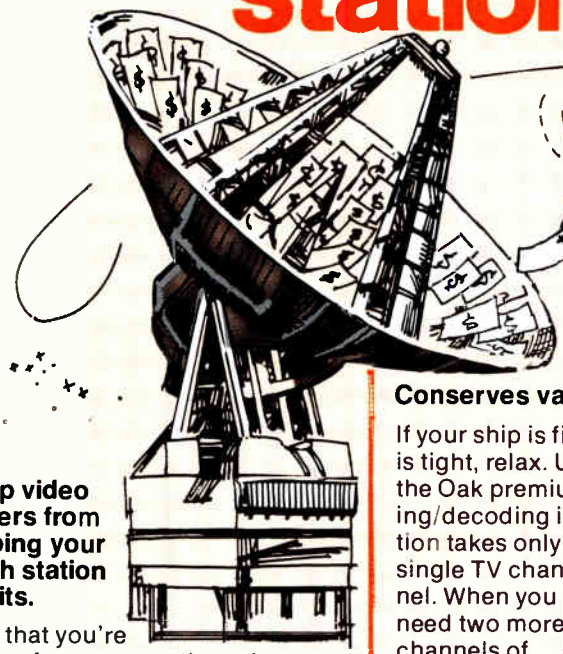
C-ED

New Satellite Section
Lightning Problems in CATV Systems

Communications-Engineering Digest
Reporting the Technologies of Broadband Engineering

February 1979
Volume 5, No. 2

Oak protects your earth station investment!



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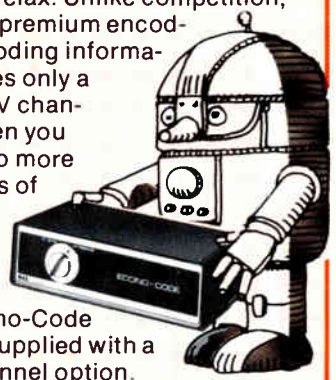

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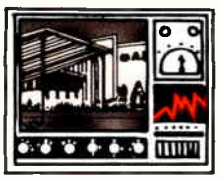

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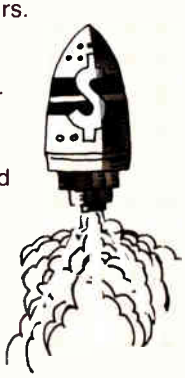

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C-ED News at a Glance

WASHINGTON, D.C.—Because of delays incurred by operators in receiving equipment necessary for completion of construction of earth stations and subsequent requests for waivers of the 90 day time limit, the Federal Communications Commission's **common carrier bureau** says it **will now be issuing construction permits for TVRO's which will allow a period of 180 days from grant of permit to completion of construction.** The bureau also says that lengthy computer printouts with detailed analyses of scatter interference will not be routinely required of applicants.

WASHINGTON, D.C.—The FCC has given **AT&T and GTE Satellite Corporation authority to conduct a market trial of video conferencing service via Comstar. RCA and Western Union had tried to block the move,** but the FCC said it was sanctioning the trial for 12 months in order to facilitate "the development of new techniques that give promise of improvement in the communications satellite service." AT&T will use its Picturephone Meeting Service. The commission noted that the **other domestic satellite carriers were capable of offering a similar service** over their satellite systems, **but none were currently doing so.**

WASHINGTON, D.C.—The **FCC has extended the special AM sterophonic test authorizations** previously issued **to stations WGM in Nashville, Tennessee, and WGAR in Cleveland, Ohio to permit continued operation through February 27 and February 28, 1979, respectively.**

The terms of the extended authorizations are the same as those contained in the original authorizations. The test authority may not be used for promotional purposes, the stations must comply with the requirements of Section 73.40 of the commission's Rules, and test results are to be submitted to the commission for inclusion in the record of Docket 21313.

WASHINGTON, D.C.—The FCC has adopted a further notice of inquiry on establishing **standards for FM quadraphonic sound transmissions.** The commission said that previous comments indicated there was substantial interest in FM quadraphonic broadcasting and added that technical comments received, as well as the FCC's own analysis of technical data submitted, indicated that **quadraphonic systems could be accommodated within the present frequency assignment plan** without objectionable degradation to monophonic and stereophonic radio service.

One of the primary questions remaining is the impact of the adoption of quadraphonic broadcasting standards and the possibility of reducing the channel spacing in the FM broadcast band to 150 kHz or 100 kHz.

WASHINGTON, D.C.—The FCC has instructed its staff to develop **proposals for studies on the effects of terrain shielding and directionalized antennas on predicted interference losses caused by VHF "drop-in" assignments.** (A VHF "drop-in" is a new television assignment that would be located at a shorter distance to another channel allocation than is required by the FCC's rules on minimum separation.)

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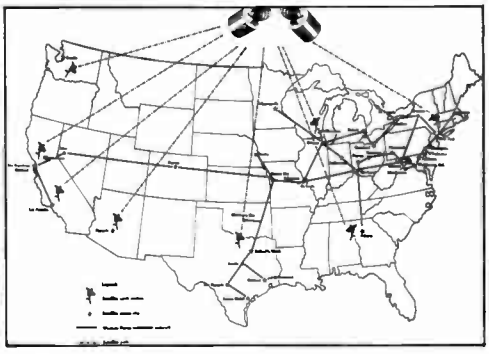

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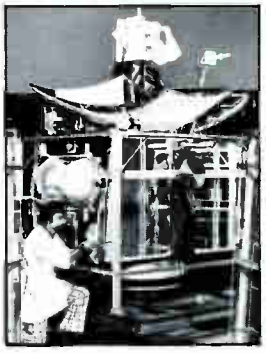

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FEATURES

DEPARTMENTS

OPINION

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Editor's Letter

This February issue of *C-ED* unveils yet another new, and we believe, informative department—satellites. Every month *C-ED* will examine one aspect of satellite-related technical issues. In addition, we will devote a page to the scheduled hours and alert signals of each satellite-transmitted program.

This time, our inaugural satellite section addresses satellite reliability. And our program schedule targets the month of March—enough time for system operators to receive *C-ED* and post the timetable up on their walls.

As we scanned this first program schedule, as well as those programs we hear are on the drawing board, we are struck by the vast programming advances the industry has made since the FCC's TVRO decision just two years ago. But we were also struck by what we see as perhaps the most serious problem facing the industry today. Channel Capacity.

In recent weeks Ted Turner's plans for a 24-hour news operation were shelved, in part, due to a lack of interest. The other more critical reason, knowledgeable sources point to, was the inability of many systems to add another service, simply because they have, or are about to, run out of room. The so-called promise of cable is seriously being threatened by the current limits on channel capacity. On the not-too-distant horizon lurks the telcos. Profits for 1978, Board Chairman deButts recently noted, were $5.27 billion—*five times* the total revenues of the cable industry. AT&T does have all kinds of wherewithal. The cable industry had best continue to look over its shoulder as well as get cracking on system rebuilds.

Paul A. FitzPatrick

Odds and Ends

By Glenn Chambers
SCTE Eastern Vice President
American Television and Communications Corporation
Englewood, Colorado

Looks like the SCTE is going to come out with a construction manual this year. It will contain guidelines on all the ways to build a system for maximum reliability at costs-per-mile we can live with. Mac Quarashi of A-M Communications is heading up the group that will gather, edit and collate all the available information. Knowing Mac and some of the others in the group, I'd bet on the manual being a good one. I'm sure Judy Baer will keep us all informed on the progress, and maybe even push a little if things get bogged down. Actually, she will thump them with her SCTE yo-yo.

There were quite a few questions raised at the Western Show as to why the SCTE has its Reliability Conference as a joint effort with the IEEE. The majority of the directors seem to feel that we do all the work, provide most, if not all, the speakers, and do most of the advertising. IEEE does do one very visible thing though, they readily take its share of any profits. Why not have our own Reliability Conference next year and let them have theirs? That way we can go to two meetings.

Maybe this column will let me squelch a nasty rumor that seems to be going around. I have been called dozens of times since the Western Show and asked why I resigned from the SCTE. I did NOT resign from the SCTE. I did resign as a Region 2 Director and as co-chairman of the Reliability Conference. My travel schedule is fast approaching the magic "80 percent on the road" mark and I am becoming very heavily involved in technical education for the company. I just don't feel that I can do justice to additional SCTE duties. In my mind, the SCTE will always be number one.

Don't forget the annual meeting held in conjunction with the Reliability Conference in Denver. For most of us, this is the one place you can meet all the officers and find out exactly what is happening in the Society. It is your chance to tell them where they made their mistakes in the past and how to solve future problems. I really exercise my 20-20 hindsight here. Besides, they may surprise you and elect you to some office.

If Bob Bilodeau retires as president (he says he will), we'll never find anyone who can equal him as the "Fastest Pun in the East." I understand that we are going to have a bunch of new officers this year. Personally, I feel that this is the best thing that can happen to an organization such as ours. Many of the office positions put a big load of additional work and responsibility on a person. If you are as underprivileged as me, and have to work for a living, one or two years can be a very long time. When you are a newly elected officer and all those people have just voted you in, enthusiasm and energy are at its highest peak. You feel you can conquer the world.

You put in untold hours thinking about, and working on, Society projects. As time goes on and you become a stranger at home, your wife starts to check your pockets for strange phone numbers, your children start to ask if you are another "uncle," and your dog bites you when you go in the yard. This tends to diminish efficiency in a hurry. Just kidding—our officers are doing a great job, but let's share the fun with everyone.

Glenn Chambers

Melbourne Technical Meeting Very Successful

MELBOURNE, FLORIDA—The Society of Cable Television Engineers conducted a highly successful two-day technical seminar on January 8 and 9 at the Holiday Inn-East in Melbourne, Florida. The seminar featured panels and discussions on CATV Towers, Lightning, Power Surges and Standby Protection. Also included on the program were CATV tower construction, maintenance and inspection, and FAA/FCC rules.

Over 150 attendees and 32 exhibitors can attest to the high quality and productivity of the seminar. In addition to the panels and exhibits, the Melbourne seminar featured outdoor sessions, films, Certificates of Completion, lunches, workshops and, last but not least, the First Annual Flaky-Frisbee contest.

Once again, Ralph Haimowitz and the SCTE must be congratulated for putting together a very successful technical program.

SCTE Elections Coming Up

WASHINGTON, D.C.—New officers and directors will shortly be elected to take office at the Eleventh Annual Membership Meeting held in conjunction with the CATV Reliability Conference in Denver, February 27-28, 1979.

The Nominating Committee, under the able leadership of its chair, Larry Dolan, met on December 21 and drew up a proposed slate of candidates for the various positions open on the SCTE board. Candidates are being contacted by telephone to determine whether or not they will accept the nomination to run for a seat as either regional or at-large director.

The Nominations Committee has unanimously approved the following slate of officers to serve in the 1979-80 year and will present this slate to the full board by mail: president, Harold R. Null, Storer Cable TV, Sarasota, Florida; western vice president, Frank Bias, Viacom Communications, Dublin, California; eastern vice president, William Ellis, Evansville Cable TV, Evansville, Indiana; secretary, Kenneth Gunter, UA-Columbia Cablevision, San Angelo, Texas; and treasurer, Thomas Olson, TOMCO Communications, Mountain View, California.

Four candidates have been nominated to run for each of the regional director positions to be elected for a two-year term: Region 1 will encompass California, Oregon, Washington, Nevada, Utah, Arizona, Hawaii and Alaska. Region 3 is composed of North and South Dakota, Nebraska, Iowa, Kansas, Oklahoma and Missouri. Region 5 covers North and South Carolina, Louisiana, Arkansas, Mississippi, Alabama, Georgia and Florida.

Glenn Chambers, long-time board member and Charter SCTE member has resigned as director of Region 2 due to health and job pressures so an election must be held within Region 2 to fill the remaining period of his term, through 1980. This region includes Colorado, Idaho, Montana, Wyoming, New Mexico and Texas. Since Bill Ellis has agreed to run for the office of eastern vice president, one year remains of his term as Region 4 director covering Minnesota, Wisconsin, Illinois, Indiana, Kentucky and Tennessee.

Larry Dolan's Nominations Committee (Bob Luff, Jim Emerson, Ralph Haimowitz, Jim Grabenstein, Bob Toner and Glenn Chambers) are to be congratulated on a fine job for coming up with so many nominees which will make this year's election race very exciting.

1979 CATV Reliability Conference Speakers Announced

DENVER,COLORADO—The SCTE and the Broadcast, Cable, and Consumer Electronics Society of the IEEE have announced the speakers and panelists participating in the Fourth Annual CATV Reliability Conference, February 27-28 at Stouffer's Denver Inn, in Denver, Colorado. Glenn Chambers and W. Sherwood Campbell, both of American Television & Communications in Englewood, Colorado are conference co-chairmen for the 1979 program.

The two-day conference will feature four major panels. *CATV and the Blue Sky: How to Keep the Clouds Away*, hosted by Robert Luff, vp of Engineering for the National Cable Television Association, will explore new technologies of fiberoptics, earth stations, satellite reliability and data communications. *The Real World: Reliability in CATV Systems Design* will address effective methods of system design using new computer technologies as well as well-known manual information gathering tools. Thomas Polis, director of Technical Services, Magnavox CATV, will moderate this panel.

Gerald L. Bahr, chief engineer of Trans Video Corporation will moderate a panel titled *Manpower Reliability: Personnel Management and Training.* Mac Qurashi, president of AM Communications Corporation, hosts speakers addressing *System Construction: Good Engineering and Business Practices Spoken Here.*

Panelists participating include Ishwar Aggarwal, director of Optical Fiber Research, Valtec Corp.; Judith Baer, executive director, SCTE; Gerald Crusan, vp-Engineering, Comcast Corporation; James Duffey, manager, Systems Design and Bid Proposals, Magnavox CATV; Dave Emberson, manager of National Technical Services, RF Communications; Barbara Lukens, manager, Design and Drafting, ATC; Richard Mueller, engineering manager, Dickinson Communications; Larry Nelson, chief engineer, Comm/Scope; John O'Neill, director of TV Services, University of Wisconsin-Platteville; William Ross, director of Field Operations, AM Communications; C. Dean Taylor, vp-Marketing, Systems Wire and Cable; George F. Taylor, division construction engineer, ATC-Orlando; Robert Vallerand, western regional engineer, ATC-San Diego; Joseph Van Loan, director of Engineering, Viacom Communications; and, Paul Workman, technical trainer, Mission Cable TV.

SCTE or IEEE member advance registration fee is $75. Non-member advance registration fee is $90. Additional charges are applicable for on-site registration. The fee includes luncheons, one reception, sessions and one copy of the Official Conference Record. Registrations must be mailed to SCTE, Post Office Box 2665, Arlington, Virginia 22202. Hotel reservations must be made directly with Stouffer's Denver Inn at (303) 321-3333. For additional information, call Mila Albertson at (202) 659-2131.

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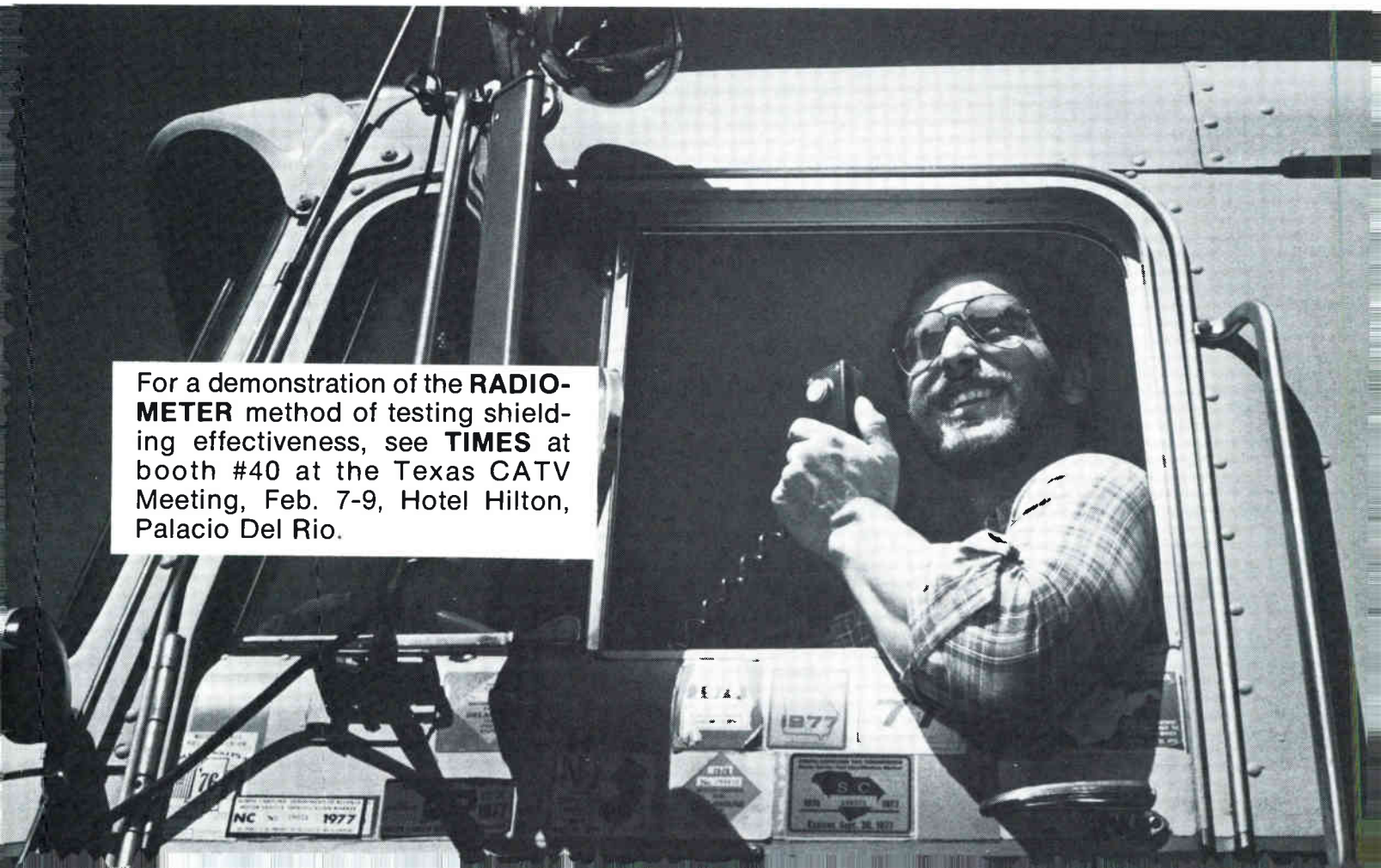

For a demonstration of the **RADIOMETER** method of testing shielding effectiveness, see **TIMES** at booth #40 at the Texas CATV Meeting, Feb. 7-9, Hotel Hilton, Palacio Del Rio.

Lightning and CATV Systems

By Hansel Mead
Vice President of Engineering
Q-Bit Corporation
Palm Bay, Florida

The subject of lightning protection is, in itself, a treatise of procedures to minimize the chances of damage or minimize the amount of damage to components during a strike. If a CATV system is spending $8,000 per year for repair due to lightning damage, protective measures could reduce this to less than $1,500 per year with less equipment down time. From a business standpoint alone, some investment in protective devices is surely worth consideration. It will become apparent, in the further discussion of lightning phenomena, that total no-damage protection is not feasible or practical. There is evidence of rare lightning strikes of such energy that it staggers the imagination. Stroke currents of over 340,000 amperes have been recorded and power explosive effects equivalent to 600 lbs. of TNT have been calculated during large lightning strikes.

According to Dr. Rodney Bent of Atlantic Science Corporation, "A cloud-to-ground lightning discharge is made up of one or more intermittent partial discharges. The total discharge, whose time duration is on the order of 0.5 seconds, is called a flash; each component discharge, whose luminous phase is measured in tenths of milliseconds, is called a stroke. There are usually three or four strokes per flash, the strokes being separated by tens of milliseconds. Often lightning as observed by the eye appears to flicker. In these cases the eye distinguishes the individual strokes which make up a flash. Each lightning stroke begins with a weakly luminous pre-discharge, the leader process, which propagates from cloud-to-ground and which is followed immediately by a very luminous return stroke which propagates from ground-to-cloud . . ."

High electrostatic fields are generated during storm activity within the clouds themselves. These fields, between the top and bottom of clouds, create electron flow from top to bottom. This discharge period occurs in very short steps of less than 1 uS (10^{-6} seconds) length and at a recurring stepped rate of 50 uS. This activity builds corona leaders (stepped leaders) which extend below the base of the clouds toward the ground. As the leader approaches the ground, its large negative charge induces a positive charge on objects below it on the ground, especially objects projecting above the earth. This in turn attracts the leader toward the ground positive potential and creates streamer corona upward from ground objects. When these corona leaders reach a close enough distance, breakdown occurs and a large discharge current from the ground-to-cloud occurs called a return stroke. This follows the original leader path and results in high electric current flow. Maximum current flow is reached in less than 1 uS and lasts for approximately 20 uS. A smaller current maintains the stroke path for periods extending over 100 uS.

The return stroke current usually causes damages. Currents, of course, vary depending on cloud size. Experimental data (by Bent) indicates a probability distribution as follows:
If lightning strikes an object there is a:

- 90% probability the current will be less than 10,000 amps.
- 10% probability the current can be as high as 60,000 amps.
- 2% probability the current can be as high as 150,000 amps.

Thus, if protective measures can be taken allowing a system to survive a 50,000 amp stroke with no damage, it may receive only minimal damage from a 100,000 amp stroke. Let's examine what happens when lightning strikes a 400-foot tower. Current is going to flow from ground to tower by whatever path it can find. If it is a 100,000 amp stroke, 100,000 amps are going to flow through various paths with most of the current following the path of least resistance. These current flow paths could include tower base, guy anchors, and downlead cables to headend electronics, and then follow a path from the electronics to power line ground and also into the system trunk cable exiting at the headend. A 400-foot tower has approximately 150 u Henrys of inductance. This causes an initial inductive voltage buildup lasting for a little more than 1 u second at the top of the tower. For a 100,000 amp stroke, this short voltage peak calculates out to about 7.8 million volts. For the rest of the stroke period, the voltage drop is developed by the total resistance to ground. If this value were ½ ohm, there would be an IR drop of 50,000 volts. In this case, if a downlead to the headend has no DC return on its center conductor, at the top it would, after the initial inductive kick, assume some portion of this 50,000 volt drop between the center conductor and shield. This, of course, would cause arc over. If a DC return was connected, the center conductor would eventually share some portion of the 100,000 amp current and possibly fuse some component. There is substantial evidence of high current flow from downlead cables to power line and trunk cable.

Once one is convinced that stroke current is going to flow through whatever paths it can find, it makes sense to furnish this charge with a controlled low resistance path(s) to conduct a high percentage of the current. The use of a lightning rod allows control of a most probable point of the lightning strike to an elevated structure.

A number six copper wire wrapped around a steel post buried six feet in the ground and attached to a steel tower is not really a serious approach to "grounding" a 100,000 amp strike. Let's look at the problems:

- The number six copper wire is

inadequate to handle the magnitude of current.

- The ground post is not deep enough.
- The copper/steel interface will corrode due to dissimilar metals and create a high resistance joint.

Good grounding of a tower is not difficult or very expensive. All of the components and services needed are available locally. Both the tower and guy wire system are of heavy duty galvanized steel. Several guys terminate at one anchor point and a multiple ground system can be incorporated because guys are required. Thus, a four point ground system can be realized (see Figure 1). Since the guy

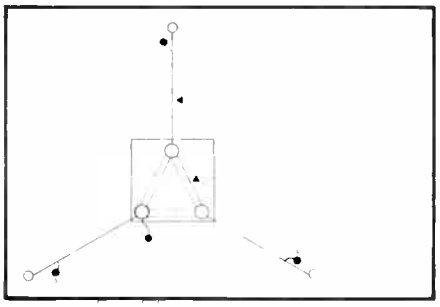

Figure 1

anchors are several hundred feet apart each ground is independent. The complete system should be constructed of galvanized steel components so a dissimular metals joint problem is avoided.

The ground rods should be made of 1½-inch galvanized pipe put down into the ground 20 to 30 feet depending upon dryness of soil and area. In rocky areas, a well drilling company can easily handle 1½-inch pipe. Drill out an outside pipe cap and insert a ½-inch galvanized full threaded bolt (see

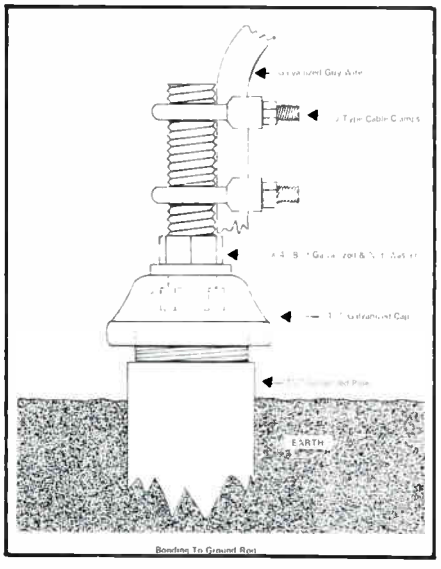

Figure 2

Figure 2) for the top connection. Using cable clamps, attach heavy guy galvanized steel wire to bolt ends and guy wires. Likewise, attach grounding to extended bolts on tower base (see Figures 3 and 4).

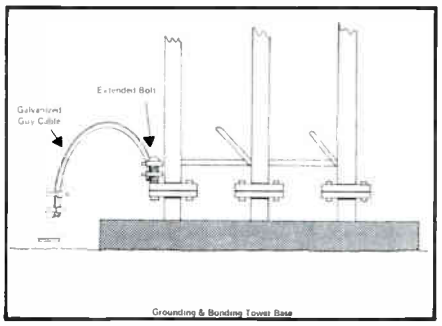

Figure 3

Battery terminal grease, or equivalent, should be used at joints to prevent corrosion and be sure each sectional leg in the tower has a good connection (at least one bolt in each leg per section).

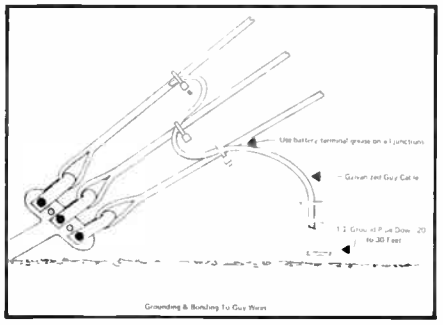

Figure 4

One sharp point lightning rod extending higher than any other point on the tower, in most cases, will divert lightning to strike the rod. For connections and size remember the rod will carry the full current of a stroke. For search antennas on rotators, use a battery cable to bypass the bearings of the rotator.

Install downlead cables so that they are running on the inside of the tower. This will protect them from side flashes and prevent electromagnetic fields from being induced into the downleads.

Protecting cable plant requires a somewhat different approach for protection. The cable system is not only concerned with protecting its equipment but also protecting the subscriber's equipment. Likewise, the cabling and grounds are often intermingled with other services, such as power and telephone, into a subscriber's residence. A ground rod into the surface of the earth sees an electrical resistance from the earth itself. Large surges of current into a rod result in large voltages at a ground rod. Likewise, a voltage gradient during a strike exists along the surface of the earth radially around a ground rod. This gradient can be several thousand volts per meter within a few meter radius of the rod (see Figure 5). It is this phenomena that sometimes kills cows and horses standing beneath trees. It is not advisable to attach to, or drive a ground rod close to, grounds for other services. Grounds closer than 60 feet can couple into each other. Grounding of underground cabling can receive good protection through proper care taken in making the grounding points.

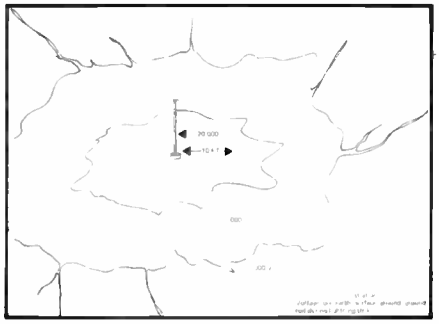

Figure 5

For pole-mounted cabling, one should look at the case in which the cabling is alone on poles. A static line (wire) over (at least ten feet) the cable run will afford some protection for strikes to poles. It is still possible for side flashes to reach the cable but the main current will be carried by the static line. The static line and cable should not use the same ground rod. The grounding wire down the pole from the static line should be kept as far as possible from the cable. During a strike several tens of thousands of volts can be on the ground wire and can arc over the cable (see Figures 6 and 7).

For cable on poles sharing other services, the cable service can use the other service cables (say power lines)

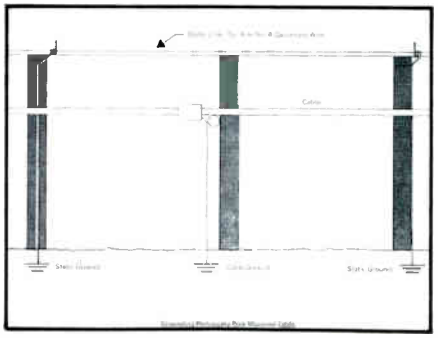

Figure 6

MICROWAVE

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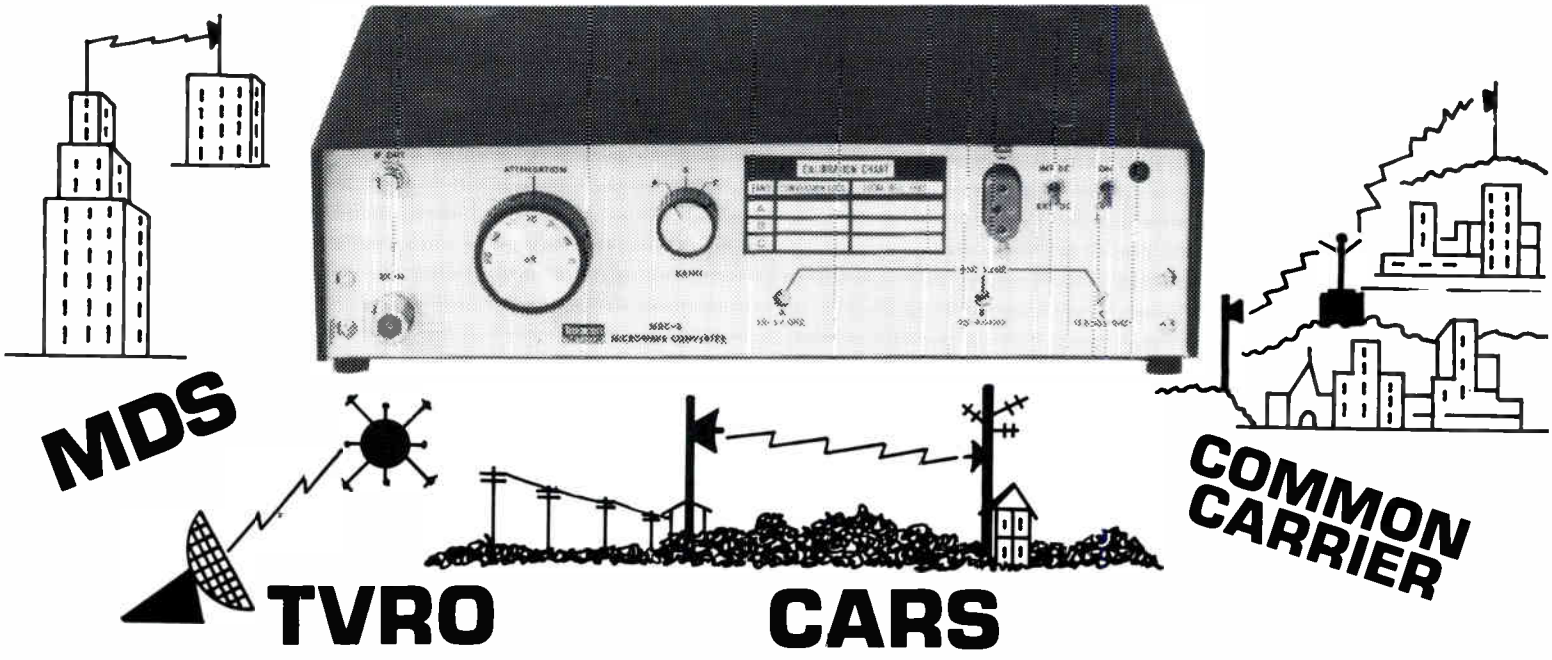

Texscan's microwave down converter permits measurement in the MDS (2.1 GHZ) TVRO (3.7 GHZ) and CARS (12.7 GHZ) band with existing VHF test equipment. Spectrum analysis, signal strength and even microwave sweeping are possible with the MDC-3.

Available as an option are three bandpass filters which speed and simplify the measurement process. The filter kit is required for sweep operation. The MDC-3 has a calibrated insertion loss and adjustable local oscillator for each band. Other frequencies are available.

Texscan

TEXSCAN CORP.: 2446 N. Shadeland, Indianapolis, Indiana 46219, (317) 357-8781, TWX 810-341-3184
THETA COM: 2960 Grand, Phoenix, Arizona 85017, P.O. Box 27548, 85061, (602) 252-5021, (800) 528-4066 TWX: 910-951-1399

for static protection. Use the same grounding philosophy as with the static line.

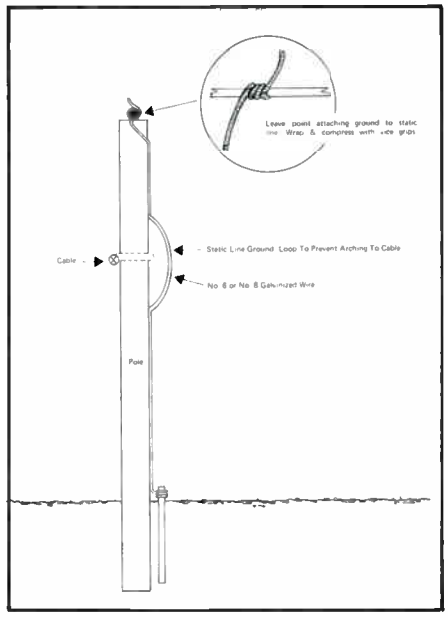

Figure 7

Bonding

Bonding is simply an electrical term used to define the electrical connection of two or more conductors. Bonding or connection is an important aspect in electrical equipment and a prime factor in failure of electrical apparatus or systems.

Normal off-the-shelf electrical apparatus usually has connections designed and provided to adequately interconnect them with interfacing equipment. Providing connections for grounding structures or equipment housings usually must be improvised by the designer or installer. Likewise, configuring a grounding system to cope with lightning discharge requires different considerations than normally powered equipment.

An antenna tower will normally conduct only a few microamperes (10^{-6} amps) to ground, except during a lightning discharge where it can instantaneously be subjected to currents exceeding 200,000 amps. Failure of the interconnect during a strike, of course, defeats its primary purpose.

Bonding is normally accomplished in one of three ways:

- Welding
- Brazing or Soldering
- Pressure bonding

The pressure bond is the most common connection in electrical equipment. Welding or brazing is, at least in theory, the most reliable connection.

Each of the three techniques, however, has some disadvantages.

Welding some metals is difficult and can destroy protective plating surfaces, subjecting it to corrosion. Brazing or soldering to some metals is difficult or impossible. Both welding and brazing are usually impractical to accomplish in the field and make it difficult to remove or change out equipment. Pressure bonding (i.e., bolting or compression fit) can be subject to corrosion especially if dissimilar metals are used. Corrosive salts create a high resistance "joint" resulting in failure of the connection.

Failure of a connection during a lightning strike usually starts an arc, generating heat, resulting in fusing and complete separation of the joint. A good pressure bond, however, with compatible metals will cold weld during a high current surge.

Aluminum conductors are the most unreliable metals for pressure bonding but can be welded to a very reliable connection. Aluminum metal forms an aluminum oxide coating immediately on contact with air. It is this oxide coating that makes it so corrosive resistant. Aluminum oxide is an insulator and is the reason aluminum is so difficult to pressure bond.

Various grease compounds are available to apply to pressure bonds. These compounds are chemically inert but seal a pressure bond from air and moisture so no corrosion can occur.

There is nothing magic about using copper conductors for lightning. Copper is a good (low resistance) conductor of current. It can also be soldered or pressure bonded easily. It is compatible with brass, nickel or tin plated bonding terminals. Fusing current and size are the main considerations in selecting a proper conductor, not resistance or type metal. The ground rod in the earth is the highest resistance path in a grounding system anyway. Copper wire is mechanically weak and expensive. This restricts its use for grounding to only special applications.

No matter how elaborate the grounding system, improper bonding makes it all for nothing. Likewise, bonds must be maintained to assure good connections.

Circuit Protective Devices

There are three different types of circuit protective devices which can be used for different applications. These devices can absorb, without damage, thousands of times the transient surges (voltage and current) that signal transistors or diodes can. Such devices are beginning to be used widely in the most modern electronic equipment. With a good, comprehensive understanding of these devices, older equipment can be modified to incorporate more protection.

The Gas Discharge device is used widely on cable signal lines. In its static condition it displays almost infinite resistance and low capacity. When it fires (arcs) due to overvoltage it displays very low resistance and can carry several hundreds of amperes of current over a short period of time. It is a crowbar-type circuit protection device going to a near short circuit, as long as enough current is available. Its main short comings are that it takes over 1.0 uS for it to arc, and, after it fires, it can become so hot that it will not release when used on low impedance power supply lines such as line

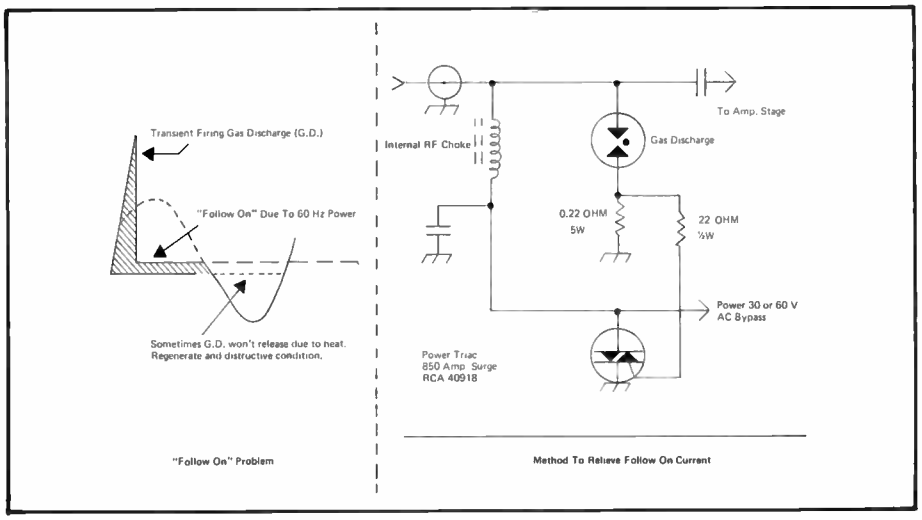

Figure 8

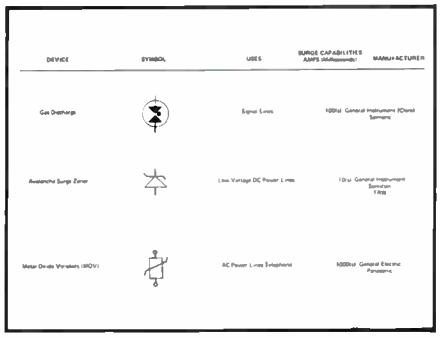

Figure 9

powered amplifiers. This effect is sometimes referred to as "follow on" current (see Figure 8).

The Avalanche Surge Zener has a sharp clamp knee. Its internal design is somewhat different than conventional zener diodes and a larger device (say 50 watt) is put in a smaller package (say 5 watt size). For short periods of time, these devices can handle large surges of power. For instance, a 5 watt unit can handle 1,200 watt peaks for 1 mS. Its failure mode, due to over-dissipation, is to internally weld to a short condition. This is a good failure mode during transient conditions because it still protects transistor circuitry even though the device has to be replaced.

Due to its large internal capacitance it cannot be used on signal lines. Its main use is for low voltage DC power supply lines. Two units back-to-back in series can also be used on low voltage AC power lines (see Figures 9 and 10).

Metal Oxide Varistors (MOV) devices are not semiconductors. They are rather a soft clamp device for AC power lines of 80 volts or more. They can, however, dissipate extremely high energy transients without damage. Large units are available which can protect 220 VAC, 200 ampere service. Q-Bit Corporation pre-amplifier power sources had invariably lost power transformers and rectifiers from lightning damage before using varistors. For three years after using varistors only one unit has been known to lose a power transformer. Voltage transients have been recorded on 117 VAC power lines to exceed 2,000 volts. Such transients can spell the end to semiconductor rectifiers and can even damage transformer and electric motors not properly protected with an MOV device (see Figures 9, 10 and 11).

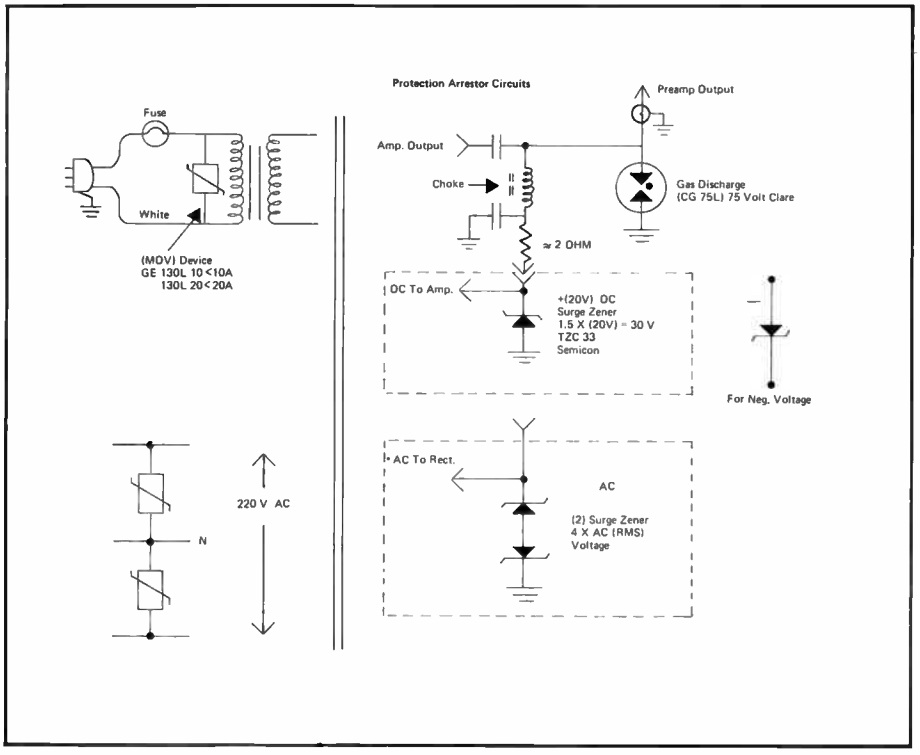

Figure 10

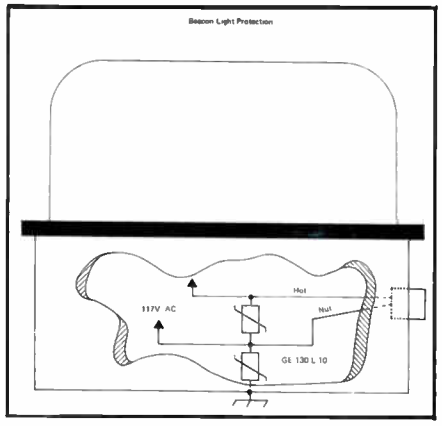

Figure 11

It is hoped this short paper reveals at least the awesome energy released during a ground-to-cloud lightning discharge. It is naive to assume protective measures can always guarantee equipment will not be damaged. The use of proper grounding techniques and incorporation of circuit protective devices can, however, greatly reduce failure and damage to equipment.

The layman points to a wire terminated at a ground rod and assumes the lightning current all ends there. It actually ends at a several meter radius from the rod. Several thousand volts can be induced on a small ground rod during a direct lightning strike.

Where do you ground a 400-foot tower? Everywhere you can. The earths' resistance to the ground rod is the highest resistance element in the grounding system. A six-foot rod can vary from a few ohms to several hundred ohms resistance in dry sandy soil. Theoretically, every time the rod length is doubled the resistance drops in half. Once moist soil is reached, however, the resistance will drop drastically.

Separating ground systems (in theory) is all right, but most fire codes require all services into a building to use the same ground points. This is for good reasons, as side flashes or voltage differentials between equipment to different grounds can be very hazardous. Grounding is mostly common sense, but whatever the designer works out must conform to local and federal electrical codes. Circuit protection devices can withstand hunreds of thousands of amps of transient current and there is conclusive evidence that even though protection devices sometimes fail during large transients, they still protect critical circuits. Gas Discharge devices contain the arc even after the metal ends have burned through and surge zeners weld to a short.

Even though this paper discusses large 100,000 amp strikes, these are a somewhat rare occurence. Ninety percent of the lightning strikes will be less than 10,000 amps. Designing protective measures and grounding to cope with 100,000 amp strikes will result in sufficient reduction in damage.

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Basic/Pay Combination Trend

Cable operators constructing new systems in major markets are offering basic and pay services in combination from the very start, and in more and more instances are offering multi-pay/multi-tiered service as well.

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*July 5, 1978 edition of Paul Kagan Associates *Pay TV Newsletter.*

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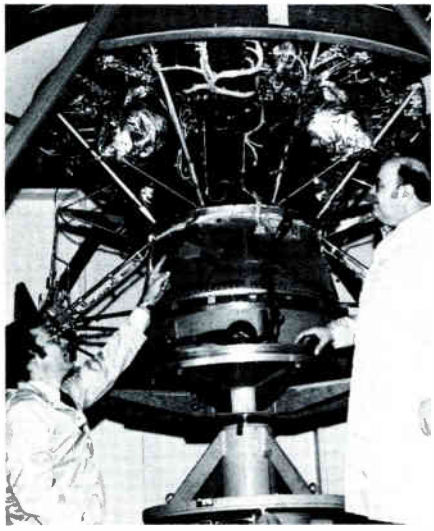
VITEK

Western Union to Launch Westar III in August

UPPER SADDLE RIVER, NEW JERSEY —Western Union has announced that it plans to launch its Westar III satellite in August, and has asked the Federal Communications Commission for approval.

Westar I and Westar II, launched for Western Union by NASA in 1974 as America's first domestic communications satellite system, are approaching full-capacity use. Westar II has been a ground-ready spare for the system, and Western Union has made payments to NASA entitling the company to a short-notice launch date.



Western Union's Westar III satellite recently underwent an extensive checkout at Hughes Aircraft Company (the manufacturer), and was found to be in excellent condition for launch. Seen inspecting the satellite are two Western Union engineers.

Western Union has requested the orbital slot at 91 degrees west longitude. Westar I is at 99 degrees and Westar II is at 123.5 degrees, 22,300 miles in space over the equator. The Westar system covers nearly all of North America and Hawaii.

The Westar system is used as an integral part of Western Union's national transmission system, which includes a 9,000-mile transcontinental microwave network and extensive local cable facilities. Many Western union services, including Mailgram messages, are transmitted via satellite.

The Westar III satellite, like the present Westar satellites, has 12 transponders. Each transponder relays 1,200 one-way voice circuits, one color TV signal or data at up to 60 million bits (units of computer code) per second.

NASA has called on Western Union to develop an advanced satellite network to track and handle communications with other spacecraft in the 1980s. Western Union is building and will share in the use of this system for its next generation of satellites.

Inquiry Begun on Electronic Computer Originated Mail

WASHINGTON, D.C.—The Federal Communications Commission has begun an inquiry to study the legal and policy issues posed by Electronic Computer Originated Mail (ECOM) as proposed by the U.S. Postal Service.

ECOM represents an end-to-end service intended to transfer information from an origination point to single and multiple destination points. Part of this service involves a transfer of information in electronic form using wire and radio communication channels and electronic message routing equipment. The remaining part of the service involves the physical delivery of information in hard copy form by postal employees.

The action was the result of a request for a declaratory ruling filed by Graphnet Systems, Inc., a specialized common carrier providing facsimile message transmission and delivery services to the public under tariff. Graphnet sought an inquiry on the scope of the FCC's jurisdiction over ECOM which the Postal Service proposes to offer using services and facilities provided by the Western Union Telegraph Company.

The commission said the inquiry would involve three basic issues: jurisdiction, tariffs and certification.

New Earth Station Policies Explored

WASHINGTON, D.C.—Due to technical and policy changes that have been (and will continue to be) occurring in satellite communications, the FCC has begun an inquiry to determine whether its present earth station regulatory program can be improved or eliminated.

"While the present regulatory program provides significant benefits," the FCC said, "it wishes to explore whether those benefits are worth the costs they impose upon both the applicant and the commission. Possibly those benefits could be obtained at a lower cost by modifying the present program. Alternatively, some users may prefer reduced benefits at lower cost."

The FCC now requires that a three-step process—frequency coordination, construction permit and licensing—be followed before putting a new earth station into operation. Frequency coordination appears to be the most time-consuming and perhaps the most expensive aspect of the application procedures.

In its inquiry, the FCC will seek comments on questions including:

- What are the benefits and detriments to cable operators and other licensees resulting from the present FCC policies?
- What changes in these policies should be made, including the possibility of an optional licensing program in which unlicensed operators do not receive protection from interference?

• Should the regulatory scheme distinguish between common carrier and non-common carrier operated receive-only earth stations?

• To what extent do the international radio regulations affect the commission's flexibility to deregulate receive-only earth stations?

Jerrold Electronics Sets Seminar Schedule

HATBORO, PENNSYLVANIA—Jerrold Electronics Corporation has tentatively set up the folowing locations for its CATV seminars:

Feb. 13-15	Inglewood, CA
Mar. 13-15	Austin, TX
April	
(no date yet)	North Central Region
May	
(no date yet)	Northwest
June	New York State
August	Denver, CO
September	New England Region
October	Kansas City, MO
November	Ohio
December	Philadelphia, PA
Jan., 1980	Atlanta, GA
Feb., 1980	San Francisco, CA

Jerrold's three-day CATV "hands-on" learning sessions cover all technical phases of CATV systems: system design, installation, setup, etc.

For additional information and registration, contact Pat Berk, Jerrold Electronics Corporation, Byberry Road and Pennsylvania Turnpike, Hatboro, Pennsylvania 19040, (215) 674-4800.

Next Hughes AML Seminar Set for April

TORRANCE, CALIFORNIA—Hughes Aircraft Company's microwave communications products has scheduled the next technical seminar on its AML local distribution microwave equipment for the first week in April.

The five-day meeting had originally been planned for later in the year, but was moved ahead to the earlier date because of the oversubscription of the company's January seminar, A.H. Sonnenschein, Hughes' AML manager, said.

The seminars are held by Hughes to demonstrate detailed operation and maintenance procedures for AML systems to technical personnel from CATV systems throughout the country. The AML multi-channel transmission technique is now used by several hundred CATV systems throughout the United States, Canada and Europe.

The tuition-free seminar will be held April 2 through 6, at Hughes' Torrance, California, facility. Registrations will be accepted by contracting Seminar Registrar, Hughes Microwave Communications Products, P.O. Box 2999, Torrance, California 90509, (213) 534-2146.

Hughes is also holding a series of similar seminars covering satellite earth terminal technology.

Further Deregulation of TVROs Being Investigated

WASHINGTON, D.C.—The FCC has begun an inquiry "to examine the costs and benefits of its domestic satellite receive-only earth station regulatory program."

In response to a petition submitted by the Community Antenna Television Association, the inquiry is to determine whether the FCC's present program can be improved or eliminated in light of the technical and policy changes that have been, and will be, occurring in satellite communications.

While the present regulatory program "provides significant benefits," the FCC announced, the commission wishes to explore whether these benefits are worth the costs they impose on both the applicant and the commission."

Comments are being sought on what are the benefits and detriments to cable television operators, MDS, broadcasters and other licensees resulting from the present FCC policies on licensing earth stations; and what changes in those policies should be made? "An optional licensing program, in which unlicensed operators do not receive protection from interference," the FCC stated, "is one alternative that could be considered."

Comments are also sought on how the commission's obligation to enforce Section 605 of the Communications Act dealing with unauthorized reception and use of the radio signals influence the regulatory scheme; should the regulatory scheme distinguish between common carrier and non-common carrier-operated earth stations; and, to what extent do the international Radio Regulations affect the commission's flexibility to deregulate receive-only earth stations.

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F59FB – ½" crimp ring

Part No.
F59FH – Hex ring

(Crimp Ring Attached)

Part No.
F59A

Part No.
F59AH

½" Hex ring attached

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Experiment in Fireman Training

Using Two-Way Cable TV

By James B. Wright, Engineering Manager
Caltec Cable TV, Baltimore, Maryland

The NSF/MSU/RCI Rockford Firemans Training Experiment, as a technical operation and from a cable operators standpoint, was an unqualified success. A subsequent experiment involving NSF and U. of M., in a test area some four times larger (currently beginning operation) is confirming our earlier experience.

In a nutshell, after an initial period of "de-ingressing" the system, of "de-bugging" the new equipment, and of technician training, the experiment proceeded, and is continuing to proceed, with virtually no special maintenance attention and only nominal technical monitoring of the return signal levels and signal-to-interference ratios.

Cable System Design Philosophy

In our assessment of all the ills (real or imagined) that beset the two-way cable system operator, we drew a few personal conclusions, from which our system design proceeded:

- It is unlikely that there will be "a TV studio in every living room," due to (a) the cost, and (b) the lack of information.
- It is equally unlikely that there will be a need for an audio communication circuit into the home as (a) the telephone very adequately provides for this specialized need, and (b) the nature of a cable system is not conducive to such service.
- There is (or can be) a great deal of data collected from a home both to aid in the routine operation of that home and to interconnect it with the active outside world, i.e., to provide it with an "interactive" capability.
- There are a number of existing or potential video sources scattered around most communities.
- There is a need for a local broadband distribution network for intra-city data transmission to points scattered around the community.

If we consider the above list (and throw out the "blue-sky" schemes) we arrive at a number of services which have a possibility of being sold, and which can be technically accommodated within the capabilities of a practical two-way cable television system.

We will discuss elsewhere in this report specific system design problems and precautions. In considering these problems in conjunction with the several service applications listed above, a fundamental decision was made to use the system distribution cables (feeders) for data-acquisition only, and to use the system transportation cables (trunk) for remote video and business-data acquisition. This decision permitted us to choose a system of feeder-return switching, under which the cable system is divided into small areas of about 150 addresses, and each is sequentially interrogated for its data content. As this "data-return" is formatted as an FSK (FM) type of transmission and is narrow-band, it is unusually immune to the interferences to which the distribution system is most susceptible. (A 20 dB signal-to-interference ratio provides an extremely reliable data circuit, and only occasional errors result at a 10 dB ratio.)

The switched data-acquisition system chosen (Coaxial Communication) was designed to operate in channel T7 (5.75 - 11.75 MHz), and this suggested a further refinement of the cable system's "return" design, that of limiting the feeder-return to this channel while keeping the trunk-return at the full 5 to 30 MHz (T7 - T10) bandwidth. This was done with the overall result that no feeder-return data or noise is injected into the trunk return path except during interrogation, at which time the 12.5 - 30 MHz feeder noise contribution is attenuated by at least 25 dB. This technique permits the trunk "return," which has a relatively low "ingress" susceptibility, to be maintained at "video-quality" (vs "data-quality" on the feeders) with respect to its signal-to-noise ratio.

Two-Way Cable System Design Precautions

In anticipation of the then known problems attendant to two-way cable, Rockford Cablevision system designers were especially attentive to factors which could contribute to interference intrusion (or "ingress") which would affect the up-stream signals.

Obviously, the active and passive equipment selected for the system (amplifiers, directional couplers, tap-off units, power-insertion units, etc.) must have high RF shielding over the entire frequency spectrum, from well below 5 MHz to above 300 MHz. A shielding effectiveness of 140 to 150 dB would seem to be a minimum acceptable rating. (Torque wrenches *must* be used in fastening covers and lids to maintain this shielding level.)

Trunk and feeder cable fittings must have a similar shielding effectiveness, and this is accomplished in part by using the available steel cable-inserts. The fitting itself must seize and hold the cable so tightly that the two become as one and relative movement is prevented. Too much pressure will result in metal deformation and "cold-flow," so it is most important that torque wrenches be used in tightening every fitting.

As a further precaution against fitting problems, the Rockford system uses two full-sized, flat-bottomed expansion-loops at each pole, one on the span side of all equipment. This provides more protection than necessary to prevent cable rupture due to flexing fatique. However, this

protection also virtually eliminates the forces on the fittings from cable flexing, twisting, expansion and vibration, and thereby removes the major cause of loose fittings.

Service drops are by far the most difficult to control of our potential interference ingress sources for three reasons: first, because there may be twice as many miles of such cable as the combined miles of the whole distribution plant; second, because system owners traditionally let up on their standards at this point to cut costs; and finally, because we are at the mercy of the subscriber after the cable enters the home. The subscriber may splice the cable, parallel other TV sets, feed it to his dog (or kids) or who knows?

Rockford selected the eight-mil bonded construction-type of cable as the only one (at the time) which provided sufficient shielding at low cost. Long ferruled fittings using a hex-crimp crimp-ring were selected, and the cable was installed using loops which in this application were designed to prevent vibration from causing metal fatigue. At the ground-block, the eight-mil cable ended and a double-braided cable continued on to the wall-plate and to the matching transformer. As a final effort towards minimizing "ingress," TV matching transformers of the "high-pass" variety were selected. In the case of 75 ohm sets a separate high-pass filter is installed. (These devices provide a low frequency rejection of 25 to 40 dB reading from 30 to 5 MHz.)

Experimental System Design

The system described in this paper consists of the studio/control devices at the cable system headend, the primary and secondary code operated switches (COS-P/COS-S) which select the cable system quadrant and the specific amplifier distribution area, and the response terminal and test end-of-line oscillators (ELO). Exhibits A through E show these sub-systems in block form.

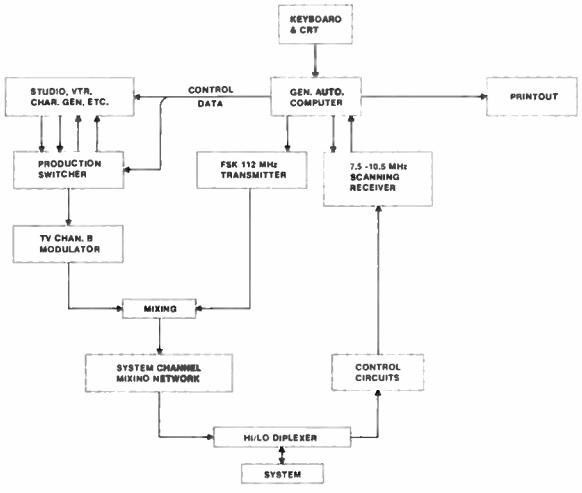

Exhibit A: Computer/Studio to System Inter-Connect.

The Rockford system departs from usual system design philosophy in one important respect: the feeder-cable "return" passes only the 5 to 10.5 MHz spectrum while frequencies of 12.5 MHz and above are attenuated by 25 dB or more. The trunk cable passes the full 5 to 30 MHz which includes the feeder data signals. This feeder-cable bandwidth limiting, together with the technique of feeder switching (Coaxial Scientific), and quadrant switching, has brought signal and noise ingress, and system amplifier noise accumulation down to very manageable levels.

The general automation computer, in Exhibit A, controls the various equipment in the studio so that the lessons are given, (and transmitted on TV channel A) without human intervention.

It also sequentially interrogates the response terminals in the field by: (1) transmitting coded FSK signals at 112 MHz to addressable receivers located in the COS-P's and COS-S's (which select quadrant and amplifier); and (2) by tuning one-by-one through the various COS, ELO, and terminal "return" FSK signals, identifying each terminal by the unique combination of frequencies and reading its data content.

All "return" cables from each quadrant (Exhibit B) are split to allow television signal reception of channels T-8, T-9 or non-switched data reception in the T-10 band to be used separately, while the switched feeder-return signals are isolated by a 5 - 10.5 MHz LPF and routed to a diode switch operated by the computer-controlled COS-P. (A COS-P identifying "tone" is made to go through this switch as verification of its operation.)

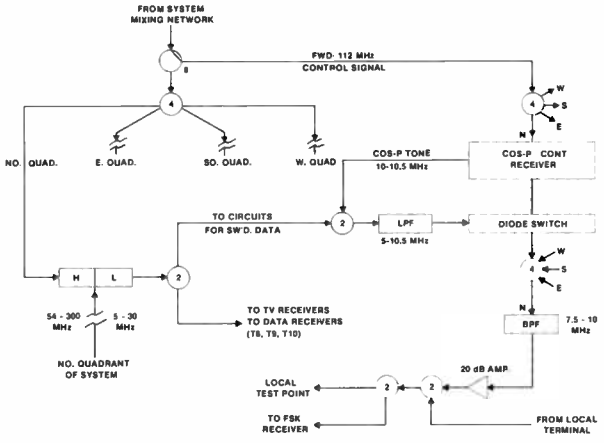

Exhibit B: Typical Quadrant Return Circuit Control.

All quadrant feeder-return diode switch outputs are brought together (note that only one is "on" at a time), and after passing through a second filter and an amplifier are fed to the FSK receiver and a "return test point."

Exhibit C shows the basic two-way cable plant as used in this experiment and indicates its exposure to "ingress" interference. At any instant of terminal interrogation, about 4,000 feet of feeder cable, 9,000 feet of trunk cable, and 15,000 feet of subscriber service cable (40 subscribers) is "on" and is a potential source of short-wave radio or electrical interference.

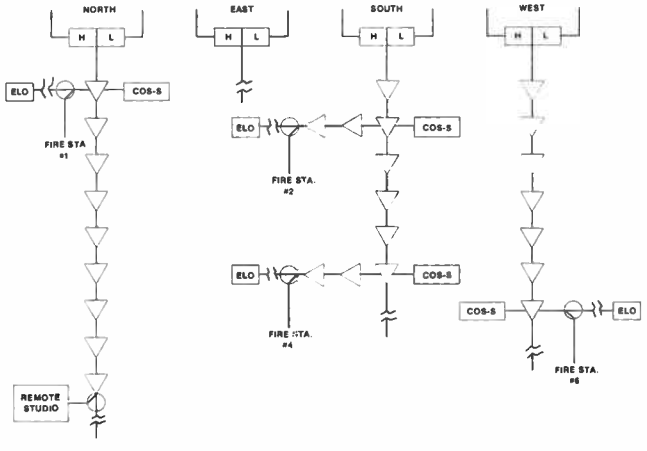

Exhibit C: Basic Test Area for NSF/MSU Experiment.

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In this experiment (and in the second, larger one) our feeder cable and subscribers per amplifier is low due to the turning-up of only enough amplifiers to effect the desired return path. A normal fully operational amplifier would have about 8,000 feet of feeder and 65 subscribers with an ingress-exposure factor twice as great.

The amplifier/COS-S configuration used in Rockford is shown in Exhibit D. A Magnavox 4-MC-2 series amplifier was

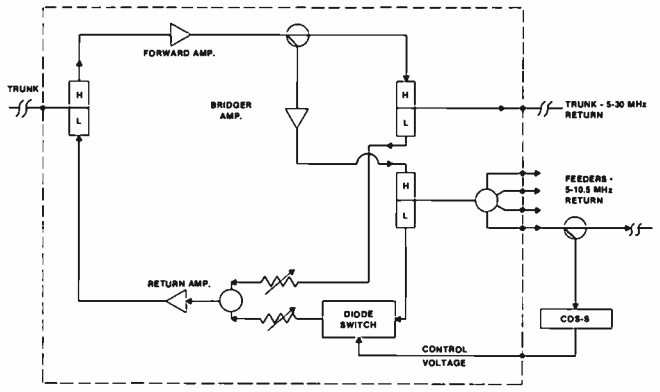

Exhibit D: Typical Amplifier Station.

factory modified (1) to limit the feeder-return to the 5 to 10.5 MHz frequency band, and (2) to include a feeder-return "disable" capability which is accessed through the amplifier's (unused) 7th port. A modified Coaxial Communications COS incorporates the FSK receiver and addressable logic which provides the control voltage to the feeder-return switch. This COS-S also injects a special frequency into the return path which signal functions for test and identification purposes.

Finally, in Exhibit E, the Terminal and ELO are shown. The terminal houses an FSK transmitter which is "on" all the time and which is modulated by activating any of several push-buttons. This causes a data word (which is also continuously transmitted) to change its content accordingly.

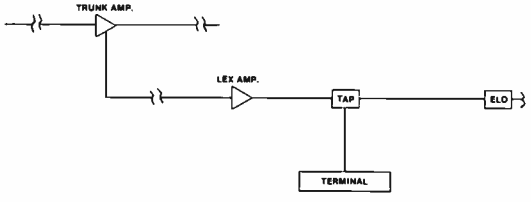

Exhibit E: Typical Distribution to Terminal.

The ELO is a test signal transmitter located, as its name implies, at the "end-of-line (oscillator)." Initially this signal was simply monitored for its presence and amplitude, however, newer units will be impressed with "forward" signal information so that total plant maintenance monitoring will be much improved.

"Return" System Operational Levels And Spectrum Assignment of Services

The manufacturer specifications for up-stream television signals call for return amplifier output levels of +30 dBmV for four channels. This level generates extremely low inter-modulation products and, in our system of switched-feeders, results in an intrinsic-noise signal-to-noise ratio of about 50 dB. (A change in level setting techniques should be mentioned here, in which one uses the return amplifier inputs as the equalization and control point rather than the amplifier outputs as in normal forward transmission. This is mandated by the multiplicity of signal sources all arriving at the amplifier by different paths with random lengths and attenuations.)

The +30 dBmV television signal was used as the starting point and four such signals accepted as the desired amplifier "loading." By assuming a 9 dB gain as required for a worse-case situation, an amplifier input (for TV) of +21 dBmV becomes the specified level for our television signal trunk return-amplifier inputs.

Assuming a 10 kHz data signal bandwidth, and a 10 kHz guardband, the 4 MHz television channel will accommodate 200 such data channels. By operating these 200 channels at -2 dBmV (amplifier input), we load the amplifier approximately as heavily as one television channel at +21 dBmV, so this then becomes our specified level for the 10 kHz data-signal trunk return-amplifier inputs. (Line extender amplifiers are operated at a +1 dBmV input—based on the output capabilities of the various signal sources and system losses.)

From these input levels we may determine the maximum permissable interference levels for each of the types of noise with which we must contend:

Type of Service	Tnk. Amp. Input Level (dBmV)	Random Noise (dBmV)	Discrete Radio Sig. (dBmV)	Electrical Noise (dBmV)
TV (4 MHz)	+21	-26	-36	-25
Data (10 kHz)	- 2	-22	-22	-22

As the nuisance value of the interference is frequency related, it is necessary to list the Rockford Cablevision frequency assignments for its "Return" system:

Data-Acquisition	7.5 - 10.5 MHz
Voice, System Alarms	5 - 7.5 MHz
Television	11.75 - 23.75 MHz
Business Data	23.75 - 30 MHz

(Note that Voice service is used only in conjunction with the remote television service. Note also that the Business Data band will avoid the CB band at 27 MHz.) Random noise, as an interference, is dealt with in system design and will be no problem whatever for Data if it satisfies the requirements of the television service.

Discrete radio interference is a major problem in the 5 to 15 MHz band and again at 26.96 to 27.41 MHz (CB). While FSK (Data) and FM (Voice) systems can tolerate interference ratios of 10 dB (even up to 4 dB), we have found that we have no problem holding this interference to at least the 10 dB ratio and normally to a 20 dB or greater ratio. Within the television channels used (T-8 and T-9), the only problem area is the 13 to 15 MHz range. Again, in that we have essentially trunk-only exposure, we are able to achieve the

desired -36 dBmV (-57 dB ratio) with reasonable maintenance measures. The CB interference problem was judged nearly uncontrollable and our goal became a two-fold one of avoiding the use of these frequencies, and of containing them to the extent of preventing them from contributing significant loading to our "return" system. This abandonment of the CB frequencies meant that television channel T-10 could not be used for television, and we have therefore assigned the resulting split-band to the business-data service.

Electrical interference (at -22 dBmV measured at a 10 kHz bandwidth for Data, or at -25 dBmV calculated to a 4 MHz bandwidth for television) does not pose a serious problem in that in our area of greatest exposure (the feeder cables) we are able to tolerate the highest interference level, and conversely, where we need the best protection (at the trunk television frequencies) we are most protected. The business-data band has no problem whatever in that by the time we achieve the necessary interference ratios for television we are 20 to 30 dB beyond the needs of a data circuit.

Maintenance Procedures and Test Equipment

Initial "set-up" of the cable system return transmission path is accomplished by inserting a composite test signal (at 6, 9, 19 and 28 MHz) into the input of the last return amplifier (first forward amp.) with all frequencies at the same -2 dBmV levels. The display at the headend is monitored and the amplifier gain and slope controls are varied to achieve a "flat" display of an amplitude consistant with the losses built-in between the amplifier and the test point. This "flat" display is logged and the field person then moves back to the next amplifier and repeats the procedures and adjusts for the same display. This procedure is repeated back to the first return amplifier. A technique is being developed to allow the field man to carry a small TV set and to remotely observe the headend display, on "command." Initially all remote signal sources (such as terminals, ELO's, TV modulators, etc.) must be set up using a two-man team to assure that the amplifier input signals are properly balanced. The remotely controlled monitoring will serve this operational need as well as for initial "set-up."

Signal-intrusion into the "return" path of a cable is directly related to signal-radiation by the "forward" system. The nature of the system defect determines the magnitude of both the signal ingress and egress, as does the frequency of the signal involved. The first step we follow in "de-ingressing" is to carefully monitor the involved area with a "Sniffer" (ComSonics), and to correct any observed radiation down to a level usually somewhat below the FCC radiation limits. After this a technician moves one amplifier at a time, feeder by feeder, tap by tap, and drop by drop, as necessary, until the ingress is some 10 dB better than the minimums. This procedure results in a rigorous testing of the overall integrity of the cable plant (excluding the forward amplifiers) and will reveal many problems that are only marginally (if at all) apparent on the forward system. A welcome end-result of de-ingressing is better performance on the forward system.

Our Rockford experience is that once we do this thorough "de-ingressing" the results are long-term. As we have been working "two-way" for a period of only a few years (and intensively in a limited area only for one year) our "long-term" evaluation is in actuality short-term. However, when considered relative to our other maintenance requirements, we are quite pleased with the results. C-ED

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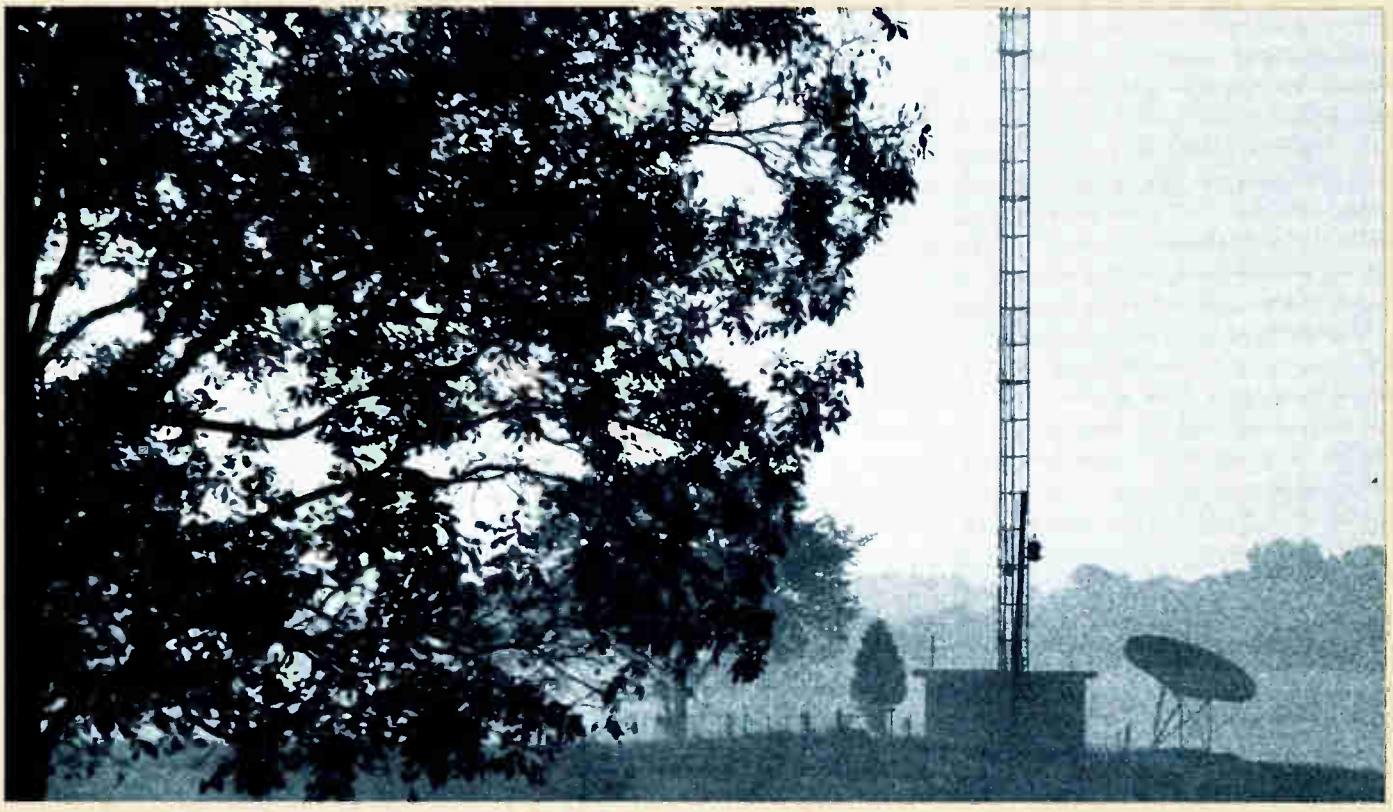

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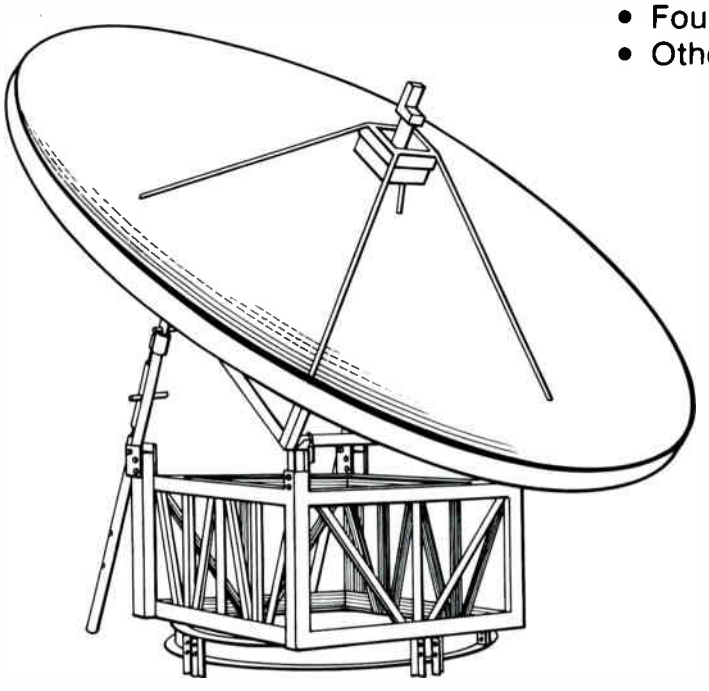

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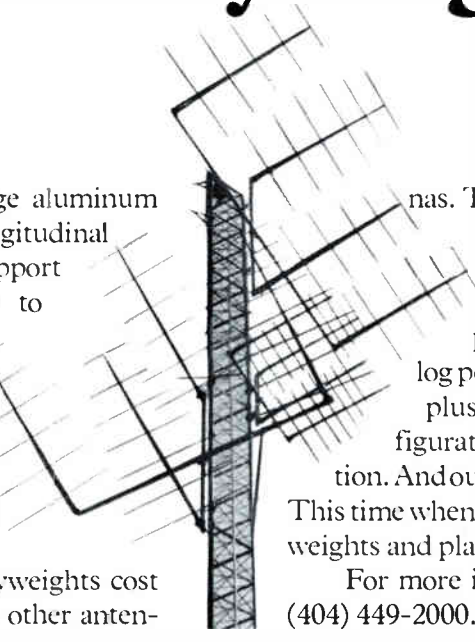

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Reliability in Satellite Transmission?

By Toni Barnett
Managing Editor

With this issue, C-ED initiates a new satellite section to keep its readers aware of the state-of-the-art of that expanding technology. A recurring concern voiced by several very knowledgeable sources in the CATV industry is the alternatives for the industry should a catastrophic failure of the satellite occur and/or transponders on which the cable television industry is programming.

Although it is not likely that a catastrophic failure will occur on the RCA Satcom I or III, it is not out of the realm of probability. A catastrophic disaster occurs when the powering system of the satellite is disrupted or when something penetrates the outer hull and the bird ceases to function.

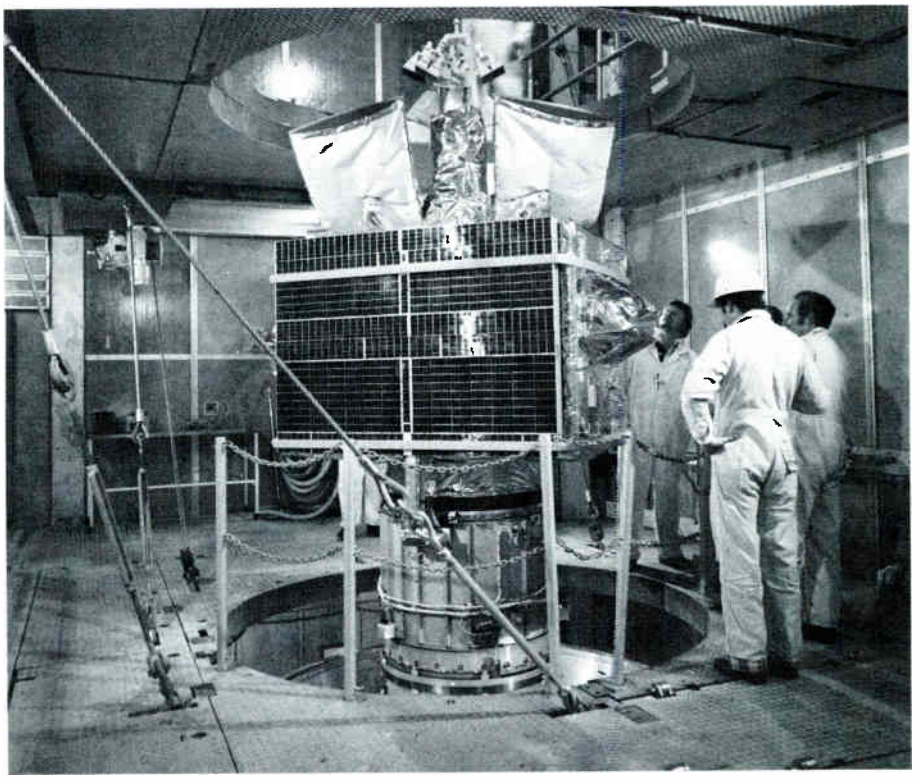
For purposes of simplicity, we will assume that all cable signals have been switched to RCA's new Satcom III (F3) satellite. We will also assume the transfer was successful with relatively minor problems, since the Satcom III will be situated in an orbital position of 132 degrees west. (Satcom I will be spaced only three [or four] degrees east of F3 at 135 degrees.) At the present time, RCA has asked the Federal Communications Commission to approve the three degree spacing. Present FCC rules state that the satellites must be spaced at least four degrees apart. RCA engineers, however, believe that the three degree spacing is adequate, and will ask the FCC to allow them to leave the F1 in its present position.

Unexpectedly, a meteor shower bombards the Satcom III and it is knocked out of orbit and rendered useless. Obviously, here is where the three classes of service offered by RCA come into play: protected, unprotected and pre-emptible. Protected service guarantees that in the case of a transponder failure, RCA will provide a replacement transponder almost immediately.

Unprotected service is as the name implies. If a program supplier's transponder is unprotected and the transponder fails, he's out of business until he can contract to rent space on another transponder, possibly on another satellite. However, the supplier is guaranteed that he won't be bumped off of his transponder for a supplier who has protected service.

Pre-emptible service is the least expensive class of service and the most risky. If a supplier has pre-emptible service, RCA can take his programming off the bird and turn that transponder over to someone with protected service.

Suddenly the industry is faced with a catastrophic failure—the Satcom III is no longer functioning. RCA is faced with a few options. RCA could try to find room on the Satcom I and II. However, reliable sources have informed *C-ED* that several transponders on Satcom I have already been allocated to non-cable services, in addition to the existing data transponders. RCA can possibly transfer all of its traffic to one of Canada's ANIK satellites on an emergency basis. However, that situation also poses a problem. The transponders used by RCA may not necessarily be the same on the ANIK satellite, leaving some suppliers without usable transponders. The Federal Communications Commission might intervene at this point and allow



RCA's new Satcom III being prepared for launch inspection.

cable programming suppliers to rent time on the Westar satellites.

In any case, if the satellite itself or several transponders fail, the cable operator would have to reorient his antenna to point at the satellite now transmitting his signal. Additionally, he would have to redirect his feed to get it properly alligned, and would probably have to change his receivers to realign them onto whatever transponder he is switched to.

Transferring from one satellite to another shouldn't prove to be much of a problem. The cable operator only has to swing his earth station to the other satellite. All FCC-approved earth stations now in use are put in to "see" the entire satellite arc. At least that's the intention. The whole idea is to put the pad with the center line in the middle of the arc so that the operator can physically sweep the antenna through the arc. However, there seem to be a lot of operators who haven't strictly adhered to the FCC's rule by cutting down obstructions such as trees, etc. In the event of switching transponders on satellites, some earth station operators might have to move their entire earth station.

C-ED asked Compucon's Dan Yost for his opinion on this problem. Said Yost: "In addition to reorienting the antenna, twisting the feeds and turning the knobs to get the frequencies aligned, there is the potential, in switching to another satellite, that the footprint pattern isn't going to be the same. You might be talking about a stronger or weaker signal from the satellite," Yost continued, "which, depending on your system design, might put you in a position where the quality of your picture became better or worse."

Switching to another satellite may mean a lower EIRP, in which case a higher quality low noise amplifier would be required.

In the interim of finding homes for several transponders, RCA has another option. Although it would be time consuming and far less effective than satellite distribution, the industry could go back to bicycling tapes via a generation of state-wide or regional-wide microwave links. Programming suppliers would lease space on common carriers as do the networks. This method of program distribution, though, has many complications.

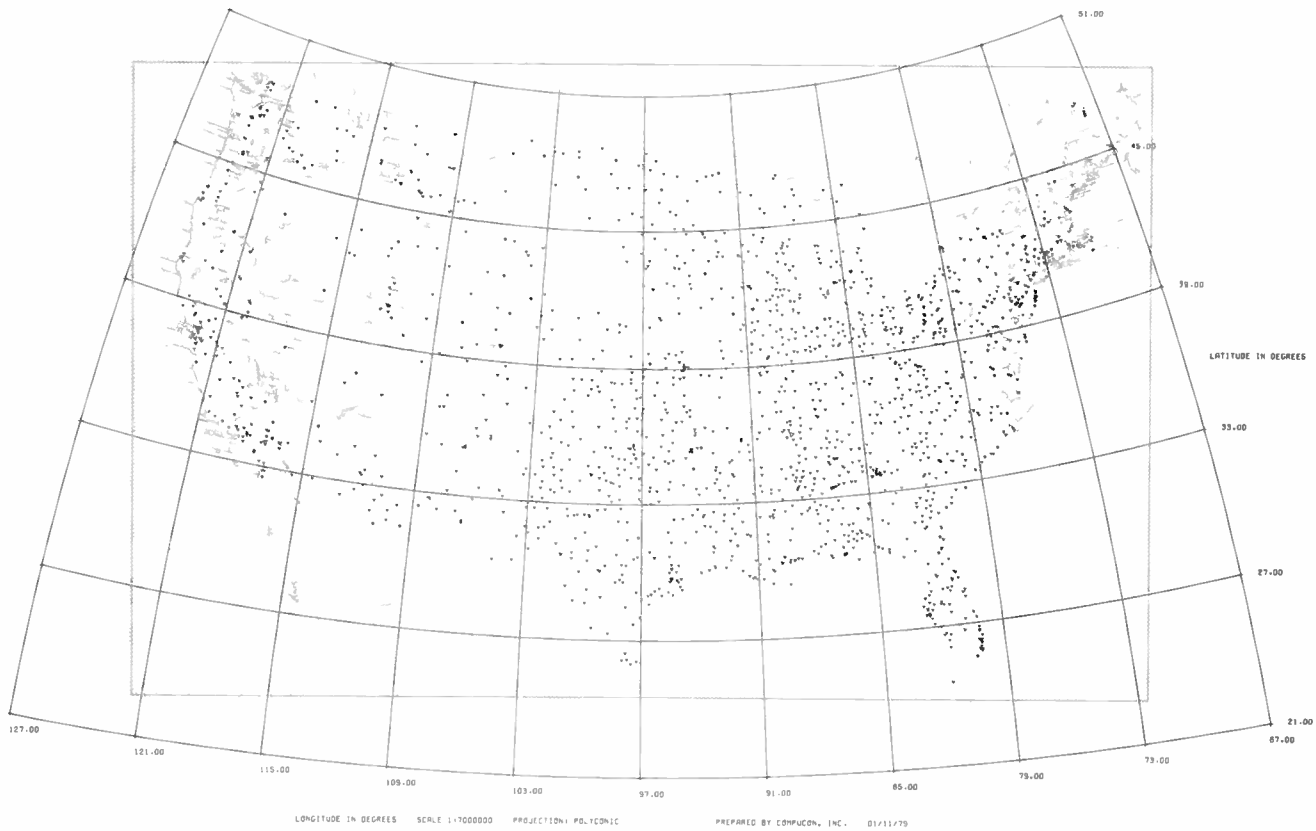
The bicycling of tapes would make the task much more difficult to provide all cable operators with the same program at the same time. The quality of the tapes when mass produced causes major problems, and reliability is threatened if a tape breaks during a performance.

One alternative to mass producing tapes is to divide the industry into regions. Say, east of the Mississippi operators are showing one movie, and west of the Mississippi they're showing another movie. The next week the program suppliers could flip-flop tapes to those cable operators. The tapes would be mailed back to the program suppliers and remailed to other systems that haven't had that movie on a routine schedule. The programming industry would now be at the mercy of the United States mail.

Distribution of programming material now becomes a major hurdle where, before, it has been the industry's biggest benefit.

Transponder Failure

Transponder failure is a more likely mode of failure than the entire satellite going bad. Noted Abe Sonnenschein, manager of Hughes' AML Microwave Products Division: "Because there is a finite probability of a transponder or two failing, we feel it's very dangerous for cable operators to put in stations that are not agile (not easily tuned from one channel to another). If there is an abrupt failure of a transponder," Sonnenschein added, "and if many operators have fixed tuned receivers, there may be great difficulty in getting them all switched over in a hurry."



Over 1,300 receive/transmit TVROs are represented, courtesy of Compucon, Inc.

Nobody has all the crystals for every transponder for all the stations in the country. This could mean important time delays in trying to equip the fixed frequency receiver to another frequency.

Despite RCA's claims that it has not had many transponder failures or degradations in signals, many cable earth station operators say otherwise.

On the morning of June 21, service on transponders 10, 12, 20, 22 and 24 went off the air for a short period. Service on transponders 2, 6, 8 and 14 were still "on," but degradated by 6-10 dB at the same time the other transponders went out. RCA has been able to explain why the transponders went totally off for a short time, but not why the other transponders degraded in signal.

C-ED attempted to get an explaination concerning the transponder problems from RCA's engineers at Vernon Valley. Nobody would speak with us and all we could get was the official, "You'll have to go through our Public Relations office."

We then contacted Ralph Graff, manager of Public Affairs for RCA. According to Graff, "That (June) was a period of testing, as I understand it. These transponders were not officially operating at the time. That is, they (transponders 10, 12, 20, 22 and 24) were not supposed to be providing programming for any customers . . . The people who tuned in on these transponders were doing so illegally. There was no problem as far as any customer goes.

"The transmission of signals, in some cases, went on and off, or showed signal breakup of various static effects. This is because they were being adjusted and turned off and on at various times."

We asked Graff why transponders 2, 6, 8 and 14 degraded at the same time the other transponders went out. "I don't know," replied Graff. "There was a period of switchover and testing. We wanted to check out the satellite and it checked out okay."

Graff also explained about the discrepancies of the EIRP footprint (it seems that the real footprint doesn't quite come up to the standards RCA said it would).

"As far as the whole question of EIRPs, we have been looking very deeply into it, spending much on Compucon to double-check and come up with accurate, optimum EIRP footprints. We said back at the CATA conference we wouldn't be surprised if there were some variations simply because the footprints everyone based their hardward designs on were developed by computer as a projection before the satellites were even launched." Graff further explained, "We feel quite strongly that the equipment manufacturers are not providing enough leeway on the numbers because there's so much competition in hardware . . ."

According to several system operators, the incident on June 21 was not the only occasion where there were transponder problems. During June and July there were several times in which the signals from the transponders degraded for a short time.

RCA spokesmen have stated that during these months transponder carrier levels didn't fall below its norm. RCA monitors the carrier levels present on all transponders all the time via an alarm system used in its Vernon Valley facility. The problem with this system is that it monitors the carrier level, not the video signal-to-noise. Therefore, the carrier level alarm would not have sounded when the transponders degraded due to interference.

An RCA spokesman maintains that "when you experience an outage like this, check your own system out." And, cable operators are doing just that and more. Because there have been many occasions when cable operators have measured noticeable drops in signal levels received, many operators are now using chart recorders.

RCA has taken several precautions in the event of transponder failures. RCA Americom plans for Satcom III include several security backups designed to expand transponder life and assure more years of full capacity operation on all 24 transponders.

"In the event of transponder failure on F3, we'll have immediate restoration capability," stated John Christopher, vice president of technical operations for RCA Americom Communications. "Four spare transponders will be on board, each one backing up a group of six transponders. If any of the six transponders on one transmit beam (there are two horizontal and two vertical beams) fails, we can recover it by switching in the spare through a switching matrix which allows recovery of any failed frequency. In addition, on F3, we are expanding our inspection, screening tests procedures and burn-in time. In that way," Christopher emphasized, "we expect to eliminate the infant mortality problem which has resulted in the loss of at least two out of 48 transponders on F1 and F2.

"Another change incorporated into the spacecraft has been the replacement of existing batteries with higher capacity batteries. The increased capacity reduces the depth of discharge during eclipse, which gives a greater margin of safety against future battery degradation. Despite the fact that F3 has been a launch-ready spare, RCA is making these protection and restoration enhancements to assure the best possible service to its customers."

This article is not intended to alarm the CATV industry. We are sure RCA and all involved parties will do their best in the event of a disaster. It is, however, our intention to investigate all possible aspects of a situation and tell *C-ED*'s readers what could happen and what to do about it.

Sun Outages—A Fact of Life

Sun outages occur twice a year and it's a problem satellite users have to live with for a short period of time. Twice a year the relationship of the satellite to the sun is such that the satellite comes directly between the sun and the various earth stations, causing a shadow over the satellite. This results in a tremendous noise level that seriously degrades the signal from the satellite.

The next outage will occur approximately between 3 pm-4 pm (eastern time) during the first two weeks in March. The northern areas of the country will experience the sun outage earlier in the period, closer to March 1 or 2. The eastern areas of the nation will experience it earlier in the day, closer to 3 pm. The dates of the outages depend on a north/south variation, and the time of day depends on an east/west variation.

The sun outage lasts for a short duration (three to five minutes) per day for three-to-six days. The exact time and intensity of the sun outage will vary with the location of the earth station and the size of the antenna dish. The larger the dish, the shorter the sun outage period and the more intense the noise interference.

For individual earth station outage information, RCA has provided as much information as possible to its customers via a computer print-out. This print-out reveals exactly when the outage will occur at all of RCA's major commercial earth stations.

C-ED recommends that earth station operators contact their program suppliers for this information.

C-ED has initiated a new monthly feature within our Satellite Section on cable programming. Our intent is to provide our readers with the cable programming information needed for the following month. Please note that all schedules are not totally firm, as programmers may make last-minute changes in their schedules. All program times are listed for the eastern time zone, unless otherwise noted.

Cable Programming for March

Signal	Day	Start/Stop	Alert Times	Satellite/ Transponders
CBN		24 hrs.	No	F1, #8
PTL		24 hrs.	No	F1, #2
Showtime		E 5:30 pm-2:30 am (weekdays) 2:30 pm-1:30 am (weekends) M 5:30 pm-2:30 am (weekdays) 4:30 pm-1:30 am (weekdays) P 3:30 pm-2:30 am (weekends) 2:30 pm-1:30 am (weekends)	March start-up	F1, #12 F1, #10 F1, #10
Front Row		M/P 2:30 pm-2:30 am E 2:30 pm-2:30 am		F1, #10 #12
Fanfare		5:30 pm-1:30 am (weekdays) 4:30 pm-12:30 am (Sat) 3:30 pm-11:30 am (Sun)	No	F1, #16
WTCG		24 hrs.	No	F1, #6
HTN		8 pm-10 (11) pm	No	F1, #1
KTVU		10 am-8 pm 10:30 pm-3:30 am (pending time)	No	F1, #1
KPIX (time permitting)		2-4 hrs. per day	No	F1, #1
SPN		7 am-10 am	No	F1, #1
Newstime		24 hrs.	No (tones only for local adv.)	F1, #6
Nickelodeon		10 am-11 pm	No	F1, #5
Star Channel		9 am-2 pm 6 pm-2 am	No	F1, #11
WGN		10 am-12 pm	No	F1, #4
WOR		1 pm-3 pm	No	F1, #1
Trinity (KTBN)		24 hrs.	No	F1, #14
Reuters		24 hrs.	Q tones every 40 sec.	Not in use yet
C-SPAN **(times approx.)**		12 pm-6 (6:30) pm Mon. & Tues. 10 am-6:30 (7:30) pm Wed. & Thur. 12 pm-5 pm—Fri.	No	F1, #9
HBO	(East) 1 (West) 2 (TAKE 2) 3 (Back-up) 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	6:30 pm-1:32 am 6 pm-2:01 am 3 pm-2:40 am 3 pm-2 am 6:30 pm-1:20 am 6 pm-1:10 am 5:30 pm-1:45 am 5:30 pm-2 am 5 pm-1:10 am 3:30 pm-2:15 am 2:20 pm-1:30 am 5:30 pm-1:27 am 6:30 pm-2:15 am 6:30 pm-1:44 am 6:30 pm-2 am 5:30 pm-2:20 am 2:30 pm-2:15 am 2:30 pm-1:45 am 6:30 pm-2:14 am 6:30 pm-1:27 am 6 pm-1:15 am 5:30 pm-1:30 am 5:30 pm-1:30 am 3:30 pm-2:10 am 3:30 pm-2:02 am 5:30 pm-1:57 am 6:30 pm-1:30 am 5:30 pm-1:20 am 6 pm-1:39 am 6 pm-2 am 2:30 pm-2:15 am	Before & after programming and promos.	F1, #24 F1, #22 F1, #23 F1, #20
MSG Sports	1 2 3 4 5 6 7 8 10 11 12 13 14 16 17 18 19 20 21 22-24 25 26 27 28 30 31	8 pm-11 pm* 9 pm-11 pm 8 pm-10:15 pm 7:30 pm-10 pm 8 pm-10:30 pm 7:30 pm-9:45 pm 7:30 pm-10 pm 8 pm-11 pm 8 pm-10:15 pm 7:30 pm-10 pm 8 pm-10:30 pm 7:30 pm-9:45 pm 7:30 pm-10 pm 8 pm-11 pm 8 pm-10:15 pm 7:30 pm-10 pm 7 pm-11 pm 7:30 pm-9:45 pm 8 pm-10:15 pm to be announced 7:30 pm-10 pm 8 pm-10:30 pm 7:30 pm-10 pm 8 pm-10:15 pm 8 pm-10:15 pm 7:30 pm-10 pm	No	F1, #9
Caliope	Mon.	6 pm-7 pm†	No	F1, #9

E=eastern
M=mountain
P=pacific

*approximate stop time
† new programming schedule week of March 19.

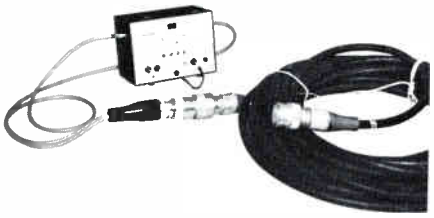
See our card on page 33.

Test Equipment

New TV Cable Tester from Muirhead

A new, high speed, low cost, portable cable tester that detects and displays open, miswired and shorted conductors in TV cable assemblies up to 10,000 feet long is now available from Muirhead Addison Division, Muirhead, Inc.

Model AS-99D, called the "Auto-Scan," is ideal for use inside studios or out on field locations. Highly portable, it can be carried easily to do on-the-spot checking of faulty cables. It will quickly show the extent and exact location of the cable faults. Repairs or replacement can be immediately decided upon with absolute accuracy.



Full specifications are available from: Muirhead Addison Division, Muirhead, Inc., 1101 Bristol Road, Mountainside, New Jersey 07092, (201) 233-6010.

New VIZ Universal Scope Probe

Total flexibility for the user has been designed and built into a new, modular 100 MHz probe system for oscilloscopes and frequency counters by VIZ Test Instruments Group of VIZ Manufacturing Company.

Priced at $39, the new universal probe system, model WG-478, includes a coax cable with direct probe and BNC connector, "low-cap" X10 adaptor wth integral probe tip, compensator with male and female BNC connectors, spring-loaded hook-on probe element, ground clip assembly, and isolation boots which slip over the probe tip to eliminate the possibility of shorting during fast measurements on single or in-line IC points. Frequency response is DC to 100 MHz (-3 dB) using an optional BNC probe ($6.00), or DC to 70 MHz using either the hook-on or the basic probe pointed probe tip with the ground clip assembly.

Complete information on the new VIZ model WG-478 scope probe is available from: Robert J. Liska, VIZ Test Instruments Group of VIZ Manufacturing Company, 335 E. Price Street, Philadelphia, Pennsylvania 19144, (215) 844-2626.

TEST, Inc., Features Antenna Survey Monitor

TEST has announced the introduction of an innovative and valuable new pay-TV instrument. The model ASM-1 antenna survey monitor allows quick and simplified field surveys and antenna orientation, eliminating the need for field strength meters.

The unit is equipped with a five-inch picture-reference screen. It displays an excellent black/white picture for monitoring purposes and two horizontal tuning lines for reference and incoming signal level readings. By using it with a battery-operated down converter and an antenna, monitoring the subject is possible with relative ease and efficiency.

The ASM-1 virtually eliminates the need for separate TV sets, field strength meters, cables and extension cords. The unit is complete with batteries, carrying strap and sun shade.

For more data, contact TEST, Inc., 16130 Stagg Street, Van Nuys, California 91409, (213) 989-4535.

Earth Stations

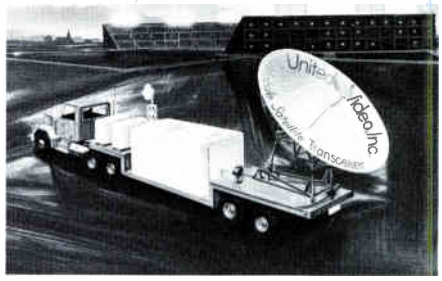
Application Filed for Portable Earth Station by United Video

An application for the first of its kind "portable" high performance satellite earth station transmitter/receiver has been filed with the Federal Communications Commission to be operated by designer and owner United Video, Inc.

The innovative equipment will make video broadcasting available via satellite from any location to any other location, and allow producing stations or companies to telecast a live event anywhere in the world that is accessible by air, rail or semi-trailer truck.

The portable system, the first of several to be built by United Video, and contracted with the Collins Division of Rockwell International, will be available to all types of networks as a truly portable high quality and economical satellite transmitting and receiving device.

The basic system will be self-contained with collapsible dish and microwave towers and is available in three options.



The first option is a satellite uplink station for use in the U.S., and is equipped with a six-meter antenna and fiberglass shelter for electronics mounted on a flatbed trailer. All primary systems are redundant, including transmitters, high power amplifiers, low noise preamplifiers and frequency agile receivers. The system also includes telephones (fixed and mobile), lighting, climate control equipment, all tools and test equipment to monitor performance. Multiple program audio channels (up to three) will be also available.

The second option is similar to the first except that it is configured to be transportable by air, ship or rail utilizing developments in antenna technology which will make the six-meter antenna compatible with all satellites in the 4/6 GHz frequency bands.

The third option is a redundant, frequency agile, duplex terrestrial microwave system for use in areas where the station cannot be located adjacent to a remote event because of frequency congestion.

More detailed information is available by calling Roy Bliss or Tom Keenze toll free at: 1-800-331-4806 or in Oklahoma 918-749-8811.

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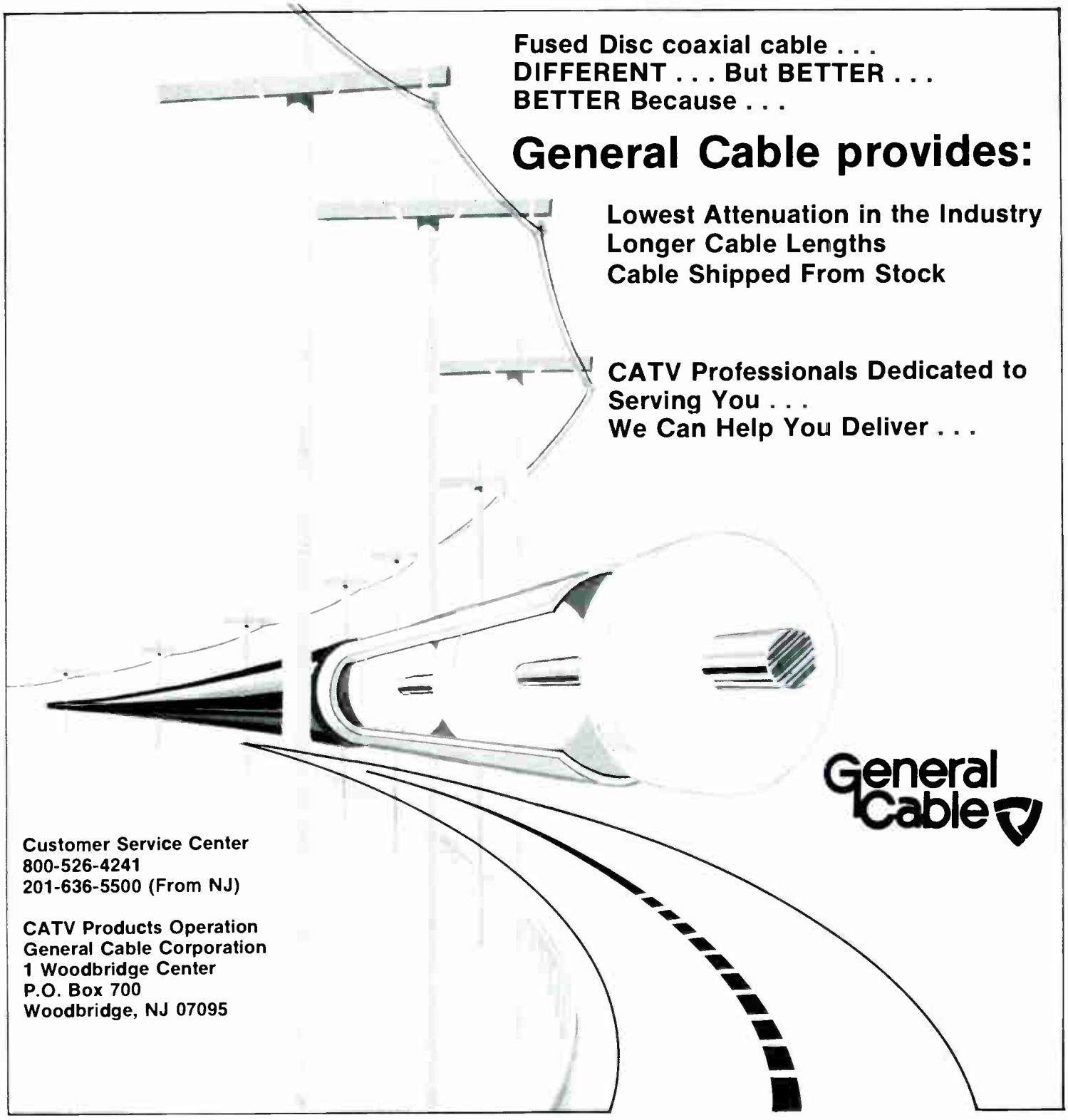

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Las Colinas—The Only Way to Live

By Toni Barnett
Managing Editor

Near Irving, Texas a new community called Las Colinas is under development. A highly sophisticated two-way interactive program for that community will be on-line in approximately two months. One unique aspect of this Texas system is that the property owners of Las Colinas comprise the Las Colinas Association—the system's owners.

The Las Colinas Association Communications System (LCACS) is a computer-controlled, electronically-operated audio/video system. The system is intended to provide special and unique services that members desire and services that may be upgraded in the future.

The Las Colinas system functions through a sophisticated network of buried cable, permitting a bi-directional flow of both audio and visual information for the benefit and protection of all property owners.

The central control center for the system, located on the grounds, houses the system computers, signal receivers, transmitters, etc. The entire central control center also has a back-up power supply and emergency generator for use in case of power failure.

There are five sub-systems which will be available to residents: security, video, audio, music and videophone.

The security sub-system of the LCACS provides an audio/video capacity and electronically-operated information bank which act as vital support links to the Las Colinas security service provided by the Association; and ambulance, police, fire and medical services provided by the Municipality of Irving. The security system will be capable of monitoring, viewing, receiving, storing, retrieving and dispatching information to appropriate points.

The Las Colinas Association monitor panel.

Las Colinas Association security panels will be located throughout the entire development area, plus those panels which may be located in every home and business throughout Las Colinas.

The Las Colinas security system uses the TOCOM III-A central data system (CDS). The CDS can monitor and control as many as 2,000 HT-3A or HT-3B home terminals (also used in Las Colinas) through miles of coaxial cable.

TOCOM's III-A CDS recognizes fire, medical emergency, intrusion, assault, supervisor fault and battery-low conditions. It also monitors the operating condition of each home terminal.

Every few seconds the CDS requests the alarm status of each of the possible 2,000 home terminals. If a change is detected, the operator's CRT console and a hard copy logger receive the demographic information that has been stored for that particular home terminal. The result is a faster and more efficient response to the emergency.

Communication occurs as a result of a combination of time and frequency division multiplexing. The CDS communicates down stream on the cable plant, utilizing an FSK mode of modulation in the 100-160 MHz frequency range. Home terminals respond on different channels called groups, using an FSK mode of modulation in the 5-30 MHz range.

After an alarm is received in the central control center and recorded in the computer's memory, it is simultaneously printed out on paper, displayed on a computer terminal screen, and flashed on the control map of Las Colinas in a color code denoting the type of alarm. Immediately, one of the Las Colinas security officers dispatches a uniformed officer to the location of the alarm.

Critical areas are monitored by cameras and displayed on TV channels 17 and 18. These channels may be used for property owner viewing and monitoring in the control center for security purposes.

While a major purpose of the Las Colinas Association communications system is the security it provides, another purpose of the system is to provide high quality and elaborate programming of entertainment, educational and informational material. This is provided via the community-wide antenna network (rooftop antennas are not permitted), which brings programs to all property owners who choose to connect to the system. One of the sub-systems utilizing this antenna network is the Las Colinas video system.

The Las Colinas video system offers high quality pictures to every television outlet on the system. In addition to area TV stations, additional channels will schedule special entertainment programming including recently-released movies, classical films and educational presentations.

The Las Colinas audio system is another sub-system utilizing the antenna network. The system offers excellent radio programming to members who connect an FM receiver to the system. Members receive 11 Dallas/Ft. Worth AM stations and 21 FM stations on an FM receiver.

The music system in Las Colinas (under development) is another sub-system using the antenna network. This system will offer six mood background music stations programmed by the Las Colinas Association for any member who connects a receiver to the system. This programming will originate in the central control center of the communications system and transmit without commercials or interruptions. Also on this system is a channel which will provide continuous weather information and a channel that will provide the accurate time.

Some services currently under research and development are two-way guardhouse-to-home communication (the videophone system), educational television with North Lake College and/or the University of Dallas, live coverage of local events and automatic home alerts for weather disturbances.

Residential Security Package

The standard security panel installation for single family dwelling units include: one TOCOM HT-3A home terminal, one Las Colinas Association monitor panel, two photo-electric smoke detectors and one 135 degree heat detector.

TOCOM's HT-3A is an alarm-only reporting terminal designed to communicate from remote locations through a coaxial cable system with the TOCOM III-A or TOCOM III-B central data system. Each HT-3A has a unique address which permits the CDS to request the status monitoring data every few seconds.

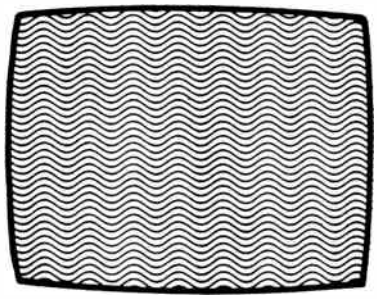
Signals from two outputs can drive external system active indicators and remote alarm annunciators. Each alarm input can be individually configured to activate the remote annunciator output, and to be a normally open or normally closed circuit.

When an HT-3A terminal is in communication with a CDS, it is visually indicated by an LED mounted on the unit.

In Las Colinas, the standard installation will have the HT-3A terminal installed in a closet of the home and plugged into an AC outlet. In addition, a cable connection will be run to the terminal and connected to the outside tap. An alarm interface cable will be connected from the HT-3A to the other monitoring devices installed throughout the home.

The Las Colinas Association monitor panel contains the fire, medical, police and intrusion emergency buttons and will be installed under the smoke detector at the master security station in the home.

Two smoke detectors will be installed in the home. The first will be installed at the master security station and the second will be installed in a hallway near the bedrooms. In addition, one heat detector will be installed in the kitchen area, preferably on the wall above the range or as close as possible.



Q I am considering the use of microwave to reduce an extremely long amplifier cascade in our system. What should I consider when looking for a transmit and receive site, and how do I go about establishing a line of sight path?

A One of the first considerations when designing a microwave system is the frequency band and whether to use frequency modulated or amplitude modulated equipment. You did not specify the frequency band but I assume you will be using the CARS band (12.70 GHz to 12.95 GHz). This band has been set aside by the FCC for use by cable TV.

So far as the modulation type goes, both frequency and amplitude modulation have advantages and disadvantages. Frequency modulation requires extensive signal processing but yields a higher signal-to-noise ratio. Amplitude modulation conserves spectrum space and reduces signal processing, but yields a lower signal-to-noise ratio for a given path length and a smaller AGC range. The determining factor in which method to choose is really a function of your particular application.

With regard to site selection there are several considerations. First of all, line of sight visibility does not necessarily guarantee that a path exists. In many parts of the country the "K" factor, or equivalent earth radius, is less than 1 and line of sight corresponds only to a K factor of one. Where the K factor is below one, a visually confirmed path may not exist at microwave frequencies.

The transmit and receive site should be selected to enhance your ability to get a path. Usually, in this type of microwave application, the transmit site is located at the headend and the CATV tower is used to mount the transmit antenna. The CATV tower is usually (but not always) located on high ground. The receive site should likewise be on as high ground as is reasonably possible. The terrain elevation between the transmit and receive sites can then be plotted on graph paper with distance on the horizontal axis and elevation on the vertical. It is then necessary to measure the heights of obstructions such as trees, water towers, buildings, etc., and plot them at the proper distance and elevation on the profile.

Once the profile with obstruction has been plotted, earth curvature at the proper K factor and Fresnel Zone clearance may be calculated and added to the height of the limiting obstruction. (Fresnel Zone clearance is the margin required to adequately clear an obstruction.)

Other considerations are power availability, site access, proximity to the cable system and guying room to the receive tower.

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CTCA Examines Canadian Cable

By Toni Barnett, managing editor

The Canadian communications marketplace is in a state of turmoil and could easily get out of control if the carriers, broadcasters, cable operators, governments and regulators don't find ways to develop policies to cope with the major fundamental issues now facing their industries and the country as a whole.

The telecommunications carriers industry has, through its organization, the Canadian Telecommunications Carriers Association (CTCA), attempted throughout 1978 to clarify the concerns and aspirations of its member companies, and to assume a more united front in facing the many new challenges of the coming years.

According to CTCA President, Don Cruickshank, the industry must intervene and state its position on all issues of principle. "As an Association," he said, "we must try to identify those issues on which our members have common interests and work together productively where we can be more effective in unison than we could independently."

CTCA membership comprises the major telephone companies across the country, CN and CP Telecommunications, the TransCanada Telephone System, Teleglobe Canada, Telesat Canada and the Canadian Independent Telephone Association. The industry as a whole spent more than $2 billion in 1978 to maintain and improve its plant, now valued at close to $17 billion. With projected operating revenues of $4.5 billion and expenses of well over $3 billion in 1978, it provides employment to some 105,000 Canadians, representing this year alone about $1.7 billion.

In 1978, the telecommunications carriers have established a number of priority programs which require immediate action. These include defining the scope of exclusive common carrier businesses, gearing up for competition in related businesses, providing industry leadership in shaping telecommunications policy, dealing with the immediate challenge of terminal interconnection, enhancing the financial viability of the industry and capitalizing on new market opportunities emerging in new service areas.

At a two-day policy planning conference held in October, senior management representatives of all 21 CTCA companies examined the major policy questions facing the industry and formulated plans for the year ahead. Particular attention was paid to the cable television industry's future plans and activities.

The industry is concerned about the degree and nature of regulation and responsibility that would be applied to the cable operators should they be licensed to provide the proposed non-programming services, and thereby become, in fact, another group of telecommunications carriers, in direct competition with those already offering similar services to the same customers.

The telecommunications carriers hope to promote a more open dialogue with CATV operators and their Association, and to participate in the ongoing debates on terminal attachment, interconnection, and other basic elements of the future structure of the telecommunications industry.

On the national scene, in addition to involvement in standards, communications for the handicapped, building industry consulting services, radio spectrum management, research and development and many other areas of importance to the provision of efficient telecommunications services in Canada, Association members have agreed to subsidize half the cost of a $5 million fiberoptics field trial in Eli, Manitoba, as a further commitment in finding ways to improve service in remote areas. Funded jointly by CTCA and the Department of Communications, the field trial, to begin this year, will be conducted to assess the technical and economic feasibility of utilizing fiberoptics technology for improving communications services in rural areas. Services to be provided, on an experimental basis by the basic system, will include single-party telephone service, FM radio and multi-channel television. This, and other fiberoptics networks now being installed in various parts of Canada by common carriers, will be capable of delivering a wide range of additional services as they evolve.

Work is also underway in preparation for the September 1979 World Administrative Radio Conference in Geneva, which will completely revise international radio regulations. This will be the first revision in twenty years, and the decisions to be taken will affect the frequency allocations and sharing criteria that will exist for the rest of this century.

TEST Features MDS Handbook

Now available from TEST Inc., is a valuable and informative handbook about MDS, multipoint distribution service.

The handbook is a result of tying experience and information together to form a technical philosophy for MDS operators. The topics treated include FCC regulations, transmitters, program sources, receiving paths, antennas, down converters and receiving installation practices. It includes 49 photos, block diagrams and installation drawings. The handbook is useful for management planning, instruction classes, on-sight installation, and assists projected business costs and planning.

Written by Ed Stark, who has experience and qualifications in MDS as well as CATV engineering and management, the price is $8.45 ea., or $5.50 for two or more.

For a copy of the MDS Handbook, contact TEST Inc., 16130 Stagg Street, Van Nuys, California 91409, (213) 989-4535.

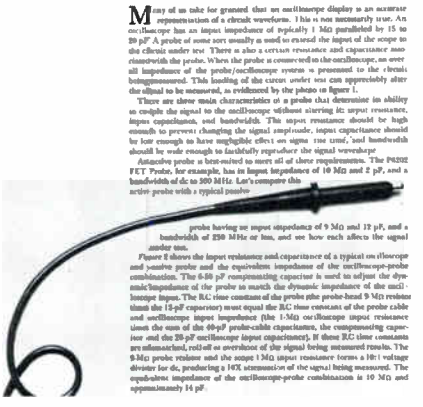
MDS Handbook from TEST.

Tektronix Application Note Explains Operation and Use of FET Probes

What does the oscilloscope user gain in return for the added expense of an FET probe: What are its advantages and limitations?

A new application note, "FET Probes: The Next Step in Quality Signal Measurements (AX-3580)" by Ron Lang, recently issued by Tektronix, Inc., answers these and many other often-asked questions from oscilloscope users. Also presented are graphs, schematic diagrams and simple equations dealing with probe response to various types of signals and signal sources. This application note is a valuable teaching aid for vocational schools and industrial training courses, as well as an informative guide for the uncertain buyer.

This free application note may be obtained by writing Julie Schmit, Delivery Station 76-260, Tektronix, Inc., P.O. Box 500, Beaverton, Oregon 97077.


FET Probes: The Next Step in Quality Signal Measurements

New application note from Tektronix.

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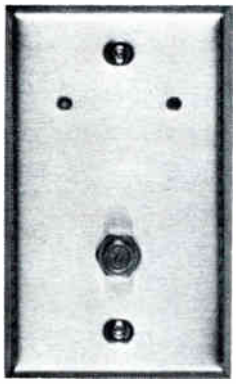

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- **Stainless steel plate**
- **Tamper detection circuitry**
- **Compatible with pay services**
- **3 remote control options to suit any operational requirement**
- **Standby memory power maintains system conditions during AC power outages**

Pay only systems choose IT-1G

These tap offs provide switching of one pay channel within a wall plate. Basic service is passed uninterrupted. The IT-1G is ideal for MDS, hotels and motels, where basic service is optional. Other features are identical to those of the IT-1.

- **Requires only one cable for operation**
- **Designed for hotel and motel loop through systems**
- **Basic service uninterrupted**
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- **Each output fully addressable**
- **Pay service options**
- **Lowpower consumption**
- **Combine units to provide unlimited pay or multi-tier service**
- **Standby memory power maintains system condition during AC power outages**

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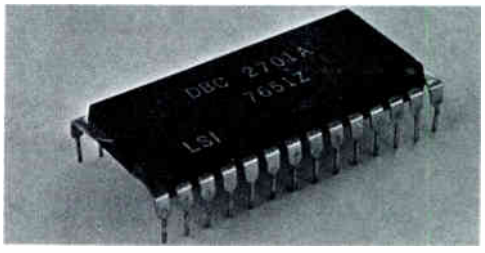

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★ **Larry A. Bowman** was recently appointed vice president, Operations, for **Comm/Scope Company.** Before joining Comm/Scope in October, Bowman was general manager of the Rocky Mount Cable Plant of Superior Cable Corporation in Rocky Mount, North Carolina, and administrative manager at its Hickory Cable plant.

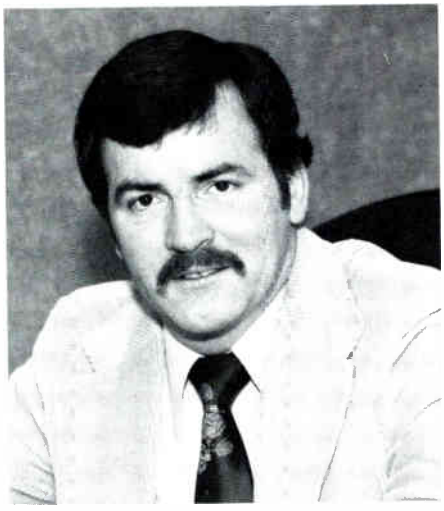
Larry Bowman

Comm/Scope's board of directors also recently announced the election of **Larry W. Nelson** to the position of vice president, Engineering. Prior to joining Comm/Scope, Nelson held various engineering and quality control positions with Pratt and Whitney at Hartford, Connecticut.

★ **Colin J. O'Brien** has been named president of **Jerrold Electronics Corporation** effective January 1st, announced Frederick Shuh, chairman and chief executive. O'Brien joined General Instrument in 1972 and has held the position of executive vice president of Jerrold for the past year. Commenting on the news, Shuh, a senior vice president of General Instrument, said, "O'Brien's appointment represents the fulfillment of an organizational plan developed almost two years ago and recognizes the outstanding growth in revenue and earnings achieved by Jerrold during this period. In his new position, O'Brien will further strengthen Jerrold's position of leadership in support of the dynamically-growing cable television industry." Prior to joining Jerrold, O'Brien spent eight years with Union Carbide in a variety of financial and marketing positions in Great Britain and Canada. A native of Australia, he holds a chemical engineering degree from the University of New South Wales.

Colin J. O'Brien

★ **Kevin Finn** has been named general manager of the **TRW Semiconductor Division,** which incorporates TRW's RF and Power Semiconductor operations. He succeeds Stan Czerwinski, who has voluntarily resigned from TRW to become president of Q.T. Wiles & Associates, Los Angeles-based electronic manufacturers' representatives. Finn has been operations manager of TRW Power Semiconductors for the past year, and previously was CATV plant manager at TRW RF Semiconductors. He also headed the Semiconductor Division's Western European operations for three years, headquartered in Bordeaux, France. He took over the Division on January 1, 1979.



Kevin Finn

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