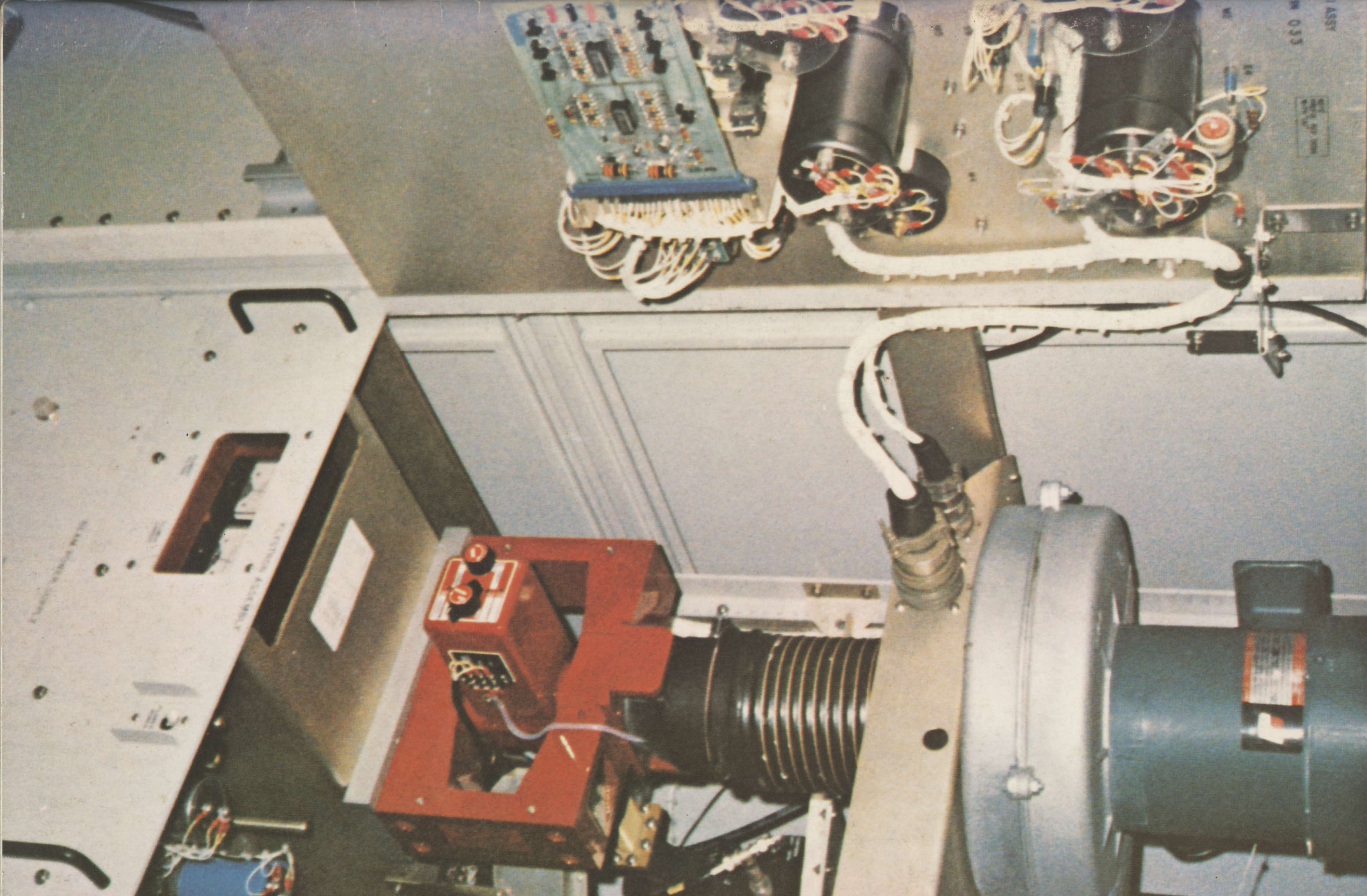

CATJ

FEBRUARY
1979

OFFICIAL JOURNAL
OF THE
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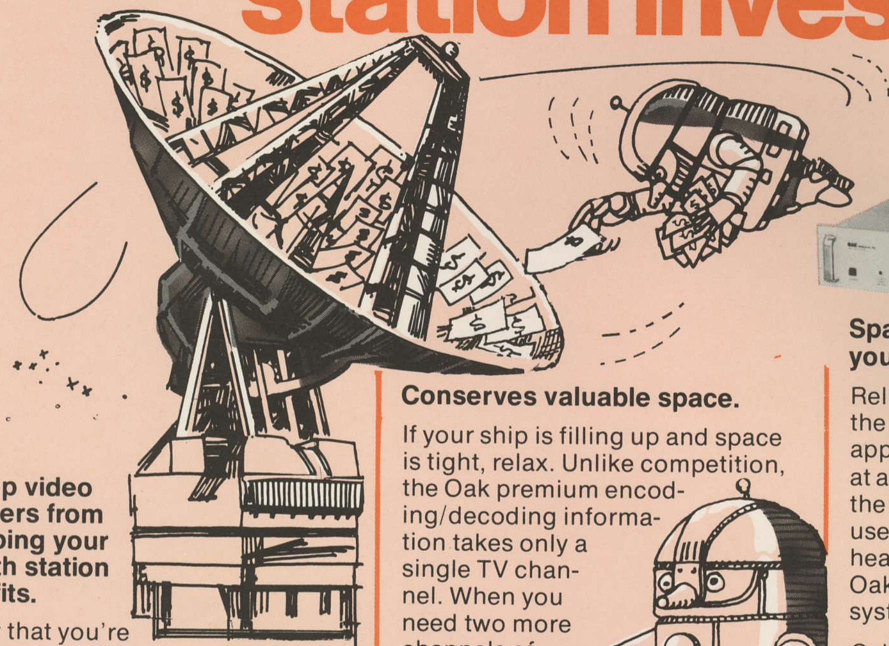
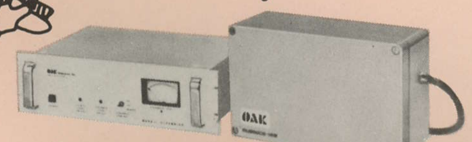
Oak protects your earth station investment!





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Reliable Oak scramblers offer the ultimate in security. In MDS applications, use the Mini-Scrambler at a remote site. For full systems, the Oak Mark II scrambler is used with your modulator at the head-end. Both employ the Oak sinewave sync suppression system for highest security.

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Now that you're paying for a new earth station, make sure all your subscribers are paying you. If you use soft security, video raiders may be tapping expensive premium programming and costing you megabucks. Let exclusive Oak pay TV security, help you maximize your profits.

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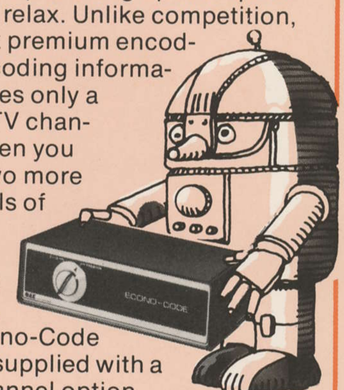

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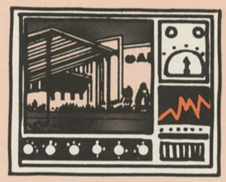

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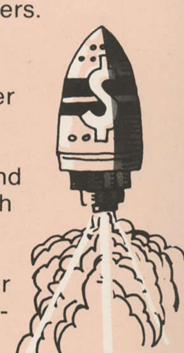

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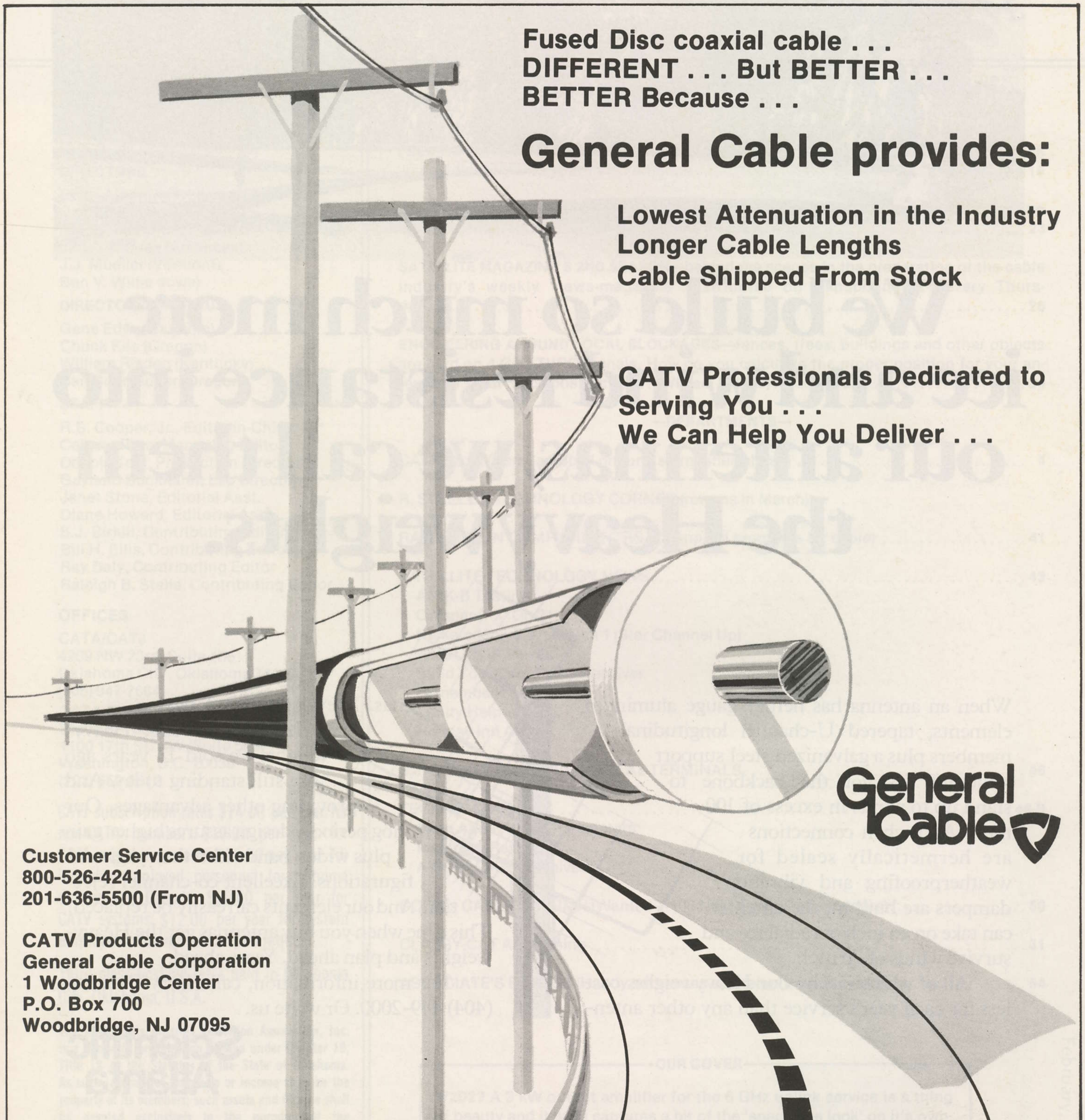

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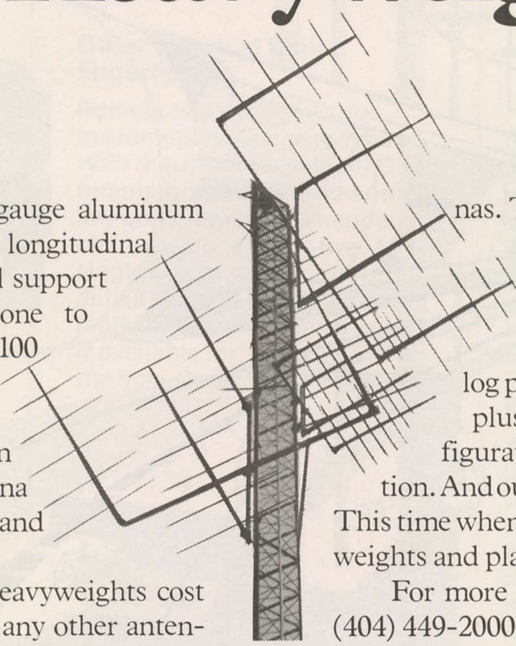

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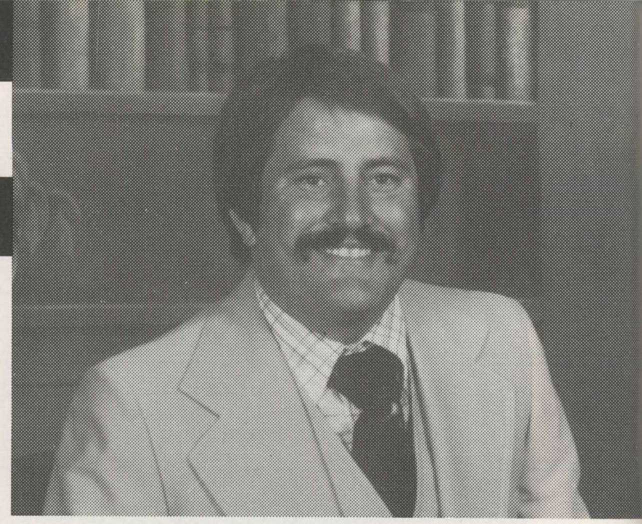
—FEATURES

—DEPARTMENTS—

—OUR COVER—

W2D2? A 3 kW output amplifier for the 6 GHz uplink service is a thing of beauty and it even captures a bit of the 'space age look' on it's own. This amplifier is one of more than a dozen in operation at the Western Union Vernon Valley (N.J.) uplink site feeding signals to WESTAR I and II satellites.

CATA ~ TORIAL



BEN CAMPBELL, President of CATA, Inc.

Rural Telecommunications — A Challenge

For several years now various federally funded study groups have been fertilizing the concept that people who live in "rural America" are being short changed by not having "access" to mainstream America. Dozens of studies have been conducted by perhaps as many federal agencies, task forces and ad hoc committees and each has come to the conclusion that rural Americans are "falling further and further behind" their city or suburban cousins in everything from an understanding of their government to their ability to cope with an ever increasingly complex American life style.

Most of the Indian signs we read suggest that much of this is going to come to some type of 'head' during 1979. **A confrontation is brewing.**

On the one hand we have all of those lovely federally funded (plus a smattering of privately funded) 'studies' which proclaim that the "quality of life in rural America is declining"...when compared to the companion "quality of life" in metropolitan USA. Carrying this message we have a number of influential members of Congress, a benevolent telephone industry and a small but dedicated cadre of FCC people who believe' **they have the answer** to this "problem". The answer they propose is to remove all of the legal roadblocks that today prevent the telephone companies from operating in the CATV arena and allow the telephone companies to bring "modern telecommunications to rural America". To fuel this scenario the telephone companies would be allowed to 'dip' into the federal treasury to float 25-30 year loans at very low interest rates (5% and under) to wire rural America for telecommunications.

On the other hand we have virtually no grass roots support or even understanding that they are being "shortchanged" by rural America. The lack of support for the program to bring "modern telecommunications to rural America", from rural Americans, seems not to bother the Washington establishment pushing this concept. They are well aware that when the time is ripe they can "sell" the concept to rural Americans with ease. There are indications that President Carter may even be anxious to lead the battle; rural America certainly has never gotten its fair share of tax revenues back home again and by spelling out that this new "rural telecommunications revolution will be possible because of 'federal seed money' " the program falls into that never-never land someplace between being a political boondoggle and just rewards to the faithful political supporters. The 'faithful political supporters' are many and varied; with firms such as 3M behind the concept it is not hard to turn up support for a multi-billion dollar new industry that seems just over the horizon.

The telephone companies want this one very badly. They recognize that their old lead-sheathed narrow band cables and plants are woefully inadequate to cope with the emergence of broadband based communication technologies such as computers and instant access data retrieval. But replacing hundreds of thousands of miles of lead sheathed cables with either fiber optics or coaxial cable super trunks is going to cost billions. "Why not" they muse "start the change-over in rural America where perhaps we can get the federal government to pick up a major portion of the conversion costs?" To get onto the federal dole requires a cause however so they have created the concept that rural America is being outpaced by metropolitan America. "Modern, broadband communications is the answer to rural America's needs" they claim.

Only cable is 'already in' rural America. Cable installed by cable television firms. No matter...it is only in spots and it is badly organized and owned by a wide variety of different firms and individuals. The telephone backers of this fiasco see no real threat here. "A few thousand one man cable operations cannot be allowed to stand in the way of bringing modern communications to rural America" a Washington type told me recently. He was serious and I was stunned by his lack of understanding of the important role played in rural America by the existing cable television systems.

Broadband communications technology such as the linking of computers to remote terminals or data retrieval on demand from computer-bank-libraries is a wonderful use of a broadband coaxial cable or fiber optics system. Unfortunately very little of the hardware (i.e. terminals) to make such a system work is yet in place; and virtually none of what is in place is in rural America. So while the telephone companies want to replace their lead sheathed narrow band systems with broadband systems of some modern new design, they lack the in-place hardware at **either end** of the circuit to make such plants economically viable **today** in rural America. The best broadband plant in the world is a poor investment today unless there is some way to make money with it while awaiting the projected and likely explosion in computer and data retrieval areas coming in the late 1980's and 1990's.

Which brings us to the only terminals that are in place today, in sufficient numbers, to make broadband telecommunications viable in the 1980's. **Television**

sets. They are terminals just like Radio Shack computers. Only unlike the TRS-80 terminals they are in virtually every home today. Ready to be served.

Cable has a challenge here. A very big challenge. The opponents in this action have been preparing to do battle with us for several years. Their conferences, their cleverly created federal studies, their 'white papers' have been drifting out for nearly a decade and we were too busy with our own petty affairs to notice the pile growing or the support for their program building.

Rural cable systems are to be the direct target of a massive offensive that we fully expect to see unleashed in 1979. Existing rural cable systems will be indentified as 'impeding the progress of rural America' and we will be severely chastised for our 'failure to serve areas outside the rural communities' where population densities do not allow us to operate with traditional cable television efficiencies. The program will become political when (and perhaps even before you read this) the President of the United States endorses "the development of rural telecommunication with federal support".

On the surface this looks like one of those 'woe-is-me' hand wringing situations. **We are damned for what we have done and damned for what we haven't done.** Is there a way out of the dilemma?

First of all, we have to separate the goals of the proposed telco backed effort. They want our cable customers because our customers represent instant cash flow for their new broadband plants. Our **small-community** antenna systems also create sufficient housing densities to allow their new broadband plants to function with 30 year low interest money in areas where mile after mile of plant may pass only a few homes. Their plan won't work nearly as well if they are forced to "build around us" only in the low density rural areas. Rural television reception is a real political grabber. With satellite fed service to rural communities now available there's hardly a farmer in America who won't welcome the "promise" that one day "soon" he will have **a cable in his home** with more television channels in it than he has dial positions to receive.

There is one offensive strike rural cable could make. Several years ago CATA founder Kyle Moore directed that a study be made of how rural cable systems could become re-distribution points for television programming utilizing UHF translators as the delivery systems. Kyle's concept called for five selected in-town cable channels to be re-distributed over a 10-20 mile radius via **'block conversion UHF translators'.** The plan called for the **'broadband translator signals'** to be scrambled so the small town operator could derive revenue by renting out receiving antennas with de-scrambling devices to the farmers in the area. Initial response from the FCC was negative and the plan was dropped. Maybe it is an idea whose time has come and it should be refined and submitted to the FCC as a Petition for Rulemaking. If it did nothing else but offer an alternative to federally funded broadband cable technology owned and operated by the telephone companies it would at least show Washington law makers that there was an option for rural America. As things now stand rural cable is headed for a tough year in Washington and perhaps in rural America as well.

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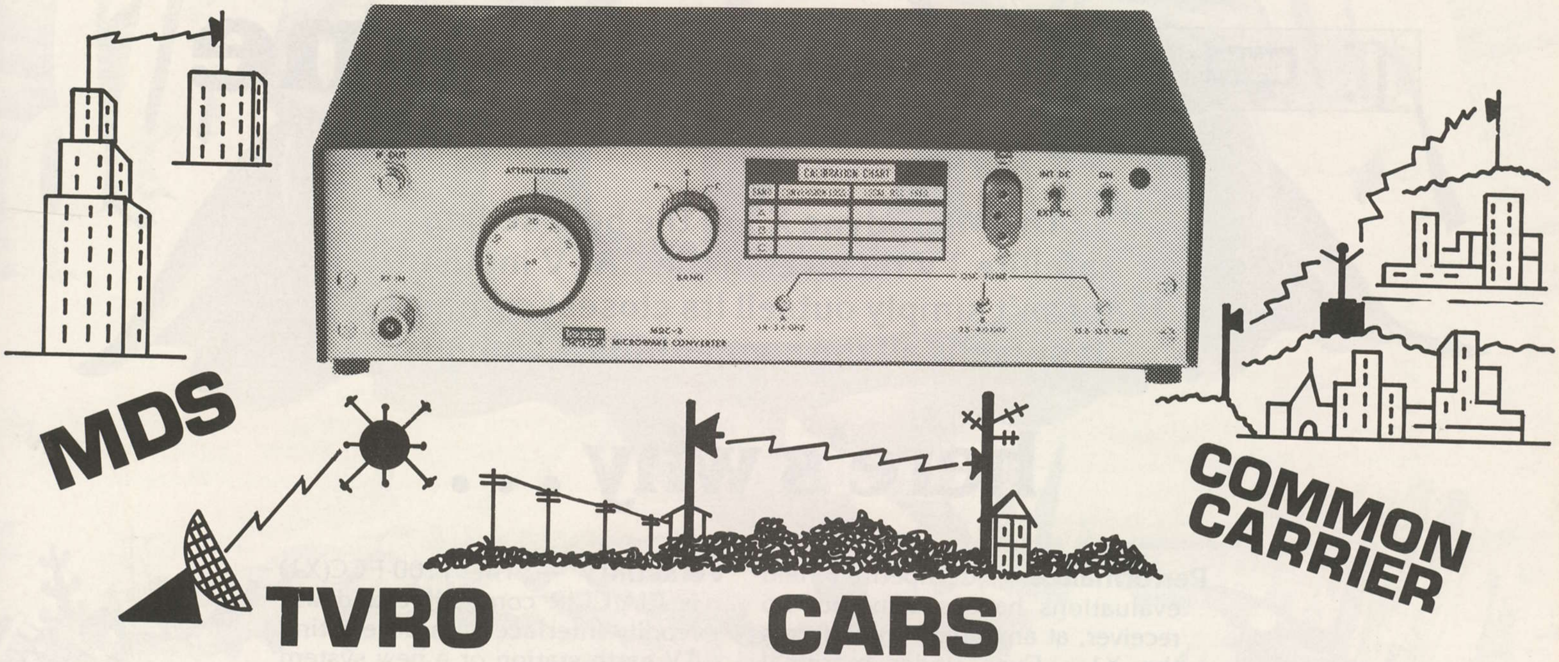

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Versatility — The 1100-FCC(X1) is EIA/CCIR compatible and will readily interface with an existing TV earth station or a new system scheduled for installation. It's the ideal back-up receiver since changing the channel frequency is as simple as one, two, three: 1) Remove front panel plate, 2) Replace crystal, 3) Adjust one control for maximum reading on front panel meter. Anyone can do this in less than two minutes without any special tools or test equipment.

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Check Polarization Discrimination

A LOW COST ROTATION SYSTEM FOR SWITCHING FROM VERTICAL TO HORIZONTAL SATCOM RECEPTION

Increased satellite transponder activity on the vertical side of RCA SATCOM F1 has placed additional demands upon the TVRO operator who formally was barely holding his head above water with the even-side (i.e. horizontal) transponders. An understanding of how the vertical and horizontal transponders interplay and where the TVRO operator must separate them for system carriage is essential as vertical activity increases.

The basics first. RCA manages to create 24 separate transponders (12 on each polarization) by employing a system they call frequency re-use. The domestic satellite downlink frequency band is finite; 500 MHz wide extending from 3.7 to 4.2 GHz (3,700 to 4,200 MHz). With 40 MHz wide downlink channels there is actually only room for **12 simultaneous** downlink transmissions at a time (with a small amount of room for beacon transmissions and guard bands between transponders). The ANIK, WESTAR and many of the earlier Intelsat birds were thus limited to a fully loaded 12 transponder system. RCA (and also Hughes under contract for COMSTAR, the ATT/GT & E satellites) developed a frequency re-use system wherein the 500 MHz band is carved up into **24** separate 40 MHz wide downlink transponders; **12 of which** are connected to **horizontally polarized** transmitting antennas and the other **12 of which** are connected to **vertically polarized** transmitting antennas. The 40 MHz wide channels are actually used twice then; with a 20 MHz frequency offset between vertical and horizontal transponders. On RCA and COMSTAR birds, for example, transponder 1 occupies 3702 to 3738 MHz while transponder 2 occupies 3722 to 3758 MHz. The center frequency for transponder 1 is 3720 MHz and the center frequency for transponder 2 is 3740 MHz **(1)**.

1 - Complete listings of transponder frequencies and other system planning data is included on the CATJ Satellite Wall Chart available through CATJ for $10.00 per copy.

On the ground at the uplink transmitter site all of the even numbered (horizontally polarized) signals are connected to a horizontally polarized feed on the uplink antenna while the odd numbered channels are connected to a vertically polarized feed. Both the vertical and horizontal uplink feeds share a common reflector surface or parabola.

At the receive site (or downlink terminal) your reflector surface (or horn antenna) sees both polarizations equally well. With a parabolic antenna, the reflector skin focuses both to the feed point; either the prime focus feed that mounts out in front of your antenna or via the sub-reflector of a cassegrain antenna to the focal point in the center of your reflector.

The dual-use of the same frequencies by two separate, un-related signals works (i.e. provides service to you without interference between the two sets of signals) because of a very carefully engineered system. Understanding how that system functions is important to all users or would be users of the domestic satellite service.

When RCA first proposed the system to the FCC (at the time RCA tendered their application for licensing of F1) they supplied the Commission with engineering data which indicated they expected to achieve as much as 30 dB of "cross-pole isolation" between the two separate polarizations. What RCA was telling the FCC was simply this: If you viewed their horizontally polarized downlink signal on a vertically polarized receiving antenna, you should see (ideally) a 30 dB reduction of the horizontal signal vis-a-vis the same signal on a horizontally polarized antenna. The 'isolation' offered between the opposite polarizations is called 'cross-pole' protection. The care with which the total system **maintains** the polarization relationship is called 'polarization integrity'.

There were many students of antenna systems who doubted RCA could keep out of trouble with

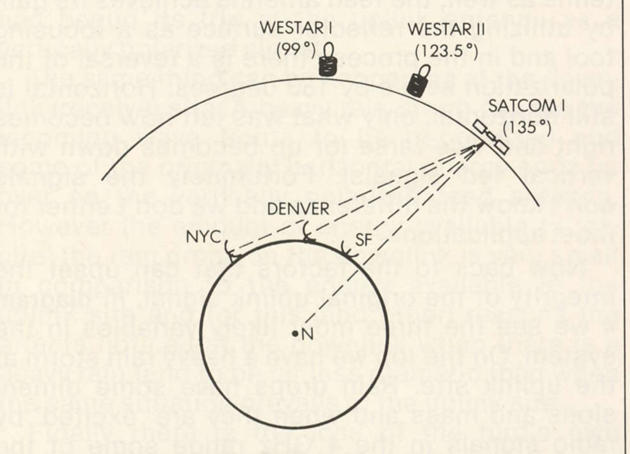


DIAGRAM ONE — LOOK ANGLE (ELEVATION) BETWEEN SATELLITE EQUATORIAL POSITION AND RECEIVE TERMINAL LOCATION.

the system. **Maintaining** a purely linear polarization **from the feed** of the transmit antenna at the uplink **through space** to the receive antenna on the bird (which has the same linear polarization as the uplink signal), then **out from the satellite** on the downlink frequency through a third same-linear polarization antenna and through space back to the receive terminal seemed like a considerable opportunity for error. The uplink (transmit) polarization and the downlink (receive) polarization are within direct human control; they can be changed or 'tuned' at will by people on the ground.

The integrity of the **bird's antenna** are indirectly controlled by telemetering commands from the TT&C station at RCA. One of the 128 sets of data that the bird telemeters to the ground every two seconds includes information on the bird's attitude at any given two second interval. If the attitude moves outside of a prescribed range telemetering initiated at TT&C can activate small rockets that will bring the attitude back to the prescribed window.

The uplink path and the downlink path are, however, beyond human control. When there is a heavy rain storm at either end (or both ends as happens in some situations) the rain drops re-polarize the linear signal by some (measureable) amount and when this happens what left the earth as a horizontal signal may arrive at the bird as a no longer purely horizontal signal. Or vice versa on the return flight back to the receive site.

Thus in the real world there is some opportunity for the integrity of the descrete **(specified)** linear polarization(s) to become unbalanced. But there is more to the integrity of the polarization than the mere chance that it will become unbalanced during flight up or back.

In diagram one we have a top-of-earth down view of the 'system'. The north pole is directly in front of you and surrounding the earth above the equator is the geo-stationary orbit 'belt' at 22,300 miles. Three reference points are identified; New York City on the east, Denver in the middle and San Francisco on the west. The bird of interest is SATCOM F1 at 135 degrees west.

Recall now that the bird has a polarization reference. It is in space and all of the usual reference points (down, up, left and right) are lost to it. So the system designers establish an arbitrary (but workable) reference point for the bird. Noting that it has a measureable longitude (degrees **west** of the prime meridian in our domestic bird case) the bird is 'aligned' due north towards the earth's true north pole. That is, the bird is told that for reference the north pole will be the position on earth which it reckons to. Having established this reference point, the bird may be adjusted (from the ground with telemetering commands) so that the linear polarized transmit and receive antennas are 'square' to that point. And while the north pole cannot actually be seen from the bird (the line of sight path from the bird towards the north stops at about the 80th parallel) the spot on earth where the north pole is situated can be calculated and the bird aligned to that point. When the bird is aligned to its north pole reference point a curious thing happens. It is along that meridian (i.e. north along the 135th longitude line) to the north pole that the bird's signals are either horizontal or vertical; and **only** along that line.

In diagram two we see a simplistic representation of what happens to the polarization when

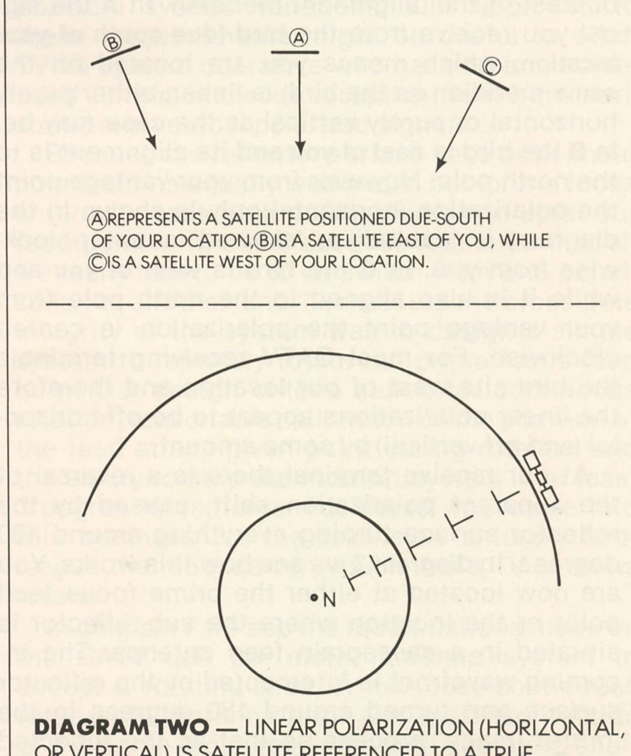


DIAGRAM TWO — LINEAR POLARIZATION (HORIZONTAL, OR VERTICAL) IS SATELLITE REFERENCED TO A TRUE NORTHERLY LEADING FROM ITS LONGITUDINAL LOCATION OVER THE EQUATOR. POLARIZATION "SEEN" BY YOUR TERMINAL VARIES AS BIRD IS EAST OR WEST OF YOUR DUE SOUTH HEADING.

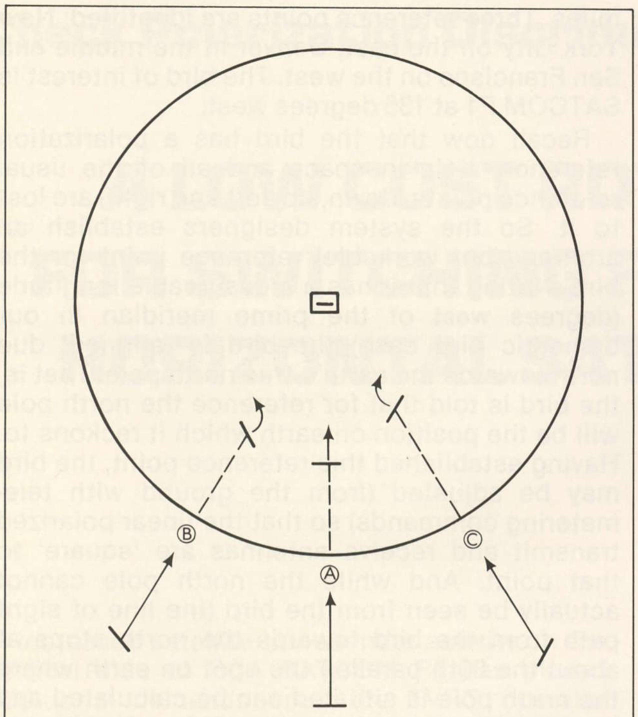


DIAGRAM THREE — SIGNALS FROM WEST SHIFT COUNTER-CLOCKWISE AS VIEWED **AFTER** REFLECTION FROM DISH SURFACE ON **PRIME FOCUS** FEED; CLOCKWISE AFTER REFLECTION IF FROM EAST. CASSEGRAIN FEED ANTENNAS REVERSE POLARIZATION "SENSE" BACK TO INCOMING TWIST-SENSE.

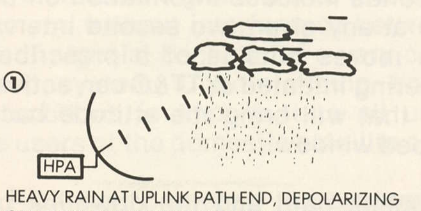
the receive terminal (your TVRO) is either east of or west of the 'alignment meridian. In **A** the signal you receive from the bird **(due south of your location,** which means you are located on the **same** meridian as the bird) is linear; either purely horizontal or purely vertical as the case may be. In **B** the bird is **east of you** and its alignment is to the north pole. However from your vantage point the polarization (horizontal only is shown in the diagram) is 'canted' or 'skewed' counter-clockwise from you. In **C** the bird is **west of you** and while it is also aligned to the north pole from your vantage point the polarization is canted clockwise. For most CATV receiving terminals the bird sits west of our location and therefore the linear polarizations appear to be off-horizontal (and off-vertical) by some amount.

At our receive terminal there is a reversal of the apparent polarization shift, caused by the reflector surface turning everything around 180 degrees. In **diagram 3** we see how this works. You are now located at either the prime focus feed point or the location where the sub-reflector is situated in a cassegrain feed antenna. The incoming wavefront is intercepted by the reflector surface and turned around 180 degrees in the 'mirror image' process so that as the reflected energy converges on the prime focus/sub-reflector point it is now twisted in polarization 180 degrees from its entry onto the reflector surface.

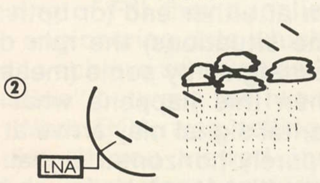
If all of this bothers you, remember that the same thing happens at the uplink or transmit antenna as well; the feed antenna achieves its gain by utilizing the reflector surface as a focusing tool and in the process there is a reversal of the polarization sense by 180 degrees. Horizontal is still horizontal, only what was left now becomes right and vice-verse (or up becomes down with vertical fed signals). Fortunately the signals don't know the difference and we don't either for most applications.

Now back to the factors that can upset the integrity of the original uplink signal. In **diagram 4** we see the three most likely variables in the system. On the top we have a heavy rain storm at the uplink site. Rain drops have some dimensions and mass and when they are 'excited' by radio signals in the 4 GHz range some of the energy from the signal is absorbed by the rain drops. However in the process of absorbing energy the rain drops also re-radiate (as in transmit) some of the energy they intercept. However, being of variable shape and size they often retransmit the intercepted energy in a polarization which bares little resemblence to the polarization which hit the rain drops initially. When you look at a single rain drop you have very little impact on the polarization integrity of the system as a whole. But the cumulative effects of millions (or billions) of rain drops can be considerable. Therefore some of the energy that left the uplink antenna in an (adjusted for longitude) horizontal polarization may arrive at the bird with more of a vertical component than a horizontal component. This more-vertical-than-horizontal energy is seen by the vertically polarized receive antennas on the bird and it is processed through

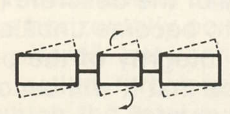
FACTORS INFLUENCING POLARIZATION SENSE

①


HEAVY RAIN AT UPLINK PATH END, DEPOLARIZING OF UPLINK CAUSING LOSS OF CROSS-POLE ISOLATION IN TRANSMISSION TO BIRD.

②


HEAVY RAIN AT RECEIVE TERMINAL PATH END, CAUSING LOSS OF CROSS POLE ISOLATION IN RECEPTION FROM BIRD.

③


LOSS OF "BALANCE" OF BIRD CAUSING BIRD'S DUE-NORTH REFERENCE POINT TO BE LOST, CANTING RECEIVE/TRANSMIT POLARIZATION SENSE.

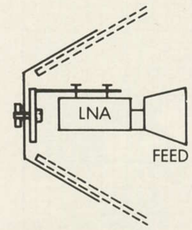
DIAGRAM FOUR

the bird and back out towards earth just as if it had begun its trip at the uplink antenna as a vertically polarized signal.

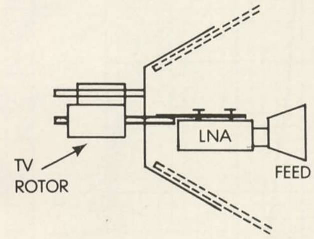
The same thing can be happening at the downlink (receive) site. A heavy rain storm causes the incoming wave fronts to be re-polarized and some of the originally horizontal energy ends up over on the vertically polarized feed antenna. However the amount of energy available to 'excite' the rain drops on the downlink is very small in comparison to the energy available at the uplink site and for this (and other) reasons the effects noticed at the downlink when there is a heavy rain tend to be far less dramatic than when the same situation prevails at the uplink site.

Finally there is the loss of the bird's own "balance" as shown in the third portion of diagram 4. Here the bird gets out of whack with its true north reference point and the receive and transmit antennas on board become 'skewed'. As the CATJ "Satellite Magazine" reports aired in November and December noted (and as covered in the December 1978 issue of CATJ) the chances for this type of error are indeed slim. However the possibility does remain.

For some months at the CATJ Lab we have been making measurements of the 'cross-pole integrity' of the satellite system and attempting to correlate our measured data with both weather variations (at our receive terminal site as well as the uplink sites involved) and other possible system variations. Our approach to these measurements might be useful to other TVRO system operators who have no immediate need for **simultaneous reception** from both horizontal and vertical polarized signals.

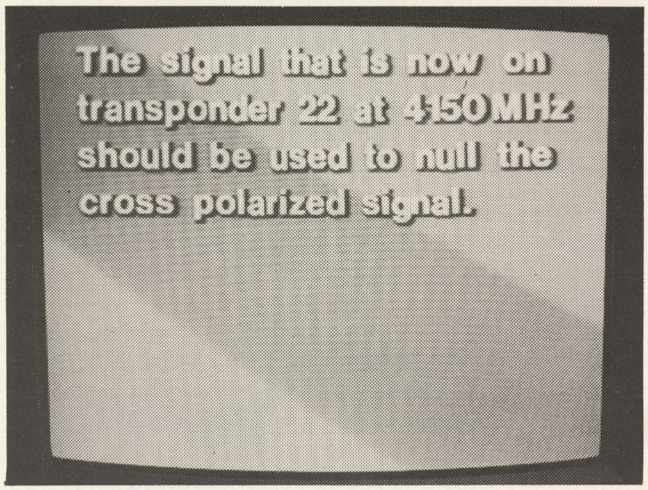


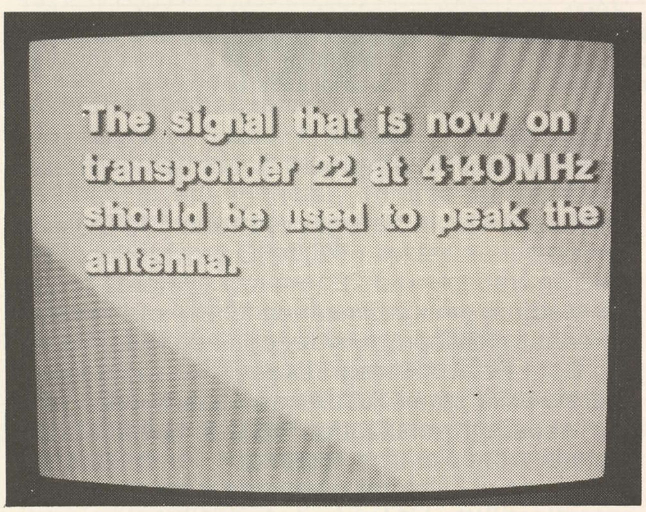
PRIME FOCUS FEED — ON USTC 6 METER PARABOLIC **PRIOR TO** MODIFICATION OF FEED MOUNT



PRIME FOCUS FEED — AFTER MODIFICATION. TV ROTOR (CHANNEL MASTER 9512A) MOUNTS OUTSIDE FEED SUPPORTS. SHAFT (MAST) GOES THRU TO SUPPORT LNA/ FEED MOUNTING PLATE.

DIAGRAM SEVEN

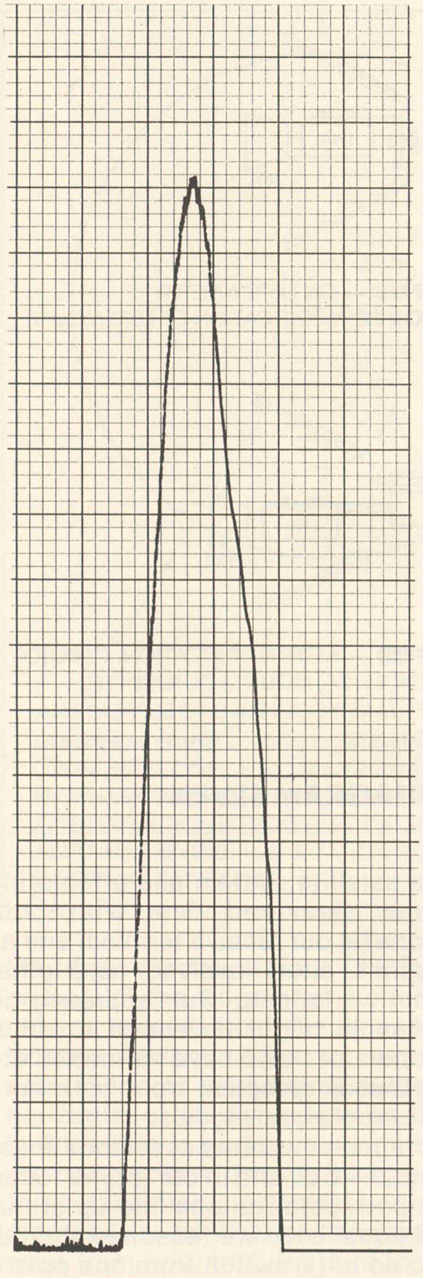




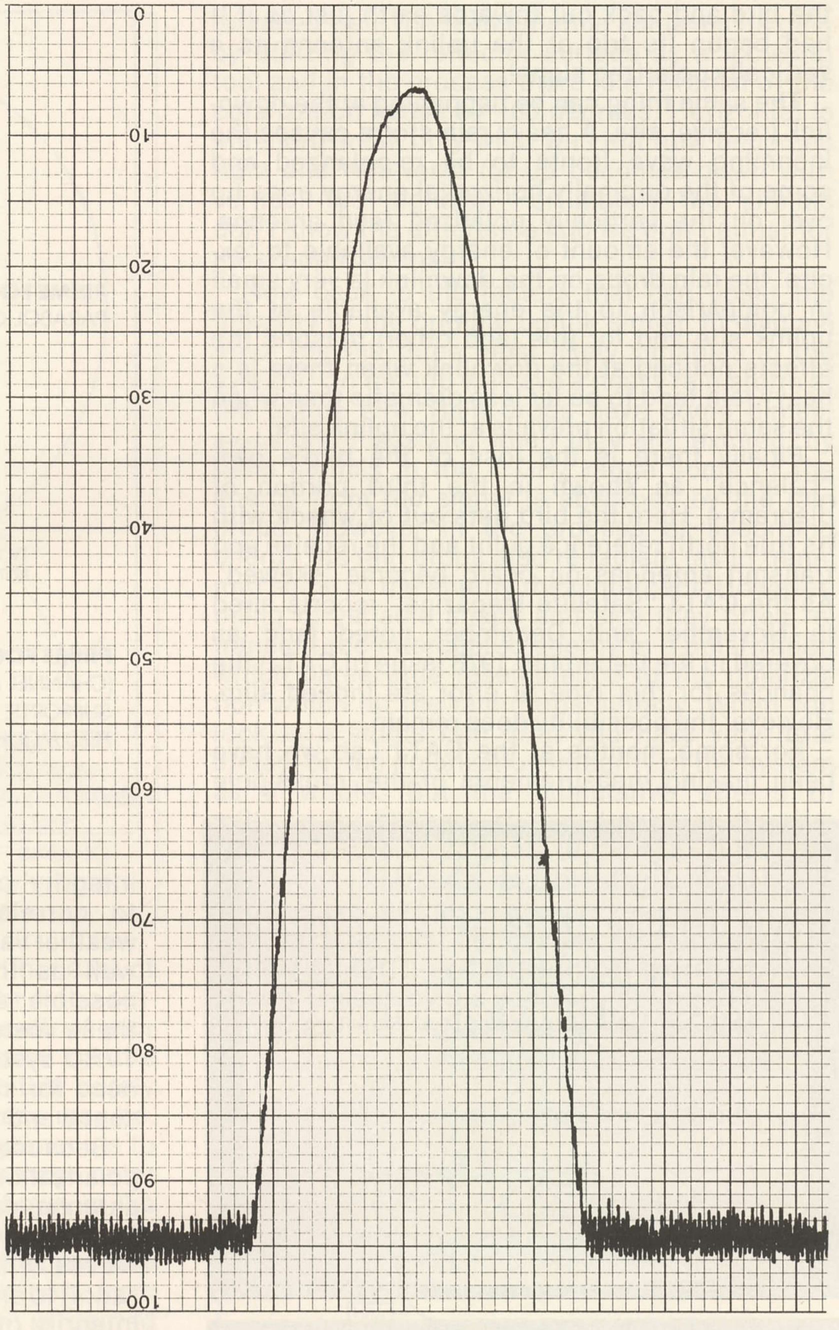
HBO TRANSMITTED visual instructions to systems making the switch on June first allowing adjustment of the cross pole discrimination or null.

Because the reflector surface sees both linear polarizations equally well and in our (prime focus antenna) cases both polarizations end up at our feed point with equal ease we reasoned that all we really had to do to **(1)** switch from one polarization to another, and, **(2)** measure the cross-pole integrity of the system was to design a simple system to remotely rotate the prime focus feed horn. Our design criteria called for continuous rotation, reasonable calibration of the position of the feed at any given point during rotation and the ability to stop the rotation system in at least 3 degree increments. For those who came into this business via the television antenna farm league that sounds very much like a TV antenna rotator.

In **diagram 7** we see the modifications made on the CATJ Lab six meter antenna system to accept a rotating feed. A low cost continuous rotation TV antenna rotor was installed outside of the prime focus feed area with a rotating shaft extending back through the prime focus point where the LNA with feed horn antenna previously mounted. The rotor turns a shaft (piece of pipe) that has the LNA (with attached feed horn) mounted on it. An 18 inch piece of RG-214 cable



CROSS POLE NULL is sharp and well defined as indicated on this chart recording made at CATJ Lab of color bar signal on transponder 20. Signal drops into and out of null very quickly.

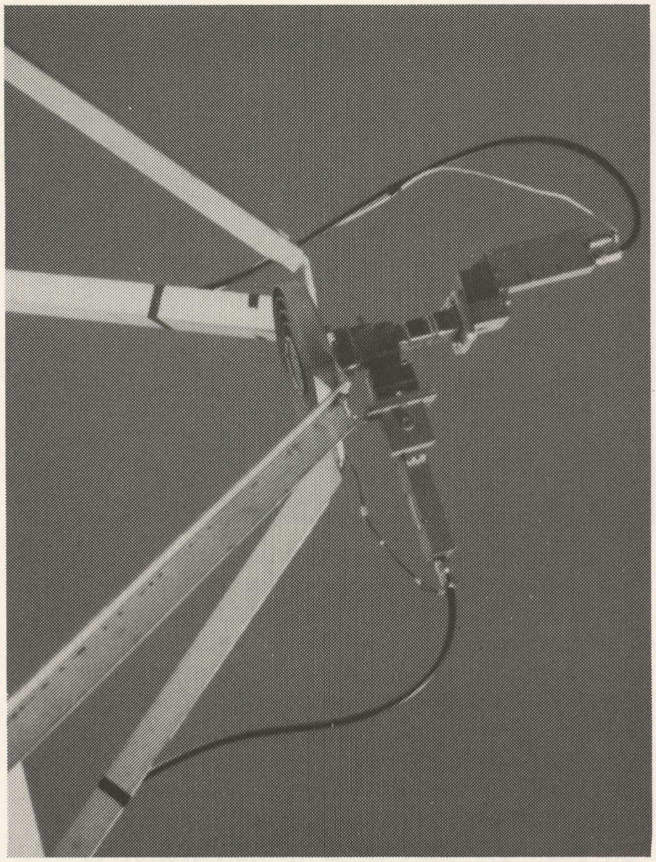


POLARIZATION MATCHING SIGNAL PEAKING is almost exactly twice as broad as cross pole null adjustment. Chart recording made at CATJ Lab using color bar signal on transponder 20. Chart speed identical both cases.

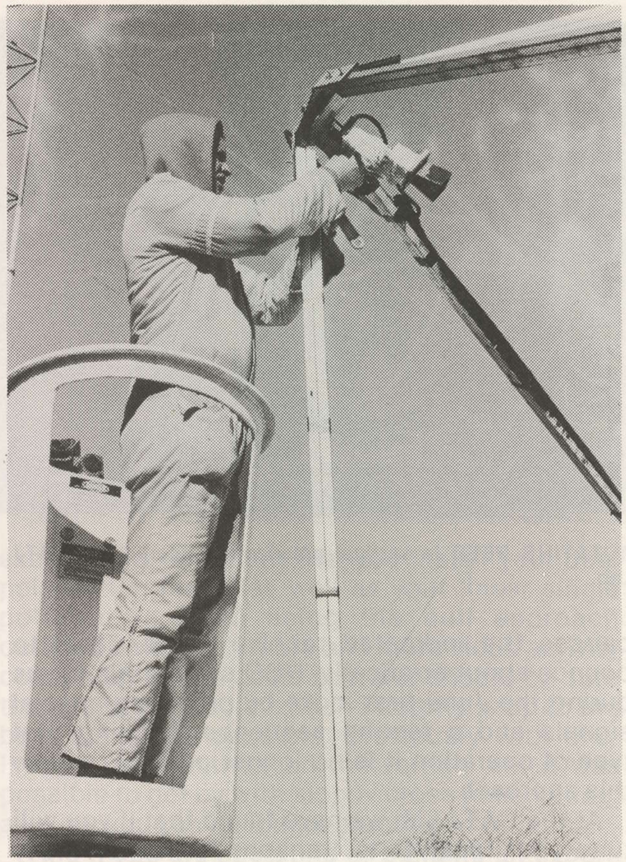
links the LNA output with the 7/8ths downline with sufficient 'play' in the 214 line to allow room for rotation of the LNA/horn.

Obviously such a system has no direct application for **normal** CATV operation since you must 'dedicate' fulltime reception to either horizontal signals, vertical signals or both. For regular CATV applications the answer is a fulltime dual-pole receiving system such as the Microdyne 5 meter antenna system shown here. Fulltime service requires a device known as an orthocoupler at the feed point to create **separate** antenna feed outputs for the two polarizations; and separate LNAs and feedlines to separate receivers. However for test and experimentation purposes the rotating feed described has many applications.

When CATV initially moved from SATCOM F2 to F1 on June 1st (of 1978) HBO provided test signals on transponder 22 to allow systems to properly adjust their polarization 'skew' of their feed antennas. HBO properly recognized that in shifting from F2 at 119 degrees to F1 at 135 degrees there was a small (but measureable) change in the 'apparent polarization' of the new incoming signals from F1. The technique for finding the 'peak' signal level in a given linear polarization is actually a little bit backwards but it turns out to be the best method for insuring the correct matching of your receive antenna's polarization



DUAL-POLE ortho-coupler installed on AFC/Microdyne dish shows typical mounting configuration for commercial dual-feed systems. Twin LNA's are installed, one for each polarization port on the coupler.



INSTALLATION OF ROTATING FEED at CATJ Lab; Lab Director Gayland Bockhahn designed the system which he is installing here.

to the incoming wavefront.

Most CATV feed antennas have a relatively broad pattern. That is, you can rotate the feed through as much as 30 degrees and detect only a very slight change in the **peak** received level. However while the **matching polarization** may be broadly tuned or received with feed antenna alignment, at the same time the null of the cross pole signal is very sharp. It turns out that the null of the opposite polarization is about two times as sharp as the peaking of the matching polarization. With the rotating feed system described here in use at the CATJ Lab we have a method of both measuring and illustrating this point.

In **diagrams 8** and **9** we have respectively a chart recorder plot of the received signal level as the feed is automatically rotated through the **peak** (diagram 8, showing **maximum signal level** as the feed aligns itself with the incoming polarization) and through the cross-pole null (diagram 9). Note that with both charts moving at the same speed (10 inches per minute) and the rotation speed identical in both instances the peak is almost precisely twice as broad (in time) as the null. Which is another way of saying the null is twice as sharp as the peak. It follows then that to have your feed antenna aligned for maximum cross pole rejection (i.e. to insure that transponder 10 does not get into transponder 11, etc.) it is best to tune your receiver measurement system to transponder 11 and **align the feed for minimum signal** from transponder 10. This is basically what HBO had systems do on June first when they provided signals on transponder 22 for set periods of time.

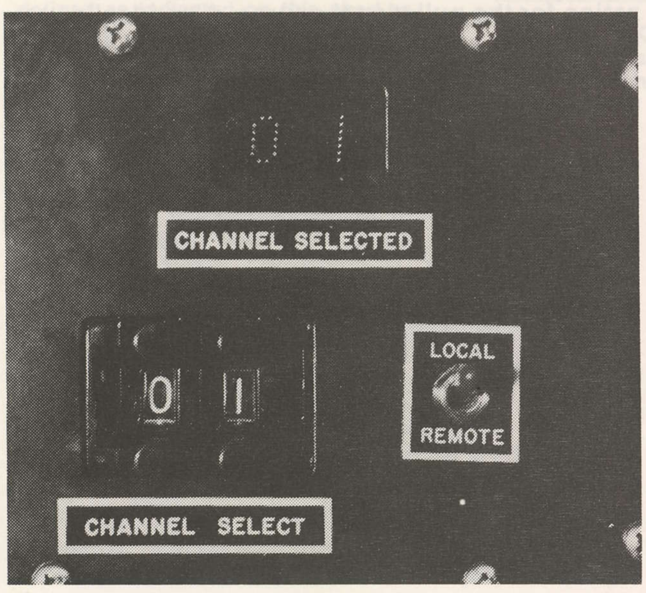
With the transponders filling up at a rapid rate the ability to do this becomes more and more difficult. Ideally you will select a transponder that is not in use on one polarization and go to the adjacent transponder on the opposite polarization for the null-signal-source. Also ideally you would have an unmodulated CW carrier to tune to with your signal level meter or spectrum analyzer since the presence of modulation

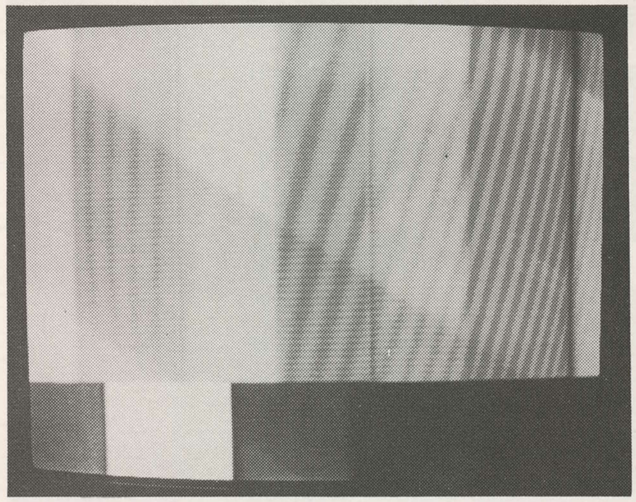
ROTATING FEED in vertical polarization position at CATJ Lab.

causes the indicated receive carrier level to bounce about erratically. HBO solved this for us during the June first move by providing special signals and a testing sequence. Lacking that type of operation it is no longer possible to use this approach.

At the CATJ Lab we have found that if you will tune your receiver to transponder 4 (nominally 3762 to 3798 MHz) you can then use the carrier signal present from transponder 3 (centered at 3760 but with useable sidebands up through 3770 or so) as your null signal source. **Transponder 4 is broken** so it has **no RF through it.** Transponder 3 is WGN in Chicago which at odd times will have color bars running through it (typically around 0600 weekday mornings). By tuning your signal level meter or analyzer to the 60-70 MHz range (on a receiver that has a 70 MHz IF) you can usually find a carrier or two strong enough to register for cross pole adjustment.

Another approach is to tune up to transponder 20 when they are on color bars and connect the



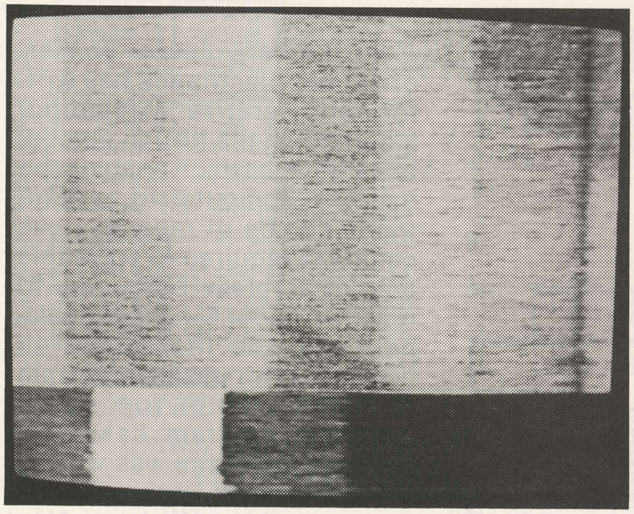
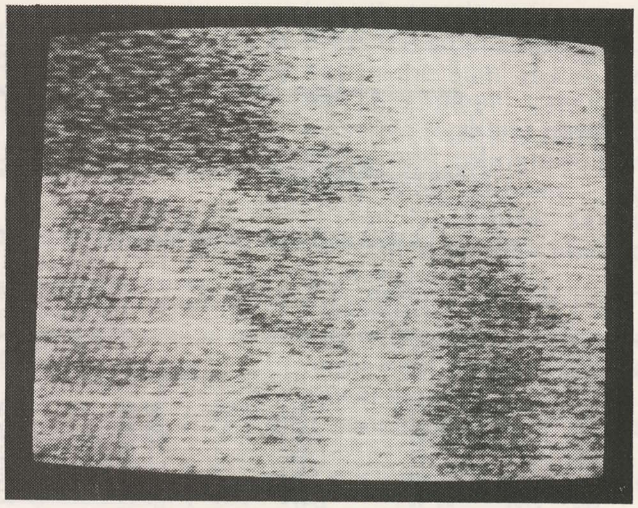


measurement equipment to the vertical port on your feed. Since 19 and 21 both have SCPC and other data on them it is usually quite easy to pick out the big, fat video carrier on 20 as a reference signal (the SCPC and other data carriers tend to be much lower in level).

Some Surprises

As noted this system was initially installed to allow the Lab to conduct some ongoing measurements of the polarization integrity of the F1 (and other) signals as received in Oklahoma. Such tests have produced some unexpected results.

1) The cross-pole check system is a very handy 'remote sensing system' for indications of where heavy rainfall is falling. How's that? Well, with fulltime uplink stations in operation in northern New Jersey (RCA), Virginia (CBN) North Carolina (PTL), Georgia (WTCG), Houston (FANFARE), Wisconsin (WGN), northern California (KTVU), and southern California (Trinity) it is possible to 'calibrate' the system for estimated rates of rainfall as measured in Oklahoma at these remote from Oklahoma locations. **By noting the degradation of the cross pole integrity** (a hard dB number) at any instant a rough idea of the weather at these distant uplink sites is possible.
2) Local weather, at the receive site, we find, has far less to do with cross pole degradation than weather in the vicinity of the uplink.
3) Perceptible degradation of horizontal signals has on occasions been traced to badly degraded cross-pole isolation of a vertical signal on an 'adjacent' transponder; weather is usually the culprit. The ability to check it out is handy since it relieves the mind to know that the degradation is beyond something you can do anything about.
4) Certain transponders 'appear' to lose cross pole integrity faster than others, even when

we are dealing with multiple uplink channels from a single uplink site. One example of this is SHOWTIME's transponder 12 which almost without fail is the first to lose polarization integrity when it starts to rain hard in northern New Jersey. From our limited observations 12 becomes harder and harder to null much sooner than the others originating at Vernon Valley and under extremely heavy rain it is impossible to totally null in Oklahoma. We have no explanation for this and pass it along merely because it has been observed on a repeatable basis.

Conclusion

If you have recently added or will be adding dual-pole receiving capability at your TVRO site perhaps this discussion will equip you to better understand the rules of the game. A dual pole antenna improperly installed will allow cross pole signals to creep into the cable 'picture'. It is exceedingly important that you install your dual polarization feeds (as well as your linear single polarization feed) using the null approach outlined here. With more and more video activity coming up F1 the cable operator should be sure that his system polarization integrity is up to the best standards possible. Previously with only limited video activity on the vertical set it was possible to get by with sloppy cross pole nulling; a luxury you can no longer practice.

And if you are operating or building an experimental terminal the information here suggests that most terminals can be equipped with a rotating feed system for very few bucks. Arguments could also be made for equipping dual-pole feeds with a rotation system since the low cost of the additional equipment required (less than $50 typically) would quickly wash out with the ease by which system operation personnel could 'tweek' the cross pole null from time to time and insure that the feeds were properly discriminating against the opposite polarization signal(s).

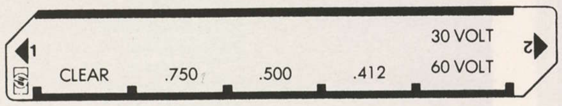
More Fun For HP-97 Owners

CATV SYSTEM POWER DESIGN

Traditionally, power design for CATV systems has been performed using rules of thumb which lead to inaccuracies and inefficiencies. The calculations required for accurate power design can be complex and tedious, particularly where switching (regulated) power units are used in the CATV amplifiers. These units draw **constant power** from the cable, **increasing current drain** to compensate for decreasing voltage.

Richard Covell[1] of GTE Sylvania has written that **"...(This) characteristic... has caused some system designers to run in circles and bay at the moon!"**

Frank A. Himsl
Supervisor, Planning Department
York Cablevision Limited
Don Mills, Ontario M3A 3L9



LABELLING FOR HP-97 MAGNETIC CARD

```
001  *LBLA      21 11
002   CLRG      16-53
003      1         01
004      0         00
005   STOI      35 46
006   GTO7      22 07
007  *LBL9      21 09
008   ST+i   35-55 45
009     R↓        -31
010   DSP1     -63 01
011   PRTX        -14
012   DSP6     -63 06
013    EEX        -23
014      5         05
015      ÷        -24
016    RND      16 24
017   ST+i   35-55 45
018     R↓        -31
019   DSP1     -63 01
020   PRTX        -14
021   DSP3     -63 03
022    EEX        -23
023      2         02
024      ÷        -24
025    RND      16 24
026   ST+i   35-55 45
027  *LBL7      21 07
028      1         01
029      1         01
030   DSP0     -63 00
031   RCLI      36 46
032      -        -45
033   STOA      35 11
034    R/S         51
035  *LBL0      21 00
036      ×        -35
037   DSP0     -63 00
038    RND      16 24
039   DSZI   16 25 46
040   GTO9      22 09
041      0         00
042    1/X         52
043  *LBLe   21 16 15
044      3         03
045      0         00
046   STOC      35 13
047   GTOa   22 16 11
048  *LBLE      21 15
049      6         06
050      0         00
051   STOC      35 13
052  *LBLa   21 16 11
053    P⇄S      16-51
054   STO0      35 00
055      .        -62
056      0         00
057      1         01
058   STO3      35 03
059      .        -62
060      0         00
061      0         00
062      5         05
063   STOB      35 12
064    EEX        -23
065      3         03
066   STO4      35 04
067   STO7      35 07
068      1         01
069      0         00
070   STO6      35 06
071  *LBL2      21 02
072   RCL0      36 00
073   STO9      35 09
074      0         00
075   STO8      35 08
076      9         09
077   STOI      35 46
078  *LBL3      21 03
079    P⇄S      16-51
080   RCLi      36 45
081    P⇄S      16-51
082   STO1      35 01
083   X=0?      16-43
084   GTO4      22 04
085    FRC      16 44
086   RCL4      36 04
087      ×        -35
088   STO2      35 02
089    FRC      16 44
090   RCL3      36 03
091      ÷        -24
092   ST+8   35-55 08
093   RCL2      36 02
094    INT      16 34
095   RCL6      36 06
096      ÷        -24
097   RCL9      36 09
098      ÷        -24
099   ST+8   35-55 08
100   RCL1      36 01
101    INT      16 34
102   RCL4      36 04
103      ÷        -24
104   RCL8      36 08
105      ×        -35
106   ST+9   35-55 09
107   DSZI   16 25 46
108   GTO3      22 03
109  *LBL4      21 04
110   RCL9      36 09
111   RCLC      36 13
112      -        -45
113   RCLB      36 12
114   X>Y?      16-34
115   GTO5      22 05
116     R↓        -31
117   ST-0   35-45 00
118   RCL7      36 07
119      -        -45
120   X>0?      16-44
121   GTOd   22 16 14
122   RCL7      36 07
123      +        -55
124   STO7      35 07
125   GTO2      22 02
126  *LBL5      21 05
127    SPC      16-11
128   RCL9      36 09
129   DSP2     -63 02
130   PRTX        -14
131   RCL0      36 00
132   PRTX        -14
133   RCL8      36 08
134   PRTX        -14
135    P⇄S      16-51
136  *LBL8      21 08
137    SPC      16-11
138    SPC      16-11
139    SPC      16-11
140    SPC      16-11
141    SPC      16-11
142    SPC      16-11
143    RTN         24
144  *LBLd   21 16 14
145    P⇄S      16-51
146    CLX        -51
147   DSP9     -63 09
148   PRTX        -14
149   DSP0     -63 00
150   GTO8      22 08
151  *LBLB      21 12
152   GSB1      23 01
153      .        -62
154      7         07
155      5         05
156      +        -55
157   PRTX        -14
158    INT      16 34
159      .        -62
160      6         06
161      6         06
162   GTO0      22 00
163  *LBLC      21 13
164   GSB1      23 01
165      .        -62
166      5         05
167      +        -55
168   PRTX        -14
169    INT      16 34
170      1         01
171      .        -62
172      4         04
173   GTO0      22 00
174  *LBLD      21 14
175   GSB1      23 01
176      .        -62
177      4         04
178      1         01
179      2         02
180      +        -55
181   PRTX        -14
182    INT      16 34
183      2         02
184      .        -62
185      2         02
186      2         02
187   GTO0      22 00
188  *LBL1      21 01
189   RCLA      36 11
190    SPC      16-11
191   PRTX        -14
192     R↓        -31
193    INT      16 34
194   DSP3     -63 03
195    RTN         24
```

Fortunately, Jacob Shekel[2] of Jerrold Electronics has written an iterative (repeating) algorithm in the fortran computer language which enables the use of a computer to perform the hundreds of repetitive calculations required to solve this type of problem. I urge you to read his paper for a full explanation of the theory and algorithm. With assistance from Al Kuolas, also of York Cablevision, a program based on Shekel's algorithm was written for the Hewlett-Packard **HP-97** programmable calculator. Also Dick Covell made several valuable suggestions which have been incorporated into the program. With a slight amount of translation, the program **will work** with the **HP-67**, the non-printing version of the HP-97.

The program also permits calculations using series regulated power supplies which draw constant current (independent of input voltage) or a mixture of both types of power units.

Program Operation

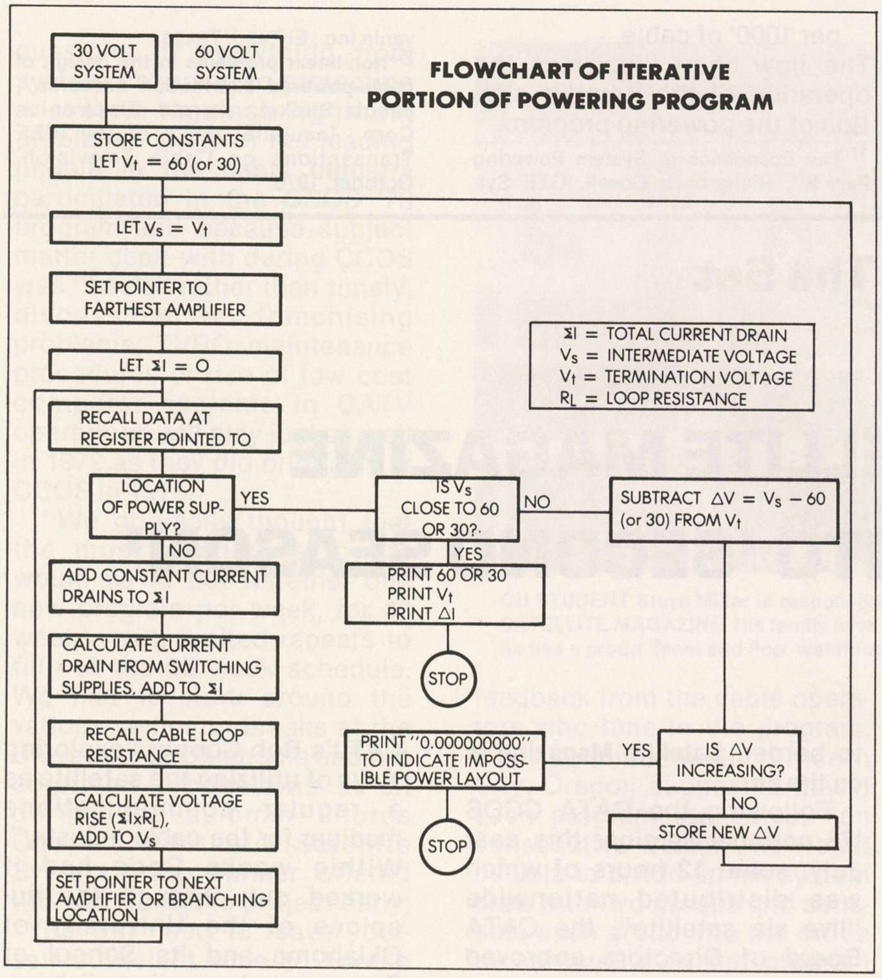
From the listing provided, key the program into your machine, record it on a magnetic card labelled as shown.

1) **Press** [A] to clear the machine memories. "1" will be displayed, indicating that the first set of data may now be entered.

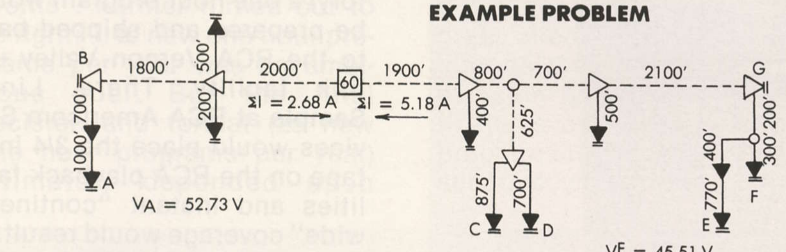
2) **After** examination of the CATV layout to be powered, select a **tentative** power supply location and power block points. Your ability to choose suitable locations will improve with practice using the program.

3) **Starting** at a power block and **working toward** the power supply location, at each location (node) where an amplifier or a splitter or directional coupler is located.

4) **Key** in the sum of the **power** (in watts) consumed by switching regulator powered amplifiers (constant power) **plus** power consumed by similar ampli-



EXAMPLE PROBLEM



LEGEND

▶ CONSTANT CURRENT LINE EXTENDER – DRAIN = 0.4 AMPS

▷ SWITCHING REGULATOR POWERED TRUNK STATION – POWER DRAIN = 30 WATTS

-------- .750" CABLE – LOOP RESISTANCE = 0.66 OHMS/1000 FT.

———— .412" CABLE – LOOP RESISTANCE = 2.22 OHMS/1000 FT.

---[60]--- 60 VOLT CATV POWER SUPPLY

KEYSTROKE SEQUENCE TO SOLVE FOR V_A:

	A					
0	ENT	0.4	ENT	1000	D	
0	ENT	0.4	ENT	700	D	
30	ENT	0	ENT	1800	B	
30	ENT	0.8	ENT	2000	B	
	E					

OUTPUT:

POWER SUPPLY VOLTAGE = 60.00
V_A = 52.73
ΣI = 2.68
(EXECUTION TIME: 41 SECONDS)

KEYSTROKE SEQUENCE TO SOLVE FOR V_E:

	A				
0	ENT	0.4	ENT	770	D
0	ENT	0.4	ENT	400	D
0	ENT	0.4	ENT	200	D
30	ENT	0	ENT	2100	B
30	ENT	0.4	ENT	700	B
30	ENT	0.8	ENT	800	B
30	ENT	0.4	ENT	1900	B
	E				

OUTPUT:

POWER SUPPLY VOLTAGE = 60.00
V_E = 45.51
ΣI = 5.18
(EXECUTION TIME: 82 SECONDS)

fiers on side-branches fed from that node.

5) **Press** the enter key: [Ent]
6) **Key** in the sum of the **current** (in amperes) consumed by series regulator powered amplifiers (constant current) **plus** current consumed by similar amplifiers on side-branches fed from that node
7) **Press** [Ent]
8) **Key** in the footage of cable to the next node toward the power supply
9) **If** the cable is **.750"**, press [B]
10) **If** the cable is **.500"**, press [C]
11) **If** the cable is **.412"**, press [D]

The input data will be printed similar to this example:

1 ← Number of node
Cable footage → 1500.
750 Cable type
1.5 ← Constant current draw
30.0 ← Constant power consumption

12) **After** the number of the next node is displayed, repeat steps 4 through 11 until all data has been entered. (N.B. a **maximum** of **9 nodes** may be keyed into the machine).
13) **For** 60 volt systems, press [E]; for 30 volt systems, press [f][E]

If the design selected cannot function, "0.000000" will be printed; otherwise, output similar to the following will be printed after 1 to 3 minutes of calculation:

60.00 ← Power supply voltage
56.96 ← Voltage at power block
2.55 ← Total current drain from power supply

If the current drain is excessive for the power supply used or if the voltage is lower than the minimum specified for the amplifier by the manufacturer, a new design must be tried.

In order to **change** the program to use the **loop resistances** for the type of cables used in **your** system, follow these steps:

To change the .750 loop resistance, **delete** steps 159 to 161 and **insert** the resistance per 1000' of cable.

To change the .500 loop resistance, **delete** steps 170 to 172 and **insert** the resistance per 1000' of cable.

To change the .412 loop resistance, **delete** steps 183 to 186 and **insert** the resistance per 1000' of cable.

The flow chart illustrates the operation of the iterative section of the powering program.

[1]"**The Economics of System Powering Part II**", Richard G. Covell, GTE Sylvania Inc., El Paso, Texas.

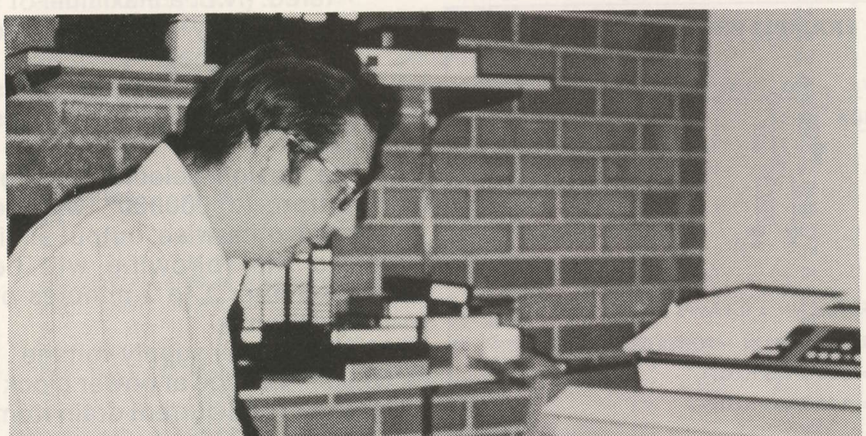
[2]"**Non-linear problems in the design of cable-powered distribution networks**", Jacob Shekel, Jerrold Electronics Corp., Inaugural Issue of the IEEE Transactions on Cable Television, October, 1976.

Fun and Games On The Set

SATELLITE MAGAZINE HEADS INTO 'SECOND SEASON'

On Thursdays at 12 noon the color bars normally found on SATCOM F1 transponder 24 fade down and a one hour tape produced by CATA and CATJ magazine fills the screen at hundreds of cable systems from coast to coast and border to border. **Satellite Magazine is on the air.**

Following the CATA CCOS '78 national seminar this past July, some 12 hours of which was distributed nationwide "live via satellite", the CATA Board of Directors approved CATJ's Bob Cooper "exploring ways of utilizing the satellite as a regular communications medium for the cable industry". Within weeks Coop had it worked out; through the auspices of the University of Oklahoma and its School of Broadcast Journalism (laboratory) a one hour program would be prepared and shipped back to the RCA Vernon Valley uplink facility. There, Linda Sample at RCA Americom Services would place the 3/4 inch tape on the RCA playback facilities and instant "continent-wide" coverage would result.



COOP in editing. Largest portion of program is videotapes prepared outside of OU studio. Tapes are dubbed to 1/2 inch for Coop's convenience in pre-production planning but program is done totally on 3/4 inch format at OU.

The CATA Board placed a number of constraints on the project; primarily monetary. First of all there would be **no CATA budget** for the project in 1978 and the earliest review for 1979 would be the July CCOS '79 Board meeting. That left Cooper on his own for the first year; the project had CATA approval but no CATA budget.

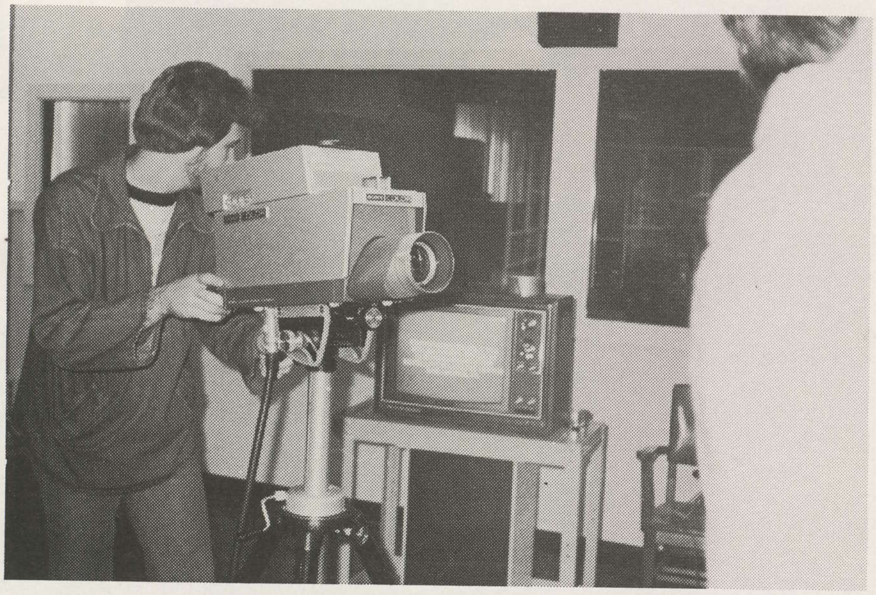
Satellite Magazine started out with a resource that may ultimately prove to be very valuable; approximately 19 hours of 3/4 inch color videotapes produced during the CCOS '78. Some of these tapes are of excellent quality; both in their production and in the content material. Topics available include excellent industry discussions of everything from system financing to protecting a system against lightning problems. Many of the leading people in the cable industry participated in the CCOS '78 program and because subject matter dealt with during CCOS was "basic" rather than timely, discussions on franchising problems, TVRO maintenance procedures or use of low cost computer systems in CATV operations will play just as well in 1979 as they did originally at CCOS in 1978.

"We originally thought that the most productive format would be to put together one new program per week, for 40 weeks, with limited repeats to fill out the 52 week schedule. We had to work around the various semester breaks at the University of Oklahoma and not count on productions at all during the summer" notes Cooper. Southern Satellite System's **Kip Farmer** offered this advice to the project early; "You will need to leave yourself sufficient time to handle field trips for taping at various events". Farmer turned out to be right. . .40 new one hour programs per year was an ambitious goal. But the final decision and format (25 new one hour programs per year) ultimately depended upon

OU STUDENT Steve Miller is responsible for much of studio camera work seen on SATELLITE MAGAZINE. His family lives in an Oklahoma town with HBO service and he has a proud 'Mom and Pop' watching the show he works on every Thursday!

feedback from the cable operators who tune in the program. **Carl Schmauder** in Lincoln City, Oregon suggested that if each program ran twice, "on consecutive weeks", he would be able to divide up his system crew into two groups and schedule each group into the office to participate in the program "without shutting the system down" for the one hour the program aires. Dozens of similar suggestions made the final decision and the format that finally evolved calls for each program running twice, on consecutive weeks for the most part.

The plan called for three separate types of material to be 'edited together' to form the one hour program. **First** there are the CCOS '78 tapes, 19 hours total. **Next,** Cooper asked the cable industry to "contribute materials to Satellite Magazine"; suggesting that state and regional cable meetings could arrange for color videotaping of the highlights of their meetings. Many cable operators have portable 3/4 inch equipment and coverage of internal industry meetings seemed a natural for the project.



PENN CLINE started out in broadcasting while in high school where his community had a local TV production center; Penn handles production recording and post production editing.

Third, for special events coverage Cooper would head "into the field" to bring raw video tape footage back to Oklahoma. **"Such trips have to be very productive and someone has got to agree to assist with the equipment required".** To date the 'Satellite Magazine' project has no 3/4 inch tape gear of its own. Nor a camera (etc.). The first 'field trip' was an early October visit to the RCA uplink facility in Vernon Valley. "Out of a one day visit we came away with around two hours of edited-form video tape" notes Cooper "and that gave us enough material for two separate 'Satellite Magazine' programs". Those programs, which explored in great depth the operation of

Somewhere in this picture there's a trouble shooter aimed straight at you.

You'll find an HBO regional manager, a real life original of the people in this picture, right near your market.

They understand your home territory because it's their home territory too.

If you're not an HBO affiliate, they're the people to contact. They'll explain exactly how profitable HBO can be to you. And handle all the details when you're convinced.

They can work with you personally to develop a launch marketing campaign customized to your needs. They can hold orientation sessions to familiarize you and your staff with HBO service. And they'll personally do all they can to help you launch HBO in your system.

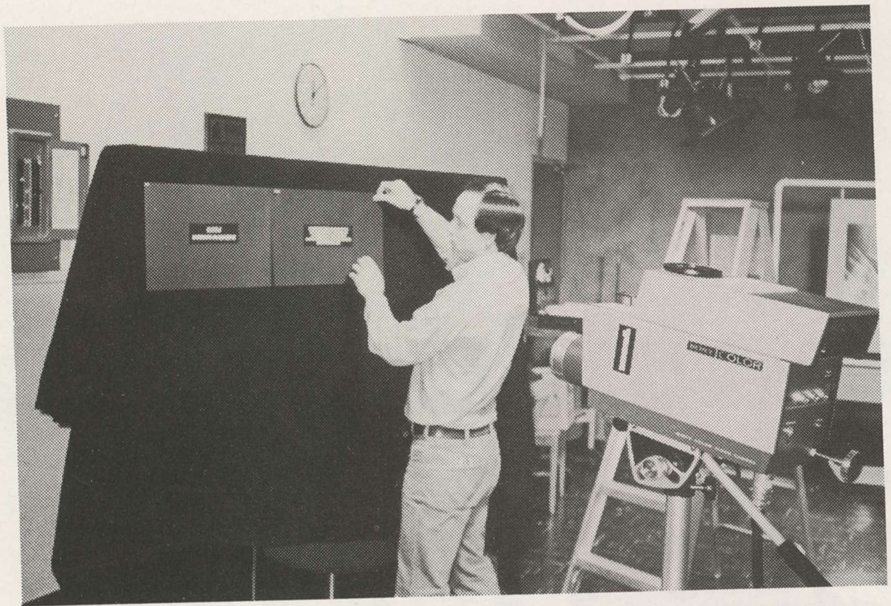
If you're already an affiliate, you know that these people can help you with on-going marketing programs to enlarge your subscriber base and increase your profits.

They're on our payroll, but they work for you.

Call one of our eager-to-help VP/General Managers:
Peter Frame (212) JU6-1212; Bill Hooks (214) 387-8557;
Don Anderson (415) 982-5000.

HBO

You know us. We know you.



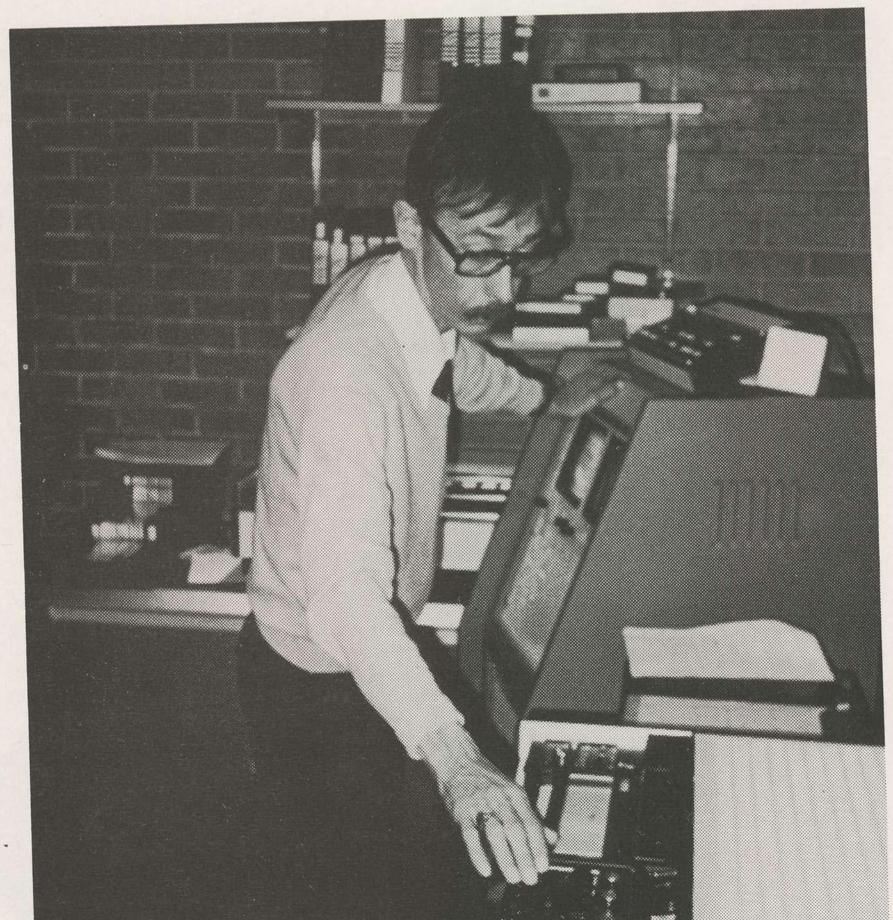
CATJ's Gayland Bockhahn sets up the 'title board' for opening sequence in SATELLITE MAGAZINE. Gayland also is responsible for operation of CATJ TAPE TIME library system and CATJ KIT KORNER projects.

the RCA uplink system as well as the 'rumors' concerning the 'health' of SATCOM birds (see **CATJ** for **December, 1978**) were broadcast during late November and early December. "RCA very kindly arranged to have a package of equipment and a man to run it on hand at Vernon Valley for our visit and that made it possible for us to prepare that documentary for the industry" adds Cooper.

During the early December Western Cable Television Show in Anaheim a similar 'arrangement' allowed 'Satellite Magazine' to videotape several hours of interviews and small group discussions during the course of the show. "I have found many of the suppliers in the industry very anxious to help us with this project; in particular at Anaheim **Abe Sonnenschein** of **Hughes Microwave Communication Products** saw to it that we had a 3/4 inch tape deck and camera available and Hughes made room for us in their Anaheim booth to do the taping". At the same Western Show **John Sie** of **SHOWTIME Entertainment** arranged to provide a dedicated 3/4 inch playback deck and a monitor where attendees could stop by the SHOWTIME booth and view either or both of the first two 'Satellite Magazine' broadcasts. Many cable people who had been aware of the weekly satellite fed program but who had not seen it got their first exposure there.

Ultimately 'Satellite Magazine' must be self sustaining with direct advertising support from the cable industry suppliers. "We began with an advertising commitment from **Ed Taylor's Southern Satellite Systems;** and this commitment allows us to pay the cost of the one hour per week on a break even basis as far as transponder time is concerned". CATA's CATJ provides the people (Debbie Teel, Gayland Bockhahn and Cooper) on a 'no charge basis' to the project. One time costs such as blank tape, the 'set' for the production and other incidentals have been shared by CATA and CATJ.

"When CCOS was telecast last July there were approximately 525 cable systems equipped to receive the telecasts" recalls CATA President Ben Campbell. **"That number is**



OU's resident Groucho Marx. Director of the Broadcast Journalism Laboratory is Dave Davis, a veteran of commercial TV production and news. Davis believes OU broadcast journalism students are developing better feel for 'real world' by working on the SATELLITE MAGAZINE project.

now past 800 and before the NCTA meeting in May it will pass 1,000 systems. We anticipate fully one third of our CATA member systems (some 675 now) **will be equipped to receive the weekly 'Satellite Magazine' program before CCOS '79''.**

Satellite Magazine editor Bob Cooper has been attempting to encourage cable systems to become involved in the project. "There are two areas where they can contribute. One, if we had a file here of those systems with 3/4 inch color porta-pak capability (or alternately, a transportable color camera and 3/4 inch record deck), this would be very helpful in arranging possible 'shoots'. I would like to visit various areas of the country to do special reports for Satellite Magazine but not having our own equipment limits where we can go to do reports. Secondly, in addition to covering some of the highlights of state and regional meetings for editorial consideration for Satellite Magazine, I know there is creative local origination going on out there which the whole industry could benefit by seeing on Satellite Magazine. Systems that are doing what they consider to be innovative local origination should arrange for us to see a (3/4 inch) dub of their work. If we like what we see, we'll share it through Satellite Magazine".

The University of Oklahoma School of Broadcast Journalism originally agreed to the project on a 'trial basis' to produce four programs during November and early December. These four 'pilot programs' were to be evaluated before a decision could be made to continue the series through the Spring semester. "We very much liked the concept of allowing some of our more advanced students work in a real work program" says **Dave Davis,** Coordinator of the **Broadcast Journalism Laboratories** at OU. "Our Lab is adequate for our own teaching and learning exercises but we were concerned that it might not be adequate for something like this". The first four programs were put together without benefit of many of the basic tools most of the more sophisticated CATV system local origination facilities take for granted. 'Tools' such as a time base corrector or an alpha-numeric generator were simply not available at OU. "I believe we will be able to repay the cooperation of OU by going into the supplier segment of this industry and obtaining the loan of some additional production equipment" adds

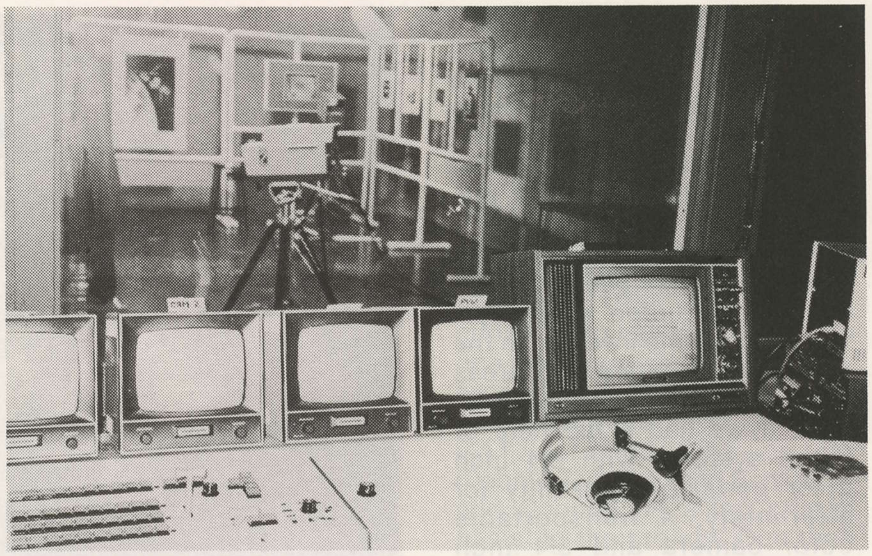
THE STUDIO. Most of the equipment for production is either SONY or Telemation. Photos hung on set vary from week to week to suit the subject matter covered in a particular SATELLITE MAGAZINE.

CLASSY-CAT advertising is handled as a no-charge membership service of and by CATA. The rules are as follows:

1) **Any member of CATA** (member-system, Associate member, individual member) qualifies for CLASSY-CAT advertising space free of any charge (limit 50 words/numbers per issue);
2) **Member-systems** pay regular dues to CATA on a monthly basis; Associate members pay a one time annual fee; "Individual" members pay a one time annual fee of $25.00 per year.
3) **CLASSY-CAT advertising is also available** to **non**-members at the following rates: **50 cents per word** with a minimum per insertion of $20.00. A charge of $2.00 per insertion is made for blind-box numbers or reply service.
4) **Deadlines** are the 15th of each month for the following month's issue.
5) **Terms** for non-members is **full payment with order** (no invoicing).
6) **Address** all CLASSY-CAT material to: CLASSY-CAT Advertising, CATJ, Suite 106, 4209 NW 23rd Oklahoma City, Ok. 73107.

Cooper "for use at the University". Several companies manufacturing production equipment have agreed to make available several needed pieces of equipment, as a loan to CATA and the University and consequently the technical capabilities of the production of Satellite Magazine will improve during 1979.

The big hurdle remaining is advertising support **within** the program itself. "We originally felt that we could probably 'afford' to sell as much as 12 minutes of the hour for commercial time" notes CATA President Ben Campbell. "The income from that commercial time will go directly into the production of the program itself. Just picking up the tab to send Cooper on a trip to bring back a report is a hurdle today when there is no budget for such things." The biggest hurdle with the advertising support seems to be the lack of familiarity with the creation of television commercial messages on the part of the suppliers. One large company, very interested in backing the project, found no difficulty allocating a few hundred dollars a week for the purchase of the commercial time. But then when the marketing VP went to their advertising agency with a request for quotation of the **costs** associated with **producing a set of two minute commercials** he was totally unprepared for the response. '$20,000 for six commercials' was the response. The advertising agency treated the request like any other client request. . .it priced out the package using commercial talent, commercial studio time and professional production facilities. To the agency's manner of thinking, 12 'original minutes' artfully done on videotape was alot of 'value' for a paltry $20,000. The CATV marketing VP still shakes his head over that one.



THE SET from the control room. Bockhahn constructed the 'open frame' PVC set based upon suggestion of OU Broadcast Journalism Lab Director Dave Davis. Format makes for very easily stored set with great deal of flexibility in week to week operation.

"There may be another way to do this" suggests Cooper. "One that makes use of the talent we have right here in the CATV industry. I have suggestd to several suppliers interested in supporting this program, and getting the exposure that television advertising can uniquely do for them, that they look around the cable TV systems within 50-100 miles of their plant. They might find a system with lots of local origination know-how and a sharp local producer who could do the job of producing some custom video commercials for them for a whole lot less bucks than the commercial shops want". Cable LO people have grown up on lean budgets (if in fact they have any budget!) and they know how to stretch the production dollar further than anyone else in video today.

Satellite Magazine has been dubbed 'a noble experiment' by those people working on the project. It has provided the cable industry with an opportunity to 'talk within the industry' using the one medium that we should have been using all along; television. The satellite distribution of the programming has made it possible for hundreds of cable systems and thousands of cable people to participate in the program. We hope your system will join those already participating.

EARTH STATION SITE ENGINEERING vs. SECURITY FENCES AND OTHER LOCAL BLOCKAGE

Earth Station Site Engineering

One problem that is likely to occur in earth station engineering concerns the distance the antenna must be located from a security fence to avoid signal blockage. Because the installation of chain link fence is expensive, it is worth a few minutes of calculation time to minimize the fence size.

Before the calculations are undertaken, a certain amount of raw data must be gathered. That data includes the dimensions of the antenna, the height of the security fence, the desired orientation of the fence and, of course, the antenna azimuth and elevation angles over the entire range of potential operation for the location of the selected sites (see **figure 1**).

Antenna data is obtained from the antenna manufacturer while the site location generally dictates the most desirable fence orientation. Perhaps the best way to proceed is to consider a specific case and perform the necessary calculations. Therefore, assume the following:

1. **7-foot tall** chain link fence
2. Scientific Atlanta's **5-meter** antenna
3. Location, azimuth and elevation **data** as shown in **figure 1**.

The worst case situation (farthest distance from fence for beam clearance) will occur at the **lowest elevation angle.** Figure 1 shows that angle is 23.58° at 241.39° azimuth. Geometrically the situation will appear as shown in **figure 2.**

Figure 2 shows the antenna at an elevation angle of θ = 23.58°. Notice that θ is the same angle. Notice also that at that elevation angle, the bottom rim of the antenna is "a" feet from the ground which is also "a" feet above the bottom of the fence. Simple geometry shows that the tangent of $\theta = \tan\theta = h\text{-}a/d$ where "d" shows the following:

$$d = \frac{h-a}{\tan\theta}$$

"a" must be determined from the manufacturer's antenna data sheet. In our case, "a" = 1.55 feet.

Therefore, the distance to clear the fence is:

$$d = \frac{(7-1.55)}{\tan 23.58°} = 12.49 \text{ feet}$$

Unfortunately that is only part of the answer. **Because the antenna is circular** and since the **bottom of** the antenna **gently slopes upward,** other parts of the antenna must be taken into consideration. Calculating the required clearance from **other parts** of the antenna requires determining **the height of the antenna** at different distances from the centerline. **(See figure 3).**

Determining the rise of the antenna rim (y distance) as we progress from the antenna center line (x distance) requires some algebraic manipulation. The equation of a circle centered at a y distance of R on a set of x-y coordinates as shown is:

$$y^2 - 2yR + x^2 = 0$$

For our 5-meter (16.4 foot) diameter antenna, determination of the y height may be made using the standard quadratic solution, i.e.:

$$y = \frac{-b \pm\sqrt{b^2 - 4ac}}{2a}$$

Where: $a = 1$

$b = (-2R) = -16.4$ feet

$c = x^2$

$$y = \frac{16.4 \pm\sqrt{(-16.4)^2 - 4x^2}}{2}$$

Solving for values of y with x increments of 1 foot gives the values shown in **table 1.**

x	y	
1	16.34	.06
2	16.15	.25
3	15.83	.57
4	15.36	1.04
5	14.70	1.70
6	13.79	2.61
7	12.47	3.93
8	10.0	6.40
8.4	8.2	8.2

Table One

The first y root represents the height of the top of the an-

William H. Ellis
Manager Systems Engineering
Evansville Cable TV, Inc.
Evansville, Indiana 47711


MENU
APPETIZER
HOME
THEATER
NETWORK
ENTRÉES
M.M. Buckner

tenna at the x distance from the centerline (assuming a vertical antenna, i.e., an elevation angle of 0°). **The second root is the one of interest** showing the height of the antenna **rim** above the **bottom most point** on the rim.

One further factor must be considered. That factor is the **distance from the bottom most point** of the antenna **to the rim of the antenna** in the horizontal direction at the elevation angle of interest **(see figure 4).**

The z distance can be calculated using the formula tan θ =

POINTING AZIMUTH AND ELEVATION ANGLES FOR

EVANSVILLE, IN
37D 59M 44S N
87D 32M 31S W

LONGITUDE RANGE OF GEOSTATIONARY SATELLITES AT WHICH THE EARTH STATION ANTENNA MAY BE POINTED ... AZIMUTHS ARE IN DEGREES FROM TRUE NORTH.

SATELLITE OWNER	LONGITUDE	EARTH STATION AZIMUTH	EARTH STATION ELEV ANGLE	SATELLITE OWNER	LONGITUDE	EARTH STATION AZIMUTH	EARTH STATION ELEV ANGLE
	70.0	152.82	42.32	ANIK I	104.0	205.63	42.74
	71.0	154.24	42.71		105.0	207.06	42.35
	72.0	155.68	43.08		106.0	208.46	41.94
	73.0	157.15	43.43		107.0	209.85	41.52
	74.0	158.63	43.77		108.0	211.21	41.07
	75.0	160.13	44.08	ANIK II	109.0	212.55	40.61
	76.0	161.64	44.36		110.0	213.88	40.13
	77.0	163.17	44.63		111.0	215.18	39.64
	78.0	164.72	44.87		112.0	216.45	39.13
	79.0	166.28	45.09		113.0	217.71	38.60
	80.0	167.86	45.29	ANIK III	114.0	218.95	38.06
	81.0	169.44	45.47		115.0	220.16	37.51
	82.0	171.04	45.62		116.0	221.36	36.94
	83.0	172.64	45.74		117.0	222.53	36.36
	84.0	174.25	45.84		118.0	223.68	35.77
	85.0	175.87	45.92	SATCOM II	119.0	224.82	35.17
	86.0	177.49	45.97		120.0	225.93	34.56
	87.0	179.11	45.99		121.0	227.02	33.93
	88.0	180.74	46.00		122.0	228.10	33.30
	89.0	182.36	45.97	WESTAR II	123.5	229.68	32.33
	90.0	183.98	45.92		124.0	230.19	32.00
	91.0	185.60	45.85		125.0	231.21	31.34
	92.0	187.21	45.75		126.0	232.22	30.66
	93.0	188.82	45.63		127.0	233.20	29.99
	94.0	190.41	45.48	COMSTAR I	128.0	234.17	29.30
COMSTAR II	95.0	192.00	45.31		129.0	235.12	28.61
	96.0	193.58	45.11		130.0	236.06	27.90
	97.0	195.14	44.89		131.0	236.98	27.20
	98.0	196.69	44.65		132.0	237.89	26.48
WESTAR I	99.0	198.22	44.39		133.0	238.79	25.77
	100.0	199.74	44.10		134.0	239.67	25.04
	101.0	201.24	43.79	SATCOM I	135.0	240.53	24.31
	102.0	202.72	43.46		136.0	241.39	23.58

FIGURE ONE

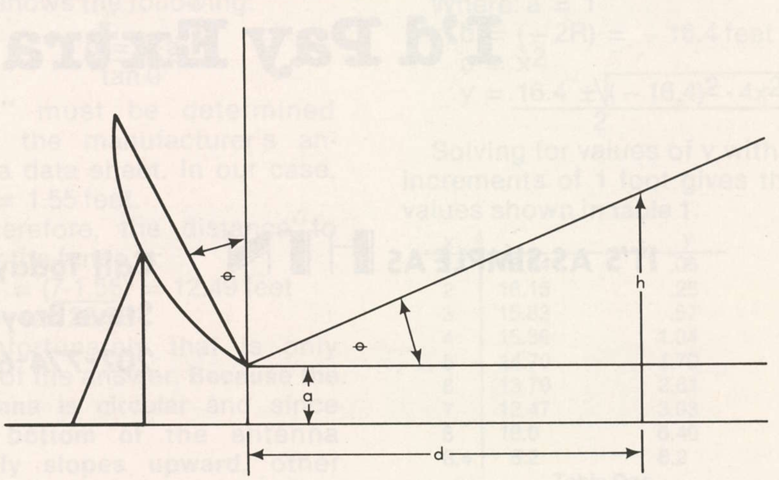


FIGURE TWO

ANOTHER WAY TO SAVE

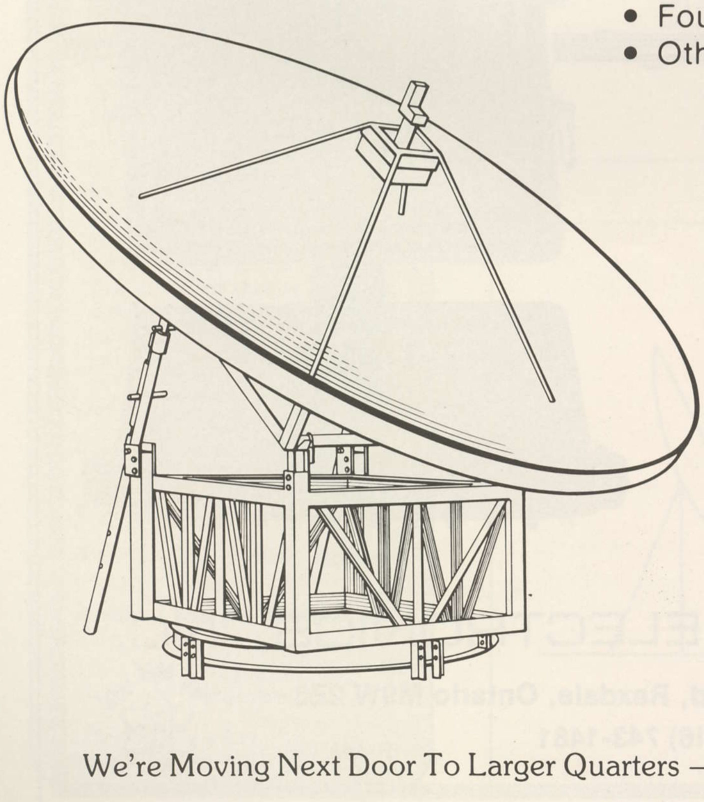
by GARDINER

CHANNELCUE®

The New Programmable Earth Station Switcher

CHANNELCUE® AUTOMATICALLY SWITCHES YOUR SATELLITE CHANNELS FOR A WHOLE WEEK

- No More Blank Screens
- Eliminates Unauthorized Material
- Crystal Controlled Programmable Clock
- Standby Clock Power Protects Memory
- Up To 256 Functions Per Week
- Internal Color Character Generator
- Four Standard Messages
- Other Messages Available



FOR DETAILS CALL
(713) 961-7348
Wally Briscoe
Bill Kassemos
Cliff Gardiner

CHANNELCUE® Will Be
Available In February

GARDINER
COMMUNICATIONS
CORPORATION

We're Moving Next Door To Larger Quarters — 1980 South Post Oak Road, Suite 2040
Houston, Texas 77056

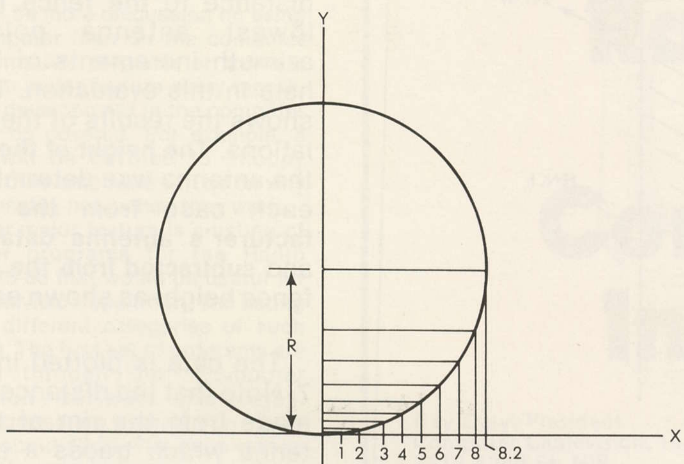


FIGURE THREE

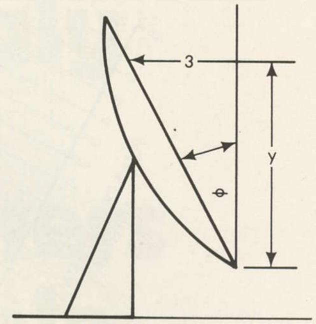


FIGURE FOUR

azimuth	elevation	rim height	distance-to-clear fence
152.82	42.32	4.51	2.75
155.68	43.08	4.6	2.57
160.13	44.08	4.8	2.27
164.72	44.87	4.9	2.11
169.44	45.47	5.1	1.87
175.87	45.92	5.15	1.79
180.74	46.00	5.20	1.74
185.60	45.85	5.10	1.84
190.41	45.48	5.0	1.97
195.14	44.89	4.9	2.11
199.74	44.10	4.8	2.27
205.63	42.74	4.6	2.60
209.85	41.52	4.3	3.05
215.18	39.64	4.0	3.62
220.16	37.51	3.7	4.30
225.93	34.56	3.2	5.52
230.19	32.00	2.8	6.72
235.12	28.61	2.25	8.71
240.53	24.31	1.62	11.91
241.39	23.58	1.55	12.49

Table Four

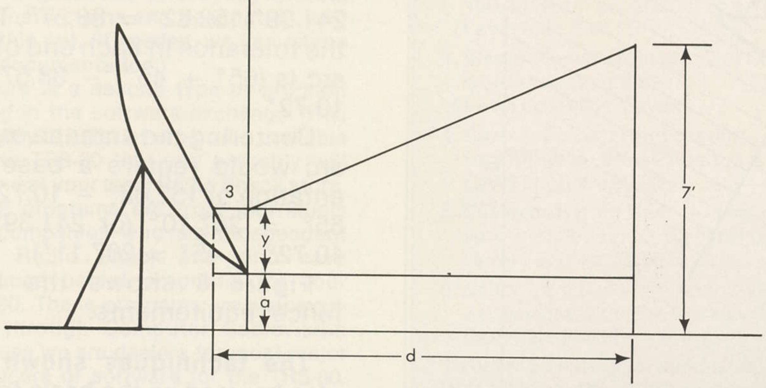


FIGURE FIVE

z/y where y is determined from table 1.

$x = y \tan\theta$

Table 2 shows the calculated z values.

x	y	z
1	.06	.03
2	.25	.11
3	.57	.25
4	1.04	.45
5	1.70	.74
6	2.61	1.14
7	3.93	1.72
8	6.40	2.79
8.2	8.2	3.58

Table Two

Finally the distance to the fence can be determined for all points on the antenna rim as shown in **figure 5.**

Table 3 shows the distance to the fence (d) at different locations on the antenna rim.

x	y	z	d
1	.06	.03	12.32
2	.25	.11	11.80
3	.57	.25	10.93
4	1.04	.45	9.65
5	1.70	.74	7.85
6	2.61	1.14	5.37
7	3.93	1.72	1.76

Table Three

For values of x greater than 7 feet from the centerline, the antenna is **above** the fence and hence requires no distance to clear.

Plotting the results shows the situation more clearly. **Figure 6** shows the results with a north-south/east-west oriented fence.

The antenna is shown pointed at the azimuth having the **lowest** elevation angle. To complete the engineering, the same calculations must be made for other azimuth/eleva-

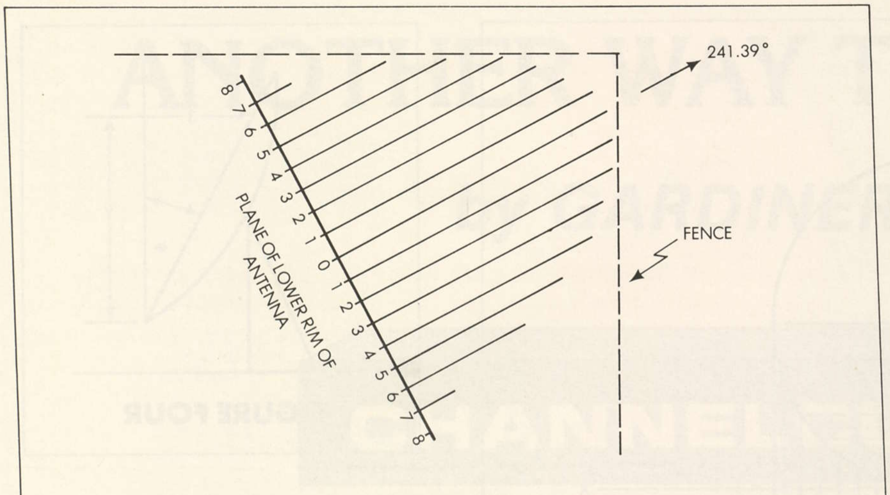


FIGURE SIX

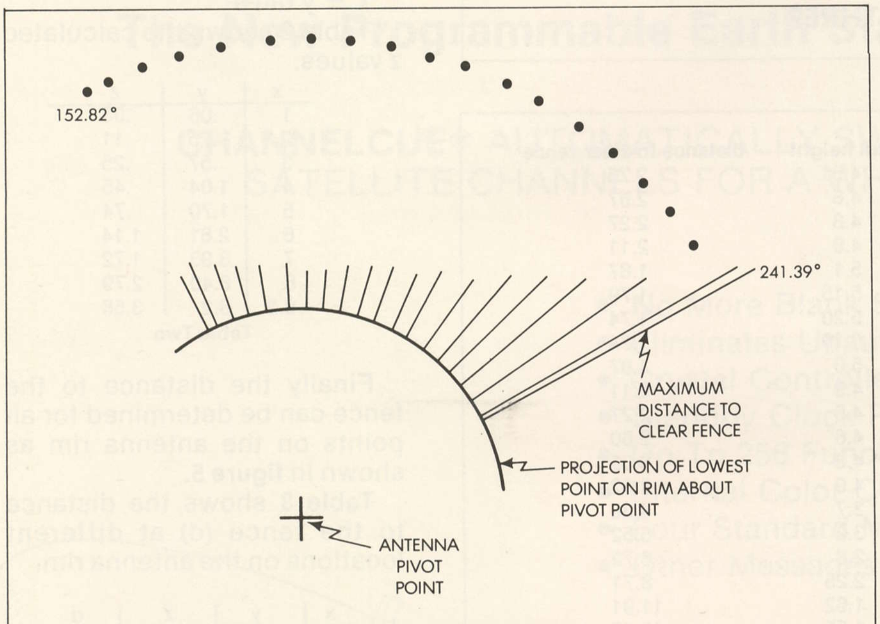


FIGURE SEVEN

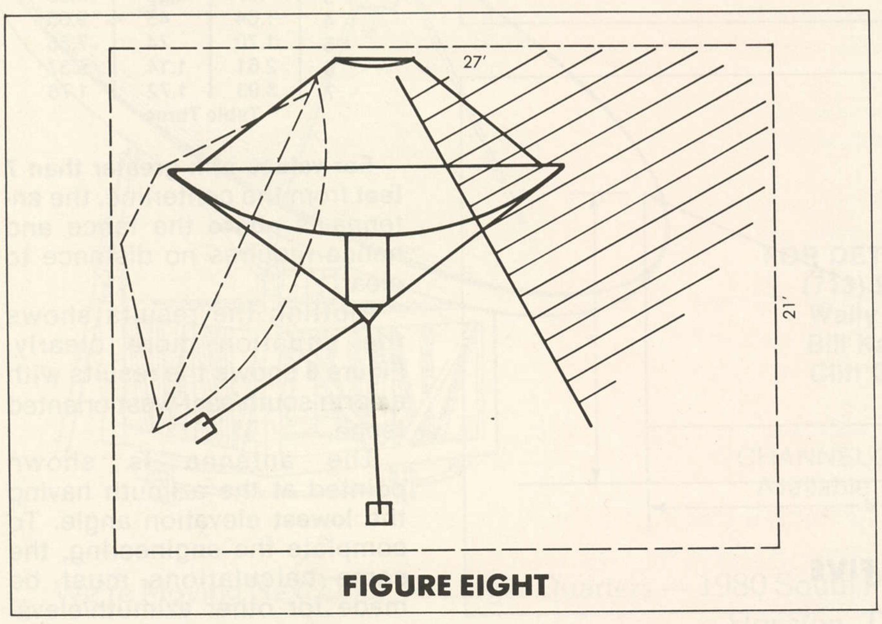


FIGURE EIGHT

tion angles. Plotting the distance to the fence for the lowest antenna point at azimuth increments of 5° will help in this evaluation. **Table 4** shows the results of the calculations. **The height of the rim** of the antenna was determined in each case **from the manufacturer's antenna data sheet** and **subtracted from** the overall fence height as shown earlier.

The data is plotted in **figure 7.** Note that the distance plot is made from the rim of the antenna which traces a circular arc from the antenna pivot point.

Because of the elevation increase, the distance from the fence **decreases rapidly** after about 5° of azimuth change from the lowest elevation angle. As a result, the fence plot of figure 6 is the worst case situation.

To determine the final fence design, the above information must be applied to a projection of the antenna from above. **The actual base pointing angle** must also be taken into consideration. That angle can be determined by looking up the actual azimuth pointing range of the antenna from the manufacturer's data sheet. The Scientific Atlanta antenna has an adjustment range of 65° counterclockwise (from above) and clockwise from the antenna centerline.

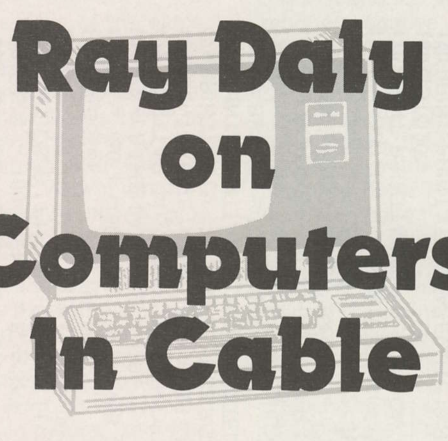
The total arc over which the antenna must look at the site in question is (from Figure 1) 241.39°-152.82° = 88.57°. Thus the tolerance in each end of the arc is (65° + 45°) − 88.57° = 10.72°.

Centering the antenna on the arc would require a base orientation of 152.82° − 10.72° + 65° = 207.10° (or 241.39° + 10.72° − 45° = 207.11°).

Figure 8 shows the final fence requirements.

The techniques shown can also be used as the basis for designing a pit for blockage of terrestrial off-air interfering signals.

Ray Daly on Computers In Cable



Ray Daly, President
Computer Cablevision, Inc.
2617 42nd St. NW
Washington, D.C. 20007

The title of this column, "...on Computers" indicates the emphasis. There will be more discussion on **using** your computer than on the computer itself. Computer **programs or software** will be the major feature every month, although development in the computer field will be covered. For example, a column will be devoted to "floppy discs" but the emphasis will be on **why** they are useful, not on **how** they work.

Another major feature is a listing of computer programs for the Radio Shack TRS-80 that would be useful for a cable television operation. The listing has two different categories of such programs. The first set of programs are available through the "Computer Cablevision Software Exchange". Many programs are available on a cassette for about $2.00. The main reason for the difference in the price for these cassettes will be the cost for printed instructions. Most of the programs in this category will be described in this column.

The purpose of this first category in the listing is to **encourage the exchange** of TRS-80 programs. For this reason we are keeping the price as low as possible. But more importantly **we are encouraging people to submit programs** to the exchange. You will be credited as the author in all listings and in the printed instructions for each program you submit. **Plus,** for each program submitted you can receive any three programs in the exchange at no charge! Hopefully this will encourage you to submit programs to the exchange for others to use. Within a few months there should be nearly a hundred programs available through this exchange!

To submit a program simply record the program on a cassette and send it along with some written instructions and a brief description. Also, when you submit this program, **please indicate which three programs you would like in return for your submitted program.** We will copy your program into our cassette library making sure that it operates correctly on our computer(s). Then we will return your cassette with the programs you requested recorded on it. When people request a copy of your program, we will simply copy it onto a cassette, photocopy (xerox) your instructions and description, and mail this out. (If needed, we can retype your documentation.)

There is a second type of program listing in the software exchange. This category is a list of programs available for the TRS-80 that you probably will **not find** at your local Radio Shack store. These programs are from individuals and companies who are independent from Radio Shack and who have produced useful programs for your TRS-80. These programs are **also available** through Computer Cablevision because we are dealers for most major producers of software for the TRS-80. The most obvious difference between this type of program and the other will be the price. These programs will cost anywhere from $7.95 to over $200. To order any of the listed programs see the program listing material.

One of the other reasons for doing this monthly column and preceeding series of articles was to quickly promote the use of computers in the cable television field and to push myself to take an active, regular part in that effort. Both of these goals are achieved by meeting CATJ's monthly deadline. However, assistance from any reader will always be appreciated. Please feel free to comment, make any suggestions, or provide ideas for possible topics.

Finally, one of the things that will regularly be included in this column is a complete copy of a computer program. To make these as useful as possible to as many people as possible these programs will be written for the **Radio Shack TRS-80** microcomputer with **Level II BASIC.** Because this BASIC is one of the variations of what has become known as 'MicroSoft'

THE COMPUTER CABLEVISION SOFTWARE EXCHANGE

Category One (for TRS-80, $2.00 each)

1. **Geostationary Satellite Finder** (see above)
   Level II 4k.
2. **Geostationary Satellite Finder II** by Ray Daly
   Level II 4k.
3. **Cable Power System Design** by Ray Daly and Bill Marshall
   Level I or II 4k.
4. **Feeder Design** by Ray Daly and Bill Marshall
   Level I or II 4k.

Category Two (for TRS-80)

1. **Renumbered from Software Associates**
   renumber any program or merge programs
   Level II 16k. $14.95
2. **Library 100 from Bottom Shelf, Inc.**
   100 different programs; 25 on business and finance
   Level II 4k. $49.50
3. **Electric Pencil** from Michael Shrayer Software
   word processing using your TRS-80 and a printer
   Level I or II 16k. $99.95
4. **Business I** from Neal Jensen
   very small business Accounts Receivable, Interest on Loans and Savings.
   Level I or II 4k. $9.95
5. **Business II** from Neal Jensen
   very small business General Ledger, Metric Conversions Plus, and one other.
   Level I or II 4k. $9.95
6. **Editor** from Software Associates
   word processor that works with disks
   DOS 32k. $39.95

To order any program send order to **Computer Cablevision;** 2617 42nd St NW #2; Washington, DC 20007; or phone (202) 337-4691. Please enclose payment with order, and add $1.00 per order for shipping.

TRS-80 Program
To Compute Azimuth, Range & Elevation
To A Geosynchronous Earth Satellite

```
1 CLS
3 PRINTTAB (14); "COMPUTATION OF "
4 PRINTTAB (7); "AZIMUTH, RANGE AND ELEVATION"
5 PRINTTAB (3); "TO A GEOSYNCHRONOUS EARTH STATION"
10 PI = 3.14159265
20 R = 6367
30 H = 35800
40 PRINT: PRINT "ENTER LATITUDE (DEGREE, MINUTES). PREFIX BOTH
 DEGREE AND MINUTE ENTRIES WITH MINUS SIGNS FOR LOCATIONS IN
 SOUTHERN HEMISPHERE."
45 INPUT Y1, Y2
50 PRINT: PRINT "ENTER LONGITUDE (DEGREES, MINUTES). FOR WEST
 LONGITUDE, PREFIX BOTH DEGREE AND MINUTE ENTRIES WITH A MINUS
 SIGN."
55 INPUT X1, X2
60 A = Y1 + Y2 / 60
65 IFA = OTHENA = .001
70 G = X1 + X2 / 60
80 PRINT: PRINT "ENTER SATELLITE LONGITUDE IN DEGREES. PREFIX
 A MINUS SIGN FOR WEST LONGITUDE."
85 INPUT F
87 CLS
90 B = G - F
92 IF B >180 THEN B = B - 360
93 IF B < - 180 THEN B = B + 360
100 X = COS (B * PI / 180) * COS (A * PI / 180)
110 C = (180 / PI) * (- ATN (X / SQR (- X * X + 1)) + 1.5708)
115 IF ABS (C) > = 81.3 THEN 122
120 AZ = 180 + (180 / PI) * ATN (TAN (B * PI / 180) / SIN (A * PI / 180))
121 IFA < 0 THEN AZ = AZ - 180
122 PRINTTAB (14); "COMPUTATION OF"
124 PRINTTAB (7); "AZIMUTH, RANGE AND ELEVATION"
126 PRINTTAB (3); "TO A GEOSYNCHRONOUS EARTH SATELLITE"
127 PRINT: PRINTTAB (2); "FOR A SATELLITE LOCATED AT"; F; "DEG."
128 IFABS (C) >= 81.3 THEN 190
130 PRINT: PRINTTAB (5); "AZIMUTH = "; AZ; "DEGREES"
140 S = SQR (R↑2 + (R + H)↑2 - 2 * R * (R + H) * COS (C * PI / 180))
145 PRINT: PRINTTAB (5); "RANGE = "; S; "KM"
150 Y = (S↑2 + R↑2 - (R + H)↑2) / (2 * R * S)
160 E = (180 / PI) * ( - ATN (Y / SQR ( - Y * Y + 1)) + 1.5708) - 90
170 PRINT: PRINTTAB (5); "ELEVATION = "; E; "DEGREES"
180 GOTO200
190 PRINT: PRINT "THIS SATELLITE IS NOT VISIBLE FROM YOUR LOCATION."
200 END
```

Apple II Program
To Compute Azimuth, Range & Elevation
To A Geosynchronous Earth Satellite

```
1 CALL - 936
3 HTAB (14): PRINT "COMPUTATION OF"
4 HTAB (7): PRINT "AZIMUTH, RANGE AND ELEVATION"
5 HTAB (3): PRINT "TO A GEOSYNCHRONOUS EARTH SATELLITE"
10 PI = 3.14159265
20 R = 6367
30 H = 35800
40 VTAB (10): PRINT "ENTER LATITUDE (DEGREES, MINUTES). PRE-
   FIX BOTH DEGREE AND MINUTE ENTRIES WITH MINUS SIGNS FOR
   LOCATIONS IN THE SOUTHERN HEMISPHERE."
45 INPUT Y1, Y2
50 VTAB (16): PRINT "ENTER LONGITUDE (DEGREES, MINUTES). FOR WEST
   LONGITUDE, PREFIX BOTH DEGREE AND MINUTE ENTRIES WITH A
   MINUS SIGN."
55 INPUT X1, X2
60 A = Y1 + Y2 / 60
65 IF A = 0 THEN A = .001
70 G = X1 + X2 / 60
80 VTAB (21): PRINT "ENTER SATELLITE LONGITUDE IN DEGREES. PRE-
   FIX A MINUS SIGN FOR WEST LONGITUDE."
85 INPUT F
87 CALL - 936
90 B = G - F
92 IF B >180 THEN B = B - 360
93 IF B < - 180 THEN B = B + 360
100 X = COS (B * PI / 180) * COS (A * PI / 180)
110 C = (180 / PI) * ( - ATN (X / SQR ( - X * X + 1)) + 1.5708)
115 IF ABS (C) > = 81.3 THEN 122
120 AZ = 180 + (180 / PI) * ATN (TAN (B * PI / 180) / SIN (A * PI / 180))
121 IF A < 0 THEN AZ = AZ - 180
122 HTAB (14): PRINT "COMPUTATION OF"
124 HTAB (7): PRINT "AZIMUTH, RANGE AND ELEVATION"
126 HTAB (3): PRINT "TO A GEOSYNCHRONOUS EARTH SATELLITE"
127 VTAB (6): HTAB (2): PRINT "FOR A SATELLITE LOCATED AT"; F;" DEG:"
128 IF ABS (C) > = 81.3 THEN 190
130 VTAB (10): HTAB (5): PRINT "AZIMUTH = "; AZ; "DEGREES"
140 S = SQR (R [2 + (R + H) [2 - 2 * R * (R + H) * COS (C * PI / 180))
145 VTAB (12): HTAB (5): PRINT "RANGE = ";S;" KM"
150 Y = (S [2 + R [2 - (R + H) [2) / (2 * R * S)
160 E = (180 / PI) * ( - ATN (Y / SQR ( - Y * Y + 1)) + 1.5708) - 90
170 VTAB (14): HTAB (5): PRINT "ELEVATION = ";E; "DEGREES"
180 GOTO 200
190 VTAB (15): PRINT "THIS SATELLITE IS NOT VISIBLE FROM YOUR
    LOCATION."
200 END
```

NOTE: Use of this program requires Applesoft II, Extended Basic. Be sure to observe data entry format. For example, a longitude of 118 Degrees 30 Minutes must be entered ?-118, -30.
Program written by Richard Hilton, Comlab Corporation, (Van Nuys, CA.).

BASIC, programs written for TRS-80 Level II can fairly easily be typed into other computers which use MicroSoft BASIC (i.e. the Commadore PET, the Apple II with AppleSoft BASIC, and others).

Okay, enough with what to expect every month, here is the first program for all of you computer owners out there. In the November 1978 issue of CATJ, there appeared an article concerning locating geo-stationary satellites for looking at Intelsat birds. Included in this article was a discussion about calculating the azimuth and elevation to any such satellite and a challenge. **"...Ray Daly...can probably be talked into putting together a program for TRS-80 users."** With that challenge and encouragement I sat down one evening and it was done. This program displays the azimuth, elevation angle, and range for any set of coordinates to ten satellite longitudes at a time. This program is now part of the "Computer Cablevision Software Exchange."

Then after this was completed, Mr. Richard Hilton of Comlab Corporation (16115 Valerio Street; Van Nuys, CA 91406) sent CATJ a copy of the same type of program to work on an **Apple II** using Applesoft II, **Extended BASIC.** Because most people don't know how the computer program differs from one computer to another, I decided to convert Richard's program into Level II BASIC for the TRS-80. And in order to show this difference, the 'same' program is printed here for both the Apple II and the TRS-80.

How do these programs work? Most of the lines in these programs are used to print information on the screen. In lines 1-5 the title of the program is printed. Lines 10-20 are used to set the values of the variables for PI, the radius of the earth in kilometers, and the distance from the earth surface to the satellite in kilometers. Next, the program **asks** in lines 40-50 for the **latitude** (Y1, Y2) and **longitude** (X1, X2) of the earth station in degrees and minutes. These values are then converted to decimal degrees by lines 60-70. The program next asks for the longitude of the satellite in degrees in lines 80 and 85. Note that the program requires negative values for west longitude (i.e., western hemisphere) and southern longitude (i.e., southern hemisphere).

With all the information entered into the machine, it can now begin calculating the azimuth, range and elevation angle. In order to do this some intermediate values are first calculated. Lines 90-93 give the value of 'B'; line 100 gives 'X'; and lines 110-115 'C'. Using these values, the azimuth is calculated in lines 120-121. Lines 122-130 are used to print out the results. However, the satellite may not be visible and this is tested in line 128. In such cases the program skips from 128 to 190 where it tells you that the particular satellite is not visible. If it is visible, lines 140-145 calculate and display the range in kilometers and lines 150-170 do the same for the elevation angle. (For a detailed explanation of these formulas see the article by Bill Johnston in the March 1978 **QST Magazine.**)

ANIK-B Testing

The new 4 and 12 GHz ANIK series bird launched by Canada's Telesat in December and intended to 'bridge the gap' between the present ANIK-A (4 GHz down) and the future ANIK-C (12 GHz down) satellites drifted into its permanent orbit station of 109 degrees by the middle of January and tests began on the bird at that time. ANIK-B, you may recall, is the **3 dB hotter-than** satellite; it has an EIRP at boresight in the +39 dBw region. That says that when it does go into video service it should have a signal level throughout Canada which will make 6-8 foot parabolic antennas (with an appropriate LNA and receiver) feasible; and here in the states those systems that have noticed sparklies on the ANIK-III signal should see most if not all of the sparklies go away.

The ANIK-B testing was to have wrapped up around February 05, with the exception of an EIRP test at Frobisher Bay (equipment is being airlifted in to make the tests) and a 'minor' attitude drift test. Tests conducted through late January showed the bird performing up to expectations.

Starting around February 07 will begin a month long series of 12/14 GHz tests (12 is the downlink band). If these tests prove fruitful the ANIK-B will be turned over to (Canadian) government use in the 12 GHz downlink band around the first of April.

What about use of the 'hotter' ANIK-B footprint for video services in the 4 GHz downlink band? No decision yet. When ANIK III was tested and put into service the video signals (Northern TV service channels and French TV channel) were shifted to ANIK-III simply because in the view of Telesat the video services (and the bulk of the audio services) needed to be 'on the newest satellite'. Some Canadian sources suggest that the same type of thinking **may prevail** with ANIK-B and that ultimately the Northern and French video channels will be shifted to ANIK-B at 109 degrees. The 12-14 GHz system will be a continuation of the type of services tested with CTS-Hermes; a satellite which is all but out of service now. One of the government sponsored programs that will be operating in the 12 GHz downlink band will be "television for Inouvit speaking Canadian natives". This will involve television programming sent via ANIK-B from both Ottawa and from one or more locations in the Canadian north, on the 14 GHz uplink and down on 12 GHz as well as possibly on 4 GHz (down) as well.

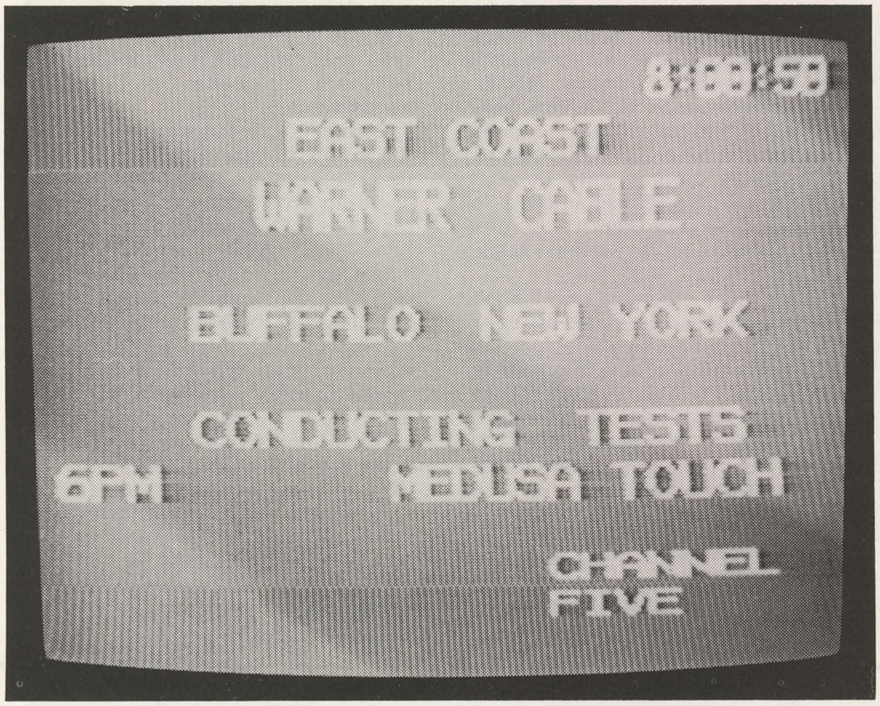
ANIK-2 which **was** positioned at 109 degrees has temporarily been moved east to 108.5 degrees where it 'rests' in a static conditions. After completion of the check out of 'B', ANIK-2 will be moved to a 'permanent' in-orbit **standby position** of 106.5 degrees.

So in the interim no **broadcast video** is intended for the 4 GHz downlink band on ANIK-B; although you might catch some video there from time to time on a **'test'** basis.

Company 'X' On 21

Ed Taylor's Southern Satellite Systems and RCA have reached agreement on the use of vertical transponder 21; Taylor's firm will take over the transponder on February 15th.

Most figured that 21 would be utilized for Taylor's uplinking of **either** the new Ted Turner News Network **or** New York City's WPIX; another indie signal.



Apparently neither of these will happen on 21. Taylor has accepted an offer from an as-of-yet un-identified group which will perhaps begin programming on 21 to CATV systems as early as the 15th of March. Here is what it is all about.

The new group has sub-let 21 from Taylor and according to our sources Taylor is 'comfortable' with their financial resources and programming plans. We understand that 'Company X' will be programming 24 hours per day on 21 from the Atlanta uplink site recently installed by Taylor (see **CATJ**, January, page 47). Taylor has ordered another uplink transmitter for the site from Scientific Atlanta. What will the programming consist off? Apparently it will be an **advertiser supported channel** not unlike that proposed last year by VISTAR. That group, you may recall, 'almost' got up on transponder 5 but they fell victim to the transponder wars of last September (see **CATJ** for November 1978, pages 45-46). Programming reportedly will consist of a mixture of off-network syndication, movies and sports with a generous helping of children's viewing fare. One source described the programming planned as "a mixture between VISTAR, SPN and Nickelodeon". Apparently the company backing the project plans to get the service up and operating on the theory that one of the best selling techniques for new satellite services from this point forward is to simply have the service on the bird and then to encourage cable system operators to 'check it out' for a period of time. This is on the premise that the service will sell itself if seen by cable people.

What about WPIX and the Turner News Network? Both apparently will now wait until the 1980 time frame after the launch of F3 and the availability of additional transponders at that time.

Nickelodeon Start March 1

The Warner Cable 'young people's television network', Nickelodeon is slated to begin regular service on March 1st on transponder 5. The start of the new children's service originating at the Warner QUBE system in Columbus (see CATJ for January) will follow by 30 days the launch of Warner's STAR CHANNEL; the pay cable service which Warner is switching from tape feed to satellite feed on February 1st.

STAR CHANNEL actually began 'experimental service' on the 2nd of January with several of the Warner owned and operated systems installing terminals prior to that date. According to Warner's Al Parinello, February 1st was the formal switch over date for Warner owned and operated systems to break with their tape feeds. Warner utilized transponder 5 to feed STAR TIME during January, and may continue to use 5 (as well as 11) during February. When Nickelodeon begins regular service on March 1st transponder 5 will be reserved for the 13 to 14 hour per day children's network feed; although late in the day it will also carry STAR CHANNEL fare as well. Transponder 11 will be exclusively for the use of STAR CHANNEL. Cable systems interested in taking the STAR CHANNEL service may find the Warner rates slightly lower than other competitive satellite distributed pay services; for example for an $8.00 cable subscriber rate Warner charges the cable company $3.75. Additionally, systems taking STAR CHANNEL will receive Nickelodeon service as a no-charge 'bonus' (normal rate ten cents per home per month).

WESTAR III 'moves'

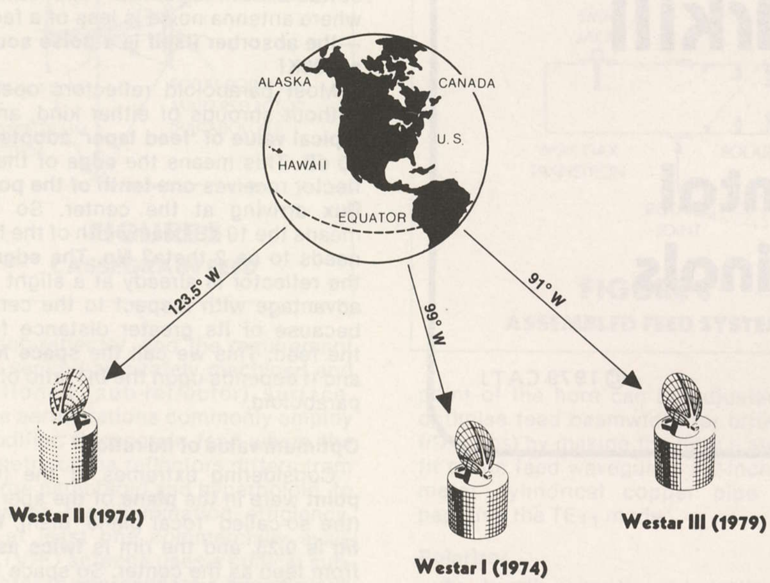
The launch of the third Western Union satellite, **WESTAR III,** previously **scheduled (tentatively) for mid-May has** been now set for the month of August of this year. Western Union has applied to the FCC for an orbit position of 91

CATV TVRO STATISTICS — FEB. 1979

Applications Filed/FCC	**Oct. 1978**	**Nov. 1978**	**Dec. 1978**
1) 11 meter	0	0	0
2) 10 meter	1	1	1
3) 7 meter	2	1	2
4) 6 meter	12	9	6
5) 5 meter	68	54	56
6) 4.5 meter	29	42	6
Total Apps.	**112**	**107**	**71**
Cost Max.	$136,200	$209,000	$106,820
Cost Min.	$17,815	$9,995	$12,600
Avg. Cost	**$34,123**	**$31,883**	**$31,431**
Channels Requested	284	241	173
Average Channels	2.5	2.3	2.4
Requesting WTCG	61	57	40
Requesting CBN	73	54	21
Requesting HBO	69	60	37
Requesting MSGE	38	25	12
Requesting SHOWTIME	12	21	14
Requesting WGN			10
Requesting KTVU			3
Requesting Warner's Nickleodeon			13
Avg. Cost Per Channel	**$13,649***	**$13,862***	**$12,935***
TVRO's Licensed/FCC	**91**	**85**	**73**

Notes: *—may no longer be valid measurement stick due to method applicants now file with FCC. Data compiled from FCC sources, advances ahead one month with each issue of CATJ.

Western Union's Westar Satellites



degrees (west) placing it between COMSTAR II (95 degrees) and COMSTAR III (87 degrees).

Coupled with the announced launching of RCA F3 in December (or earlier) 1979 (see page 44 CATJ for January) this will bring to 9 the number of U.S. domestic satellites in operation in the 4 GHz downlink band. In their general press release detailing the launch and their present business 'load' from domestic users of satellite relay services one additional item of note; Western Union explained who their present and future customers are (by service categories) and conspicuous by its absence was any mention of the ASN proposal to bring four CATV service channels up on WESTAR II as early as March of this year.

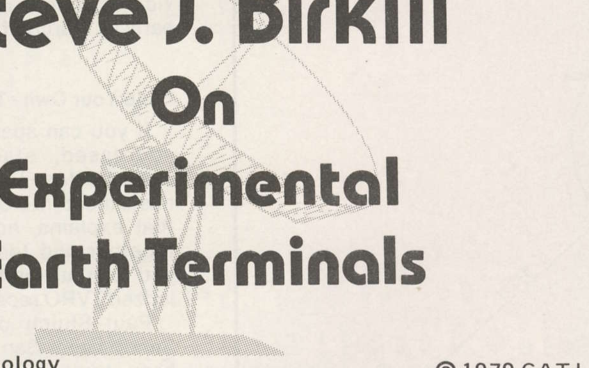
Build Your Own - TVRO Receiver

If you can spare a dollar plus a self addressed, stamped envelope (15 cents postage U.S.) a chap in California has most interesting 8 page brochure that explains, how with modules put together and tested by his company, you can assemble your own modularized TVRO receiver.

Paul Shuch of **Microcomm** (14908 Sandy Lane, San Jose, Ca. 95124) has been turning out exceedingly sophisticated microwave modules for amateur and industrial use for several years as well as writing extensively about microwaves in a wide variety of publications (including the IEEE "Transactions on Microwave Theory and Techniques"). Microcomm's best known module line, perhaps, is the 1.691 GHz Wefax downconverter for reception of SMS, GOES, GMS, METEOSAT and TIROS satellite pictures. Shuch has been interested in offering high quality modules for builder-final-assembly of TVRO receivers for some months now and he

Continued - Page 53

Steve J. Birkill On Experimental Earth Terminals



Steve J. Birkill
Real-World Technology
128 Cross House Road
Grenoside, Sheffield S30 3RX England

A practical feed antenna for plane or circular polarization

The feed to be described is one I constructed some eighteen months ago to provide a circular polarisation facility for my then newly-tried 4 GHz receiver. Most of the satellite signals receivable at this location employ circular polarisation, and to receive them with a **plane-polarised** pyramidal horn feed would have incurred an unacceptable **3 dB loss of signal.** The f/D (focal length to diameter) ratio of my 8-foot dish is 0.375—rather a short focus for an earth-station, but one I had to live with. Why should I regard this as a disadvantage? If we look at the geometry of the direct-feed (prime focus) arrangement (**figure 1**), we see the requirement to provide illumination of the reflector surface from the focus of the dish, and confine the feed radiation within an angle **2 theta,** and, distribute it **evenly** over the dish surface. (In keeping with antenna convention, we speak of radiation, though the antenna is a reciprocal system and behaves identically in the receiving mode.) Desirable though it is to achieve an even distribution of energy over the surface, with sharp cut-off at the rim of the dish, **no practical feed can achieve this ideal.** As with most directional antennas, the feed has maximum radiation on axis, tapering toward the edges. So to define feed beamwidth we must specify the beam-edge power level relative to on-axis or boresight power density. For a complete antenna we normally speak of the half-power or 3 dB beamwidth. For dish feeds the 10 dB beamwidth point(s) are a more useful value.

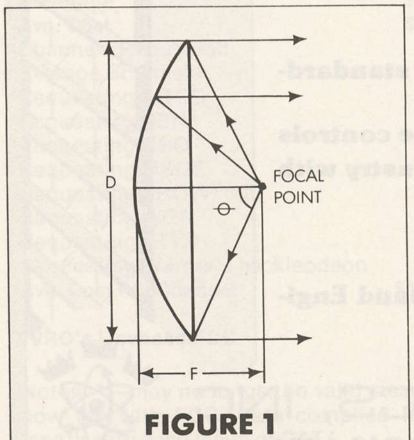


FIGURE 1
DIRECT FEED

Optimum beamwidth of feed antenna

Given that our feed must radiate a beam tapering from its on-axis value, we must decide how most efficiently to illuminate our dish with this beam. If we adopt a **narrower than optimum feed beamwidth,** then most of the energy radiated by the feed is intercepted by the reflector, but the center of the reflector is receiving a proportionately greater concentration of energy than the edge, such that the edge contributes little to the gain of the antenna. And square meters are expensive! Conversely, if the feed distributes its energy over **too wide an angle,** then while our dish is illuminated more evenly, we are now **losing** a significant amount that is missing the reflector and 'spilling' over the edge. This not only reduces the gain, but more importantly in a **receiving** application this spill-over means the feed sees not only satellite and cold sky reflected from the dish surface, but also whatever is in its line of sight **around the edge** of the dish. And this is usually some kind of terrestrial real-estate, all radiating healthily **and noisily** at 290 degrees Kelvin (or so)! So up goes our antenna noise temperature, along with the loss of gain. Some commercial antennas use a reflecting **shroud** around the edge of the dish, to convert these stray 'back-lobes' of the radiation pattern to **less harmful** 'side-lobes' in the forward direction. Another technique is to employ an RF-absorbent material for the 'shroud', but though it can give a very clean radiation pattern it is more suitable for terrestrial applications where antenna noise is less of a factor —**the absorber itself is a noise source at 290K!**

Most paraboloid reflectors operate without shrouds of either kind, and **a typical value of 'feed taper' adopted is 10 dB.** This means the **edge** of the reflector receives **one-tenth of the power flux** arriving at the center. So this means the 10 dB beamwidth of the feed needs to be 2 theta? **No.** The **edge** of the reflector is already at a slight disadvantage with respect to the centre, because of its greater distance from the feed. This we call the **space loss,** and it depends upon the f/D ratio of the paraboloid.

Optimum value of f/d ratio

Considering extremes, if the focal **point** were in the **plane** of the aperture (the so-called 'focal plane' dish), **then f/d is 0.25,** and the rim is **twice as far** from feed as the center. So space loss is 6 dB—for **edge** illumination of **minus 10 dB,** the reflector intercepts only the energy **within the 4-dB beamwidth of the feed,** that beamwidth being 180 degrees (the angle subtended by the reflector at the feed, or 2 theta). To design a feed having such a **wide** beam, and still obtain **good VSWR** over the required bandwidth is not easy. Efficient illumination also requires the E- and H-plane beamwidths of the feed to be equal, and to have the same phase center (the point from which radiation appears to diverge, and which we require to be at the focus of the reflector). All these considerations point to the advantage of a relatively **high** f/D ratio, **as high as 1.0.** Above this, the structure starts to become unwieldy, and the long feed support struts become a problem—as they are necessarily made stronger, the obstruction and scattering they cause becomes significant.

The Cassegrain Feed

One way of combining the **low noise** of a **low f/d reflector** with the high efficiency and feed realizability of the high f/d dish is to use the **Cassegrain system. This places a hyperboloidal sub**-reflector between the main reflector and its focal point **(figure 2).** This generates a new focus **closer to** the dish, and reduces the angle subtended at the focus. So the feed horn can sit on the end of a short waveguide run to the LNA, sheltered behind the dish surface, improving reliability and accessibility without the need for the long 'button-hook' waveguide needed if we require our LNA to be **away from** the focal point in a direct-fed antenna. The half-angle 0' is clearly much reduced from 0 in figure 1, for a given f/D ratio. The principal **disadvantages** of the Cassegrain arrangement are the inevitable blocking (shadowing) of the center section of the main reflector by

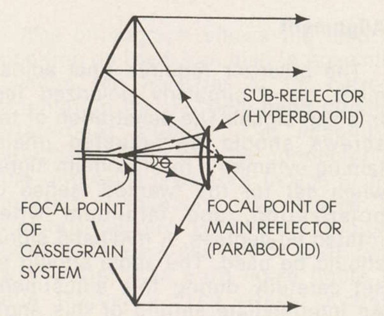


FIGURE 2
CASSEGRAIN FEED

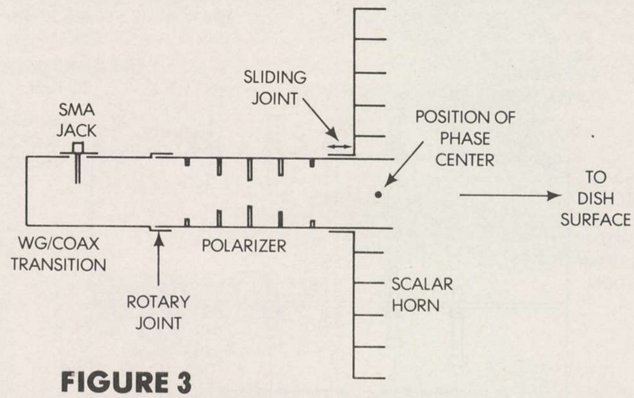


FIGURE 3
ASSEMBLED FEED SYSTEM

the sub-reflector, and the requirement for a second accurately machined and positioned (sub-reflector) surface. Large earth stations commonly employ a modified Cassegrain feed where the geometry of the reflectors differs from the true paraboloid and hyperboloid, to maximise the illumination efficiency. And at least one commercially available TVRO antenna uses a conical sub-reflector to approximate a hyperboloid, apparently with success.

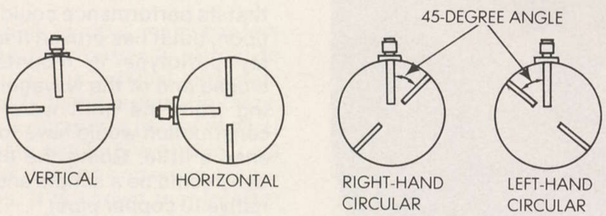


FIGURE 4
FEED ORIENTATIONS FOR THE FOUR PRINCIPAL SENSES OF POLARIZATION. VIEW INTO OPEN END OF FEED HORN.

Hybrid-mode feed

An alternative means of efficiently illuminating a low f/D dish is the **hybrid-mode scalar feed** or **corrugated horn.** This overcomes the limitations of the conical or pyramidal horn by providing a reactive surface along the flare of the horn such that it cannot support a surface wave, and the hybrid-mode HE_{11} is generated in the aperture, a combination of the TE_{11} and TM_{11} modes. The reactive surface is formed by the corrugations along the flare, and by feeding the horn away from the vertex a 90 degree flare angle can be used, which simplifies construction. The axial symmetry of the HE_{11} mode is of value not only in maximising illumination efficiency, but also in maintaining polarization purity for circularly-polarized waves, essential where orthogonal polarizations enable frequency re-use. This type of horn was chosen for the feed to be described, being easier (at the time) to construct than the Cassegrain system. The feed point of the horn can be adjusted (to optimise feed beamwidth for different f/D ratios) by making the horn a sliding fit on its feed waveguide, a 2-inch diameter cylindrical copper pipe propagating the TE_{11} mode.

Polarizer

To handle circular polarization as well as plane (or linear), a polarizer (or, since we are interested in receiving, a **depolarizer**) is required. This needs to be **birefringent** to orthogonal TE_{11} modes in the circular waveguide. **That is, it must introduce a 90-degree differential phase shift between horizontally and vertically polarized waves.** Thus a plane polarized wave passing through the polarizer at 45 degrees is converted to a circularly polarized wave, the sense of rotation dependent on which direction the initial 45-degree rotation is applied. And similarly circular polarization will be converted to linear. So, for a given orientation of the polarizer, **the two senses of circular polarization** will give rise to **either** horizontal **or** vertical polarization out of the polarizer. If we then insert an orthogonal mode coupler, we can recover **both** senses simultaneously and independently. See **figure 4.**

But if we don't need both at once, a rotatable joint in the circular waveguide will enable us to select one **or** the other. As a bonus, if we set the rotation to its mid-position, such that the elements of the polarizer are at 90 degrees to the output plane, they will then have **no effect on** a linearly-polarized wave. So by then rotating the entire feed we can line up with **any direction** of plane polarization as well!

Waveguide-to-coaxial transition

The design here shows an adaptor from linear TE_{11} to an SMA 3mm coaxial connector. This was just the most convenient connection at the time the feed was built. A more appropriate interface for TVRO hardware would be the **CPR 229 waveguide flange.** The way to do this is by forming a gradual transition between the 2-inch circular waveguide and the 2.290 x 1.145 inch rectangular WR229. Provided this is **internally smooth** and **at least 3 inches in length,** it should perform as well as, or probably better than, the coax version. See **figure 5.**

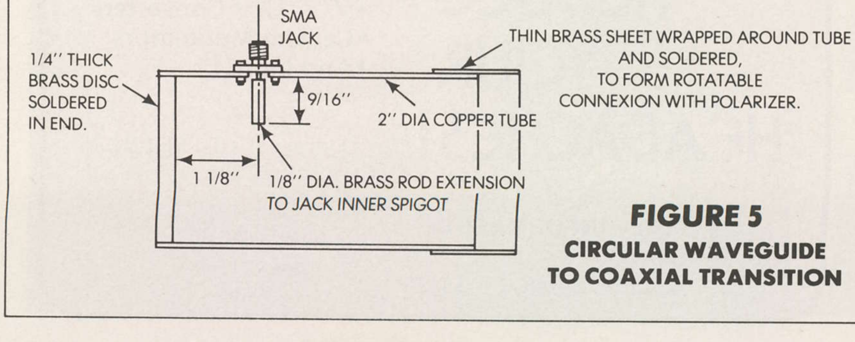


FIGURE 5
CIRCULAR WAVEGUIDE TO COAXIAL TRANSITION

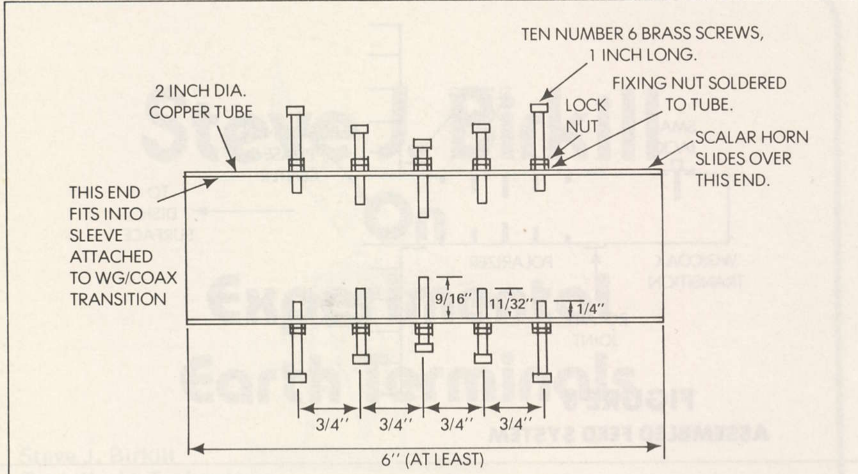
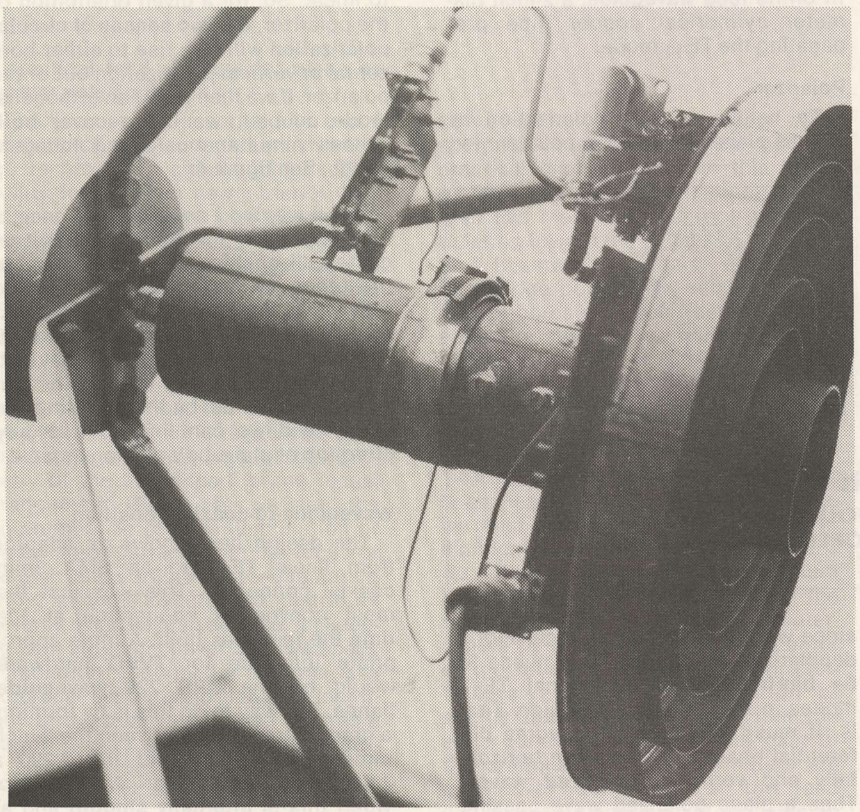


FIGURE 6
POLARIZER



Alignment

The polarizer requires final adjustment on a circularly polarized (eg. Intelsat) signal. The penetration of the screws should be adjusted (maintaining symmetry) for maximum signal when set for the 'wanted' sense of polarization, and minimum when rotated 90 degrees. A mid-band signal should be used. The angle should be set carefully during this adjustment. An intermediate setting of this angle (between polarizer elements and coaxial probe) will give elliptical polarization. Precise aiming of antenna onto satellite should be checked before concluding the adjustment. The scalar horn should be positioned to maximise carrer/noise ratio on the satellite signal, bearing in mind that its adjustment will shift the feed's phase center—feed-to-dish spacing may have to be optimized at the same time. See **figure 6.**

Caveat

This design is offered with the experimenter in mind. It has been in near continuous use since its construction, and has not been evaluated in the lab. It is quite possible that its performance could be improved upon, but it has proven itself in service. My prototype is mounted from the closed end of the waveguide. If mounting from the horn were desired, the construction would have to be strengthened a little. Going the other way, tin cans could be a simple and cheap alternative to copper pipe!

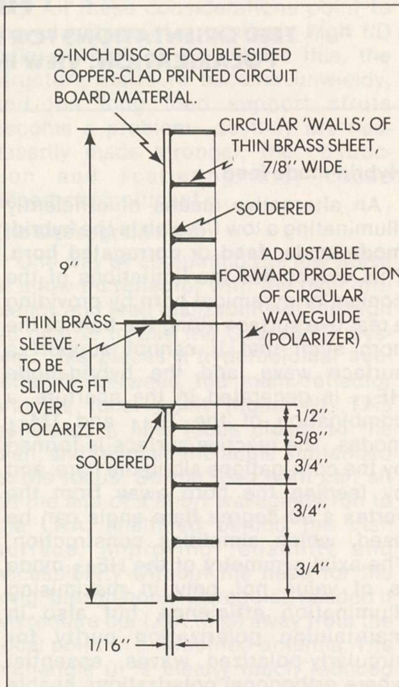
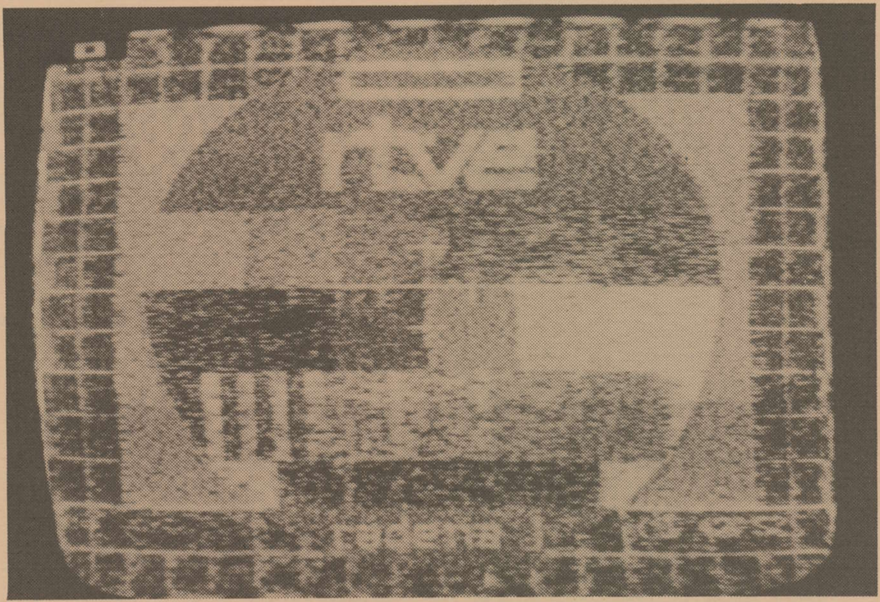
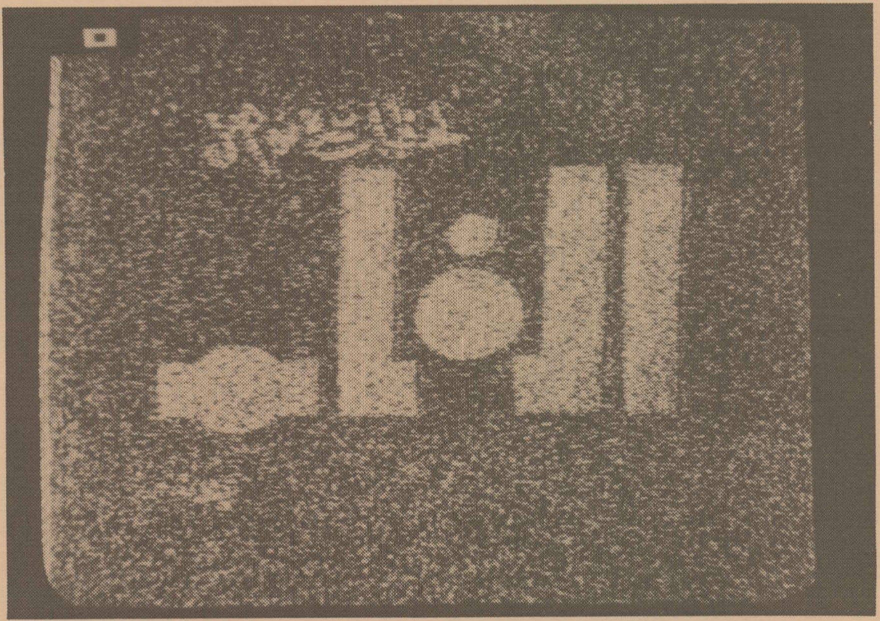
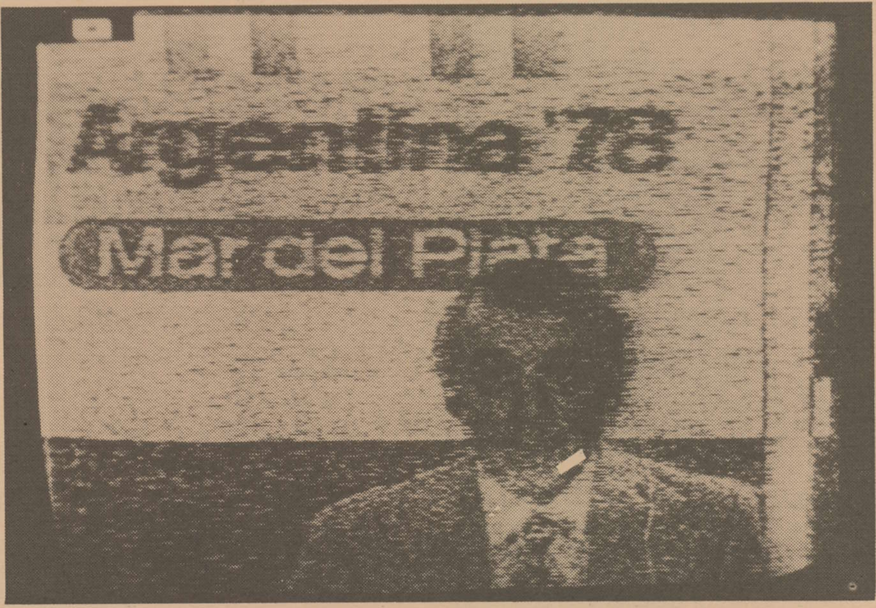


FIGURE 7
SCALAR HORN

The photograph shows the feed in position on the 8-foot dish. A hose clip clamps the polarizer at its correct orientation for the **right-hand circular** Statsionar signals. The assembly attached to the coaxial connector is the original 4 GHz LNA in use at my location, comprising two stages of Hewlett-Packard HXTR-6101 bipolar transistors, each capable of 10 dB gain with better than 3 dB noise figure at this frequency. The overall system noise temperature achieved with this arrangement was about 400K. Also visible on the photograph is part of the first down-converter, which provides a gain of around 40 dB while transposing the entire 4 GHz band to the UHF range (450 to 950 MHz in this case) where it can be fed to the house with low loss using standard coaxial cable, channel selection then being a simple matter. The rear surface of the scalar horn provides a convenient mounting for this down-converter, the intermediate frequency output (and 12V DC power input) appearing on the BNC connector lower center of picture.







Rare Birds

I should think by now, many readers will have had their curiosity stirred to explore among the Intelsat channels and see what is flying around up there. I would like to compile a listing of what TV services are regularly available, on a bird-by-bird, transponder-by-transponder basis. It is known that **Intelsat time is currently leased** for TV by **Algeria**, Brazil, **France**, Malaysia, **Nigeria**, Oman, **Spain**, Sudan, **Portugal**, Uganda and **Zaire.** We don't yet know 'where' to find all these services. Of course they aren't all in view from any one location, but it would be handy to know which one appears on which satellite and transponder. So if you could share your findings with me, I can't guarantee a personal reply to all letters, but the results will be published in this column and give us some idea where to find the new services and how the signal levels, transmission standards and program times compare.

The screen photos in this month's column show **half-transponder** TV transmissions from **Spain** (the daily program relay to the Canary Islands on **hemispheric** beam), **Sudan** (internal TV distribution, **global** beam) and **Argentina** (typical international news/sport type coverage, **global** beam, taken during the World Cup soccer series of last summer). If they don't look too good, compare your system with the 8 foot, 185K presently in use here and remember Intelsat operates 10 to 14 dB(w) **below** your 'potent' U.S. and Canadian domestic birds! Any readers' screen shots would be most welcome for publication.

TECHNICAL TOPICS

More About Video

"Your Article "What You See" (December CATJ) was interesting to read. It was somewhat disappointing that you omitted the CATEL TM-2300/2400 modulators, which are widely used. Of greatest concern however is that your article contains some technical errors and misconceptions, born in that blurry no man's land between video and RF called 'the modulator'.

"Since there is apparently a misunderstanding as to the meaning of 'Color Phase', 'differential phase', 'differential gain', and 'group delay distortion', I am offering some comments on these topics.

1. **Video Signal Distortions in a CATV Mod/Demod Combination**

"In practical terms we cannot isolate the modulator alone, because it is followed by a demodulator. The point is partly made on page 33 of the article but completely missed in the eyeball evaluation "CATJ looks at Modulators" page 35. **Typical TV sets** (i.e. a Demodulator and Color Monitor combo) exhibit differential phase errors of 5° or more, differential gain errors of 5% or more, and video spectrum flatness that can be as high as 20 dB down at 4.18 MHz. No wonder your observers couldn't see much difference between the 2 modulators! Had you tried any other good make, the results of your test would have been the same.

2. **COLOR DISTORTIONS**

"Please rest assured that differential phase and gain errors will NOT cause "color bleed" or a "vertical table leg to wander".

"To understand color distortions we must first understand the video color signal. Information seen on the TV screen by the subscriber is manifested in 2 ways: luminance information, or the black & white "basic" picture, and chrominance (or chroma) information, or the pretty color which is superimposed on luminance.

"Color in turn has two characteristics, namely hue (also called chroma phase or color phase) and saturation (also called chroma amplitude). **Hue** tells us if an object is yellow or green etc. and is represented by the phase difference between the 3.58 MHz color subcarrier modulation in the active line region, and the reference color burst on the back porch of horizontal sync. **Saturation** determines if the color is weak (pastel) or deep and intense and is represented by the amplitude of 3.58 MHz color subcarrier modulation in the active line region. Transmission errors in any or all of the above will affect picture quality.

"'**Color Phase'** or (or chroma phase) error will create an absolute shift in hue of all colors on the screen, because all chroma information in the active line regions is phase shifted by the **same** amount relative to burst.

"'**Differential Phase'** error will create a hue shift of one given color at say, low luminance level, relative to the same color at high luminance level. A good example of differential phase is a color bar signal in which the yellow (first bar) is way off (say orange or green) and the blue (last bar) is correctly blue. Attempts to re-establish the correct yellow now makes the blue the wrong color. This is a classical example where the yellow (high luminance) bar chroma phase in the active line region is **differentially** shifted in phase relative to burst, while the blue bar (low luminance) retains the correct phase relationship to burst.

"'**Chroma gain'** error will create an overall high or low color saturation in the picture, regardless of luminance level, similar to the effect obtained when you turn the "color" knob up and down on a TV set.

"'**Differential gain'** error will create a saturation shift of color from one luminance level to another, and is in practice even harder to see than differential phase. Differential gain is often forced, in very gross form when a CATV modulator is highly overmodulated (along with white clipping). This shows color bars to be washed out, almost white or light gray, on the higher luminance bars (yellow, cyan).

"Here are, in table form, some real world numbers for the cable person to ponder.

Practical Numbers	Differential Phase	Differential Gain
Test generator	1°	1%
Home TV Set	5°	5%
Videocassette recorder	5 to 10°	5 to 10%
Typical CATV Modulator	2°	5%
Human "eyeball" resolution—color bars, broadcast technician	3°	10%
Human "eyeball" resolution—typical program, home viewer	10°	15%

"While I can anticipate the hues (no pun intended) and cries of those keenly trained observers with calibrated 6500°K reference white (illuminant D), broadcast color monitors, you will find that the average observer cannot see errors **below** these limits.

Group Delay Distortions and "Cures" thereof

"The North American Television transmission system (CCIR System M) is the grand daddy of all modern VSB AM TV broadcast formats, and a marvel of compromises. One such clever compromise is the inclusion of an FM modulated sound subcarrier, just above video frequencies at 4.5 MHz. The 4.5 MHz is easy enough to put in (e.g. figure on page 34, December CATJ) but must be filtered out at the TV receiver, otherwise the sound carrier would appear on the screen as a very fine herringbone pattern in luminance. There's a catch! Any filtering introduces group delay. A minimum of 20 dB notching is required at 4.5 MHz, but frequencies up to 4.18 MHz must be left untouched. This is one heck of a trap, and means a great deal of group delay at 4.18 MHz, and even at 3.58 MHz, relative to the lower frequencies.

So, what is group delay?

"Technically, group delay is the first derivative of phase, with respect to frequency(do/d). What is really means to us is that different frequencies transmitted simultaneously may not arrive simultaneously, or to put it another way, different video frequencies may get delayed in time, which means displaced (left to right) in position on the TV screen. The practical result is that squares waves are no longer clean, because the harmonics making them up have different delay (this gives us the characteristic preshoots and over-shoots). It also means that the chroma information will arrive later than the luminance upon which it was originally superimposed, and **that's where** the FCC and pre-distortion comes in the picture.

"Way back when the TV transmissions specs were being formed up, someone at the FCC characterized the "typical" group delay in a TV receiver, mostly caused by the aforementioned sound trap. It was thus **DECREED** (!) that the "typical" TV receiver had absolutely no delay up to 3 MHz, and 170 nanoseconds of chroma delay (relative to the lower luminance frequencies). A very arbitrary decree, and not really representing true TV sets, but nevertheless 'the law'.

"FCC Para. 73.687(a) (15) became a regulation for broadcasters requiring them to predistort baseband **phase** (sorry but nothing to do with baseband **gain** as implied on p. 35). The amount of delay pre correction was defined as 0 nanosecond up to 3 MHz and MINUS 170 nanoseconds at 3.58 (**minus** delay implying + 170 nanoseconds, **the reverse of the receiver**, or more appropriately a true delay of 170 nanoseconds at luminance respective to 3.58, again the reverse of the TV receiver).

Is the Predistortion network necessary?

"To strictly comply with FCC specs for broadcasting, we should say yes. **In practice** you will find thousands of modulators in the field with**out** predistortion correction with users unaware of the (theoretical) 170 nanoseconds chroma delay at the receiver. We have simulated in plant chrominance to luminance delays of up to 900 nanoseconds, **with totally inconclusive results from observers.** A 170 nanosecond horizontal displacement of color relative to luminance, represents about 1/20 of an inch on an 18" wide screen. The 2 axis of color modulation (I and Q) are limited to 1.5 and 0.5 MHz bandwidth, in other words very low definition. (Detail is conveyed by luminance up to 4.18 MHz). The question is: Can **you see** a displacement of 1/20" of an inch, in a very low bandwidth color signal, in the average program, on the average home TV? Q.E.D.!"

Gilles Vrignaud
Product Manager
CATEL
Mountain View, CA. 94042

Q.E.D. indeed! We stand corrected on the manner in which we characterized modulator compromises in our December report Gilles and we thank you for the extremely informative short course in correct color technology. As for 'leaving CATEL out' of the December issue synopsis, we attempted to select modulator units about which we receive the largest number of reader inquiries. CATEL units are widely utilized by cable systems but we never seem to hear much about them. There is possibly a positive **message in that** negative **response!**

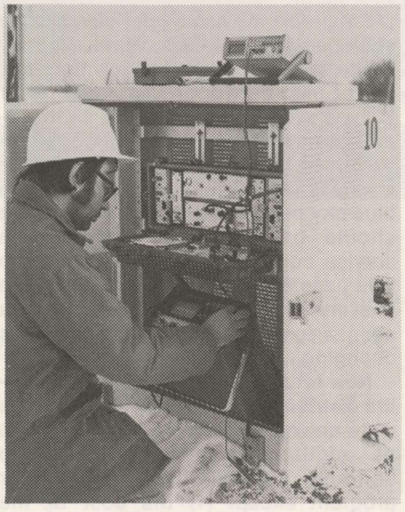
Manitoba Revisit

In the August (1978) issue of **CATJ** a paper described the design and construction of a 225 mile CATV trunk system by the Manitoba Telephone System in Canada. Subsequent issues (see **October** 1978, page **36** and **November** 1978 page **29**) provided a forum where one of the ICBN designers debated the technical parameters of the system with noted CATV engineer I.S. Switzer.

That system is now largerly operational. Manitoba Telephone describes the system as "the world's longest CATV trunk" and the initial 145 mile trunk connecting the two largest cities in Manitoba (Winnipeg and Brandon) is now operational. As the photos here show the system includes both in field test facilities at each 'Superlinear' trunk station as well as Status Monitoring of all amplifier stations at the Winnipeg forward direction origination point.

The new amplifier developed for the system by Century III of Vancouver utilizes the feed forward technique to reduce or cancel distortion products built up in conventional amplifier stations. According to Manitoba Telephone the measured signal to noise ratio in Brandon (after 145 miles of trunk) "exceeds 50 dB" on a CCIR weighted measurement basis.

The trunk cable is 3/4 inch fused-disc coax buried at a depth of approximately four feet. Repeater stations are spaced at 6,300 feet and each repeater station has a hot standby module for redundant protection in the event of a parameter failure. In the field photo the



system technician is checking system response alignment at a trunk amplifier station. In the in-house facility the operator is calling up remote monitoring of an amplifier station at the CRT display where he can check the individual power conditions, voltages, and pilot carriers in both forward and reverse amplifiers. The forward direction bandwidth is 50 through 106 MHz while the reverse bandwidth is 5 to 30 MHz.

As reported in detail in the August 1978 CATJ, the present use of the new ICBN system is to provide first time multiple channel television and FM radio to remote Manitoba communities too far back from the U.S. border to receive **both** U.S. and Canadian television programming via off-air pickup sites. The system has been designed to allow expansion to coaxial network carriage of high speed data, teleconferencing, medical and educational television.

Gunn TVRO Receiver?

"In looking at various methods of tuning in satellite signals, it appears to me that a 'simple' method might be:

(1) Incoming signal - 11,950 to 12,130 (MHz)
(2) Gunn Local Osc - 11,380 (MHz)
(3) Output IF - 570 to 750 MHz

By changing the TV detector from AM to FM and adding a sub-carrier detector for the audio, would you not be in business?"

Paul F. MaGee
Berlin, Maryland
21811

Yes and no. The only television broadcasting via satellite in the Western hemisphere in the frequency range you note as your input range is the experimental joint Canadian-U.S. satellite. It is utilized primarily for video teleconferencing experiments and is on the 'air' only a limited portion of the week (like a few hours) **with three separate 'spot beam' antenna patterns** (they could be 'on', but using another antenna beam than the one that favors your area and you'd never know it). **And this program is due to wind down** (and out as in 'off the air') **by mid-summer. The next problem is the 11.38 GHz Gunn oscillator source. This is not a 'standard' Gunn frequency source and it would have to be special order if you could get it at all. Changing the** (UHF TV) **receiver IF 'to FM' will typically be more complicated than starting all over again with a 40-50 dB gain IF strip that is designed for the wide passband** (80 to 120 MHz) **of the 11/12 GHz video signals. Individual 'channels' or transponders in the 11/12 GHz range are typically 2 or 3 times 'as wide' as they are at 4 GHz where the 36/40 MHz wide 'channels' prevail.**

Coop's cable column

bob cooper editor in chief CATJ

WANTED—100 Video Transponders

I have listened with rapt interest to the cynics who have read or heard Southern Satellite's Ed Taylor forecast that within a very short time the cable industry **alone** will require 40 to 50 active transponders during 'peak load times'. Most people seem to think that once we have 4 or 5 religious transponders, between 8 and 10 pay type channels and perhaps 4 to 6 indies available on the bird we will have reached the point of saturation; any more transponders cannot be supported by the industry. A few reluctantly suggest there may be a handful of additional specialty services, such as the new Reuter's high speed data service and Ted Turner's latest dream. . .a twenty four hour per day news service. But even when these plus C-SPAN (which will share a transponder) and some regional services (FANFARE, ESP) are added, they have a hard time counting beyond say 27 full transponders 'at peak load times' at the outside. **''Add them all up''** said the man **''and you have to come to the conclusion that Taylor has not done his homework. He's dreaming!''.** Perhaps.

But I don't think so. For many months people (meaning firms, associations, what have you) who have been biten by the lure of satellite television relay have been beating a path to Taylor's door. He's had so many wild-eyed promoters in his office asking for advice that he's established a rather healthy (five figure) basic consulting fee which he whips out whenever someone starts to lean on his service company for assistance. That usually shuts down the promoter although a few have ponied up the money and Taylor is busily engaged in researching the viability of their particular scheme for them.

And since the **TV GUIDE** piece last October, and the subsequent appearance on the Cronkite newscast I've had my share of these people banging away at my ear as well. Most mean well, some even have the financial ability to do what they **think** they want to do. **From each I have learned something** and now there seems to be a pretty clear pattern forming. The numbers pretty well tell the story.

Say you want to rent time on a transponder. Say one hour per week, 52 weeks a year. At the current rates, if you go through one of the bulk time buyers such as Ed Taylor, this will set you back **something less than $300 per hour** or around $15,000 for the 52 weeks. That gets you nationwide one hour ever week to as many terminals as wish to, or as are legally able to receive your program.

Enter now the cable television system equipped with a TVRO. Thanks largely to the satellite, cable is finally breaking out of the ''network relay'' mold. After 30 years of being non-paid ''retransmission systems'' (that's the copyright definition of what we are), the industry is finally starting to look like what the blue sky people of the 60's thought we should be all along; ''information service conduits''. Getting free of the ''we pass along, exactly as we receive it, everything we receive'' mentality has been a long time changing; but it is changing.

Now return to the economics of satellite distribution. If the receive terminals were universally **in place** and there was no additional expense attached to sending via satellite a one hour program except (1) the cost of the satellite relay, and (2) the cost of preparing the programming material, then that (round number) $300 per hour looks like the bargain of all communication bargains. How else can you send one hour of real-time television to hundreds, no—thousands of widely scattered receiving terminals so cheaply? The answer is you cannot. Satellite time is one hell of a bargain.

My telephone tells me dozens, perhaps hundres of groups (some organized, some not yet organized) are coming to grips with this reality. So let us paint **a theoretical situation** that as far as I know is not yet happening, but which I see as inevitable just a year or two down the road. Because they fit my 'mold' let's pick on the AMA.

The American Medical Association decides it wants to provide a 'continuing education' program to its members, and to those associated professionals such as the RN's, the anesthesiologists, hospital administrators and so on. Medicine is big business and there are several hundred thousand people involved at a professional level in this field.

A really sharp operator would go to AMA and ask their 'blessing' on a nationwide ''Satellite Medical Network''. He would start with an hour per day (or more) on the bird and he would put together **'continuing education'** videotapes that would appeal to the people in this industry. Because this is a highly monied industry he would **sell commercial sponsorship time** to the pharmaceutical houses and other suppliers in the field and if he did this right his sponsorship time would more than cover (1) his program production costs, (2) his satellite delivery time, and (3) his general operating overhead.

Then he would go to the hospitals and offer them a ''leased earth terminal''. **''This earth terminal, which I will install and maintain, will bring directly into the hospital 'X' hours per week of continuing education for the doctors and other personnel who work here or who work through here''.**

Why would he put the terminal at the hospital? Because that is the one central place where all medical people pass through every day or week.

''Then I will staff this terminal with an operator who would videotape the daily programs, maintaining a videotape file against which any doctor or other personnel could draw 'for a nominal rental fee' **one or a whole series of programs as often as they wish. The videotapes can be viewed privately here in the facility, or for a nominal extra fee taken from the premises for 24 hours''.**

Why, since possibly much of this program would involve tape delayed programming would not such an operation simply skip the satellite and do everything on tape? Several reasons. One, at less than $300 an hour satellite time, it is actually far less expensive to 'send' programming via the bird today than it is via the normal surface routes; especially when you have hundreds of sites to send to. Next, having the satellite will make special live feeds possible; from AMA meetings, live coverage of new surgical techniques and so on. Finally there is the obvious use of the in-place TVRO facility for other related purposes.

''I am also going to offer to the hospital a way for the facility to tack an extra buck or two on each room per night. During the 'off hours', which is during the evening, I am going to bring to the hospital first run movies and other entertainment specials via satellite. By con-


JETTVILLE 25 MI
BRIGGTON 8 MI
NOLTAN 4 MI.
DODFORD 36 MI
TRENT 6 MI
JOHNSTOWN 2 MI.
KERN 17 MI
Extra revenue is right down the road.

necting into the hospital MATV system we can offer patients a choice of very special television in their rooms 'just like the cable systems get'.'' Why people may start checking into hospitals just to see the movies!

Do you have any idea how many hospitals there are in the United States? Thousands. And hospital beds? Hundreds of thousands.

Why wouldn't this chap skip the earth terminal and go to the local cable firm for the 'connection'? Perhaps he would, in some situations or for a limited initial period of time. Doctors might want the 'service' in their offices (away from the hospitals) or in their homes as well. But no smart operator would want **your cable system between him and his money making machine** for very long. And besides, this program would generate so much cash flow he'd be looking for ways to curtail the government's take; depreciation of his owned and operated facilities would help. You can't depreciate what you don't own.

So much for the medical field; it is barely the tip of the iceberg.

Many professional groups have ongoing 'continuing education' requirements. Real Estate Brokers and agents are a prime example. In California a person holding state issued credentials in this field **must** absorb around 15 hours of accredited 'continuing education' **per year**; just to hold onto the state license. This is usually handled by attending two day seminars with a typical 'fee' of $150 plus travel and lodging expenses. If groups of 1,000 gathered at a central point and were fed 15 hours of 'continuing education' via satellite the transponder time would cost less than $4,500. Each site would take in $150,000 at the $150 each fee. Very good numbers most will admit. Oh yes, in California there are approximately 50,000 such people associated with real estate so the 'satellite nurtured industry' that would evolve would generate in excess of $7,500,000 per year.

Public meeting places (municipal auditoriums, gymnasiums, privately run biggies such as the Astrodome) are often badly in need of business. Many such facilities, in communities of 100,000 or less, regularly lose out to nearby major market facilities simply because it takes a certain minimum number of paying participants to stage an affair. Satellite 'networking' changes the economics of group gatherings. It means more people can 'attend' events and not leave their homes, or in the worst case travel far shorter distances and stay at less expensive facilities. In an era of national concern about needless travel and spiraling costs of travel (fuel, lodging, etc.) the satellite comes on the horizon with near perfect timing.

Satellite 'networking' really says that people with specialized interests can share their interests with others in the same interest area for far less expense than by virtually any other 'communications medium'. In person meetings included. Let's see how this might work.

Transponder time is a bargain; even at today's dollar levels. And it will come down, perhaps considerably when ATT/GT & E get into the act with their 72 channels of COMSTAR birds in mid 1979. It is such a bargain that one of the wonders of our time is that every special interest group of 10,000 or more people in the United States has not beaten the door down at RCA and Western Union to buy transponder time. Ignorance of the facts is the primary reason why this has not yet happened.

Labor groups. Stamp collectors. History buffs. French food freaks. Basket weaving enthusiasts. Hot rod builders. Joggers. Ladies who like to sew. Men who like to work with wood. People who paint. People who like to ride horses. Build your own list. . .I stopped at 200 and had only drawn one deep breath.

The economics are very elementary. Collect 10,000 people spread out across the full United States who are interested in one subject. If these 10,000 people are willing and able to put **$.50 per week** into a national 'pot', somebody out there has a golden business opportunity staring them in the face. How so?

That's $5,000 per week gross income. For **$300** you can rent an hour's transponder time. That leaves the person or firm engaging in this business **$4,700** to produce one hour of video tape that will interest these people. The local universities get $75 per hour to use their studio facilities (multiple color cameras, switcher, film chains. . .the whole works). I believe that for around $500 per week I could put together a first rate program on basket weaving using people already in this field for 'talent'. The 'talent' would come out on the arrangement because they would promote their latest 'booklets', basket weaving materials and other 'sellables' on the program. When I got all done I'd have at least $4,000 left in my pocket for my 'trouble'. Each week.

''Ahh yes. . .'' you respond **''but how are these 10,000 basket weaving enthusiasts going to see this satellite relayed program?** They don't own satellite terminals, **and the cost of one, even at the $6,000 level, makes your proposal impractical''.** Does it now?

I noted that I had drawn up a list of 200 'special interest groups'. What I really did was open up the yellow pages of the Oklahoma City telephone directory and start counting. I got as far as the M's and quit. Let's be conservative and say there are at least 300 such 'special interest categories', each with at least 10,000 or more readily identifiable enthuasiasts on a national level. That works out to around **one enthusiast** (per category) **per 25,000 people.** And that says we can get down to some pretty minor interest groups at the 10,000 level nationwide.

Obviously these people have no business congregating at the local hospital to share the medical transponder receive terminal facility. Hospitals have enough problems without welcoming the basket weavers at 10 AM, the joggers at 11 AM and the turquoise jewelry crowd at noon each Thursday. Most communities have a hospital; what else do most communities have?

Six points to the guy who said library.

Now a library is supposed to be an 'information center'. A place where people come to study, to research material, to learn and to share. Too few people use the libraries these days and consequently too few libraries have sufficient money to carry out their mandate. There is an information explosion underway, and a revolution in information storage techniques. One of the primary reasons fewer people use libraries is that fewer and fewer libraries have what people need or want.

Bring back on stage our satellite relay promoter. He goes to the library and he says **"Tell you what I am going to do. I am going to give you, for $1.00 per year, your very own** 'Satellite Information Retrieval Center'. **Out of that terminal will come hours and hours of educational, instructive and even entertaining materials each and every day. We will become partners in the project. You will promote the programming for basket weavers and joggers and turquoise jewelry freaks and all of the rest that the programming will appeal to.**

"For the hour that the enthusiasts come into the library's 'Video Information Center' **you will charge the people 50 cents each. Then we will also provide you with a video taping facility so that you may build a library of the material sent to your** 'Satellite Information Retrieval Center'; **a library which people may come in and use, for say $1.00 per hour. We'll share the income from this service. Or you can make tape dubs for people who want these tapes in their homes, all using equipment that I will provide as a part of the** 'Satellite Information Retrieval Center'. **All I want is a small percentage of that dubbing business."**

You don't think it will work? Hah. Think again. Go to a local Weight Watcher's "Class" sometime and see how fast people cough up a couple of bucks to be 'entertained' for 60 to 90 minutes. There are millions of people nationwide with nothing to do and (they believe) no opportunity for diversion. They would flock to the local library in droves! And for the first time since the turn of the century, the local library would again become a center of community action. Who knows; it might even become financially viable again.

If the local library has 'political problems' there are community centers, Elks and Masonic buildings, YM and W CA's. There are schools. There is probably enough money in this to consider building special 'Video Information Centers'; a facility with separate meeting/'viewing rooms' that could be arranged theater or classroom style to suit the audience there.

The satellite is the key. And when you **really** get down to dealing it can come in for around $200 per hour nationwide. At just 50 cents a head you could break even on transponder time with a paltry 400 people. And that's nationwide.

I think, perhaps, I see your 'light' coming on.

What about the cost of the terminals? Assume a $15,000 installed terminal (with some video taping hardware included). And assume a five year depreciation base. **How many people.** minimum, must use a single terminal per year to make it profitable? At the 50 cents per showing level, with 100 'affiliated terminals' nationwide:

a) 10,000 people nationwide, averaging 100 per terminal for **each of 20** separate 'categories' of 'programming' per week, the costs per viewer are $0.02 for satellite delivery time, and $0.058 per viewer for terminal amortization and maintenance. The gross income per viewer is $0.50, remember.
b) 5,000 people nationwide, averaging 50 per terminal for **each of 20** separate 'categories' of 'programming' per week, the costs per viewer are $0.04 for satellite delivery time and $0.116 per viewer for terminal amortization and maintenance. Gross income is still $0.50 per viewer.

This suggests twenty separate categories of 1 hour programs per week, or perhaps 4 hours per day five days per week. If the operation started out with only ten hours per week (i.e. 2 hours per day) the "do-able" number is around 5,000 'participants' nationwide with 100 terminals. Of course you can raise or lower the number of terminals and create all sorts of additional number sets.

Now how would cable fit into all of this? The most obvious way would be for your cable TVRO to provide a feed on a 'secure channel' to the local library (or wherever) for the system. Since his operating expense and amortization for his terminal projects around $500 per month (or a tad less) you could be cost effective by providing a secure channel for him for something less than that. And if he doesn't have to fool with floating financing for terminals at 100 locations, he'd probably be in operation much sooner.

What about allowing your own viewers to partake in this educational material through their cable drops? Here we have a problem. Remember a **single transponder** must be used for multiple program categories; those are the economics of the situation. What the programming guy wants is for you to have the ability to switch your subscribers on and off individually as the programming they have agreed to take optionally comes and goes. And that says a 'switched system'. QUBE has some of that capacity; **a handful** of systems have limited DBC and AMECO addressable tap experimental 'sections' in operation. The majority of us do not.

Pity.

Because this is all likely to happen very fast. So fast that before most systems can justify the additional expense of addressable taps there will be hustling promoters all over the countryside offering to put satellite terminals at libraries, hospitals, YMCA's and the like. They are liable to take the cream off the satellite delivery system while we sit it out agonizing about how slowly we adapted.

Cable's use of satellites launched the satellite information delivery era in this country. The second phase is now preparing for launch. Whether cable is a part of it, directly, or not remains to be seen. Even if we do not participate directly we will feel the impact. Hundreds of new terminals will be built and sold and many new transponders will be put into use. And shortages of both, which we battle today, will continue.

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has a package approach which should appeal to many experimenters.

Starting off with a 2.8 dB noise figure LNA (24 dB of gain), followed with a double balanced mixer that produces a high IF of 1.2 GHz and following that with an IF stage at 1.2 GHz Shuch suggests **these modules be antenna mounted** along with the tuneable VCO (2.5 to 3.0 GHz). Your downlink signal is then fed via coaxial line to another 1.2 GHz IF stage, a second double balanced mixer which creates a 70 MHz IF. There Shuch leaves you on your own to provide additional IF gain (if required) plus your own demod scheme (such as the Birkill PLL demod featured in the October 1978 CATJ).

Shuch's approach is basically this; he'll provide one or all of the modules you need to construct your own TVRO system. Modules are turned out in small quantities to highly professional specs and there is a fair waiting period for modules. A complete set of modules (from the 2.8 dB noise figure LNA through the 70 MHz IF output) will set you back around $1,700. Individual modules vary from $700 for the 24 dB gain, 2.8 dB noise figure LNA down to the $130 balanced mixer that turns your 1.2 GHz IF into a 70 MHz IF.

For a more comprehensive look at what Microcomm is all about, request **"Application Note #3"** with your $1.00 enclosed to cover printing costs, plus a self addressed stamped envelope to the address given above.

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Remember The Snow!

For those newcomers to the wonderful world of TVROs this timely reminder from the 'old timers'. Snow will cause your satellite signal level to go into a nose dive.

Because of the inclination (elevation) angle of most dish antennas the dish slope encourages the pretty white stuff to build up on the lower half of the antenna. As long as the pretty white stuff remains **dry** (i.e. the water content is relatively low and is not packed tight) you will probably not notice the 0.2 to 0.7 or so dB signal loss from the satellite.

However, if the weather warms up and the snow starts to pack down (getting wetter and wetter as it melts), or if you get a wet clinging snow to begin with. . .the high water content of the snow will cause the 4 GHz signals from the satellite to think they have found a new reflection surface. That new reflection surface will be someplace above the real one, where the wet snow has built up. Signals reflected from the wet snow area will focus someplace other than at your feed (or sub-reflector) and **you'll lose** as much as **half of your effective antenna aperture.**

The solution, when there is wet clinging snow on the dish surface, is to get it off. A rake, hoe or any tool that can be dragged (carefully!) over the surface will pull the wet snow off to the ground and you'll be back near regular antenna efficiency levels once again.

Trinity Helpful

Trinity Broadcasting Corporation (licensee of KTBN which appears on transponder 14 of F1) has ordered twenty receivers from a major supplier of earth terminal equipment and is actively soliciting carriage of its 'specialty station format' programming (religion, 24 hours per day) by cable systems operators. Trinity has taken a low profile in the cable industry until recently, now having established a cable relations department and hiring cable veteran Frank Sanders to head up the activity.

Trinty is looking for cable carriage of its KTBN signal in markets which do not yet have religious programming available and reportedly will 'assist the cable operator' by making a receiver available to him.

Holiday Inn Award

The initial group of Holiday Inn satellite terminals, to go to their owned and operated Inns, has been awarded to a pair of cable-familiar suppliers. **Scientific Atlanta** and **Microdyne Corporation** each were awarded one-half of the initial order, which amounts to just over 300 initial terminals total.

The terminals will typically be utilizing 5 meter dish antennas, 120 degree LNAs and 24 channel tuneable receivers. The first introduction of the Holiday Inn movie channel service (via satellite) is expected in mid to late spring of this year. The Holiday Inn programming will initially combine with the FANFARE service on SATCOM 1 transponder 16.

Expansion of the service, to 'franchisee operated Holiday Inns', will not take place until the Memphis based firm has installed terminals in its owned and operated Inns.

MID STATE Communication, Inc., P.O. Box 203, Beech Grove, IN 46107 (**M8**) 317—787-9426
Modern Cable Programs Division of Modern Talking Picture Service, Inc., 2323 New Hyde Park Road, New Hyde Park, NY 11042 (**S4**) (516) 437-6300
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
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
Southern Satellite Systems, Inc., P.O. Box 45684, Tulsa, OK 74145 (**S9**) 918—664-4812
Systems Wire and Cable, Inc., P.O. Box 21007, Phoenix, AZ 85036 (**M3**) 602—268-8744
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 (**S9 Automated News SVC**) 212—262-4014
Theta-Com CATV, Division of Texscan Corporation, 2960 Grand Avenue, Phoenix, AZ. 85061, (M1, M4, M5, M7, M8) 602—252-5021
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), 1018 West Peachtree St., Atlanta, GA 30309 (**S9**) 404—875-7317
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
United Video, Inc., 5200 S. Harvard, Suite 4-D, Tulsa, OK 74135 (**S9**) 918—749-8811
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

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