 degrees K.

At least one satellite receive system now on the drawing boards is out shopping for TEC cooled LNA units. Col-



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lins Radio, with the contract for the NPR (National Public Radio) WESTAR audio-only receive terminal packages has an RFQ (Request for Quotation) out that is soliciting bids on 90 degree K LNA units. The quantity of units involved is relatively small (fewer than 20) but the handwriting is apparently on the wall; system designers are asking for performance that today is only possible with TEC (cooled) systems. With this incentive, it does appear that by the end of 1978 there may well be several TEC (cooled) LNA systems on the market commercially. In the interim, the CATJ Lab is working with our own TEC approach built around enclosing the entire LNA on a back-of-dish mounting system in a commercially available TEC cooler.

A Very Narrow Base

Past reports of the status of 1/2 micron GaAs-FETs suitable for use as first stage (or first two stages) amplifiers in 3.7 to 4.2 GHz LNAs have come to the confusing conclusion that anyway you slice it, **GaAs-FETs are in very short supply.**

One US company that **has** tooled up for 1/2 micron gate (lead length) GaAs-FETs has reportedly dumped $500,000 into the tooling and equipment necessary. To date they have **yet to produce** GaAs-FETs suitable for use in LNAs any better than the 200 degree K(elvin) range. Other US manufacturers of LNAs who **'claim'** to be manufacturing their own GaAs-FETs are apparently having no better 'luck'; some of these LNA suppliers **are** utilizing their own GaAs-FETs **in the second stage** (where a lower grade transistor will sometimes suffice) but according to our sources **nobody** is using **US manufactured** GaAs-FETs in the **first stage** of a 3.7-4.2 GHz LNA.

Which means that every LNA out there, we are told, has a (Japanese) **NEC** GaAs-FET in the front end (first stage). The world, or our CATV 3.7-4.2 GHz world at least, is totally dependent upon the incoming shipment of NEC low noise GaAs-FETs. Now what does that **shipment** amount to in a typical month? Which is another way of gauging the depth of the shortage for LNA units in the CATV world.

Our concern here is with 120 degree K LNAs. By the time you get to 150 or 180 degree K units there is plenty of product available. To put together a **120 degree LNA,** you **start off with** a 75 degree GaAs-FET in the **first** stage. This transistor is preceded by a 0.15 dB loss isolator (that's equal to around 12 degrees K 'loss' right there) which means the 75 degree GaAs-FET in the front end becomes a 75 + 12 or 87 degree **stage.** By the time the noise temp of the **87 degree front end** is rolled into the noise temperature of the following stages you end up with a 120 degree K amplifier. So **how many 75 degree K GaAs-FETs** come out of Japan **per month?** The month of May may be typical; it is at least recent. Our sources indicate the importer for NEC brought in 500 GaAs-FETs which NEC had represented to the importer as "qualified for LNA service". The importer, who is directly responsible to his customers (the LNA manufacturers here) for his money then ran the transistors through a **second** selection process. When he got all done, he had 50 (or 10 percent) of the total 500 shipment 'qualified' **at the 75 degree Kelvin level** (which, remember, translates to fifty 120 degree K LNAs). Then he had to 'parcel' ('partial' might be a more appropriate word!) those 50 out amongst the half dozen or so manufacturers of TVRO LNAs.

The 75 degree K 'qualified' transistors are obviously expensive. We've heard reports that a manufacturer who turns out a 120 degree K unit has as much as $500 wrapped up in just stages 1 and 2 (both GaAs-FET stages although the first stage is the more expensive of the two by around 200%).

Logic suggest there are **more than 50 LNAs coming out each month** which are 'represented to be' 120 degree K (or better) units; from the **combined outputs** of the six or so suppliers. How can that be? Well, **perhaps** not all of the units meet the 120 degree spec; not all the way across the full 500 MHz wide band anyhow. Some, logic suggests, **may not** make 120 degrees K anyplace within the band; irrespective of what their data sheet suggests.

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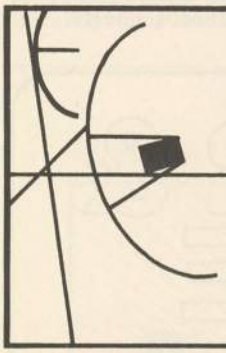
The whole foundation for rapid growth of the TVRO technology in the 3.7 to 4.2 GHz region is at best rather precariously perched atop an extremely thin thread that extends all across the Pacific to NEC/Japan. One year ago many felt that by now the situation would have improved; alas, it appears it has only gotten worse. For in the past year **the demand** for 120 degree LNAs **has doubled** while at the same time **the supply** of 75 degree K GaAs-FETs has improved **not one bit.** If this industry is to grow, on a firm foundation, a major break though in 1/2 micron in low noise GaAs-FET **manufacturing techniques** is mandatory. There is no more pressing 'problem' facing the expansion of the TVRO industry today.

Latest—Motels & Hotels Service

Following the detailed report appearing in the May issue of **CATJ** of the announced plans of Holiday Inns of America, Bell & Howell and Twentieth Century-Fox to join with Ed Taylor's Southern Satellite Systems in a nationwide movies-for-hotels and motels program, a change of plans has occured.

The original plan called for approximately 6-8 hours per day of movies and a limited amount of other programming to be distributed via an existing horizontal transponder to 'receiver cluster sites' in approximately 500 U.S. markets. The original plan had the cluster sites so located that they could 'feed' movies via either terrestrial cable or terrestrial microwave to **multiple motels and hotels** in a 'segment' of a community. It was anticipated, at that time, that 'competitive motel/hotel' establishments would be taking the service.

Well, Holiday Inns has re-thought that aspect of the program and they now say that this will be an **exclusive Holiday** service. There will be no cluster sites (unless multiple Holiday



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Custom Building Products, Inc., P.O. Box 32231, Okla. City, OK 73132, (**S9, Underground Boring Equip.**) 405—495-1935
Daniels & Associates, 2930 E. 3rd Ave., Denver, Colo. 80206 (**S3, S9 Brokerage**) 303—321-7550
DAVCO, INC., P.O. Box 861, Batesville, AR 72501 (**D1, S1, S2, S8**) 501—793-3816
DF Countryman Co., 1821 University Ave., St. Paul, MN 55104 (**M2, S1, S8**) 612—645-9153
Durnell Engineering, Inc., Hwy. 4 So., Emmetsburg, Iowa 50536, (**M9**) 712—852-2611
EAGLE COM-TRONICS, INC., P.O. Box 93, Phoenix, NY 13135 (**M9 Pay TV Delivery Systems & Products**) 315—695-5406
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
FANFARE TELEVISION, 10 Greenway Plaza, Houston, TX 77046 (**S4**) 713—960-8731
FARINON ELECTRIC, 1691 Bayport, San Carlos, CA 94070 (**M9, S9**) 415—592-4120
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
Gardiner Communications Corp., 2000 S. Post Oak Rd., Suite 1490, Houston, TX 77056 (**M9 TVRO Packages, S1, S2, S8**) 713—961-7348
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—993-1510
Heller-Oak Communications Finance Corp., 105 W. Adams St., Chicago, IL 60603 (**S3**) 312—621-7661
HOME BOX OFFICE, INC., 7839 Churchill Way—Suite 133, Box 63, Dallas, TX 75251 (**S4**) 214—387-8557
HUGHES MICROWAVE COMMUNICATIONS PRODUCTS, 3060 W. Lomita Blvd., Torrance, CA 90505 (**M9**) 213—534-2146
International Microwave Corporation, 33 River Road, Cos Cob, CT 06807, (**M1, M4**) 203—661-6277
ITT SPACE COMMUNICATIONS, INC., 69 Spring St., Ramsey, NJ 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

Inns can be served from a single location) and you won't drive into a motel area and see **several** marquees **all** advertising 'Stay With Us and See "The Bad News Bears Visit Japan" '.

As the program now stands there will be 12 hours per day of service, with the programming coming up around 4 PM eastern time and running until approximately 4 AM eastern time. The service will be on one of the vertical SATCOM I transponders, and is still likely to begin by early 1979.

Although we never reported it in our May issue, the original concept called for the motel/hotel service to be intertwined in and around the FANFARE (transponder 16) movie schedule (FANFARE is partially owned by Twentieth Century-Fox). One of the things that gave this approach problems was the regional sports coverage of FANFARE; the proposal then was for the sports to go out on yet another transponder leaving transponder 16 essentially exclusive for movies. With the new Holiday Inns-only plan and their own vertical transponder FANFARE will now stand alone.

SSS Plans Expansion

Southern Satellite System is putting the finishing touches on a 'phase III' program which will bring up two additional independent TV signals on SATCOM I (on vertical polarization), sometime in mid to third quarter 1979. SSS has been carefully studying the programming direction, signal carriage and other parameters for New York and Los Angeles independent stations and is expected to provide **Los Angeles KTLA** (owned by Gene Autry), channel 5, and **New York WPIX** (Yankee baseball), Channel 11, as their next two 'indie choices' via SATCOM.

Because of the very long delay in the SSS application to bring San Francisco's KTVU to the satellite (approximately one year and still running with no approval) SSS feels that they should now be planning a year to 15 months in advance of a scheduled launch date for any new services.

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Extraordinary signal: by satellite via RCA's Satcom I.
Extraordinary service: to you and your subscribers.
Go with the extraordinary.
The Extra Channel.
The pay-TV service that brings results. As your first pay channel or as a tier.

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THE EXTRA CHANNEL

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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. 10357 (**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
NORTHERN CATV DISTRIBUTORS, INC., 8016 Chatham Dr., Manlius, NY 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., 6920 Melrose, Oklahoma City, OK 73127 (**M1, M4, M8, S8**) 405—495-3953
RMS CATV Division, 50 Antin Place, Bronx, NY 10462 (**M5, M7**) 212—892-1000
Sadelco, Inc., 299 Park Avenue, Weehawken, NJ 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
Showtime Entertainment, Inc., 1211 Ave. of the Americas, New York, NY 10036 (**S4**) 212—575-5175
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
The Associated Press, 50 Rockefeller Plaza, New York, NY 10020 (**S4**) 303—825-6046
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
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
Trenco Inc., P.O. Box N, 385 South 300 West, Salem, UT 84653 (**S1, S2, S7, S8, S9 Consulting**) 801—798-8633
Triple Crown Electronics Inc., 42 Racine Rd., Rexdale, Ontario, Canada M9W2Z3 (**M4, M8**) 416—743-1481
TURNER COMMUNICATIONS CORP., (WTCG-TV), P.O. Box 4064, Atlanta Stadium, Atlanta, GA (**S9**) 404—522-7250
UNITED PRESS INTERNATIONAL, 220 East 42nd St., New York, NY 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, NY 11787 (**M9**) 516—231-4400
VITEK ELECTRONICS, INC., 200 Wood Ave., Middlesex, NJ 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
Winegard Company, 3000 Kirkwood Street, Burlington, Iowa 52601 (**M2, M3, M4, M5, M7**) 319—753-0121

NOTE: Associates listed in bold face are Charter Members

Distributors:
D1—Full CATV equipment line
D2—CATV antennas
D3—CATV cable
D4—CATV amplifiers
D5—CATV passives
D6—CATV hardware
D7—CATV connectors
D8—CATV test equipment

Manufacturers:
M1—Full CATV equipment line
M2—CATV antennas
M3—CATV cable
M4—CATV amplifiers
M5—CATV passives
M6—CATV hardware
M7—CATV connectors
M8—CATV test equipment
M9—Other

Service Firms:
S1—CATV contracting
S2—CATV construction
S3—CATV financing
S4—CATV software
S5—CATV billing service
S6—CATV publishing
S7—CATV drop installation
S8—CATV engineering

Coop's cable column

bob cooper editor in chief

Is F1 A Sick Bird?

Inspite of the generally favorable report appearing in this month's Satellite Technology News sections of CATJ, all is **not** well with F1. The RCA bird may even be 'sick'. At least that's what the rapidly mounting pile of evidence suggests.

Three weeks ago today (the day this is written) the CATV industry moved birds; from RCA F2 at 119 degrees to RCA F1 at 135.0 degrees. Most of us **found** F1 alright, after some isolated problems and we settled back to enjoy more of the bird delivered signals. The first red flag appeared within days. The LNA people report they had a sudden increase in 'trouble calls'; terminal operators yelling that LNAs had gone bad. **"I've got sparklies on HBO and I never had it before. . .your LNA has lost a stage".** Receiver manufacturers, antenna manufacturers and software suppliers had similar calls. Many (but by no means all) of the problems were in the southeastern USA, say from Texas east along the Gulf Coast to Florida.

Then suppliers started comparing notes. **"San Diego, which was supposed to lose as much as 1.4 dB ended up 2 dB** hotter **on F1"** came one report. **"St. Louis which was supposed to gain a few tenths lost a couple of tenths"** came another report. **"Central Florida, forecast to gain 1.8 dB** (on transponder 2,6 etc.) **gained less than 0.5 dB"** said another. And **"New England was supposed to pick up 2.4 dB on 4,8** (etc) **and it only gained .4 dB".**

Humm.

Others reported 'erratic signal levels'. **"Up through June 21st we've had four periods of very poor reception—lasting from five minutes to hours. The one on June 21st was a doozy"** reported a mid western operator. He's right. . .it was. We were in the CATJ Lab at the time checking out a new receiver. At 9 AM (give or take a minute. . .we failed to check the precise time in the panic) we saw every transponder **but** 2,6,8 and 14 **go off;** and those four went into 'instant sparklies' **losing around 10 dB of S/N** as fast as someone might throw a switch. After ten minutes the color bars on 22 and 24 reappeared, followed a few minutes later by 10 and 12. The 6 transponder got back out of the sparklies first, but 14 still had them an hour later (we are normally 3-5 dB **above** sparklies). Thinking **we** had lost an LNA, or an antenna (we had two receivers running at the time and both had the same poor reception) we called around to three other operators in Texas and Oklahoma. All reported the same problem.

A phone call to RCA resulted in two answers. One was **"Who the hell are you to ask if we are having problems?",** and this was followed by **"Of course** (with an implied 'you idiot') **everything is OK!"** Hummm again. And that was just the 'occurence' of the 21st.

More checking resulted in more stories. Howard Hubbard at AFC in central Florida had done extensive testing (50 measurements per transponder spread out over several weeks before and after the move). Howard's bottom line? At a location near Fort Lauderdale, in Florida he found on the 2,6,10,14,18 and 22 transponder set where he had been told to expect a **1.8 dB improvement** in C/N on F1 (over F2) he barely had a **0.6 dB improvement.** On the 4,8,12,16,20 and 24 transponder set he was expecting to **lose 2.1 dB** C/N and he **lost 2.5 dB.** Ollie Hensler in south Texas found HBO pictures poor after the switch, CBN a tad better and WTCG about the same as on F2. His system in Virginia was more uniform; **all** of his signals **looked worse** than they did from F2.

The puzzle was beginning to fill in and it was not pretty. HBO, we learned, had 'commissioned' COMPUCON to direct a set of field tests (real world C/N measurements) over the weekend of June 23-25. At various locations from Texas to Florida qualified terminal people would measure 5 test signals on F1 and 3 on F2 to make **direct comparisons** between the two birds. HBO, it appeared, was after the real facts. 'RCA was cooperating' to the extent they were putting up the test signals.

RCA did something else. On June 22nd, in the morning hours, you may have noticed some strange looking video information on 20,22 and 24. On that morning RCA conducted a 'pitch and roll test' of the bird; to check out whether the bird was in fact pointing where they have been saying all along it is pointing. Results? Too early to tell and RCA isn't talking.

Meanwhile the telephones continued to ring at the suppliers. **"I've got a bunch of LNAs in here that have absolutely** nothing **wrong with them"** lamented SCI's Humphries. **"I'm tearing my hair out trying to find out what is wrong".** Nobody had bothered to tell Tom that F1 might be 'sick'. He wasn't alone.

'Sick' needs some explanation. We **wish** we could give you that explanation at this point; we can't. It may be weeks before the trouble is pinpointed. And it will probably be far longer than that before RCA has figured out how to correct the problem. There are several possibilities. Most are speculation, some are rumors. We air them both here because they need to be properly identified.

Rumor. 'When RCA launched F1 originally one of the solar panels failed to deploy fully; that reduces the power available for F1 operation.' **Rumor.** 'When RCA moved F1 from its original spot at 120 degrees to 135.8 degrees they used more of the propulsion fuel than they should have used; that has greatly limited their ability to do station keeping with the satellite' (that suggests it moves around too much). **Rumor.** 'The partially deployed solar panel forces RCA to accept an antenna pointing attitude further north and west than they **claim** to insure the solar panel gets enough sunlight to keep the power at minimum levels; the published footprints are not the real ones'.

Speculation. 'HBO will have to buy their affiliates 100 degree LNAs in the southeastern USA to make up for the low F1 signal levels'. **Speculation.** 'RCA when they have all of the facts it can simply re-boresight the bird'. **Speculation.** 'We'll all have to move back to F2'. **Speculation.** 'This will force RCA to launch F3 (a standby bird now on the ground) to replace F1'.

Fact. There **is** a problem. **Fact.** CATJ has mailed questionnair forms to some 450 licensed terminal operators asking them how **they** rate (or measure) F1 service against F2 service. **Fact.** We'll be reporting to the industry on the results of this 'survey' and the latest in the 'saga of the sick bird' during the still-scheduled CCOS '78 satellite distributed seminar program. **This 'special report' is scheduled for Wednesday July 19th at 12 noon CDST on transponder 24.** You might want to tune us in.

Oh yes. . .**just in case** something goes wrong and we are **not** up on transponder 24 between 8:30 AM and 1:30 PM (CDST) July 17,18 and 19. . .we've made arrangements with HBO and RCA (whom we hope is still speaking to us!) to run the **full** CCOS '78 Seminar (from tapes made at CCOS) on July 24,25 and 26. . .same times and transponder.

Post Script

We ran this whole column by the office of RCA Americom President Andy Ingliss. On June 23rd we got this official statement from an 'RCA spokesman'.

"RCA Americom's F1 satellite is operating normally and can only be characterized as being in excellent health.

"Minor signal level changes were expected at some locations as a result of the different footprints of F1 and F2. These are being investigated on a case by case basis."

We'll see what the CATJ survey sheets from 450 operators say.

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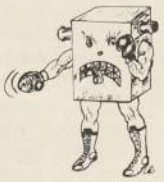

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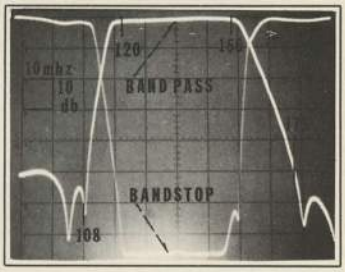

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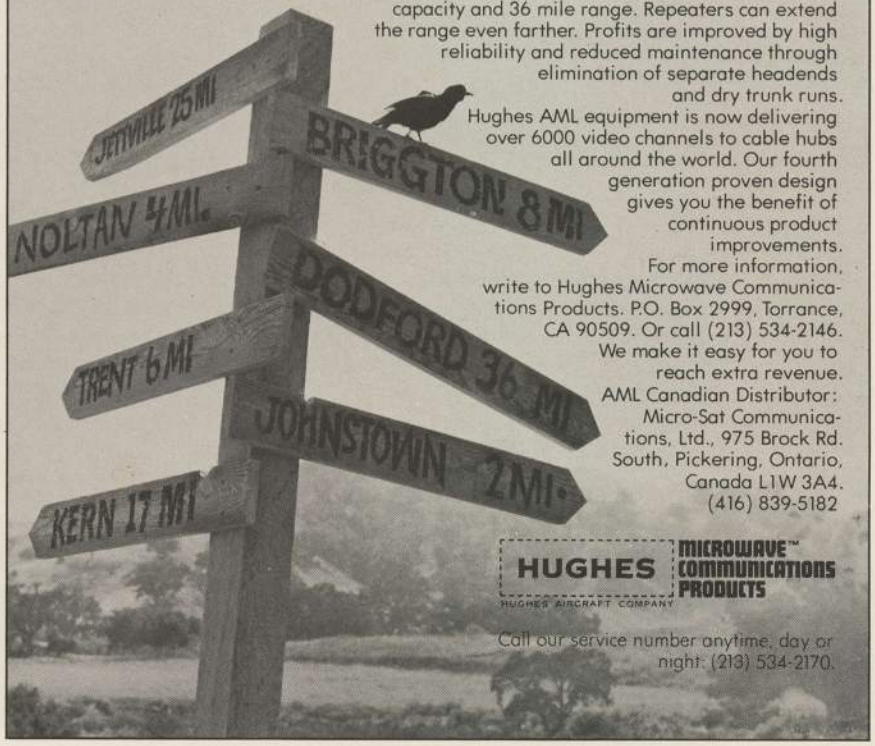

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Famous Manufacturer's closeout on H.D. MATV and CATV Yagi antennas (real good) at great prices (real cheap). Too many to list here. Please call or send for listing to—Jim Emerson, Northern CATV (800) 448-5164, 8016 Chatham Dr., Manlius, N.Y. 13104—include your name and phone number so we can discuss your needs. Thanks!

Wanted! Used Head End Processors in good shape. Box M-52478, c/o CATJ, 4209 N.W. 23rd, Suite 106, Okla. City, OK 73107

For Sale: Modulators, Ameco ATSS-II, Channel 8 and 11, 4.5 MHz audio input, rack mount. Also numerous Dynair Mini-Cha Filter Amps various channels. 213—957-0618.

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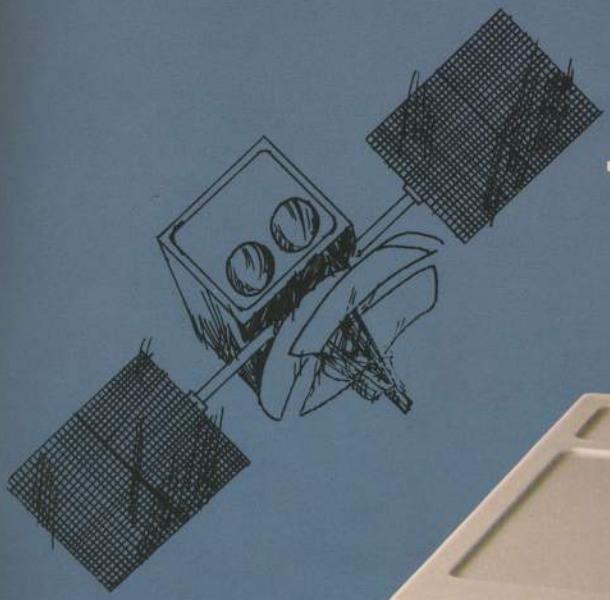

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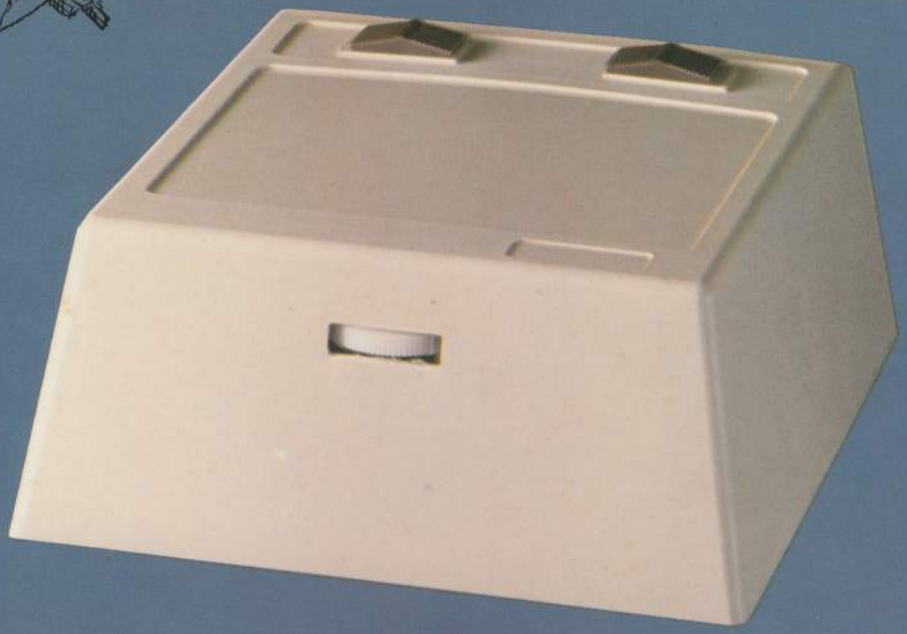

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