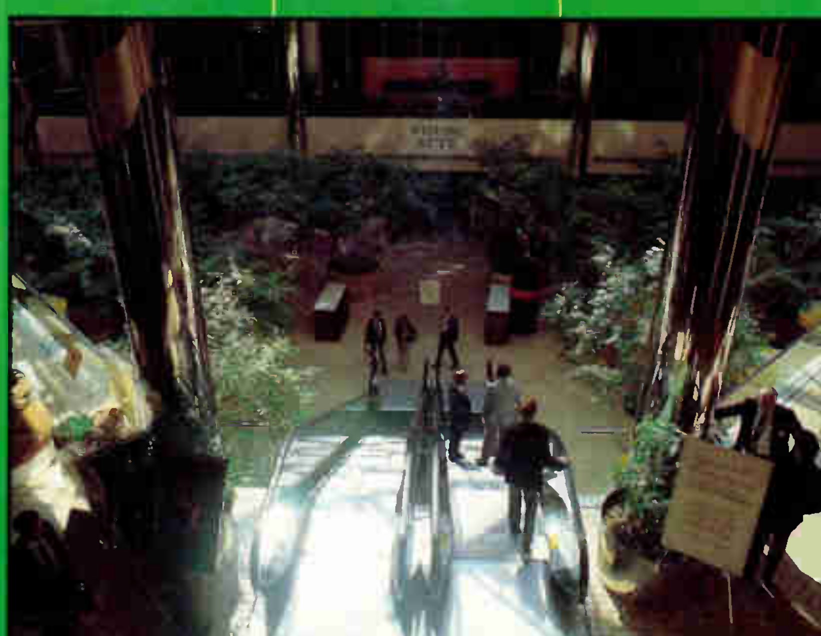
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

...ction practices
Page 54



Tec Expo recapped
Page 20

April 1985

Technology Above the Rest

Product design and technology are often copied but seldom duplicated.
At Utility Products, we advance the state-of-the-art by designing better pedestals.

We are thinking of the future when taps, couplers, and amplifiers
may require a more compact designed closure.
Also, the environment is changing; acid rain, pollutants,
and coastal salt contaminants promote corrosion
so we've improved our already long-lasting finish.

In addition, all our closures feature increased mounting capacity
and variety through improved bracketry.
It is this attention to detail that keeps Utility Products above the rest.
Your future is assured with Utility Products.
Phone or write us at the address below.

Reliable Electric/Utility Products 11333 Addison Street/Franklin Park, Illinois 60131/312-455-8010

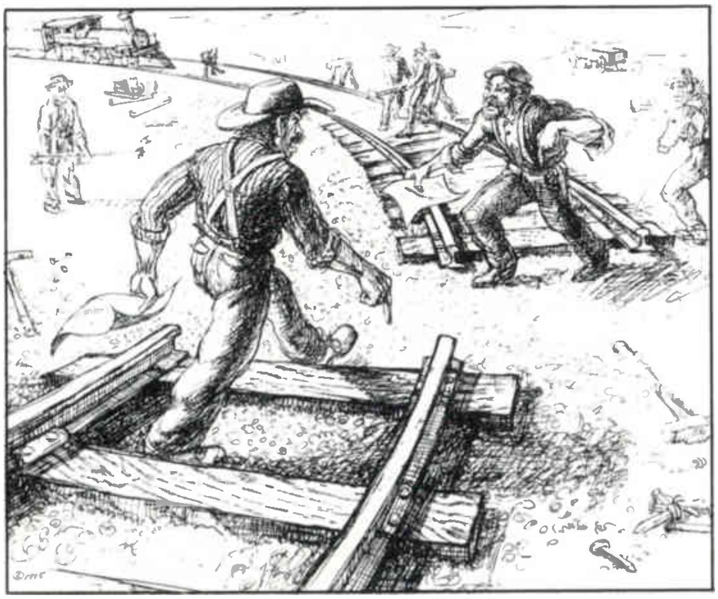
RELIANCE COMM/TEC

Reader Service Number 1.

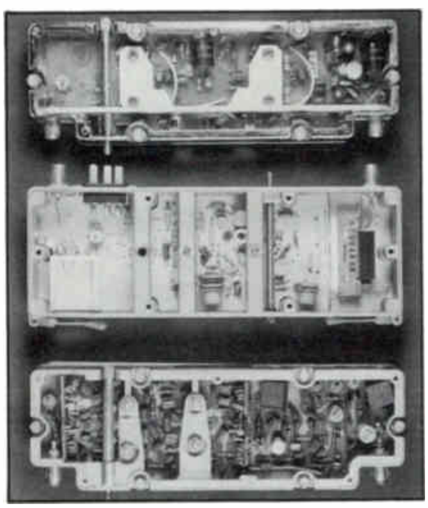
CONTENTS

Departments

Cable-Tec Expo 20



System design 34



Upgrades 60

Features

Cover
Construction photo courtesy of Tamaqua Cable Products Corp. Expo entrance photo by Bob Sullivan.

 Communications Technology™ is published monthly by Communications Technology Publications Corp., 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112—or—P.O. Box 3208, Englewood, Colo. 80155, (303) 792-0023. April 1985, Volume 2, Number 2

Remember, in cable's early days, when your system went down and you had that utterly helpless feeling knowing there was nothing you could do til morning? Back then, service meant plugging in a spare amplifier or waiting for assistance – usually half the country away. As an operator, you were virtually on your own. Recognizing this, Jerrold became the first manufacturer to supply operators with needed test equipment and strategically-located field engineers, thus providing the first on-site installation support and training. Even then, Jerrold was there.

Remember when factory service meant waiting til morning? Now...

JERROLD. Service Anytime, Anywhere.

Today's cable systems are becoming more complex and sophisticated. That means your support needs are more critical than ever. And Jerrold is there to help you make the most of your investment with the largest, most comprehensive service network the industry has ever known.

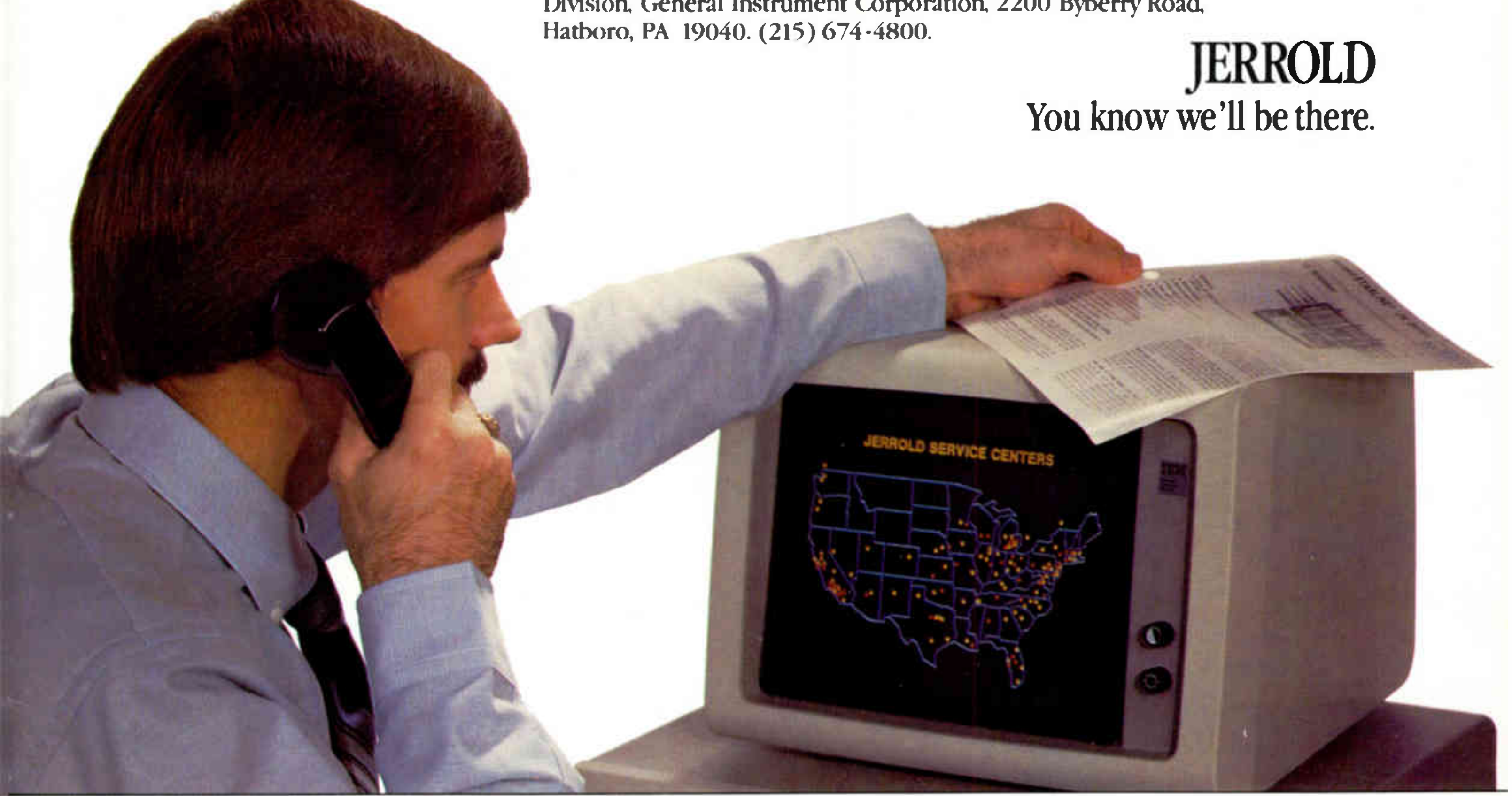
- A Technical Response Center (1-800-JERROLD) accessible 24 hours a day, every day.
- 160 engineers in four locations supporting Jerrold, Century III and TOCOM products and systems.
- Simulation facilities to pinpoint and resolve problems instantaneously.
- 160 field locations to provide on-site installation and applications support.
- 13 field repair centers located nationwide.

The Jerrold Service Network. More than service, it's training – upfront and ongoing. It's communications. Listening to your needs, providing answers and suggesting better alternatives to give you the competitive edge. And it's solutions. Three decades of solutions. It's why you can count on Jerrold today – and tomorrow – to provide the backup you need anytime, anywhere.

To learn more about Jerrold's service network, call or write today. Jerrold Division, General Instrument Corporation, 2200 Byberry Road, Hatboro, PA 19040. (215) 674-4800.

JERROLD

You know we'll be there.



Reader Service Number 3.

GENERAL INSTRUMENT

Not what, but how

This year's Cable-Tec Expo attendees left armed with plenty of information and incentive for improvement. Cable engineers, technicians and manufacturers alike, participated in workshops and sessions concerning the technical community. And many people realized that it's not the complex but rather the simple things that at times are overlooked—such as better communication.

All in all, I think the Expo provided a very creative environment. One whose flavor is best summed up by Skip Litz, of the Jerrold Division of General Instrument Corp. "There are any number of trade shows where SCTE members can go to see products on display. It has been our philosophy that the Expo could be put to better use on behalf of SCTE members by addressing the 'how' and 'why' of cable system electronic equipment instead of the 'what,' which are the products themselves."

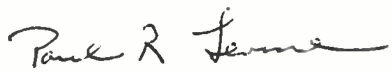
Getting it sooner

We at *CT* also believe in sharing knowledge and disseminating useful industry information. We view this as our primary goal and in an effort to provide our product on a more timely basis, we are preparing to apply for our second class postal permit. To do this we need your help. If you haven't filled out a subscription card recently, complete one enclosed in this issue. A subscription card also will be on the cover of the May issue for your convenience. Those subscribers who do not renew by June will be removed from our mailing list.

Coming through in the clinch

I'd like to take this opportunity to congratulate George Tamasi and Tom Polis, of Communications Construction Group (now a part of RT/Katek Communications Group), on receiving the SCTE Presidents Award. In late 1983 many problems faced the Society that threatened its very existence. The organization was deep in debt after a long period of low income and high overhead. Tom Polis and George Tamasi undertook to ensure the continued existence of the Society by providing their management skills, facilities, staff and funds. The results of these efforts are self-evident. At the end of 17 months the Society has paid all of the debts, has streamlined the national headquarters staff and operational costs, has restored previously existed reserve funds and has gone on to implement many new valuable services to the membership and the industry. The future now looks bright with membership on the increase and more dollars being returned to membership services. When asked why they undertook this massive project while developing their own business both George and Tom responded: "The contribution of the Society to the technical community of the cable industry is a valuable asset. We could not imagine the industry without it."

Polis and Tamasi received the award from SCTE Immediate Past President Jim Emerson (see *The Interval*), for helping the organization in a number of ways. Congratulations to George, Tom and the staff at Communications Construction Group. They know not only what to do, but how.



COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

Paul R. Levine
Publisher

James G. Trevathan
Comptroller

Sherwood S. Sumner
Vice President-Sales (N.Y.)

Toni I. Barnett
Vice President-Editorial

Wayne H. Lasley
Managing Editor

Rob Stuehrk
Account Executive

Greg Packer
Director of Circulation

William Eager
Associate Editor

Peyton G. Koeppel
Editorial Assistant

Sharon F. Lasley
Art Director

Pamela K. Macy
Production Coordinator

Marla Sullivan
Artist

Nancy Hardy
Production Assistant

Sherri R. Wakehouse
Office Manager

Denver: Communications Technology Publications Corp., 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112—or—P.O. Box 3208, Englewood, Colo. 80155, (303) 792-0023 **New York:** 1641 Third Ave., Suite 2K East, New York, N.Y. 10128, (212) 599-0209

BPA membership applied for November 1984.

Bob Sullivan

Expo draws solid crowd, provides learning forum

Eight hundred and fifty people attended Cable-Tec Expo '85. The show allowed engineers to soak up information at numerous workshops and exhibit floor demonstrations. The Society of Cable Television Engineers also inaugurated the Broadband Communications Technician/Engineer (BCT/E) Professional Designation Certification Program. The program was designed as a means of recognition for the demonstration of technical knowledge. It also may serve as a substitute for the FCC's first class license examinations and may assist in personnel evaluations by management. Pictured here are UA Cablesystems' Bob Luff, SCTE Executive Vice President Bill Riker, and Wendell Bailey, NCTA vice president of Science and Technology. For more on the Expo, see page 20 and 'The Interval.'

S-A nets $40 m order, enters new market

ATLANTA—Hi-Net Communications, a partnership between subsidiaries of Holiday Inns Inc. and Communications Satellite Corp., has contracted to purchase approximately $40 million worth of Scientific-Atlanta equipment and services. Delivery and installation of satellite television receiving equipment will commence late spring 1985 and continue through mid-1987.

The S-A equipment will receive programming delivered by satellite to Holiday Inn hotel guests in hotels owned or franchised by the Memphis-based hospitality chain. "Some 350 Holiday Inns now have some satellite television receiving equipment," said William Goforth, president, Hi-Net Communications Inc. "However," he continued, "the new installation by S-A will replace the existing systems and add a more reliable service to these and eventually the balance of the approximately 1,500 U.S. Holiday Inn hotels."

A separate uplink facility to be installed at the Hi-Net Communications headquarters will broadcast four channels of television programming to Holiday Inn locations via a Ku-band satellite.

The system to be installed by Scientific-Atlanta at each hotel will include a 4.5-meter Ku-band earth station, a control computer and a newly designed two-way interactive program selector unit in each guest room. The computer will automatically list pay-per-view charges by room number when programming is selected.

Also, Scientific-Atlanta announced its plans to enter the home satellite television market with a line of Homesat products available in early summer. The satellite systems will be sold to homeowners through a network of authorized Homesat equipment dealers supplied direct from the company's regional warehouses located across the United States.

Scientific-Atlanta's dealer strategy includes product supplied direct to the dealer through S-A's regional warehouses. The company has targeted a select group of dealers and will begin to authorize Homesat equipment dealerships in May.

Tech issues before FCC

WASHINGTON—Interested parties have until April 15 to reply to comments received by the Federal Communications Commission concerning deregulation of cable TV technical requirements. The commission specifically asked for comments on whether the quality performance standards for cable systems should be modified or removed and whether signal leakage limits should be relaxed (MM Docket No. 85-38).

The FCC has proposed that signal leakage limits be increased to 50 microvolts per meter from 20 microvolts per meter. In addition, the commission would like signal leakage measurements to be taken at a standard three meters from the cable instead of at different distances for different frequencies.

Storer selects Pioneer

COLUMBUS, Ohio—Pioneer Communications has begun shipment toward a projected $1.7 million addressable terminal order from Storer Cable Communications.

Storer is using Pioneer's BA-2130R converters with an M3 addressable system configuration using a DEC Micro 11 headend in Montgomery, Ala. The system will be tied to Cable Data's billing interface in the Storer system. Storer also will be using the BA series #2520 one-way addressable in Fairfield, Calif.

C-COR supplies RF devices

STATE COLLEGE, Pa.—C-COR Electronics Inc. is supplying the RF distribution electronics for two broadband data communications systems. Both systems are for Department of Energy nuclear fuel plants, one at Rocky Flat, Colo., the other at The Mound in Ohio.

Equipment to be installed includes C-COR's conventional and feedforward split-band amplifiers and standby power supplies. Rockwell International is the general contractor on the project. Design of the system was done by Allied Data Communications Group Inc., a nationwide LAN design/installation firm.

Lightwave systems added to Avantek line

SANTA CLARA, Calif.—Avantek Inc. announced the addition of lightwave systems to its digital microwave radio product line, through the acquisition of the Communications Systems Group of Magnum Microwave Corp., Mountain View, Calif.

With the addition of the Ametrocom® line of analog and digital lightwave systems, Avantek now offers a full range of telecommunications transmission equipment for local distribution and trunking applications. The new lightwave products offered include the Ametrocom ALW-600 and ALW-960 analog lightwave systems and the Ametrocom DLW-2 digital lightwave system.

THE LEADING TECHNOLOGY IN
CATV AUDIO
CAN SATISFY YOUR REVENUE
GROWTH NEED
FM CONVERTER MODEL 1700-1
Ca Sat
Technology
MODEL 1700
CABLE FM
OFF AIR FM
PREM FM
Designed with your needs in mind ......
Solid state switch — to ensure durability and reliability
Crystal Oscillator — to meet FCC emission requirement
Through Gain — to improve reception quality
"LOW COST" — to increase your profitability
CaSaT
A CABLE & SATELLITE TECHNOLOGY COMPANY
CASAT TECHNOLOGY, INC.
UNIT 5, 6 NORTHERN BLVD., TEL.: (603) 880-1833
AMHERST, N.H. 03031 U.S.A. TELEX: 756700 CASAT

The patent: a failed capitalistic invention

By Isaac S. Blonder
Chairman of the Board, Blonder-Tongue Laboratories

Guilds flourished during the Dark and early Middle Ages, each possessing some secretive skills in manufacturing that established virtual monopolies able to control distribution and prices. Quite frequently, the product was only available from a guild in one country, which placed in jeopardy the welfare of other countries if trading was interrupted by warfare.

An interesting sidelight on the guild mentality was the comment by one historian that the American Revolution was not primarily based on the Stamp Act (Boston Tea Party), but on the refusal by England to allow manufacturing of goods in the Colonies if they were available from the motherland.

It is not surprising that the Western civilized nations emerging from the Dark Ages would desire the secretive guilds to disgorge their knowledge for the benefit of all. Thus appeared the alternative to the guild—the patent—a state awarded monopoly for a fixed period in return for a public disclosure of the secret.

"Patent" is derived from the Latin *literae patentes*, signifying that which is open or disclosed. The first recorded patents were issued by the Republic of Venice in 1474. Galileo Galilei in 1594 received a patent for an invention relating to pumping water. The first patent in the United States was issued by the Massachusetts Bay Colony in 1641 to Samuel Winslow for a process of manufacturing salt.

The right to issue United States patents was taken over by the Constitution, Article 1, Section 8, "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." The first patent law was enacted on April 10, 1790. In fact, George Washington signed some of the patents!

After five hundred years of patents here are the consequences as I see them.

Freedom of information

Whether due to patents or to the natural growth of civilization, we are on an eminently gratifying exponential expansion of knowledge. Along with the release of technology encouraged by the patent scheme, some unusually generous gestures have been made by governments and corporations.

The invention of photography, one of the landmarks of science, by Daguerre in January 1839, based upon his partnership with Niepce, was purchased by the French government, who granted Daguerre an annuity on June 15, 1839, and generously gave the invention to the world. Its monetary value may be measured by the fact that upwards of 100 million daguerreotypes were manufactured between 1840 and 1855 until supplanted by other processes.

Bell Laboratories also made a grand gesture in giving the world the transistor.

Are patent policies uniform worldwide?

Not at all. The communist countries have non-existent or unenforceable patent laws. Freedom of information in the communist world is subject to the whim of the state, generally secret unless needed to stimulate a flow of technology from the free world.

Socialism may have a freer exchange of knowledge but the granting of private monopolies is an anathema to their psyche.

Does the patent system reward inventors?

Answer: Not now, if ever.

Here is what Samuel F.B. Morse had to say in 1851 about patents. "A patent is a mockery. It is a mirage cheating the sense with unreal images of comfort and delusive ramports of protection. A patent is an announcement that another prize is afloat that pirates may contend for its possession over the murdered body of its rightful owner."

Some more words of wisdom and experience come from Thomas A. Edison, the possessor of more than 2,000 patents. "If I had to do it all over again, I would be tempted not to take out any patents at all. I am inclined to believe more and more that at least in the United States the only adequate protection for an invention is to keep it a trade secret."

In other words, back to the time of the guilds!

My own experience, with a patent contest all the way through the Supreme Court, confirms that the grant of a patent in today's social climate offers no peace of mind and quiet enjoyment of the rewards of a patent monopoly as promised by the founding fathers.

THE PATENT SYSTEM IS A FAILURE AS CONSTITUTED.

What is the solution? I do not have an answer. Perhaps one of you out there will invent a perfect patent procedure. Will you be rewarded? Don't ask!

Diagnostic and remedial procedures

Preventive maintenance is the act of correcting plant deficiencies before they result in customer service interruptions. It is accomplished through comprehensive, systematic application of procedures aimed at locating and eliminating weak "links." These procedures range from complex system performance tests to simple visual inspection.

By David Franklin
Vice President of Engineering Director of System Development
Adelphia Communications Corp

CATV plants are generally divided into three main sections: trunk, distribution and drops. Table 1 provides some parameters to be checked in the different sections, and a schedule of activity for plant preventive maintenance. Though certain sections of the plant are considered more important than others (because of the number of subscribers affected), every section warrants careful attention when a preventive maintenance program is initiated. The order given in Table 1 is indicative of the opportunities to effect improvement by routine adherence to a schedule.

Table 1: Plant maintenance schedule

	Daily	Monthly	Semi-annually
A. Drops			
1. Signal levels	X		
2. Picture/sound quality	X		
3. Signal ingress	X		
4. Mechanical inspection	X		
5. Physical security	X		
6. Hum	X		
B. Distribution (system test points)			
1. Signal levels		X	
2. Hum		X	
3. Signal egress		X	
4. Linearity (flatness)		X	
5. Carrier/noise		X	
6. Carrier/co-channel (off-air channels)		X	
7. Carrier/intermod		X	
8. Mechanical inspection		X	
C. Trunk amplifiers and line extenders			
1. Input levels			X
2. Output levels (trunk and bridger)			X
3. Pad/equalizer			X
4. AC voltage			X
5. DC voltage (unregulated)			X
6. DC voltage (regulated)			X
7. Mechanical inspection			X
8. Linearity (flatness)			X
9. Gain (minimum, full)			X

Drops

Drops, because of their numbers, constitute a major portion of the plant. Drops are often neglected in maintenance programs even though they are a major contributor to the daily service calls in many plants. Subscriber drops are also a major cause of signal egress (leakage) as indicated in the *Final Report to the Federal Communications Commission*[1] (released by the Advisory Committee on Signal Leakage in November 1979). The FCC's Field Operations Bureau conducted leakage measurements in 65 systems covering 1,147 miles of plant. They located 165 separate leakage points with 185 total sources. Table 2 lists the individual contributions of different components to the total number of sources. A quick review of Table 2 will show connectors and cables to be the two greatest contributors to the signal egress problem, with drop connectors yielding 9.7 percent of the detected signal emission and drop cables giving 10.8 percent. Altogether, known drop-related egress points contributed 24.3 percent of the reported total.[2] Also, as noted in the study, the two worst cases of signal egress were caused by bad drop lines.

The first step in drop preventive maintenance is to ensure the initial installation is done properly. This requires the application of general installation procedures with specific guidelines as to attachment means, placement, routing, etc. Also, frequent routine inspection of the work performed, with checks for appearance, mechanical integrity and workmanship, will help in ensuring reliability.

At every opportunity (new install, reconnect, service level change, etc.) the installer should check the signal levels at the tap to ascertain proper system operation. Measurement of a few channels spaced across the spectrum can indicate sub-standard performance such as reverse tilt, excessive peak-to-valley deviation or abnormal levels. Signal levels that are too high can be just as troublesome as those that are too low. The installer should record the readings and report questionable levels to the area maintenance technician and/or chief technician.

While the installer is up the pole, he should "re-snug" all drop connectors using a small, 7/16-inch wrench. He also can check the distribution line connectors for proper tightness using a larger adjustable wrench. This simple procedure could locate and/or eliminate several potential leakage sources every day. It also may prevent a failure of a distribution line or subscriber drop.

The installer should verify the adequacy of physical security measures by checking locking terminators, traps, shields, etc. Look for signs of tampering or abuse. Signal pirates are getting smarter every day, which means we need to be more diligent in checking for illegal drops and in assuring that the traps and terminators are real and have not been altered to allow unauthorized reception of signals. As shown in Table 2, illegal drops contributed significantly to the detected signal egress sources (5.4 percent).

The next step is simply to look at all of the pictures, and listen to the audio, to ensure a proper install and proper system operation. Especially observe the local broadcast channels for signs of signal ingress. Also look for beats, snow, hum, ghosts, co-channel or "crud." Any of these distortions indicate substandard plant operation and should be reported to the area maintenance technician and/or the chief technician.

Note that the same guidelines can be used by the subscriber service technicians during the performance of their duties. With the combined forces of the installers and the service technicians spending a few extra minutes on each call, significant improvement in general system operation and elimination of many irritating service interruptions can be achieved.

Distribution test points

The regular, routine monitoring of dedicated distribution test points will provide a wealth of information about the static condition of the distribution and trunk system. Careful analysis of readings (past and present) will aid in identifying long-term detrimental changes that could help the operator to avoid more serious system problems or outages.

Sufficient test points to cover all major trunks and sub-trunks should be used. A low value, two-port tap located immediately after the last active distribution device should provide sufficient levels (20 dBmV or more) to allow reliable, repeatable testing. The system test points should be accessible to facilitate regular checks. A drop line run down the pole (with a section of ground wire molding for protection) could be terminated into a standard ground block. This ground block should be mounted high enough to deter vandals.

The first step in checking a system test point is to record all visual and aural carrier levels. These levels can be graphed in such a way as to provide a good indication of the peak-to-valley response of the system. They should be checked for proper adjacent channel difference (not more than 1 dB), visual/aural carrier ratio (13 to 17 dB, unless otherwise specified), and proper tilt. Since the test point is located immediately after the last active distribution device, the recorded levels should match the specified distribution tilt, with the high frequency carrier greater than the low frequency carrier by an amount specified by system design.

The meter used for the test point check should have hum and carrier-to-noise measurement capability. Assuming such capability, these tests should be accomplished. (It's a good practice to perform these two tests at every opportunity.)

Hum measurements should be made on an un-modulated (CW) carrier. Generally, a single carrier will suffice for locating system-generated hum, but this test will not isolate individual channel hum caused by defective headend devices, therefore one also should check pictures at these test points to locate single-channel problems. Hum measurements should yield 1 percent or less in most cases. You should investigate if you read more.

Carrier-to-noise measurements generally require signal levels in excess of 20 to 25 dBmV for reliable results. These levels allow measurement sufficiently above the test equipment noise floor to ascertain minimally acceptable performance. Carefully follow the measurement procedure prescribed by the test equipment manufacturer. The carrier-to-noise ratio should be greater than 40 dB in almost every case, with 36 dB as the specified (FCC) minimum. You can see some graininess at a 40 dB ratio, and 36 dB would be unacceptable to most subscribers.

Table 2: Signal egress sources

	Sources	Percent
Drops		
Connector	18	9.7
Cable	20	10.8
Passive	2	1.1
Unterminated tap port	5	2.7
	45	**24.3**
Plant		
Connector	16	8.7
Cable	15	8.1
Active	3	1.6
Passive	6	3.2
Pressure tap	9	4.9
	49	**26.5**
Not specified		
Connector	33	17.8
Cable	4	2.2
Passive	3	1.6
	40	**21.6**
Unknown	**41**	**22.2**
Illegal attachment	**10**	**5.4**
Total	**185**	**100.0**

No egress detected at 13 test locations.

Another very effective means of signal quality analysis is simply to look at the pictures and listen to the sounds. Too often we hurriedly run through quantitative measurements and proceed to the next location, but many deficiencies will not be apparent with signal level measurements. These problems include signal ingress, co-channel, intermod and composite triple beat or "crud." We also can identify single-channel problems such as hum, noise or ghosts. Do yourself a favor and take a look at your product.

Signal egress measurements should be performed not only at the dedicated test points, but also during the travel to the test points and throughout the system. Take the time to note all egress points for subsequent correction; if it is severe enough, correct it yourself immediately. If you can't correct it, or if it doesn't warrant immediate attention, at least write down a detailed location so that it can be found and repaired later.

The same advice applies to a mechanical inspection. As you are traveling around the system, look for things such as broken lashing wire, tree branches on the cable or possible kinks. If you have the time, correct the problem right away; if not, make an accurate, detailed written record of the problem so that subsequent remedial action can be taken. Don't do it later, do it now!

Amplifiers and line extenders

The final section of the plant to be considered are trunk amplifiers and line extenders. The trunk portion of the plant is no more complicated than the other sections, but a mistake made in this area will affect all subsequent equipment and subscribers.

In checking trunk amplifiers and line extenders, there are a few general guidelines to follow, with specific instructions to be found in the manufacturer manuals. The first guideline is to read the manufacturers manual for specific instructions. Don't assume that you know what you are doing just because you've been in the business for five or 10 years. If you don't read the manual, you've already make a mistake. If you don't have the manuals, get them. General parameters to be measured when checking amplifiers and line extenders are listed in Table 1, section C. A brief survey of these parameters may prove beneficial.

Amplifier and line extender input levels vary. A general rule, however, states that input levels are to be at least equal to the noise figure of the device they are feeding. Therefore, if a trunk amplifier has a noise figure of 9 dB, the least one should allow for an input would be 9 dBmV. If an equalizer or pad is used, the input level should be sufficiently higher to overcome the insertion loss of these devices. Most equalizers exhibit 1 to 1.5 dB of insertion loss at the high end of their specified bandwidth, hence, an amplifier with a 9 dB noise figure, an equalizer and a 3 dB pad must have at least 13 dB into it, otherwise the output carrier-to-noise ratio will be unduly degraded. One final note about equalizers: An equalizer that has a specified bandwidth in excess of the equipment or system capability adds unnecessary insertion loss to the systems highest carrier; i.e., 400 MHz equalizer used in 300 MHz system will cause the highest carrier (channel W) to be over-attenuated due to the increased insertion loss at this frequency. Also, unless the equalizer value is increased (further increasing the insertion loss at channel W) the system will be under-equalized and system levels will be difficult to set and maintain.

The next parameters to check, even before setting the output levels, are the AC and DC voltages. The AC voltage will vary as a function of the distance from the source and of the current load in its path. In a 60 VAC system, the available voltage at an amplifier or line extender could vary from 35 to 60 VAC. A 30 VAC system limits the voltage to a range of 18 to 30 VAC.[3] Most manufacturers specify a power-tap to be used dependent upon various input voltage ranges. Some manufacturers recognize the problem of obtaining correct AC voltage readings and supply an unregulated DC voltage test point. You are to use the proper power-tap to bring this unregulated DC voltage to a certain level. Prior to selecting the proper power-tap one should ensure the cor-

(Continued on page 79.)

Sensible practices for system operators

By Ralph Haimowitz
Director of Engineering, American Cablesystems of Florida

When I started to write this article, I thought about making a list of various ways that a cable system operator could save money: by carefully shopping for materials, buying in bulk lots, taking advantage of "show specials" and all of the other day-to-day practices that should be taking place. Then I began to think about those specific things that produce the greatest economies for any cable system and I realized that these were not items that saved dollars initially, but in the long run were responsible for phenomenal dollar values that the cable operators realized. In general, there are three categories that produce tremendous savings in our industry.

The first is intelligent purchase of equipment and materials. I'm not referring to price shopping, although that becomes a minor factor overall. What I am addressing is establishing minimum standards and technical specifications for what you spend your dollars on. By now, everyone should realize that cheaper is not usually better, and the most expensive equipment is not necessarily the best—just overpriced. The best process of selection is to set minimum standards for your system and minimum technical specifications for the equipment that you put into it. And don't compromise by lowering your standards because of price, availability or because yours are higher than the so-called industry standards; 18 dB port-to-port isolation on drop materials just isn't good enough.

Signal egress (leakage) from devices has become a matter of concern, yet many manufacturers still haven't published RFI statistics on their products. Shielding on drop cable is also an important item to consider. A few dollars more per thousand feet today easily may save two or three times that initial investment amount before you have to replace a drop; and think of what it will do for CLI. I could go on from one item to another, but I think this covers the general idea.

'Set minimum standards for your system and minimum technical specifications for the equipment'

Other economical measures

Preventive maintenance is the second area ensuring a cost-effective system. Every technical supervisor should be scheduling testing and maintenance on the entire system plant, from the antennas and headend to the terminated distribution taps. System operators should be striving to make the trouble call non-existent. This is accomplished through an established monitoring program where headend levels and quality are checked and recorded weekly, end of trunk amplifier runs weekly, terminated distribution monthly, and a complete system sweep/proof performed at least twice a year.

Installers and service technicians always should be looking for early signs of developing problems in distribution and house drops. Items such as connector corrosion, sagging or unburied drops, lack of grounds, etc., must be corrected on the spot.

Probably one of the best detectors of developing system problems is an aggressive signal leakage detection program, often overlooked as a principal part of preventive maintenance. The latest FCC requirements in this area are sure to lead to some new, easy to use, inexpensive equipment that will locate potential problem areas and allow technicians to correct them before they become serious enough to result in deterioration of service or outages.

Last but by no means least, have skilled and knowledgeable technical personnel taking care of the cable system. This only can be accomplished by providing these personnel with adequate training through a combination of well-developed, rigidly monitored, regularly scheduled in-house training programs, and attendance/enrollment in NCTA, SCTE and manufacturers' technical programs/seminars. The Broadband Communications Technician/Engineer (BCT/E) Certification Program recently implemented by the Society of Cable Television Engineers may prove to be this industry's best indicator of technical capability. Knowledge and capability will not get the job done efficiently or effectively if the technicians are not provided with the necessary tools and test equipment.

Real solutions

If you carefully analyze the opinions stated here, it seems that all I have talked about is spending money for better equipment, maintenance programs and educational levels. The strange truth is that this is the one truly effective way to achieve continuing system economies. I hope everyone will examine the facts and institute these programs for good system economics, otherwise the old axiom about being "penny wise and pound foolish" will never be truer.

The Society of Cable Television Engineers drew 850 people and 77 exhibitors, representing companies from across the country, to its '85 Cable-Tec Expo. Tom Polis became the Society's new president.

Expo recapped

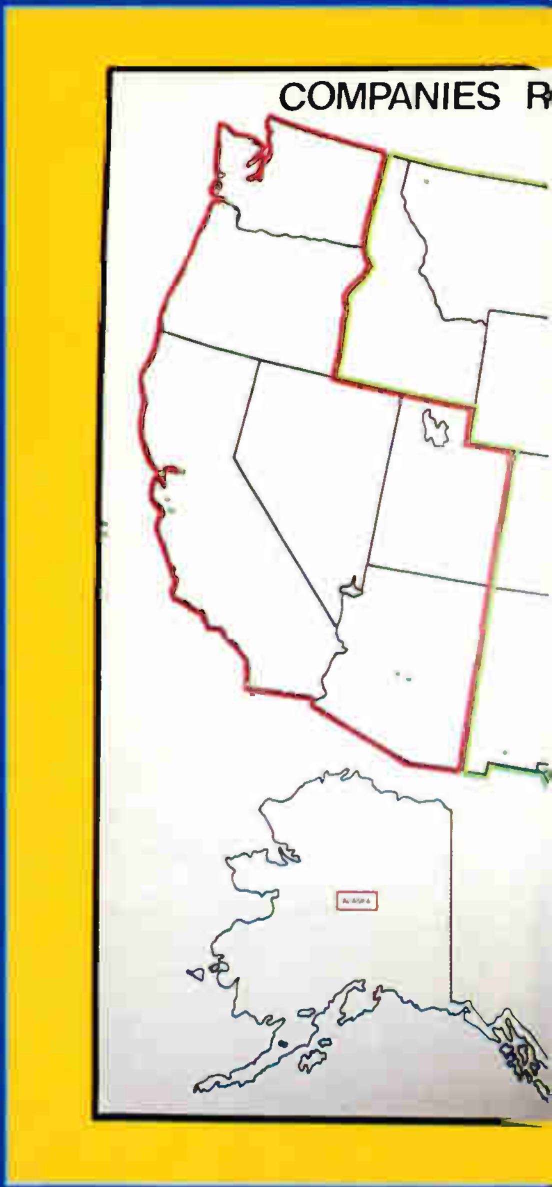
By William Eager

Q: What annual event features workshops with the cable industry's technical leaders, exhibit floor technical sessions, a myriad of FCC representatives, and more than 800 cable engineers and technicians?

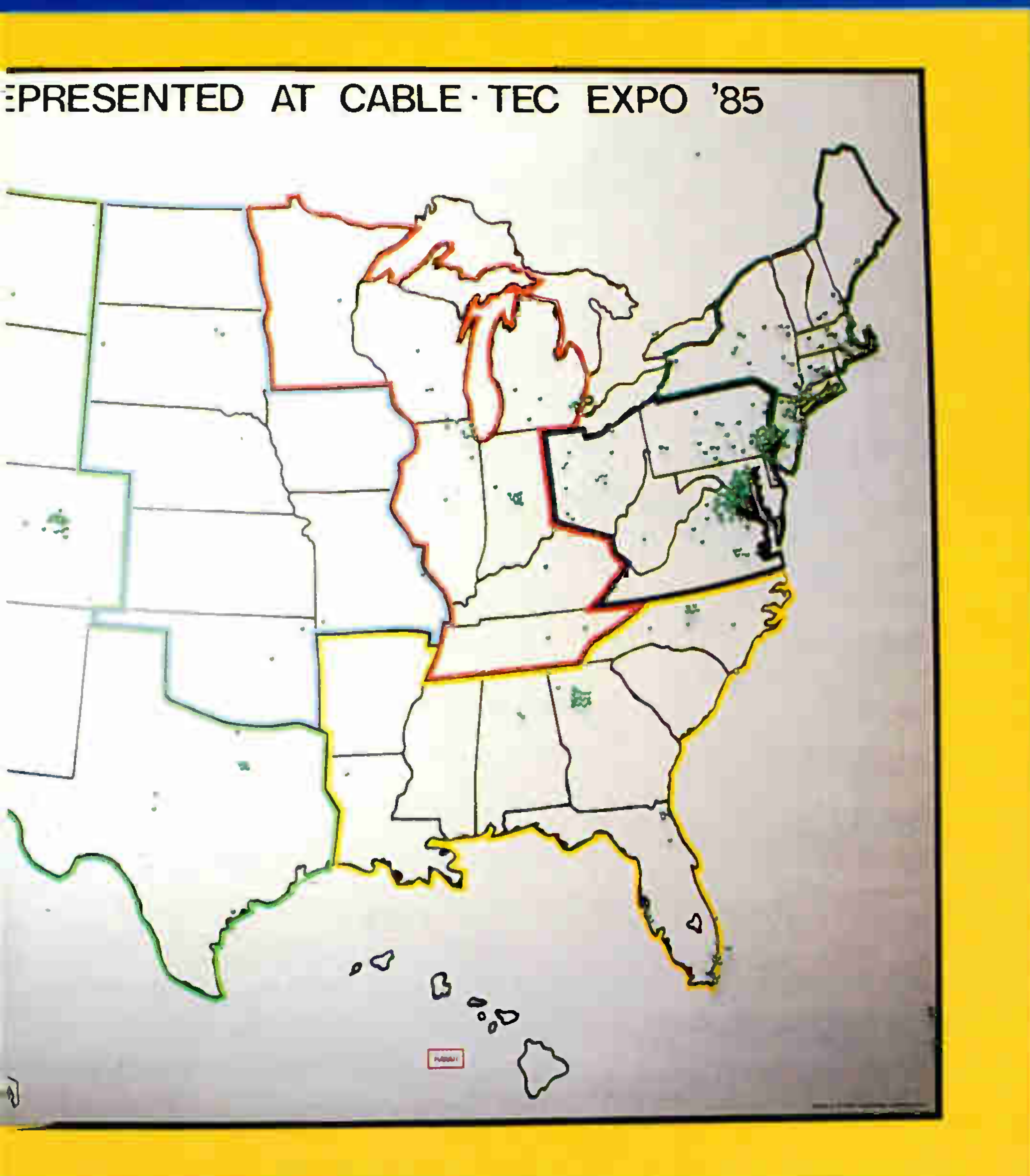
A: The Cable-Tec Expo.

This year's Cable-Tec Expo affirmed that engineers wear many hats—that of the engineer, of course, but those of manager and lobbyist as well. Numerous speakers, including FCC Mass Media Bureau Chief James McKinney (see *The Interval*), noted that cable engineers must help management and the FCC make policy decisions (besides ensuring that the cable system is technically fine-tuned).

In his opening remarks, Bill Riker, SCTE executive vice president, expressed concern over the "lack of communications between the managers in the office and the technicians in the field." Those views were echoed by Bob Luff, senior vice president, UA Cablesystems. Speaking at the first session, "Increasing interaction between management and engineering," Luff explained that communication between technicians and management has become more critical because the cable industry (and its technology) has become increasingly complex. Language, he noted, is often a barrier to communication. Engineers and managers should strive to improve written and oral communications. "Most of us," he said, "are technical managers, with a little *t* and a capital *M* most of the time."



CABLE-TEC EXPO '85
WASHINGTON, D.C.



SCTE

Engineers, it seems, also have a responsibility to help the FCC determine the technical regulatory policy. Keynote speaker McKinney said, "This society (SCTE) as well as NCTA (National Cable Television Association) needs to become more active in cable technical policy matters . . . engineers need to convince the operators that cable technical issues are important."

The impact that cable engineers can have on FCC policy was illustrated during a presentation by Alex Best, manager of research and new business development for Scientific-Atlanta, at the "Multichannel television sound: Can cable carry it?" seminar. In 1982 the NCTA formed an ad hoc audio committee that performed a series of technical tests to determine whether cable could carry multichannel sound if the FCC ruled it as a must-carry. Best presided as chairman over the committee. It was estimated that it would cost the cable industry more than $700 million to become completely compatible with multichannel sound. Costs involved upgrading headend equipment (approximately 8,700 headends), purchasing new converters, and additional service calls. As a result of NCTA research the FCC ruled this past February that CATV does not have to (must-)carry multichannel sound.

The FCC's emphasis on deregulation was perhaps the most talked about topic at the convention. Again, summing up the current attitude at the FCC, McKinney said, "The premise of technical deregulation that we are following at the FCC can be very simply stated—we wish to delete those rules that go to the 'quality' of communications services and concentrate, instead, on matters concerning interference. The marketplace will handle quality . . . but the marketplace will not provide for interference concerns."

Ralph Haller, FCC Policy and Rules Division deputy chief, echoed McKinney's statement in his presentation at the "Technical deregulation: Blessing or burden?" session. "With deregulation comes increased competition and increased responsibility for the industry," Haller said. "The demand for the specific quality of products we (the FCC) think should be controlled at the consumer level . . . not by the federal government."

Although generally in favor of deregulation, NCTA Vice President of Science and Technology Wendell Bailey expressed concern over the issue of technical standardization. "Who," he asked, "replaces the FCC?" In the free marketplace environment the cable operator and the subscriber will both determine appropriate levels of quality.

Nevertheless, as McKinney noted, the FCC will continue to regulate CATV signal leakage. In fact, the workshop entitled "Signal leakage: The impact of the FCC's decision" attracted a full house at every session. Jim Higgins and John Wong, both from the FCC, explained the commission's thoughts on regulation of aeronautical frequencies as well as proposals regarding quality performance standards and signal leakage requirements (see "News").

Panelists at the "Technical Deregulation: Blessing or Burden?" session included Tom Polis, Ralph Haller, Wendell Bailey and Edmund Williams.

During the opening remarks, SCTE's Bill Riker summarizes the workshops that will be held.

Cable-Tec Expo attracted more than just CATV system engineers. Robert Smith, director of the Baltimore Mayor's Office of Cable Communications, registered for the conference because, "We look at our role as being more than just a regulatory body. We are trying to maintain the best possible knowledge of the industry and the technology so when we sit down and talk with the cable operators we have an idea of what they are talking about and an idea of how to work with city agencies."

The views of both the cable operator and the local regulatory agency were presented in the "Data transmission: Operational considerations for making it a business" workshop. Graham Holland, data communications engineer for Media General, explained the economics of wiring and operating a data network. "We (CATV operators) can be a part of the data revolution,or we can be spectators," Graham said. Speaking on behalf of the county of Fairfax, Va., Tom Robinson, manager of the Technical and Regulatory Section, Cable Communications Division, discussed how municipal users will have to make cost and needs assessments.

The exhibit floor was another learning environment for the engineers. More than 70 exhibitors offered technical advice on how to use their products. Magnavox and General Electric both brought mobile trucks. The Magnavox Mobile Training Center houses a variety of headend and distribution system electronics, which are used for training purposes. Comband (General Electric) exhibited its signal compression system in its van. (See page 77 for more on Comband.)

Other exhibit floor workshops included "How to make measurements without really trying" by Wavetek; "Construction and drop installation hardware" by Sach Communications; "Commercial insertion equipment" by Jerry Conn Associates; "Stereo module and converter upgrades" by Westinghouse-Sanyo; and "Converters and addressable update" by Jerrold.

The smorgasbord of information presented at this year's Cable-Tec Expo allowed every conventioneer to learn something. Engineers exchanged ideas, examined technical developments, became familiar with FCC regulatory policy, and gained insight into management/technician communications. Yes, the Cable-Tec Expo was a great success.

In the Distribution System workshop, consulting engineer Anthony Flores, P.E., prepares engineers/technicians for the BCT/E examination.

Inside the Comband van, engineers learn about bandwidth compression technology.

William Johnson, of Microwave Filter, details the construction of a screen enclosure to protect an antenna against terrestrial interference in the TVRO Tricks workshop.

Bob Bilodeau, chairman of RT/Katek, asks James McKinney a question about FCC policy.

In the SCTE Chapter Development workshop, Pete Petrovich of Viacom tells how to find meeting places for SCTE groups.

The Technology of Tomorrow

from the Innovators — LRC Electronics

LRC Electronics introduces its latest connector engineering innovation—the "K" Series. Designed for ease of installation and total reliability in future systems, the "K" Series features:

- 30db minimum return loss from 0-850 MHz. (LRC will supply test data.)
- Identifying part number permanently stamped on main body of connector.
- Design incorporates LRC's patented seizing mechanism for complete reliability.
- No cold flow of plastic materials —Mechanical holding strength is maintained through temperature cycles of −100°F to +200°F.
- Time proven positive stops for elimination of torque specifications.
- Silver plated terminals for excellent RF conductivity.

For more information about the innovative "K" Series, contact your LRC sales representative or call (607) 739-3844.

AUGAT® LRC

Quality and Innovation

LRC Electronics, Inc
901 South Avenue
Box 111, Horseheads, NY 14845

Reader Service Number 14.

Roy Ehman of Storer displays the results of a survey that indicates cable managers generally believe that communication between technicians and managers needs improvement.

Terry Bush of Wavetek answers questions during the System Sweep Techniques workshop.

In the session on Multichannel Television Sound, Alex Best of Scientific-Atlanta, explains that the cable industry cannot afford must-carry rules with regard to audio.

Approximately 850 people attended this year's Cable-Tec Expo, which had over 75 exhibitors.

Ninety SCTE members turned out for the first exam in the BCT/E certification program.

The Signal Leakage workshop was by far the most well attended. Here John Wong of the FCC explains the aeronautical frequency requirements.

Paul Beeman of MTV Networks discusses the relationship between audio subcarriers and video modulation in the workshop 'Understanding Video: How To Raise Your I.R.E.'

Bob Levy and Albert Richards, of the New York State Commission on Cable Television, watch as a Studioline program director explains the production facilities. Studioline invited all of the conference attendees to visit its Reston, Va., facilities.

Jerrold's Len Ecker discusses converters and addressable technology in a technical workshop at the Jerrold booth.

Bob Luff describes UA Cablesystems' electronic mail system for the audience attending 'Increasing Interaction Between Management and Engineering.'

Burnup & Sims
Teamwork and experience, a winning combination.

There's no substitute for experience. And no other cable products company has more of it than the combined resources of our Cable Products Group.

LECTRO STANDBY POWER

Over the past 10 years our Lectro Products Division has grown to become recognized as a leader in providing standby power systems to the cable TV industry. Today we design, engineer and manufacture over 50 separate models capable of performing a variety of emergency power supply functions—nobody else even comes close. Maybe that is why we currently have more standby units in the field than any other manufacturer.

For low price, high quality and advanced technology, Lectro leads the way in standby power.

CAPSCAN CABLE

In just a few short years, our Capscan Cable Manufacturing Division has firmly established itself as the preferred supplier of choice for hundreds of cable systems and MSO's from coast to coast. Capscan has earned this position because of its commitment to quality standards and reliable service. That translates into reduced inventory costs and improved cash flow for both MSO's and system

Terry Bush of Wavetek lectures at the 'How To Make Measurements Without Really Trying' technical session.

Tom Polis, newly elected president of the SCTE, believes deregulation will help the industry.

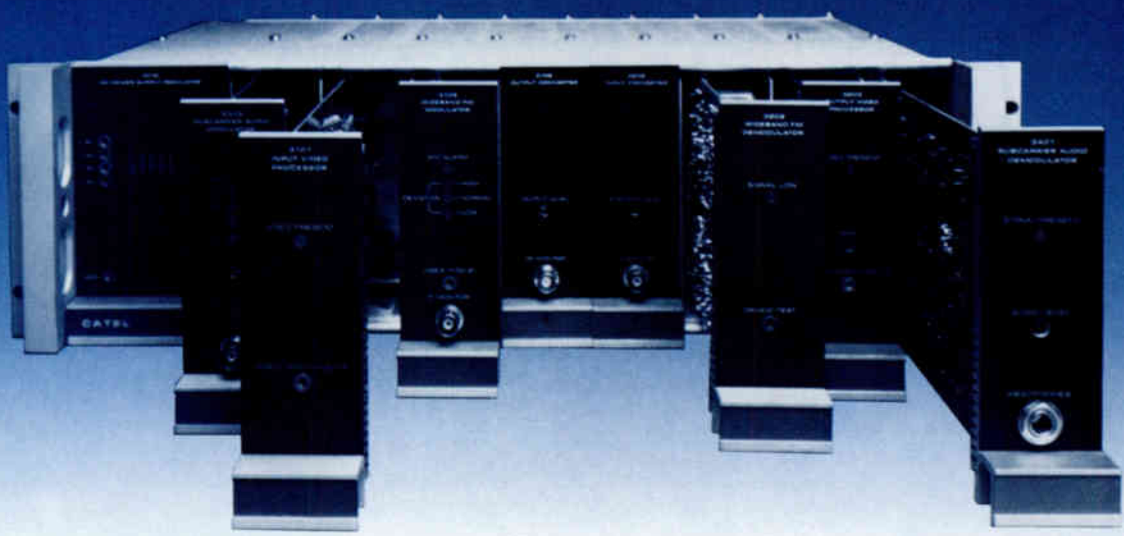
The general manager of several small cable systems asks whether the communication techniques that apply to large MSOs also apply to smaller operators.

Magnavox Regional Manager Stan Loose shows Maurice Gagnon, president of Cass Cable, the cascade of 16 amplifiers housed in Magnavox's mobile training center.

During the Technical Deregulation session, Wendell Bailey, NCTA vice president of Science and Technology, discusses the issue of standardization.

Fred Rogers, Quality RF Services, and David Chavez, Broadband Engineering, examine the positive and negative aspects of feedforward technology during the workshop entitled 'Upgrade or Complete Rebuild.'

Combine innovative ideas with more than fifteen years of experience in broadband system design and the result:



CATEL SERIES 3000

The Multi-purpose Modular FM Transmission System for Broadband Networks...
Coaxial Cable, Fiber Optics and Microwave.

HANDLES YOUR SYSTEM REQUIREMENTS

The Series 3000 offers a modular construction which can be readily configured to meet your requirements. The chassis is a standard EIA 5¼″ rack mount with regulated power supply that accepts up to eight (8) modules including:

- Video Transmission Modulators/Demodulators (NTSC or PAL/SECAM)
- Wideband I.F. Modulators/Demodulators (NTSC or PAL/SECAM)
- Sub-Carrier Audio Modulators/Demodulators
- Video Input/Output Processors
- Input/Output Converters (14 MHz to 450 MHz)
- T1 Modems

ADVANCED CIRCUITRY–ADVANCED CHOICES!

- Covers 5 octaves of Operating Frequencies
- Fiber Optics, CATV Coax and Microwave Compatibility
- User Programmable–Different Clamping Emphasis, Supplementary Phase Equalization and Signal Filtering
- Front Panel Diagnostics for Easy System Adjustment

MEETS YOUR APPLICATION NEEDS

- CATV Supertrunking
- Studio Links (STL)
- Satellite TVRO to Headend
- High Speed Transmission of Data & Voice

The CATEL Series 3000 is the FM transmission system that gives broadband users superior performance, high reliability and unequalled convenience. Call CATEL Telecommunications today at (408) 988-7722 for the answer to your broadband transmission system needs.

Reader Service Number 18.

CATEL
TELECOMMUNICATIONS
DIVISION OF UNITED SCIENTIFIC CORPORATION
4800 PATRICK HENRY DRIVE
SANTA CLARA, CA 95054
(408) 988-7722/TWX 910-338-2263

During the Coaxial Distribution workshop, Herb Longware of Magnavox discusses matching amplifiers.

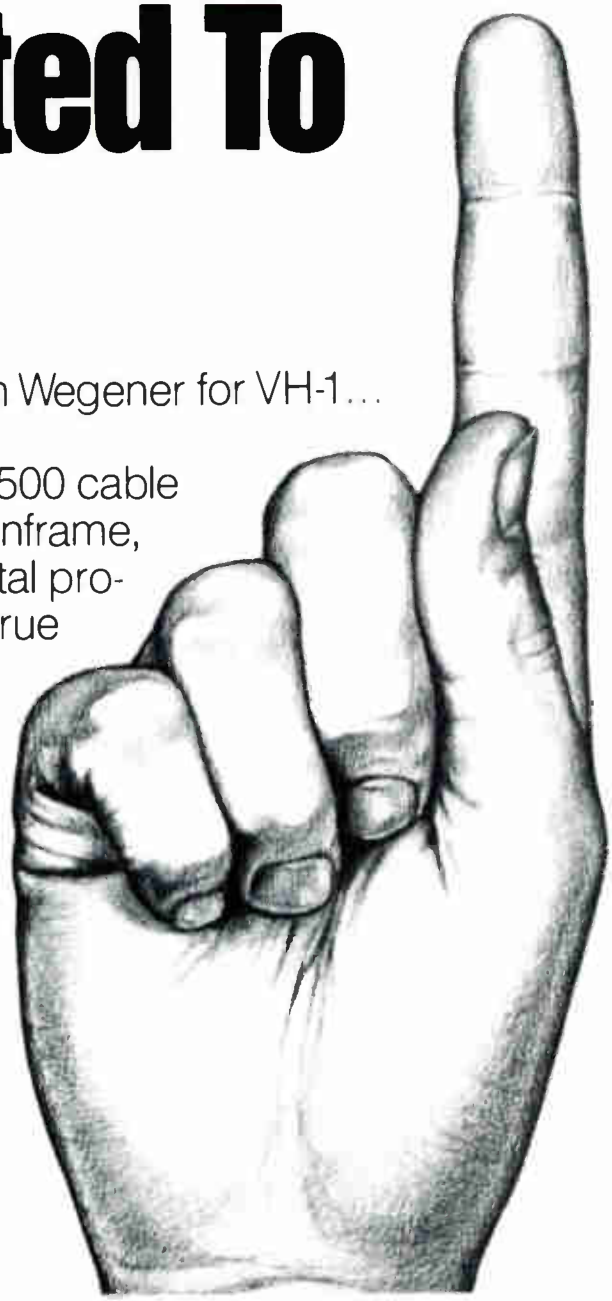
Graham Holland, Media General Cable, discusses the emerging data communication market in the Data Transmission workshop.

Ron Adamson of Texscan presides over the workshop entitled 'Are You Getting the Most Out of Your Test Equipment.'

A good time was had by all at the Wild West Buffet and Gambling Casino Night.

SCTE

When VH-1™ Needed Digital Audio, They Pointed To Wegener.



Introducing Dolby® digital audio from Wegener for VH-1... the latest in high quality audio.

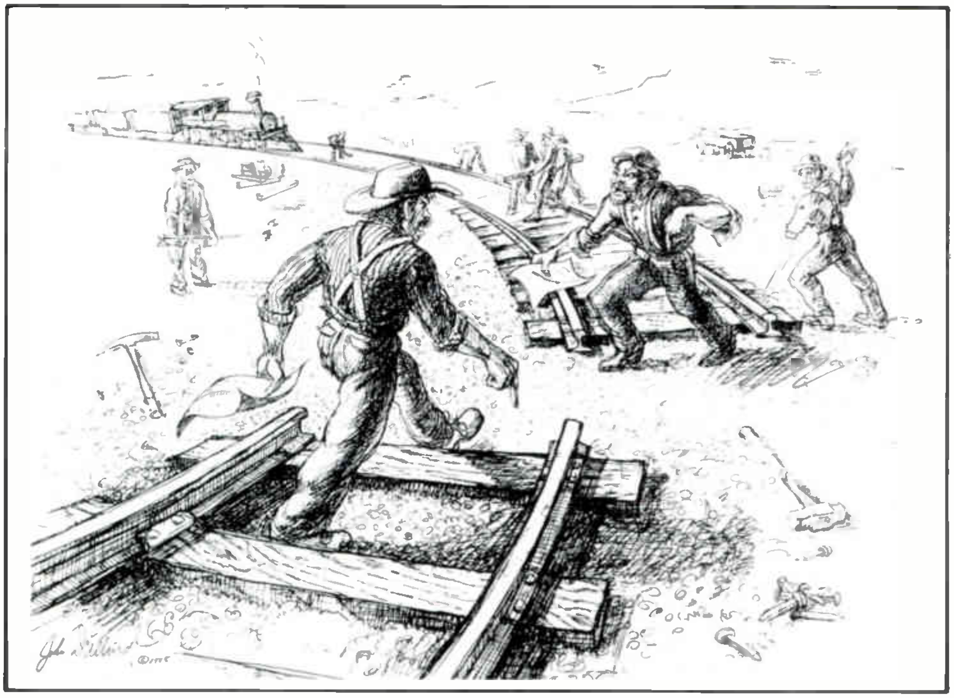
If you're one of the more than 3,500 cable systems with the Wegener 1601 Mainframe, all you need to do is plug in the digital processor card for VH-1 and you'll get true digital stereo sound.

If you don't have your Wegener Mainframe yet, get started with a digital stereo processor for VH-1. You can even add digital stereo to your MTV.

Get the latest in video music from VH-1 and the greatest in stereo sound from Wegener. Call today for more information.

WEGENER COMMUNICATIONS
150 TECHNOLOGY PARK/ATLANTA
NORCROSS, GEORGIA 30092
(404) 448-7288 TELEX 54-3634

Reader Service Number 19.



'The routing of trunk lines is something of an art . . . (and) the experienced designer is well worth his salt'

A system design primer

By Paul M. Bischke
Technical Writer, Magnavox CATV Systems Inc

So you want to design a cable system. Or maybe you need to understand how it's done so you can oversee someone else's design work and do so intelligently. This article speaks to those who are new to system design or need to refresh their memories; it will not offer profound new insights to the experts.

Our story begins after you've settled the politics of your franchise. Matters of zoning, easements, permits, and clearances could complicate your plans immensely—so settle them before you begin design work.

The following pages will explain the basic steps you must take to design a system, emphasizing matters of distribution equipment and soft-pedalling matters concerning headend and subscriber gear. We will limit our discussion to subscriber coaxial systems; and we will proceed from the global to the particular, from system mapping to the equipping of mainstations.

Step 1: Draw strand maps

You will define your franchise area on strand maps, which are usually derived from the documents of the local power or telephone company. Your strand map will include four vital parameters for your system:

1) A house count that tells you how many potential subscribers will be served off a pole (or pedestal for underground plant);
2) A street layout;
3) A record of the utility companies' aerial and underground routings; and
4) A record of pole locations and distances between poles.

Since designers will work from the strand map in developing their system design maps, the strand map must be accurate and complete. Have your strand maps prepared by a competent professional.

Step 2: Locate your headend or hub site

Knowing where your subscribers are, find the best place for your headend or hub. The best place, of course, is where you can reach the most customers with the least amount of hardware. Unless your headend is merely a pick-up point for signals arriving on a "transportation trunk" or "super trunk," you must choose a place where you can receive microwave, satellite and off-air signals.

Unfortunately, the ideal criteria for receiving satellite signals conflict with those for receiving microwave and off-air signals. Ideally, you would locate a satellite dish slightly below the lay of the surrounding land to shield it from microwave interference. But you want to locate microwave and off-air antennas on high ground. The best you could hope for is high ground with a dip in the terrain to shield your satellite antenna. In general, avoid airports and sources of off-air interference.

Step 3: Specify highest frequency

Determine the highest frequency you need in the forward bandwidth. These are the standard top frequencies used and the channel capacity for each:

Frequency (MHz)	Channel capacity
300	35
330	40
400	52
450	60

Extended bandwidth ranges as high as 600 MHz, also are available. Some of this extra bandwidth may be allocated to return signals, perhaps using 5-108 MHz instead of the 5-30 MHz that is standard for subscriber systems. This extra return bandwidth gives ample opportunities for commercial data traffic in a subscriber system.

Prepare for possible future expansion of services. Amplifier spacing depends upon the highest frequency used because of the way coaxial cable behaves. Coaxial cable attenuates high frequencies more than lower frequencies. For example, 2,000 feet of one type of ¾-inch cable would attenuate a 450 MHz signal by 22.4 dB, a 300 MHz signal by 18 dB—more than a two-fold difference in signal power. If you under-allocate and need a higher forward bandwidth later, you would need to change-out trunk amplifiers for higher gain models and do significant respacing in feeder networks.

Step 4: Find maximum trunk amplifier cascade depth

The maximum trunk amplifier cascade is the number of mainstations (in a row) that you must run to reach your most distant subscriber. You must choose the most appropriate combination of cable diameter, trunk amplifier, and headend equipment to deliver acceptable signals to your most distant subscriber. The diameter of cable used determines its attenuation per foot. Trunk amplifiers are available in different gain values. And both the specifications of the headend equipment and its delivery system (standard, HRC or IRC), as well as the trunk amplifier you choose, will determine how far your signal can reach

Behind every Panasonic® cable converter lies 25 years of cable know-how.

Cameras. Switchers. Monitors. Video recorders. You name it. For over two decades Panasonic has been supplying high-quality video components to both the broadcast and cable industries. In fact, we've been supplying CATV converter components for years.

But cable know-how is just one reason to install Panasonic CATV converters. There's also the reliability you and your subscribers expect from Panasonic.

For your subscribers who want remote control, there's a Panasonic converter with a full-function infra-red control unit that fits snugly on the converter when it's not in use. You can also give them 15-channel memory for easy tuning. Two-speed up and down channel scanning. Even an optional parental guidance key for controlling the channels children watch.

No matter which Panasonic converter you choose, you'll discover that it pays to buy CATV converters from Panasonic. After all, we've been cable ready for years.

For more information, call Panasonic at (201) 392-4109 or contact one of these Panasonic CATV distributors.

Cable TV Supply Company
1-800-241-2332

S.A.L. Communications
1-800-645-9062

Panasonic
Industrial Company

Reader Service Number 20.

In the real world...
nobody boils the MC² Coaxial cable.
Customers don't complain about its performance either.
Not one. (And that's no B.S.)

Maybe you've seen our competition boiling our cable. Or chopping it up. Or crushing it with a 2000-ton truck. Or doing something else outrageous with it. We agree, it makes a great demonstration. But it doesn't prove a thing about MC² Coaxial Cable. Because these aren't real-world situations.

In the real world, there's never been a challenge MC² couldn't meet. In test after test, MC² not only performed, it actually out-performed the competition. Just ask our satisfied customers.

In the year since MC² was introduced, we haven't had a single complaint. Because our product has lived up to our promises. When we promised superior flexibility, we delivered that flexibility. We patented a design of using air instead of foam to deliver less attenuation. We promise you'll save money on installations, connections, labor and on the cable itself. Also, MC² is extremely resistant to moisture ingress and migration because each cell is an hermetically sealed compartment.

Honestly, we don't know of a single real-world test that MC² couldn't handle. To prove it, we invite seriously interested persons to tour our test facilities. Just call toll free 1-800-526-4385. No other cable outperforms MC² in the environment that counts most....the real world. That's a promise.

Not one complaint in one year.

General Cable Company CATV Division

before distortion and noise become objectionable.

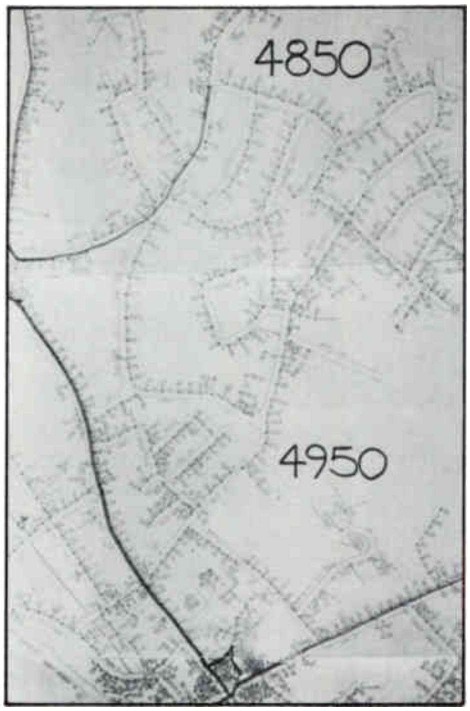
We will arrive at our worst-case cascade through four sub-steps:

a) Measure distance to remotest subscriber
b) Choose carrier allotment scheme (headend type)
c) Select best combination of cable diameter and trunk amplifier type
d) Find average mainstation spacing

Step 4a: Measure distance to remotest subscriber using your strand maps. Measure along a reasonable path of thoroughfares and side streets along the strand. Headend signals will reach that farthest subscriber using cable and a cascade of amplifiers.

Step 4b: Choose carrier-frequency allotment scheme (headend type)—You can use standard carriers, harmonically related carriers (HRC) or incrementally related carriers (IRC). The HRC and IRC frequency allotment schemes reduce certain kinds of distortion but the equipment costs more. (Cable operators use HRC more often than IRC.)

Because the HRC scheme "hides" the beat products where the TV doesn't see them, you can run a longer cascade before intermodulation becomes objectionable. You also can run your system at higher levels, which means you'll have less trouble with system noise. The intermodulation advantage of the HRC headend also means you can load more channels without causing objectionable distortions. Your choice of carrier schemes will affect the maximum reach of your amplifier cascades.



Strand maps developed from utility or telco records form the basis for system mapping.

Step 4c: Select best combination of cable diameter and amplifier type—You now must choose the most beneficial combination of cable diameters and amplifier types to determine spacing between mainstations and the depth of your cascade. You will use the amplifier's gain ratings and the cable's dB/100 feet ratings to find the spacing, i.e., the length of a single mainstation-to-mainstation run.

The larger the diameter of the cable, the less it attenuates RF signals. For example, 22 dB of spacing at 450 MHz means 1,913 feet of ¾-inch cable whereas it means 1,333 feet of ½-inch cable.

Push-pull, parallel hybrid (power doubling) and feedforward trunk amplifiers have different gain ratings and different distortion and noise characteristics. These characteristics will determine how deep a cascade can be, i.e., how many mainstations you can have in a row before distortion and/or noise become unacceptable.

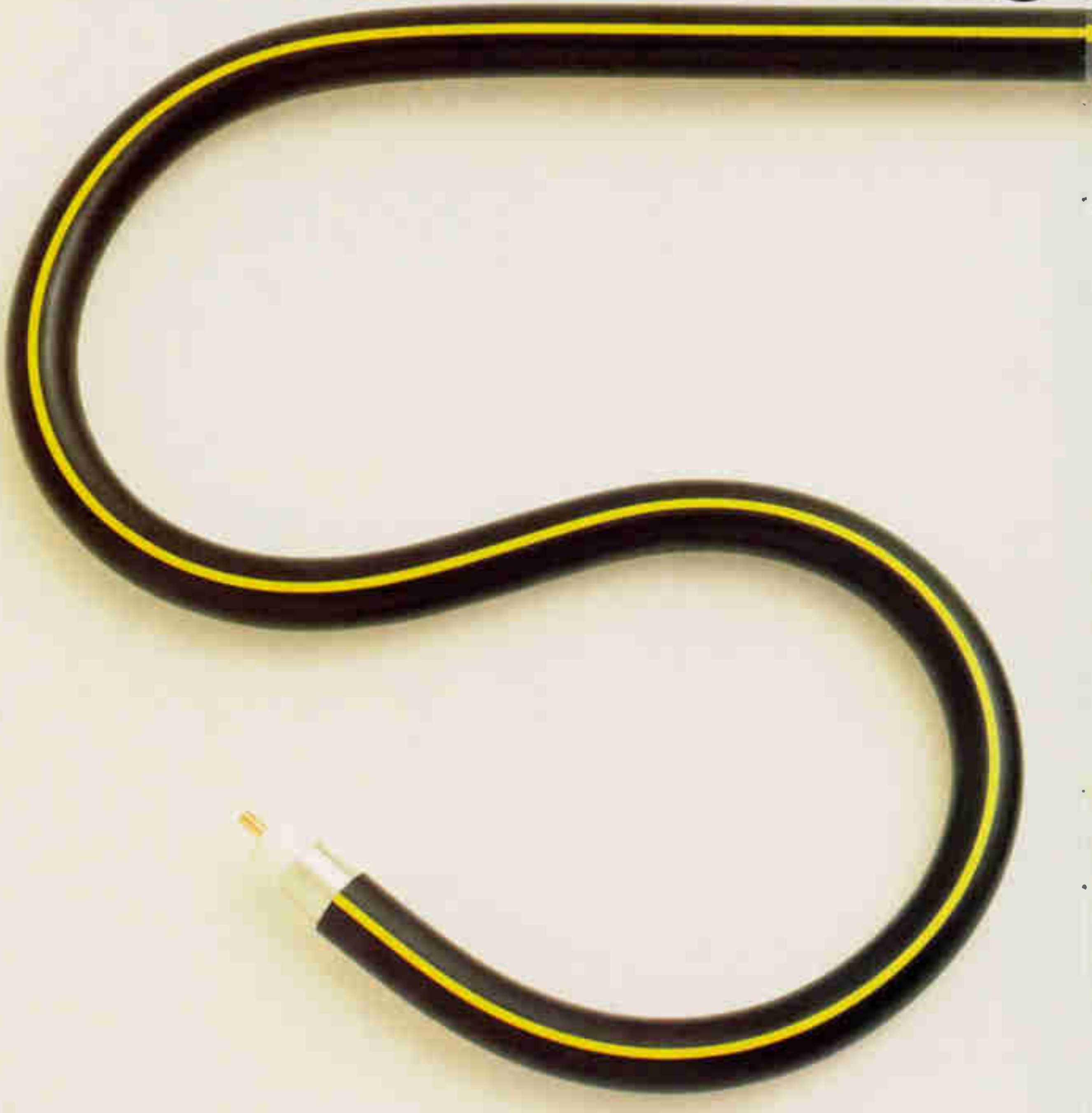
Make a nominal selection of cable diameter and amplifier type. Note that you will certainly use more than one cable diameter in your system: large cable in the trunk, smaller cable in the feeder. You also may mix amplifier types in your system.

Keep in mind that you can change your initial selection of amplifier types. For example, a deep cascade could force you to switch to power doubling amplifiers if your end-of-the-line distortion characteristics are unacceptable. More on this later.

Step 4d: Find average mainstation spacing using the cable's db/100 feet rating and the

(Continued on page 52.)

QUANTUM REACH.® T
WHEN LIFE THRO



Bend the average coax too tightly too often and the return loss goes kerflooie. What do you do? Climb the pole again or go back in the box and make a splice.

It doesn't sound like much until you do it ten times a day. Then the time it takes and money it costs to make splice after splice mounts up.

M/A-COM's new QR™ is the most flexible coax on the market, so flexible in fact that it will take more bends and tighter curves than any low loss GID made.

(Continued from page 37.)

trunk amplifier's operational gain figure. Manufacturers tell you the trunk amplifier's operational gain. To get the average gain used for designing, subtract 2 dB from the operational gain for 300 to 330 MHz trunk amplifiers; subtract 3 dB from the operational gain of 400 to 450 MHz amplifiers; for 600 MHz, subtract 4 dB. This "average gain" is a rule-of-thumb figure that designers have found convenient; it gives them enough leeway for the inevitable variations in actual pole footages.

Now divide the trunk amplifier's average gain figure by the cable's dB/100 feet figure to get the average mainstation spacing in feet:

$$\frac{\text{Average gain (in dB)}}{\text{Cable rating (in dB/100 ft at highest freq.)}} = \text{Avg. spacing (in ft.)}$$

For example, suppose your 400 MHz system uses a standard push-pull trunk amplifier, whose operational gain is 22 dB, with ¾-inch cable. In this case, the amplifier's average gain is 19 dB and the cable's rating is 1.07 dB/100 feet at 400 MHz. The average spacing is:

$$\frac{19\text{ dB}}{1.07\text{ dB/100 ft}} = \frac{19}{1.07} \times 100\text{ ft} = \text{1,776 feet between mainstations}$$

We can find the maximum cascade depth by dividing the distance to the most remote user (from step 4a) by the average spacing figure. This gives you the cascade depth, which is the number of mainstations you need in your longest cascade:

$$\frac{\text{Distance to remotest user}}{\text{Average mainstation spacing}} = \text{Cascade depth}$$

If you get a fraction here, round it *up*.

Again, these mainstation spacing and cascade depth figures reflect the worst case you will encounter in your system.

The satellite antenna placed near protected, low ground for good reception.

Step 5: Calculate distortions and determine operating levels

Having established your spacing and cascade depth, you must confirm that your combination of headend type and trunk amplifier type will deliver acceptable signals to that worst-case point in the system, and at what level. But what is an acceptable signal?

Designers have found that the FCC's guidelines do not produce a TV picture you'd want to watch. (Note that the FCC's standards are not ill-informed, merely antiquated. It established the standards during the early days of rural CATV, when some picture was better than none at all.) Compare the FCC's minimum standards to those used by reputable system designers:

	FCC minimum	Normal design standard
Carrier-to-noise ratio	36 dB	44 dB
Cross-modulation	−47 dB	−52 dB
Composite triple beat	−47 dB	−53 dB

Once you have established your standard for distortions, calculate your worst-case distortions to see if they measure up.

Distortion calculations will be performed by the system designer or engineer, who will cal-

1MHz-1GHz Sweep Generator

Texscan VS60C

This latest derivative of the Texscan VS series sweep generators features high performance in a modern package style. The long history of the VS series insures reliability in use and low maintenance costs.

Wide sweep width and excellent flatness enable measurement of frequency response both in the laboratory and on the production line. Harmonic frequency markers 1, 10 and 50Mhz are standard and other single frequencies can be supplied (optional). A full line of accessories including: detectors, VSWR bridges, dc log amp., and 12″ XY display are also manufactured by Texscan. Available in both bench and rack mount, 50 or 75ohms, the VS60C represents unparalleled value in VHF/UHF sweep generators.

Specifications

Center Frequency	1MHz-1GHz
Sweep Width	100KHz-1GHz
Output Level	+10dBm(+57dBmV)
Flatness	±¼dB
Residual FM	10KHz max
Linearity	0.5%
Distoration	−30dBc (>10MHz) −25dBc (<10MHz)
Level Control	1 and 10dB step Atten
Sweep Rate	.05Hz-60Hz
Markers	1, 10, 50MHz (STD)
Impedance	50ohms (75ohms optional)

Accessories Available

Detectors	CD51
VSWR BRIDGE	KRCB3
12″ XY display	DU-127
DC Log Amp	LN-70

Texscan CORPORATION

Texscan Instruments
3169 North Shadeland Avenue
Indianapolis, IN 46226
(317) 545-4196

Reader Service Number 25.

DYNAMIC DUO

THE DRAKE PROFESSIONALS

Thousands of CATV, SMATV, and broadcast operators everywhere have placed their trust in DRAKE's professional equipment — and for good reason. Our name has been synonymous with excellence and reliability in the communications field for many, many years.

And this proud tradition continues with our professional VM2410 Modulator and ESR2240 Earth Station Receiver. Operated together or separately, the VM2410 and ESR2240 are an unbeatable choice for solid dependability and performance.

The DRAKE VM2410 Modulator
With the Drake VM2410 a single modulator provides 60 channel frequency agility. A simple push of a button will set the VM2410 output to any VHF Broadcast, Mid-Band, Super-Band and Ultra-Band channel up to 400 MHz.The VM2410 also features video low pass and IF SAW filtering for reliable operation in the most crowded systems. A full 57 dBmV output ensures maximum performance.

The DRAKE ESR2240 Earth Station Receiver
A true step ahead in design technology. Some of the ESR2240's outstanding features include fully synthesized transponder and subcarrier selection, block down conversion with our BDC-24 Block Converter or LNB, IF loop-through for easy multiple receiver installation, SAW filtering for maximum interference rejection and adjacent channel performance, full signal metering on front panel — and much more.

When the bottom line is reliability, long-term service, and simple peace of mind — demand a DRAKE!

Call or write us today for more information.

R. L. DRAKE COMPANY DRAKE

540 Richard St., Miamisburg, Ohio 45342, USA
Phone: (513) 866-2421 • Telex: 288-017

Reader Service Number 26.

culate noise and intermodulation for single amplifiers and for amplifiers in cascade. (Intermodulation is a catch-all term for several types of distortion, including composite triple beat and cross-modulation.) The most critical parameters for modern systems are: carrier-to-noise ratio (C/N), carrier-to-composite triple beat ratio, and cross-modulation. You can find formulas for these calculations in cable textbooks.

Worst-case distortions are based on the maximum trunk amplifier cascade, a bridger, and the maximum line extender cascade (usually two or three). Note that there is a hierarchy among our noise and distortion villains; as a cascade deepens the first distortion parameter to become objectionable acts as the limiting factor. Manufacturers should be able to identify the limiting factor of their amplifiers. Each type has its own limiting factor. These factors also depend upon the highest frequency you use. How soon in the cascade you reach the limit depends, of course, upon the manufacturer's specifications.

Since composite triple beat (CTB) and cross-modulation (X-mod) depend upon channel loading, you must leave some headroom in your allowances for these distortions if you plan to add more channels later.

Knowing the amplifier's limiting factor can be very handy. It tells you that by the time this limiting factor distortion has become objectionable, all other distortions would still be tolerable. You will still want to calculate all the distortions, but the limiting factor distortion tells you very quickly where you stand.

Operating levels and operating gains are constrained by noise and distortion. If your operating levels and gains are too high, you get excessive distortion; if they are too low, excessive noise results. Manufacturers recommend an input level for their amplifiers, or rather a range of possible input levels. Magnavox, for example, recommends 7-11 dBmV input levels for its trunk amplifiers.

Noise and distortion will constrain level and gain selection inversely. In fact, an inverse square law applies. For every dB of improvement in C/N you get by raising operating levels, you should expect a degradation of 2 dB in X-mod and in CTB. In effect, there is more reason to keep trunk levels low than to keep them high—though, of course, not too low!

The trunk-amplifier/bridger-amplifier junction also constrains your choice of operating levels (for reasons related to our discussion of the opposing influences that noise and distortion exert upon operating levels). A well-designed system minimizes trunk splits (sub-trunks) and covers as much territory as possible by judicious use of the feeder system, i.e., the bridger amplifier and line extender. This means you want the bridger's output level as high as possible without producing objectionable distortion. If the trunk signal levels are low, the signal portion handed on to the feeder system will have the low distortion characteristics needed to use high gain figures in the feeder system.

Reaching subscribers along an extended feeder system is much more efficient than reaching them using sub-trunks. In this context, one advantage of power doubling equipment is that it lets you make better use of your feeder system. Specifically, power doubling trunk amplifiers operate at lower levels so that feeder networks can operate at higher levels without violating noise specifications.

The input and output operating levels you establish will be standard for each device type. Every trunk amplifier in the system should have the same input level; every bridger should have the same output level. Input levels for line extenders will vary according to the length of their cascade. For example, each line extender in a cascade of two would operate at lower levels than a single line extender. Input levels to each device type should not fall below the standard.

Inevitably, because poles do not stand exactly where you want them (and are ever so reluctant to move), some input levels will be too high. For situations where the input is so high that the amplifier's potentiometer alone cannot compensate for it, manufacturers make input attenuators that diminish the signal so it is within the manufacturer's acceptable range. Such attenuators are standard attachments that plug into the amplifier.

Let us consider an example of trunk operating levels in a system whose forward bandwidth is 50 to 450 MHz. Suppose we chose standard output levels as 26/32 dBmV. That means the signal level of a 50 MHz signal is 26 dBmV and that of a 450 MHz signal is 32 dBmV. If the trunk amplifiers standard gain is 22 dB we would need a minimum input level of 10 dBmV at 450 MHz.

Most feeder systems and some trunk systems operate with a "sloped" or "tilted" output. We specify slope in dB. If a bridger's output levels are 40 dBmV at 50 MHz and 46 dBmV at 450 MHz we say it has a positive slope of 6 dB, i.e., its highest carrier operates at a power level 6 dB above (or about four times) that of the lowest carrier. Sloped outputs offer the advantage of lower overall distortion.

Step 6: Account for return system

The next question you might ask is, "Is this a two-way or a one-way system?" Of course, you wouldn't proceed with a complete spacing scheme without knowing this. The presence of return signal would influence the designer's choice of levels and spacing.

A principal problem in return design is the signal loss through passive devices (flat loss). The cable attenuates the 5-30 MHz return bandwidth much less than the high end of the forward bandwidth. For example, the same length of cable that attenuates a 450 MHz signal by 22 dB would only attenuate a 30 MHz signal by about 5 dB. (Because of this attenuation pattern, you can sometimes substitute jumper wires for return amplifiers in certain transportation trunk stations.) But passive devices attenuate all frequencies roughly equally. Therefore, when passive devices account for a large part of that 22 dB of attenuation at 450 MHz, they would attenuate the return bandwidth beyond the return amplifier's gain range (typically 12 dB or so).

Although the return bandwidth influences spacing and level decisions, the forward bandwidth comes first. It is much better to fit your return design to a properly designed forward bandwidth than vice versa. Most system operators nowadays design for a return system even though they don't use it immediately. Addressable converter systems and system monitoring devices require the use of the return bandwidth.

Step 7: Determine tap types and specs

Look over the strand maps noting the house counts. The tap used at any given pole depends upon how many houses you will serve from that pole. You can buy 2-, 4-, and 8-way taps. Your final bill of materials will call for a selection of these two tap types.

It is possible to use two 4-way taps instead of a single 8-way tap in a dense location. Such an arrangement offers the advantage of having a more homogeneous (and hence less extensive) inventory of back-up taps. However, the 8-way tap offers both cost and maintenance advantages over the dual 4-way arrangement. Also, you may need to equip your system with plated tap housings, particularly if the system is in a highly corrosive environment. Systems in maritime and northerly climates, for example, may have corrosion problems from salt.

Step 8: Select signal-splitting devices for trunk and feeder splits

As noted earlier, a good system design minimizes trunk splits but, of course it does not eliminate them. Signal splitting devices will divide both trunk and feeder lines and send appropriate signal portions along multiple paths. For trunk lines, you can buy 2- and 3-way splitters that distribute equal or unequal signal portions to their output legs. And as with taps, you can buy standard or plated splitter housings, depending upon their operating environment.

Step 9: Route trunks and feeders

Once you have decided upon your levels, based on worst-case trunk runs, you must establish your trunk network and your feeder networks. You want to cover your territory making most efficient use of the feeder system and minimizing trunk splits, so the routing of trunk lines is something of an art. In this function especially, the experienced designer is well worth his salt.

One thing to watch for is that every section of

cable and every subscriber must have a path back to the headend. If not, you might end up with a situation like that of two railroad crews working from opposite directions, where the left rail joins the right rail and trains from both sides *de*-rail. Just as you don't want to be caught with bits of networked cable that lead nowhere, you don't want to arrive at a multiple dwelling building with insufficient signal. Don't expect to feed an apartment building with a depleted signal at the tail end of a line extender run.

Step 10: Place line power supplies

Once you know where to install each mainstation, you must place the line power supplies throughout the system. A line power supply feeds AC power into the cable; the mainstation's (or line extender's) DC power supply converts this AC into the DC that powers active devices. A single line power supply will serve several mainstations and their feeder networks.

The number of line power supplies you need depends upon how many mainstations (and line extenders) each can serve, which depends upon the mainstation's power consumption and upon the efficiency of its DC power supply. Generally, advanced technology amplifiers (feedforward and power doubling) consume more power than standard push-pull units. Also, mainstations containing an ASC/AGC (automatic slope control/automatic gain control) unit and/or status monitoring circuitry will draw a bit more current. A switching DC power supply operates more efficiently than its linear counterpart.

You already may have deduced that the higher power consumption of the advanced amplifiers calls for the improved efficiency of the switching power supply. Indeed, they go hand in hand. You want to locate line power supplies to make good use of their power capabilities, however, practical considerations keep you from mounting them on transformer poles or easement poles (e.g., poles in someone's back yard). Also, if your status monitoring system monitors the line power supply, it should be close to a mainstation.

Step 11: Outfit mainstations

Let us quickly summarize the basic set of equipment you will find in a mainstation.

Baseplate (also called "chassis" or "motherboard")—Wiring in the baseplate routes RF, AC and DC signals to the appropriate equipment modules. The baseplate is the heart of each mainstation.

Trunk amplifier—Amplifies trunk signals. Sends a portion of its signal to the bridger for distribution in the feeder network; sends a portion of its signal to the ASC/AGC unit for monitoring. Every mainstation in a cascade, except the last, contains a trunk amplifier.

Distribution amplifier—Replaces the trunk amplifier in the last mainstation of a cascade. Performs the same functions as the trunk amplifier except that it need not amplify trunk signals for another span of trunk cable.

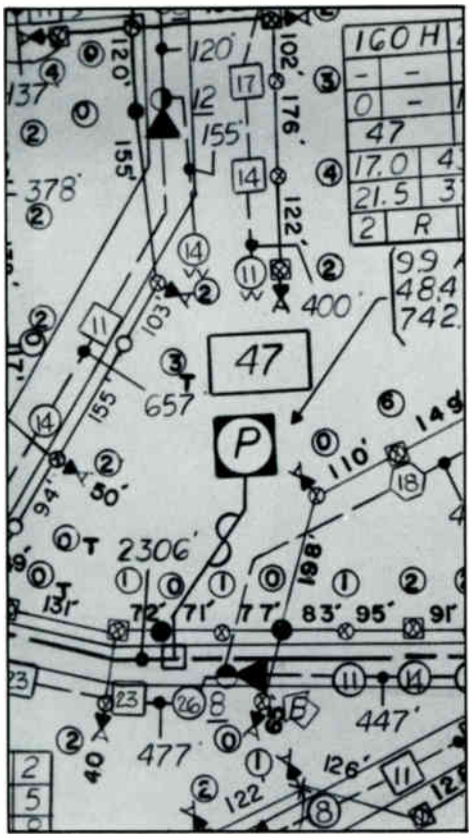
Bridger amplifier—Amplifies a portion of the trunk amplifier's output signal and sends it out on the feeder lines that originate in that mainstation. Each mainstation from which feeder lines originate, needs a bridger module.

Feedermaker—A signal splitter that divides the bridger's output into one, two, three or four parts, for outgoing feeder lines. Each mainstation from which feeder lines originate, must contain a feedermaker of some sort.

Return amplifier—Amplifies signals in the return bandwidth, usually the 5-30 MHz range. If your system uses the return bandwidth, every mainstation will have its own return amplifier module.

ASC/AGC module—Maintains proper signal levels by monitoring two channels in the forward bandwidth (one low and one high) and sending control voltages to the trunk amplifier. (We call the monitored channels "pilots.") The control voltages adjust the trunk amplifier's slope and gain to compensate for deviations caused by temperature fluctuations. Usually an operator need only monitor and adjust the forward bandwidth; return ASC/AGC units are rare in subscriber systems.

Thermal compensating unit—Adjusts the



Each line power supply sends AC to several mainstations as shown on map.

trunk amplifier's levels on the basis of temperature changes sensed inside the mainstation. Uses no pilots. This method of slope and gain correction is cheaper but is usually considered inferior to the pilot monitoring method. If used it replaces the ASC/AGC module in alternate mainstations (every other or every third mainstation).

DC power supply—Converts AC, which is generated by the line power supply and arrives via the coaxial cable, into the DC needed by the mainstation's electronics. A switching power supply produces power more efficiently than a conventional (linear) power supply. Each mainstation has its own DC power supply.

Status monitoring devices—Usually these are not separate units but are built into a return amplifier or ASC/AGC unit. These devices monitor the status of line power supplies and DC power supplies, help detect system breakdowns, locate ingress, etc. These devices send status reports back to the headend via the return bandwidth. If you have equipped your headend with such a system, you will need to buy the corresponding equipment for all monitored mainstations.

Step 12: Conclusion—Count the cost

When your system's design is complete, you'll receive a bill of materials. You can specify how you want that bill broken down. For example, if your bill is broken down by power supply, you will receive a list of the materials for the distribution gear served by each line power supply. The designer also may list all materials associated with each mainstation, or all equipment located on each strand map section, or in other ways.

Your primary concern in designing a system will be to minimize costs. But you cannot totally separate your build budget from the completed system's operating budget. A full cost analysis includes the day-to-day maintenance of the system when it is operating.

The project overseer must keep costs down, however, it would be a mistake to urge your designer to cheapen the design to the point of its being only just satisfactorily operational. Operating on the "hairy edge" of the equipment's capability invites line maintenance problems and subscriber dissatisfaction.

Indeed, conscientious designers may resist cost-reducing shortcuts if they foresee resultant maintenance problems for the completed system. In such a case, they are doing right by you in the long run. A good system design finds the middle ground between technical laxity and extravagance. A system design proposal should be as inexpensive as a reliable and maintainable system can be. You can't afford anything cheaper.

Author's note: Special thanks to Jerry Redmond, Magnavox's system design supervisor, for his help in developing this article.

Upgrades vs. rebuilds: Analyzing the choices

By David M. Chavez
National Sales Manager, Broadband Engineering Inc.

Peggy Isaacson
Marketing Coordinator, Broadband Engineering Inc.

And Fred Rogers
President, Quality RF Services Inc.

You cannot properly make the choice between upgrading and completely rebuilding a system if you equate it with the technologies used in new-builds. Cost effectively adding new channels to an existing system is its own art. An electronic upgrade may entail more preliminary planning and testing to achieve state-of-the-art specifications, but the resulting advantages over a complete rebuild are dramatic.

Cable operators faced with the necessity of increasing channel capacity have two choices of technique—upgrade or rebuild—and three choices of technology—feedforward, power doubler or conventional push-pull. Careful analysis of a system's condition, technical requirements, marketing plans and budget allowances, coupled with an understanding of the relative advantages and disadvantages of the available options, will help the operator to zero in on what is best for the individual system.

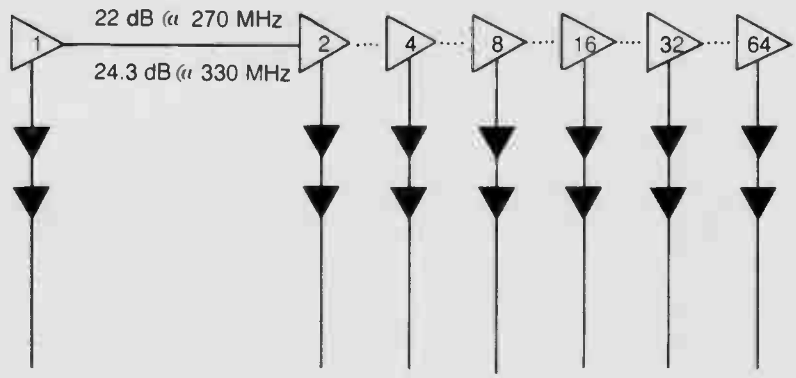
Amplifier technology: Which one?

Each of the three previously mentioned amplifier technologies can improve a system's performance. However, when considering existing system design, minimally acceptable specifications and monetary limitations, you will find that no single technology is a "cure all." Therefore, a system operator should examine what each can and cannot do for the system before a commitment is made.

In feedforward technology there are essentially two amplifiers: one creates a normal distortion while amplifying the signal, the other amplifies the distortion. Added together at the output with a 180 degree phase shift, the two achieve gain with very low distortions. This allows for longer cascades, often with greater spacing and fewer amplifiers, and is particularly best suited to trunk applications where the feedforward amp will provide 14 dB better composite triple beat performance when operated at the same level as a conventional hybrid amp. Attention should be given, however, to a feedforward amp's higher noise figure, power consumption, heat dissipation and the deviation

Table 1: Amplifier technology comparison for system upgrade from 270 MHz to 330 MHz

	Push-pull	Power doubler	Feedforward
Level in	6.7	8.7	10.4
Level out	32	34	36
Ch. load	40	40	40



Min. acceptable dist.

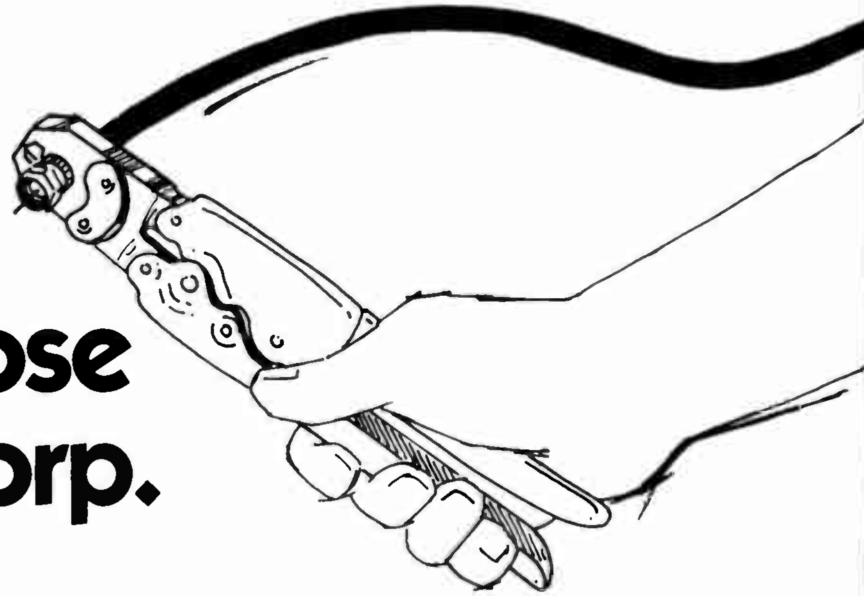
S/CTB	52
S/XMOD	52
SNR	45

		1	2	4	8	16	32	64	Max. cascade	
	S/CTB	56.6	56.6	55.9	55.4	54.4				53.2
Push-pull	S/XMOD	58.7	58.6	58.3	57.7	57.1			29	55.4
	SNR	59.7	56.7	53.7	50.7	47.7				45.1
Power doubler	S/CTB	62.7	62.5	62.1	61.4	60.1	58.2			55.7
	S/XMOD	62.1	62.0	61.7	61.2	60.3	58.6		58	56.5
	SNR	62.7	59.7	56.7	53.7	50.7	47.6			45.1
	S/CTB	62.5	62.4	62.3	61.9	61.2	60.1	58.1		55.4
Feedforward*	S/XMOD	61.2	61.1	60.8	60.3	59.5	58.0	55.6	120	52.5
	SNR	65.9	62.9	59.9	56.9	53.9	50.8	47.8		45.1

*Theoretical situation, as feedforward plug-in upgrade electronics are not universally available

Approximate cost per mile

Push-pull (Assumes upgraded trunk and line extenders)	Power doubler (Assumes upgraded trunk and new LEs)	Feedforward (Trunk only)
$300-$600/mile	$500-$1,000/mile	$1,000-$3,000/mile



'Operators are realizing that upgrading can give them what their systems require without trading off performance'

Table 2: The return on investment for an upgrade vs. rebuild using push-pull technology

	Current system	Upgrade: Add 9 channels	Upgrade: Add 23 channels	Rebuild: Add 23 channels
Channel capacity	12	21	35	35
New services		9	23	23
Subscribers:				
Basic service – $9	1,000	1,400	1,500	1,500
Expanded Basic – $6		500	600	600
Pay I – $8.50	400	400	400	400
Pay II – $17		200	200	200
Pay III – $26.50			75	75
Monthly revenues	$12,400	$22,400	$25,900	$25,900
Program costs	1,800	3,600	4,700	4,700
Operating costs	5,600	5,600	5,600	5,600
Cash flow/month	$5,000	$13,200	$15,600	$15,600
Current cash flow/month	5,000	5,000	5,000	5,000
Increased cash flow/month		$8,200	$10,600	$10,600
Increased cash flow/year		$98,400	$127,000	$127,000
Plant miles upgraded/rebuilt		40	40	40
Cost/mile		$550	$550	$10,000
Increased plant investment		$22,000	$22,000	$400,000
Increased headend investment		$18,000	$46,000	$46,000
Total increased investment		$40,000	$68,000	$446,000
Return on investment		246%	187%	28%
Months to pay back		5	6	42

Note: ROI analysis is based upon conventional push-pull technology. Upgrading to 23 channels with power doubler technology can be 50 to 100 percent more/mile; rebuilding with power doubler, 20 percent more/mile; rebuilding with feedforward, 100 percent mile. Chart updated from November 1982 *CATJ* article, "Financial Optimization of Channel Capacity."

from 2-for-1 in distortion at output levels above 50 dBmV. Of the three technologies, feedforward is the most expensive, per amplifier, in operation and in maintenance.

Power doubler technology has been used by CATV systems in stacked (paralleled) headend antennas. When two antennas are properly combined in parallel, an increase of nearly 3 dB in signal gain is achieved. Power doubler amplifiers use the same logic. Two hybrids in parallel achieve higher output capability while still maintaining good distortion levels or, by operating at standard output levels, attain almost a 6 dB improvement in distortions over conventional push-pull technology. (This describes parallel hybrid power doubling; the same results are achieved when a special power doubler hybrid is used.)

Longer cascade potential is an advantage power doubler amplifiers have over conventional push-pull. Composite triple beat is better with power doubler than with push-pull, although not quite as good as in feedforward. Power consumption and heat dissipation are concerns to be reckoned with; however, power doubler technology is superior to feedforward in noise, second order, temperature stability, flatness, output capability and cost. The technology lends itself well to trunk, bridger and line extender applications. An additional advantage of power doubler technology is that it is now available in modules for system upgrades.

Conventional push-pull hybrid technology is the least complex, the least costly and consumes the least power of the three technologies. It performs well, at good distortion levels, in the majority of situations calling for moderate spacing and average cascades. The demand for increased bandwidth, longer cascades and lower distortion requirements, however, is quickly bringing this technology to its limits. Given those restrictions, conventional push-pull is the best value technically, financially and in long-term maintenance.

Which of the three is appropriate for a specific system is dependent upon spacing, cascade, distortion requirements and monetary considerations. Table 1 is a composite illustration in which each of the three technologies is used to upgrade a system from 270 MHz to 330 MHz. Distortions for each have been calculated for comparison with each other, as well as for comparison with standards generally acknowledged as minimally acceptable by the CATV industry. Also shown are the cascade limits beyond which each of the technologies begins to lose acceptable distortions. (It should be noted that data calculated for feedforward plug-in upgrades is theoretical, as the units are not universally available at the time of this writing.)

Upgrade or rebuild: More than specs

Much has been written about the need to evaluate the condition of a system before the upgrade or rebuild decision is made. Obviously, if the system is an older one, with equipment that physically is not in condition to pass additional bandwidth, a complete rebuild is called for. The grayer areas occur when the plant is in basically good shape, but for franchise or marketing reasons, requires bandwidth beyond existing electronic capability.

It is tempting to opt for all new equipment. That, after all, gives the system the state of the art in technology and assures the operator of the best possible performance. Or does it? Since most of the technologies are available for upgrade purposes, state of the art can be obtained at less expense and with less interruption of service than in a complete rebuild.

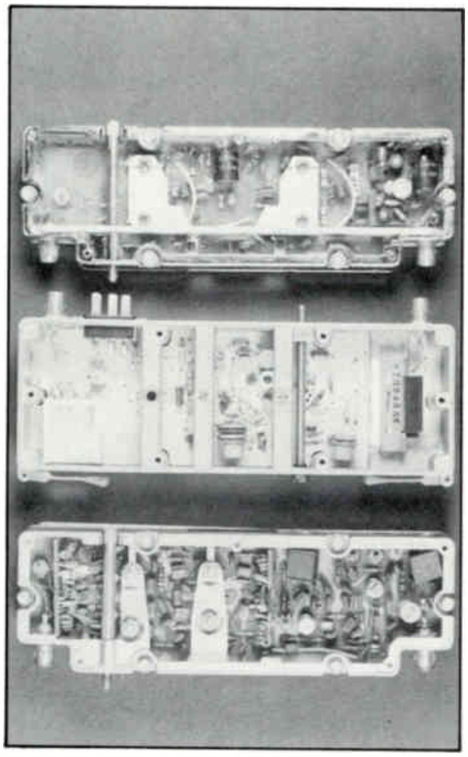
It also is tempting to believe that upgrading is a "bargain basement" way to go and, since you get what you pay for, cannot provide the performance and reliability levels of a complete rebuild. Or is it? Suppliers of upgrade electronics are able to provide equipment that expands system bandwidth with as good or better distortions than were achieved in the existing system. What upgrading can't do is allow for control of amplifier spacing as is possible in a complete rebuild.

What is also important in the upgrade or rebuild decision is obtaining answers to questions that go beyond issues of technology and specifications:

- Is the system in physically sound condition? If most of the passives and coax must be replaced due to limited bandwidth capability, environmental wear or damage, then rebuilding is clearly the answer, regardless of cost (except as it is affected by selection of technology).
- How much channel capacity is actually needed? This question addresses marketing and technical concerns. The number of channels you can sell to your subscriber should influence how many you put on. Once this number is decided upon, it must be determined whether or not you can upgrade with existing amplifier spacing. If you can, an upgrade is advantageous.
- Do upgrade electronics exist for your equip-

ment? There are upgrade electronics for most, but not all, existing brands of amplifiers. If your system is equipped with very old brands, it is wise to consult with an upgrade electronics manufacturer to be sure that modules are available, or if they can be reasonably designed for your amplifiers.

- What capital is available for channel expansion? When and where the money is coming from can determine when, and sometimes if, you can start your project. Upgrading is a solution for those who cannot finance a complete rebuild, as well as for those who just plain want to save money.
- How quickly can the new channels generate additional revenues? What is the payback period? Rebuilding can be up to 10 times more expensive than upgrading. That is a lot of debt to carry in the current economy. Because of the high capital outlay and a low return rate, rebuilding can take much longer to pay for itself than can an upgrade. Table 2 illustrates costs, revenues and payback periods for upgrading versus rebuilding using conventional push-pull technology. The return on investment (ROI) analysis is based on some assumptions about penetration before and after channel expansion, subscriber fees for basic and pay services, and plant investment requirements. However, given acceptance of the assumptions—the comparative rates of increased cash flow, return on investment and length of the payback periods—the financial advantages of upgrading are evident. Upgrading with power doubler technology and rebuilding with power doubler or feedforward can be expected to show a lower ROI and take far longer to capitalize on the investment.

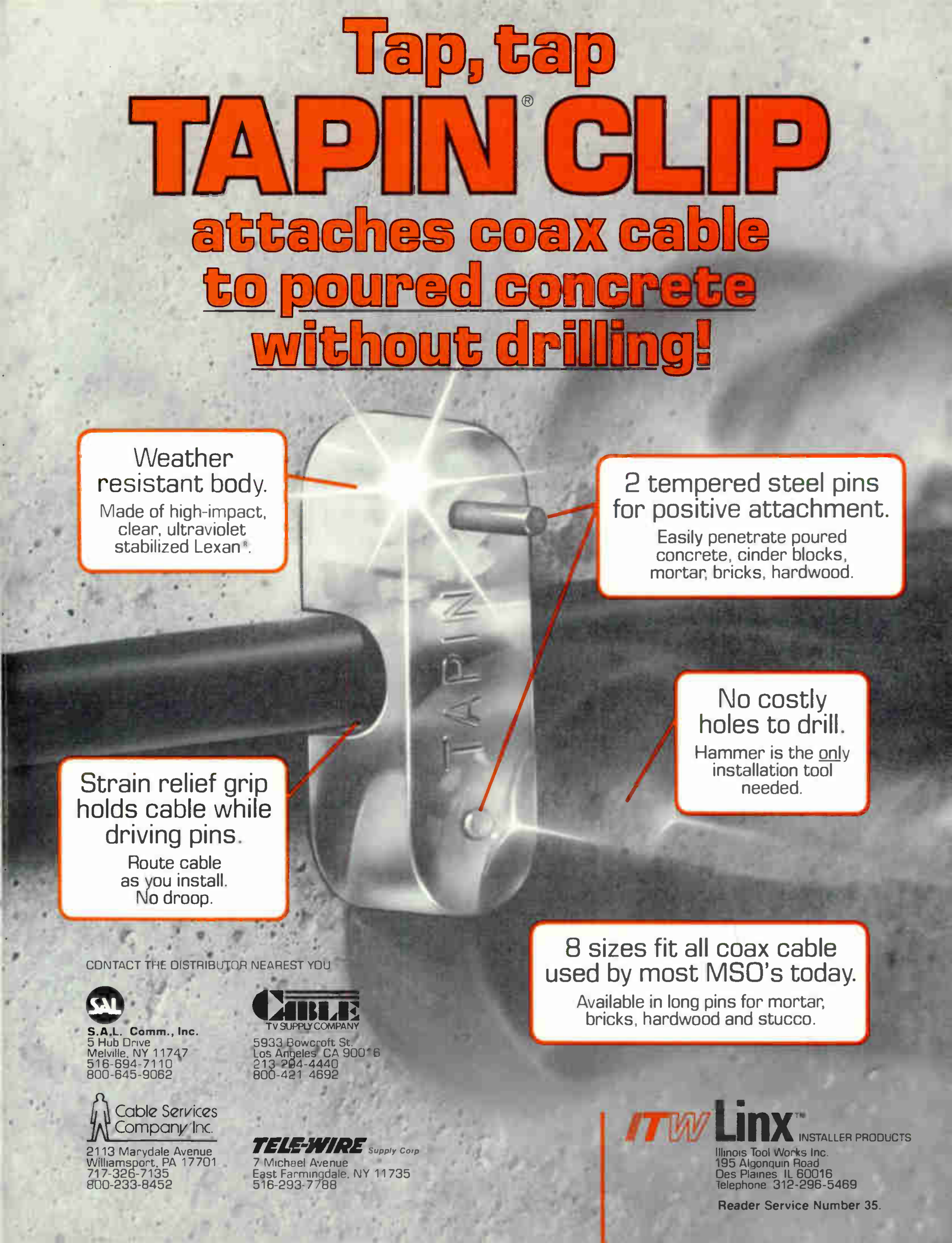


Examples of three types of amplifiers (top to bottom): a two-hybrid (quad) 400 MHz amplifier; a 300 MHz amplifier with single ended input and push-pull hybrid output; a 240 MHz amplifier with single ended input, discrete push-pull output (transistor).

- How long will it be before this decision will be made again? If long-range plans call for even greater expansion, the short- to intermediate-term outlook may be more adequately satisfied by upgrading, rather than by rebuilding.
- How sensitive are your customers to interruption of service? Few of us can afford the ill will of our customers. Upgrading can minimize the inconvenience experienced by your subscribers in either of two ways: by quickly and all at once replacing existing modules with their upgraded counterparts, or by installing upgraded amplifiers as existing ones are due for repair. These methods reduce "down time" considerably from what occurs in a complete rebuild.

What you need is what you buy

As a result of this analysis, you can see that there is not a single "pat" answer to the channel expansion question. It should be helpful to system operators contemplating this step to know that it is possible to avoid buying more than is needed in the way of technology, operating levels, equipment, expense and hassle. Completely rebuilding a system can be advisable in certain cases; however, more and more operators are realizing that upgrading can give them what their systems require without trading off performance.


Tap, tap
TAPIN® CLIP
attaches coax cable
to poured concrete
without drilling!
Weather resistant body.
Made of high-impact, clear, ultraviolet stabilized Lexan®.
2 tempered steel pins for positive attachment.
Easily penetrate poured concrete, cinder blocks, mortar, bricks, hardwood.
TAPIN
No costly holes to drill.
Hammer is the only installation tool needed.
Strain relief grip holds cable while driving pins.
Route cable as you install. No droop.
8 sizes fit all coax cable used by most MSO's today.
Available in long pins for mortar, bricks, hardwood and stucco.
CONTACT THE DISTRIBUTOR NEAREST YOU
SAL
S.A.L. Comm., Inc.
5 Hub Drive
Melville, NY 11747
516-694-7110
800-645-9062
CABLE TV SUPPLY COMPANY
5933 Bowcroft St.
Los Angeles, CA 90016
213 204-4440
800-421 4692
Cable Services Company Inc.
2113 Marydale Avenue
Williamsport, PA 17701
717-326-7135
800-233-8452
TELE-WIRE Supply Corp
7 Michael Avenue
East Farmingdale, NY 11735
516-293-7788
ITW Linx™ INSTALLER PRODUCTS
Illinois Tool Works Inc.
195 Algonquin Road
Des Plaines, IL 60016
Telephone 312-296-5469
Reader Service Number 35.

CATV system rebuilds: A maintenance tech's viewpoint

By Peter Carr WB3BQO

Joe Strand and his staff at the local cable TV company have just gotten the word from the owners; their system is scheduled to be rebuilt. Joe's initial thoughts are of the hours to be spent at the coffee shop, cup in hand, while the new system purrs along with minimal maintenance. He then ponders the inevitable flood of trouble calls that are sure to be generated by the frequent signal outages. Finally, he thinks about all the work involved in maintaining all those extra channels, the strange new equipment and converters. About now, the coffee shop is fading and the gray hair is beginning to sprout.

Happily for Joe, reality is somewhere between the gray hair and the coffee pot. Since a rebuild will erase the poor picture quality of the old system and replace his maintenance problems with converter installs, new connects and additional outlets orders, there will be as much to do as before. The difference is that instead of running to put out fires, Joe can schedule his work now and put some organization in his workday. Some forethought and planning will cushion the effect of change and make the system update a welcome improvement.

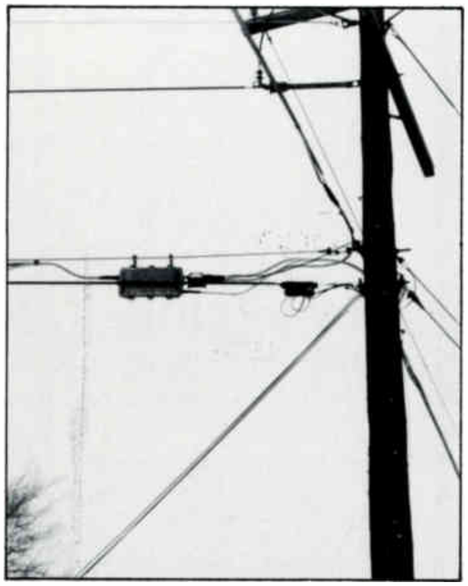
Facilitating a rebuild for everyone

Rebuilds can be broken down into three broad categories. These are: the rebuild design, the physical construction and the post-construction maintenance. By getting involved in the process early, Joe can help spot and minimize problems in each area so that he can maintain his subscribers' pictures, his staff's morale and his hair color, all at the same time.

That's a directional tap on the left side of the amplifier. Can you imagine trying to install a pay service trap on the port of that tap using a line belt and hooks?

In the initial phase Joe will be called upon to assist the system designer and the strand mapping computer in marking up the "as-built" maps of the existing system. These are used to help lay out the new trunk and feeder lines and this is a good time to note items like high lightning areas, hilly or swampy terrain, extra long pole spans or other possible influences on the finished design. Less apparent may be such things as recent changes in local building or electrical codes, proposed new road construction, and housing developments or trailer parks in the planning stage that may alter the system design. By contacting the local telephone and electric companies, zoning board and the highway department, Joe can better judge what changes are needed in the new design.

During the actual construction of the new system, Joe will need to spend some extra working hours. Normally the work is done by crews of strand and cable stringers and teams of cable splicers that install the actives, tune up the system and reconnect the subscriber drops. The cable crews are generally paid on production, by the foot, rather than on a good job. It is usually the responsibility of the construction supervisor to check the work, however, it will pay Joe to act as a second set of eyes to be sure that he gets a smooth lash and a quality job. At the same time, it will be Joe's job to keep up good relations with the telephone and electric people. There are bound to be minor problems with clearance and such, which will cause these companies some extra work. Since Joe will be around long after the crews are gone, he would do well to give attention to these areas in the name of good future relations. And most importantly, it should be Joe's task to make everyone aware of safety. Some construction crews make safety second to production. Pushing footage with new or partially trained workers in unfamiliar terrain is an invitation for accidents. Even the company staff, working to maintain service through the construction, can forget safety in the haste of trying to restore service. Joe's extra watchfulness can pay big dividends for everyone involved in the rebuild.



Not only is this amplifier too far from the pole, it will be difficult to open the lid due to the six-pair telephone cable. It's little things like this that will cause a technician to go home and kick his dog!

Physical construction

As a splicer hoists a new amplifier station onto the strand, Joe watches and wonders what it will be like to work on that equipment in the future. Most splicers use bucket trucks, a big cable bender that tends to locate the station quite a distance from the pole. In some situations they make large sweeping bends in the feeders rather than using 90- or 180-degree angle fittings at the housing. This makes it hard to lay a ladder on the strand near the housing for service. Even if the system uses buckets for maintenance, it is wise to consider the worse-case situation and mount equipment where even the shortest lineman on gaffs can reach the far end of the housing.

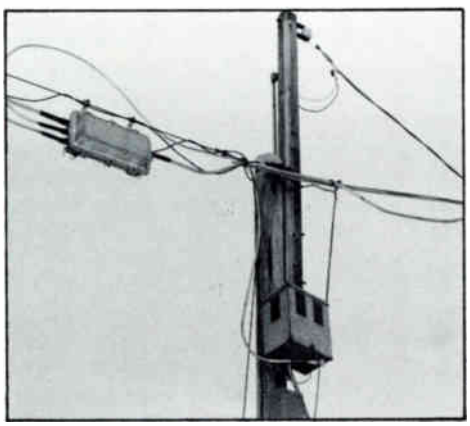
Most electric companies now require that CATV power locations be metered. They may not require a cutout switch be used between the meter and the transformer, but Joe would be wise to make sure one is included. Even if it doesn't have standby power, a power supply is heavy, awkward and bulky to handle. Without a cutout switch the lineman would have to pull the meter to disconnect the power while reconnecting the new power supply. Besides everything else, this will raise the wrath of the electric company. Also, check to be sure that the power location has an easy method of transferring the grounding connection. The easier the job is, the more likely it will be that it gets reconnected to the new equipment.

First week check-up and restock

In a rebuild, the RF integrity of the system should be excellent. Once completed the new equipment should not leak signal and it would be wise for Joe to use a signal Sniffer or other radiation test gear to sweep the system for emissions. This is an effective way to pick up all the loose fittings, sheath breaks and loose equipment covers. It is also a good time to test the house drops and see how much RF they are radiating. In most rebuilds the old drops are transferred over to the new distribution lines with maybe a new "F" fitting and some grease. Where before, the drop had some fairly low signals fed into it, now it gets a fat 10 to 15 dBmV and all that corroded braid spreads free pictures all over the neighborhood. In some cases a new cable strung from the pole over to the house and "barreled" will cure the leak. It is also a good spot to add a ground block and ground the drop. If there is still a RF leak then checking inside may reveal unauthorized hookups, homemade splices or other problems.

In working on leaks it will save time and effort to mention the situation to the local police, fire fighters, taxi company and ham radio people. It may be that a frequency they use is the same as one that the cable utilizes. As they are around the area using their radios they can note "hot spots" that open the squelch of the rig. They gladly will tell you where these spots are. It is better to let them know that you are working on the problem and are on their side than to have them take the problem to the FCC.

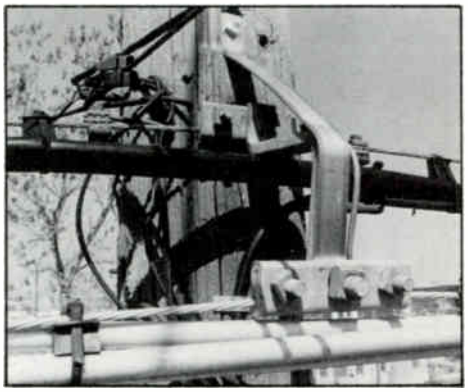
After all the crews have gone, the salesman have done their thing, and the dust has settled, it's time to plan for a peaceful post-construction phase of the rebuild. Just because the amplifiers are new, the converters are new and the cable is new doesn't mean that Joe doesn't need spares. It is time to restock the store room with enough equipment to handle the typical disaster. For example, even with the best grounding techniques and surge protection there will be damage if the electric primary cable falls down through the cable lines. Having enough modules, fuses and assorted spares on hand will make everyone sleep better. The same reassessment goes for tools. Where the tickle of 30 VAC in the old system didn't seem like much, it would be wise to use a fuse puller when changing fuses in the new 60 volt equipment. Similarly, heavier trunk and feeder cables may be too much for that old light duty wire rope hoist or come-along. The strand grip you have used for years may have grips too worn to handle the bigger loads during pole changeouts.



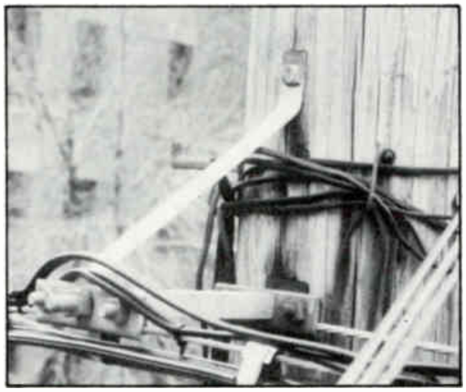
What is wrong with this picture? Nearly everything! Out of the picture to the left is a directional tap. A ladder placed between amplifier and pole will crush the drop cable. The loose power cable is asking for a sheath break, as is the looped feeder. Now how would you climb this pole? At least it has a power cutout switch.

Conscientiousness breeds happiness

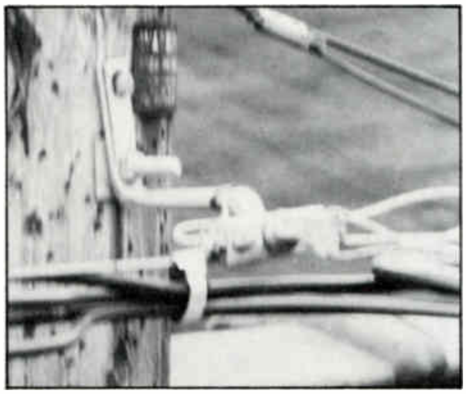
Now Joe and the staff are doing premium service regrades, lots of new installs, additional outlets orders and even finding some coffee shop time. The RF leaks reappear from time to time but that only serves to keep them sharp. People on the street and even the local politicians smile at Joe thinking that their fine pictures and extra channels are all his doing. Joe, who remembers the old days of poor reception, grumbling subscribers and never-ending system trouble, smiles in silence and sips his coffee. He's earned it!



The CATV L Bracket is used on the majority of poles to facilitate makeready.



The straight extension bracket is used to maintain clearance over streets or to add a second cable when clearance is a problem.



The T-Alley bracket is used for alleys or building junction poles.

Making makeready ready sooner

By Steven E. Breck
CATV Consultant, Illinois Bell

Two years ago Illinois Bell was faced with a major problem. It had a CATV build in Chicago, with 162,000 poles involved, and the city could not wait the projected four years for the makeready work to be completed. A joint task force including Illinois Bell and Commonwealth Edison was formed to solve the problem.

The task force looked at virtually every type of stand-off or extension arm on the market. A test system was built at the Illinois Bell Training Center in Westmont, Ill. The system consisted of 20 poles hauling both telephone and CATV cables. The different products were placed on the poles to determine which would solve the problem. Unfortunately, none of the existing hardware satisfied both Illinois Bell and Commonwealth Edison.

At the same time, a group of management and craft people at Illinois Bell decided that they could come up with a system that would work. After repeated efforts, they settled on a system using three different brackets. When the system was shown to the joint task force, they agreed that it was the solution they were looking for.

In-house designed system

The main bracket in the system is the L Bracket. It is placed by removing the nut from the existing thru-bolt, placing the bracket on the bolt, then replacing and tightening the nut. A reinforcing strap and suspension clamp are then attached to the bracket with a ⅝" x 2½" track bolt, and a ½" x 4½" lay screw is placed in the top hole of the reinforcing strap and driven into the pole.

Extensive tests have been performed on the L Bracket by an independent testing lab. It found that the lay screw would start to pull out at approximately 4,000 pounds. It pulled partially out, then would lodge once more into the pole. Even though at this point the bracket itself starts to fold, the tests were continued to 8,200 pounds. Illinois Bell felt it would be pointless to go beyond this figure since 8,200 pounds exceeds any load to be placed on the bracket.

The second bracket in the system is a straight extension bracket. This bracket is used when crossing a street where the clearance is at a minimum. It also allows a second cable to be attached to the pole without violating the minimum clearance over a street. The bracket is placed by removing the nut from the existing thru-bolt. The threaded end of the straight bracket is screwed and tightened on the thru-bolt, and a reinforcing strap and suspension clamp are then placed on the end of the bracket and a nut tightens the assembly. Finally, a ½" x 4½" lay screw is driven into the top hole of the reinforcing bracket. This bracket also has been tested and will support in excess of 4,200 pounds.

The third bracket in the system is a T-Alley bracket. It is used when there is a need to have a cable T off, or junction from a cable running through. This could be a junction cable feeding a building or a cable at the end of an alley. The bracket is attached to a pole by drilling a hole 12 inches below the existing thru-bolt, placing a new thru-bolt and attaching the T-Alley bracket (by its lower hole) to this bolt. The assembly is tightened to the bolt with a nut, and a ½" x 4½" lag screw is then driven into the top hole of the bracket. A ⅝" track-bolt is placed through the hole on the end of the bracket, and a suspension clamp, ⅝" nut and ⅝" thimble eye nut are then placed on the bolt. The entire assembly is then tightened.

The system's advantages

The best example of time savings inherent in this system was in Chicago. The first brackets were placed at the end of April 1984; by January 1, 1985, more than 40,000 poles had been bracketed. This was accomplished by using only six two-man crews, which also represents a savings, in this case monetary. Illinois Bell is charging the cable TV companies a specific charge per pole to place the brackets. This allows each cable operator to better project his building expenses and also allows the telephone company to make a profit, while doing cable TV makeready.

In addition, every pole that has an L Bracket or straight extension bracket has a mechanical bond between the two strands. And through testing it was determined that this bond was better than one using a #6 copper bonding wire. Illinois Bell still requires a bond be placed at all dead-ends, and anywhere a T-Alley bracket is used.

Damage to existing telephone plant is kept to a minimum while performing makeready because the telephone cables, terminals and drops are not moved. Also, slack does not have to be cut from lateral cables that in the past had to be lowered. As well, the cable television construction crew has ready access to the bracket without having to go over the telephone company plant.

New procedure

To facilitate both the telephone and cable TV companies' rebuilds in the future, Illinois Bell has instituted a new procedure for service drops. The telephone company employees, when going to the property side, will take their drops directly to the customer. But when going to the alley side of a pole at midspan, the drop will attach to a midspan clamp on the telephone strand, then loop over the telephone strand and attach to a midspan clamp on the CATV strand, then go to the customer. The cable television drops, when going to the alley side, will go directly to the customer. When cable television runs a drop to the property side of the pole, the drop will attach to the CATV strand, then loop over to the telephone strand, and go to the customer. This leaves an open channel below both cables so when rebuilding takes place, it can be done without going over any drops or cables; and, it pulls the cable apart preventing any possibility of the cables ever hitting one another. The finished product is a build with a minimum amount of rearrangement or damage to the telephone plant.

Toward better signal shielding

By Joe Lemaire
Manager CATV Application Engineering Raychem Corp

Signal security, the leakage or disruption of CATV signals, has received considerable attention since the late 1970s. The consequences of poor signal security were documented by the Society of Cable Television Engineers in an extensive report prepared in 1979.[1] This, and similar studies, have focussed on signal egress with emphasis on the disruption caused by the CATV signal. Less well documented are the incidents of signal ingress, which pose a serious threat to the quality of CATV entertainment signals, and total disruption of data and system management signals. Here, we will review signal security principles and discuss new efforts to restore and maintain cable system integrity.

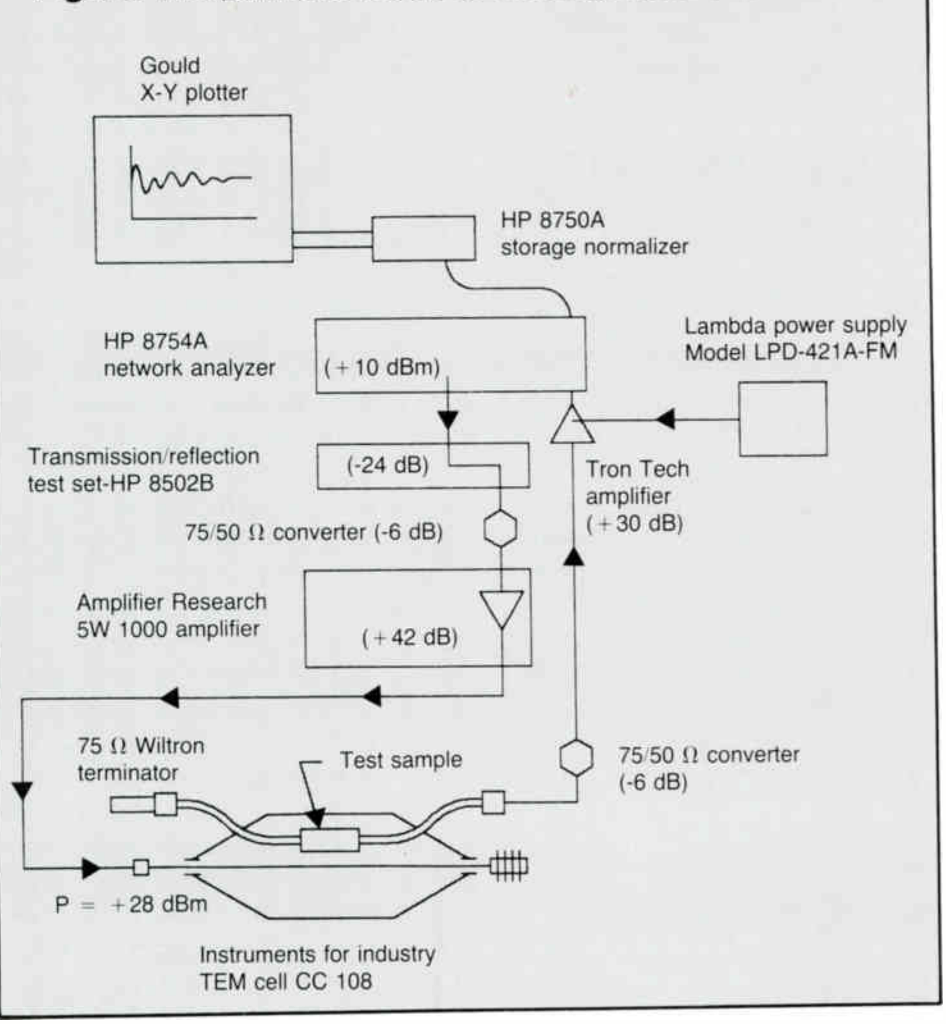
CATV signal security

CATV systems are designed and operated as closed systems. The assumption of a closed system permits the sharing of critical aeronautical frequencies by cable systems as well as the use of television and FM broadcast frequencies. A closed system is one where the signal carried is not affected by external electrical fields and does not affect these fields. This is possible only by coaxial cable design and special attention to electronics housings, ports and connectors. Although the CATV signal may be secured up to the subscriber's television, as federal laws require, the system cannot ensure that the subscriber's television is not a source of signal egress.

A perfectly closed system is unlikely to exist because an installation suffers environmental damage and grows older. Common causes of signal leakage include damage to cable, electronics housings and connectors. When damage occurs, leakage may be detectable immediately or it may increase to detectable levels as the effects of corrosion and mechanical load concentrations worsen the initial damage. The severity of signal leakage (and its detectability) increases as the local system power level and the size or broadcast efficiency of the defect increases. Normal CATV power levels and relatively small (in some cases invisible) system defects can result in easily detectable levels of radiation.

The consequences to the cable system from signal ingress, depend on the relative strengths of the interfering, external signal to the internal signal; the nature of the system defect; the efficiency of the CATV system to serve as an antenna to pick up the external signal; and the location of ingress. Signals received near the headend or along the system trunk are potentially of much greater consequence to proper forward system performance than are signals leaking in at the outer extremities of the system. Two-way systems may be particularly vulnerable to signal ingress at the weak signal extremities of the system.

Figure 1: Experimental set-up for shielding measurements



Government standards

The FCC has established standards for the levels of signal leakage that are permitted, and for the standardization of methods used to measure these signals. Federal laws state that signal leakage above permitted levels must be corrected with "immediacy." The National Cable Television Association[3] and SCTE[2] have published guidelines for signal egress measurement. A variety of commercial equipment is available to assist in system monitoring. Most operate on the principle of using standard, calibrated field detectors of electric field strength and tuned signal generation sources inputted into the system headend.

The extensive work by the SCTE has shown that margin exists beyond the stated federal limits to the threshold of interference to vital aeronautical equipment, even at the maximum operational signal strengths used in most cable systems. Less margin exists to signal detection by amateur radio operators in the immediate vicinity of leaking CATV signals. Interference to amateur radio operators also is forbidden by federal law. The NCTA has worked with the American Radio Relay League to establish mutually agreeable standards for measurement.

While the current federal laws do not offer explicit guidelines for signal security aimed at limiting signal ingress *into* CATV systems, the licensing process does permit the CATV industry to challenge threats to its signal security that might arise from low-power television broadcasting operations. Largely, it is the responsibility of the system operator to protect himself against signal in-leakage. The operator also must ensure that his system meets government and franchise requirements for signal quality. Here one must consider the minimum system signal strength and decibels of desired shielding against the likely signal strength of external, unwanted interference.

Effects of pending rule changes

The FCC has proposed new rule changes in its November 1984 Second Report and Order in Docket No. 21006. These changes have the potential to affect signal security rules in two ways. First, the period during which complete system check-ups for signal leakage must be performed may be reduced from one year to 90 days. System checks would therefore, be required four times as often. Concurrent with this change, an increase in the system operational power level by a factor of 10 would be permitted. Since system power level is directly related to the strength of signal leakage, the detectability of smaller leaks would increase among operators utilizing increased power. More recently, the FCC has proposed to revise the detectable field strength requirements to a uniform value and measurement distance for all frequencies. These recent changes in standards serve to increase the CATV industry focus on signal security issues.

Signal shielding adequacy

In evaluating the effectiveness of signal shielding devices, one must first answer the question: "How much signal shielding is adequate?" The answer depends on the characteristics of the system in question and the margin desired against the specific ingress/egress threat. There is no consensus on these variables, and differences of opinion also exist on the best means of calculating the resulting shielding requirements. A practical approach is outlined next. One should keep in mind, however, that the "antenna efficiency" of the damaged CATV system as a receiver or transmitter, is difficult to assess for all cases, and that the reflection of signals can serve to increase the field strength and detectability of leaking signals.

An expression relating the significant variables for shielding can be found.[4] These variables include the detected level of electric field strength permitted by government standards, E, the distance of the detector from the leakage source, R, the power level of the leakage source, P_t, and the negative gain (or shielding) afforded by the shielding device, $-G_a$. Combining these variables in one expression, we obtain:

$$E = 14.8 - 20\text{Log}(R) + P_t + G_a$$

where: E is in dBV/meter,
R is in meters,
P_t is in dBW, and
$-G_a$ is in dB.

If we assume that all of the CATV signal is leaked at perfect antenna efficiency, a 75 ohm system operating at 47 dBmV would provide a leaked signal strength of .000668 watt, or −31.75 dBW. The field strength of the leaked signal and the distance of the detector from the source of leakage are specified in the FCC

Table 1

Frequency	Field strength E		Distance R	Shielding $-G_a$
(MHz)	(μV/m)	(dBV/m)	(m)	(dB)
0-54	15	-96.5	30.4	50.5
54-216	20	-94.0	3.04	67.4
> 216	15	-96.5	30.4	50.5
Proposed:	50	-86.0	3.0	59.5

Figure 2: Heat-shrinkable CATV connector

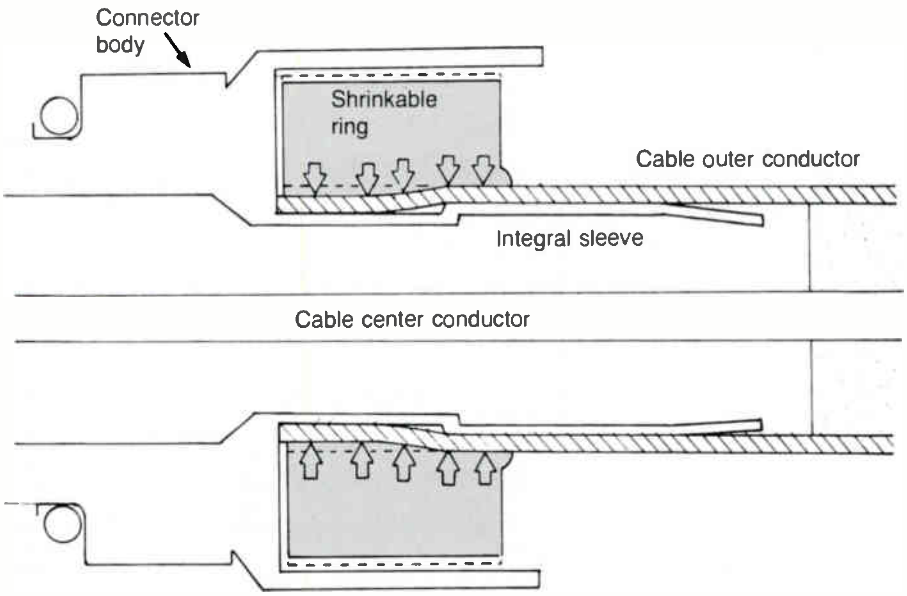
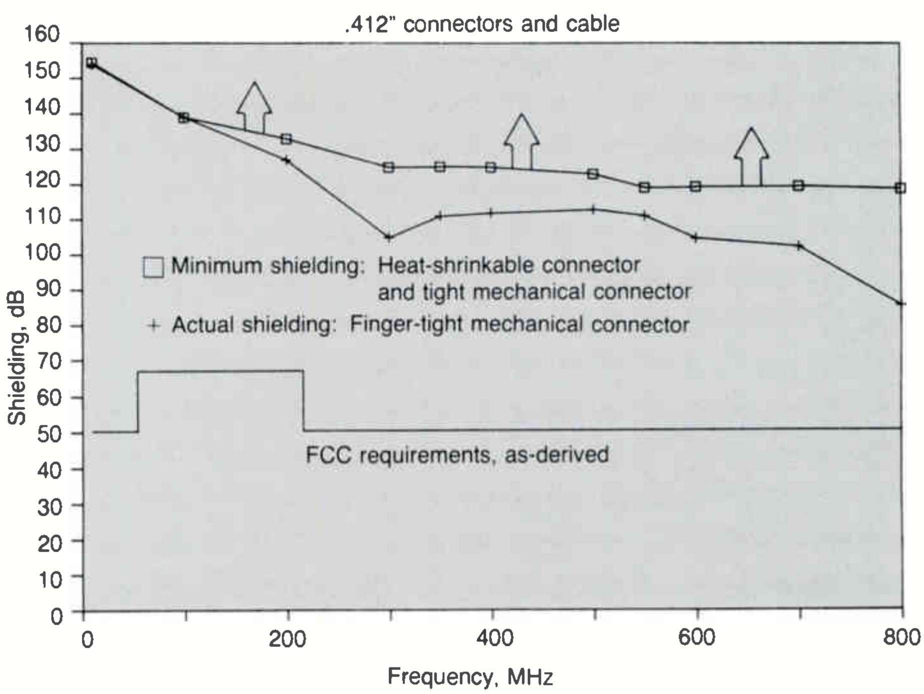


Figure 3: Loss of shielding performance due to loose connector



regulations, leaving the required shielding to be calculated from the above expression. In tabular form these values are shown in Table 1.

Although the FCC requires that field strength measurements be made under well-defined conditions comprising an approved site, simpler and more easily reproduced tests can be conducted in a special apparatus.[5] One of those techniques employs a transverse electromagnetic (TEM) cell, in which a uniform electromagnetic field is generated for effective evaluation of signal ingress into a test sample. A signal generator sweeps a frequency range of interest as an input into the cell, and a network analyzer compares the strength of the signal generated relative to the signal detected in the shielded test sample (Figure 1).

The expression for shielding effectiveness can be derived from the relationship for transmission and reception of signals:[6]

$$E = 6.8 - 20(\text{Log } \lambda) + P_r + G_c - G_a + P_t$$

where, as shown in Figure 1:

E = electric field strength, dBV/m
λ = wavelength in meters (= /freq. in MHz)
P_r = power received in the network analyzer, dBm
G_c = cable loss, dB
G_a = antenna gain (opposite of shielding effectiveness)
P_t = power absorbed in the terminator = 3 2 dB

In tests recently completed, a field strength of 81 volts per meter was established in the TEM cell (38.2 dBV/m). This was much greater than would be expected in actual field installations. The network analyzer could measure signals that were approximately 75 dB below the strength of the signals it transmitted, establishing a maximum measurement capability for shielding effectiveness of approximately 120 dB at 550 MHz, using the amplifiers in the test setup shown in Figure 1.

Leakage sources and solutions

Loose connectors serve as one of the worst signal leakage sources. If inadequate contact exists between the connector body and the coaxial cable outer shield, two problems can result: immediate signal leakage at some fraction of the full CATV signal strength; and a gradual increase in leakage as corrosion increases the contact resistance of the remaining contact area. In the mid-1970s, connectors with integral internal sleeves or mandrels were introduced. This measurably improved the electrical shielding performance of connectors.

More recently, innovative means have been found to improve the integrity of coaxial connections. Thermocrimp™ connectors utilize heat shrinkable rings to force a tight connection between integral sleeves and coaxial outer sheaths with a high state of residual stress applied over a relatively large area (Figure 2). Contact resistance is minimized and the connection strength exceeds the axial load limit. Most important, the connection is not dependent on the mechanical tightness achieved during installation with wrenches. Shielding comparisons have been made with other types of connectors. Although all types of connectors show shielding values in excess of the test measurement capability, when optimally installed, the mechanical connectors illustrate a reduction in shielding effectiveness when loosening is simulated by measurement of finger-tight installations (Figure 3).

Coaxial trunk and distribution cable represents a high state of signal security when intact. With variations in installation practices and in service, however, cable damage can be expected. Flexure from temperature cycles, vandalism, rodent damage, incidental damage during system maintenance and storm damage can result in unacceptable levels of signal leakage. Splice repairs can be time consuming and often necessitate interruption of service over large areas.

Splice connectors provide a level of signal security consistent with that provided by other distribution connectors. The connector must provide an environmentally tight and leak-free joint at both ends and at all internal, threaded swivel locations. Service interruption is required.

An alternative to cable splicing and service interruption can be found in wraparound repairs for coaxial cable. Here the challenge is to restore signal security to an acceptable level and environmentally seal the repair to prevent subsequent deterioration. Although practiced for many years, the use of aluminum foil and tape provides neither signal security nor a seal with permanence. Requirements for environmental sealing of coaxial cable are similar in many ways to the repair of telephone in-

Figure 4: Wraparound cable repair cross section

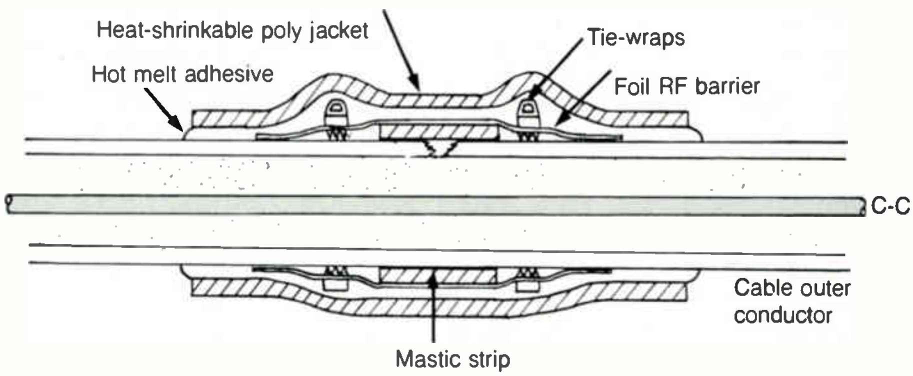


Figure 5: Shielding performance for wraparound cable repair, as-installed and after flexure

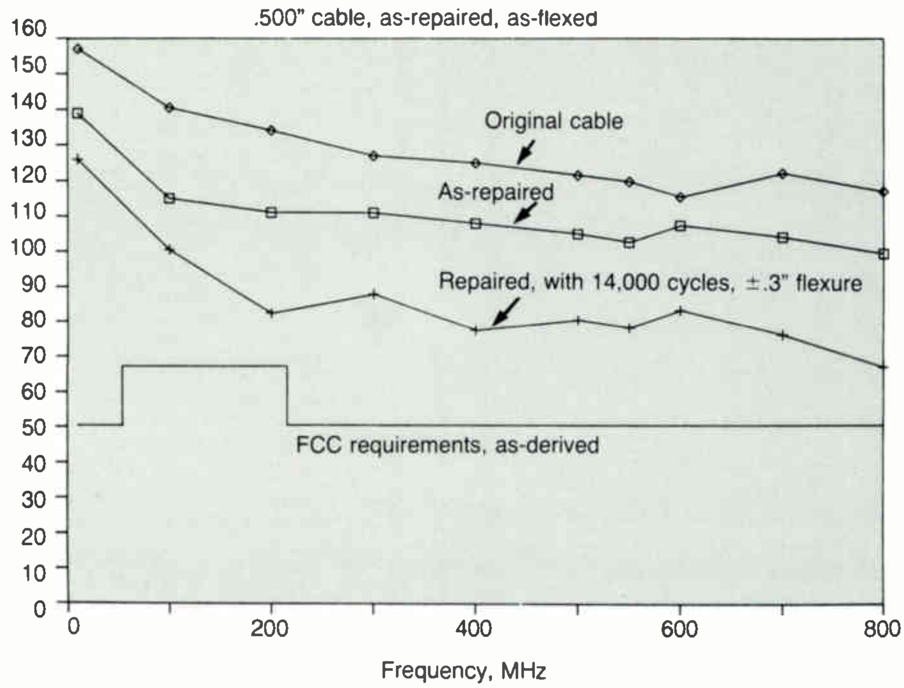
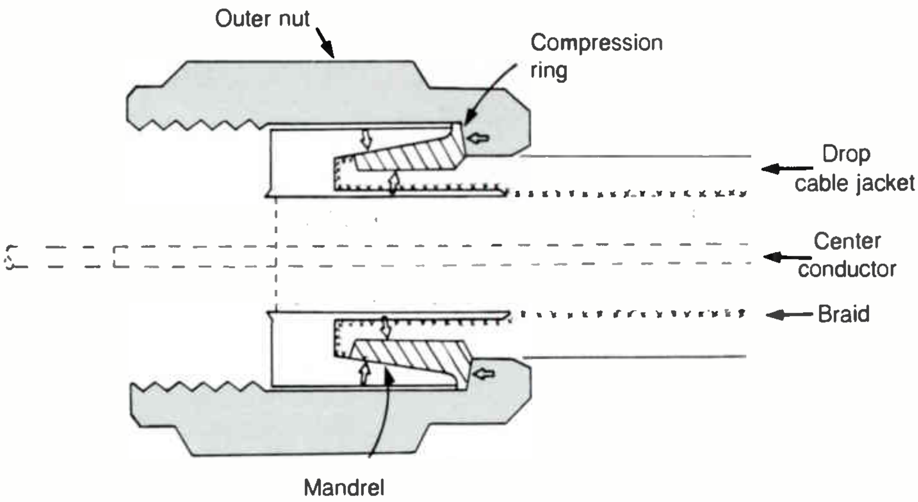


Figure 6: Compresson ring F-drop connector



stallations. A new product, called the Thermoshield™ cable repair system, has been developed for the CATV industry from the design methods used for telephone splice cases. This repair product employs a plated copper RF barrier to minimize galvanic action and contact resistance. An outer wraparound sheath is shrunk in place over the repair to seal and reinforce the cable with hot melt adhesives (Figure 4).

Shielding measurements have been obtained on repairs in severely damaged cable that indicate signal integrity is largely restored and maintained under subsequent cable service simulation. Figure 5 illustrates excellent shielding performance of a repaired cable expansion loop, both as-installed and after 14,000 cycles of .7-inch flexure.

Many systems have reported that the most frequent source of signal leakage results from loose drop cable connections and deterioration of drop cable. Drop cable is available in many forms to combat the effects of weathering and deterioration and to provide very high levels of signal security. Premium drop cable can be compromised and standard grades can deteriorate rapidly if inadequate connections are made to the cable or if the connection with the tap permits moisture to enter.

Major connector suppliers are introducing a variety of improved F-drop connectors, all with special design features to improve environmental resistance and shielding performance. Among these are a family of drop cable connectors that utilize an internal compression ring to exert a uniform seal around the cable sheath and braid. They also create a low resistance connection between the foil cable shield and an internal mandrel (see Figure 6). The compression ring of these EZF™ connectors is inserted by threading an outer nut over the tap port. Although installed with a standard wrench, insertion forces brought to bear on the compression ring exceed the equivalent of 1,000 pounds of axial load due to the mechanical advantage of the threads. A very tight, uniform seal is created that prevents leakage associated with hex-crimp connectors.

Long-term testing of these drop connectors continues. Early results, however, indicate that the resistance of the drop connection to extremely corrosive environments, such as an ASTM B117 "salt fog" exposure, is substantially better than current drop connectors due to the improved environmental seal.

Summary

Signal security is not a new subject but has received recent emphasis as system requirements extend beyond providing relatively few channels of entertainment. Now system requirements include management and data handling tasks. Government standards have been strict, and enforcement efforts have increased. System power levels and periodic inspections also have increased the likelihood of problem detection by operators.

A number of suppliers are offering new products to the CATV industry. These products have the potential for reducing signal leakage incidents, while also reducing system maintenance costs and subscriber inconvenience. And these related goals are likely to receive increased attention as system performance and operating costs receive increasing scrutiny. ◻

References

[1]Society of Cable Television Engineers, *Final Report to the Federal Communications Commission*, Nov 1, 1979
[2]FCC Rules, Part 76 605
[3]Delmer C Ports, *Signal Leakage and Interference Control*, National Cable Television Association, Manual 741, 1974
[4]Society of Cable Television Engineers, *Primer on CATV Signal Leakage*, No TR-4, October 1983
[5]Sandy B. Livermore, "Quantifying Signal Leakage—How Do Current Methods Measure Up?," *Cable '84 Technical Papers*, National Cable Television Association, June 1984, p 205
[6]Samuel Y Liao, *Microwave Devices and Circuits*, Prentice-Hall Inc , 1980, pp 475-480

EXCLUSIVE

Technology to improve economics

In last month's issue the first part of this article provided a technical introduction to the Comband system under development by General Electric. This new technology provides cable operators with a means of significantly expanding the number of channel offerings without having to rebuild or upgrade the channel capacity of their existing systems. Part 2 covers the results of field tests on a UA Cablesystems network in Hattiesburg, Miss.

By Thomas A. Gilchrist
Manager, Comband Transmitter, General Electric Co

The field tests of the Comband system began in Hattiesburg at the then General Electric Cablevision Co. system. (In December 1984, General Electric and UA Cablesystems Corp. merged their cable holdings, with GE retaining a 37 percent ownership of the combined company.) Testing of the Comband system was first initiated in April 1984 and since then has utilized Hattiesburg as an ongoing test bed for product verification from prototype through sample run designs.

To conduct these tests Comband bandwidth compressed signals were injected into the system at the headend. Testing of the converter was performed at the headend, as well as at two remote observation sites. The Hattiesburg Holiday Inn, which is located approximately eight miles from the headend and 13 amplifiers into the distribution cascade, was selected as a typical field observation location. The second site was established in Purvis, a small town approximately 25 miles from the headend and 31 amplifiers into the cascade. Initial Comband system field testing used rack-mounted discrete hardware operating in an emulation mode. The converters under test in December and January contained actual custom ICs; therefore, they electrically and mechanically simulated the final product.

Detailed testing concentrated on three primary aspects of system operation: addressability, subjective viewing of video picture quality, and performance with varying signal levels.

Test results

Addressability testing proceeded by varying the amplitude of the FSK (frequency shift keying) signal at the input of the converter. At each signal level step, installation of the converter was conducted using the Technician Set-Up Unit (TSU). The TSU is a proprietary element of the GE system that eliminates the need to burn PROMS or correlate converter serial numbers to address codes. Following a successful installation, the converter under test was disabled and subsequently re-enabled via addressing commands from the headend.

The results of the addressability testing showed that the converter could be installed using the TSU with FSK signal levels 23 dB down from the video carrier level. Enable and disable commands could be successfully received at FSK signal levels as low as 32 dB down from the video carriers, demonstrating a significant safety margin for data signals to all converters.

The subjective viewing of the Comband picture was done on an A/B comparison basis with three 19-inch conventional TV sets utilizing fixed pattern and live video signals. TV set #1 was a cable-ready version, TV set #2 used a commercialy available set-top converter, and TV set #3 used the Comband set-top converter. All who viewed the comparison were favorably impressed with the Comband pictures and agreed that they would satisfy even the most discriminating viewer. For good-to-moderate quality of incoming signals, all three displays looked essentially the same. Only the technically trained viewers were able to identify specific artifacts. With typical incoming signal conditions, contrary to expectations, the Comband picture frequently displayed more apparent horizontal resolution while giving crisper pictures than the comparison monitors. Under these same typical input conditions, the Comband picture displayed less streaky noise, which is particularly noticeable on dark scenes. Under extremely weak signal conditions, the Comband picture was judged to be superior in quality and sync stability until the input level was such that complete loss of sync was reached.

With a strong RF input level at +6 dBmV, the overall picture quality of all three monitors was judged to be essentially the same. While a few minor artifacts and differences were observed in the Comband picture by some viewers, the differential was slight. With a moderate RF input level set at -6 dBmV, the Comband picture maintained video quality and on some program material outperformed the comparison monitors on the basis of picture crispness and absence of streaky noise. Additional picture characteristics tested for included luma artifacts, contrast consistency, sharpness/preshoot/overshoot, and black level retention. No significant problems were observed with any of these additional characteristics.

Observations for system anomalies were detailed and intentionally critical. The specific areas identified for observation and measurement in order to ensure proper operation of the converter included the following: picture/sound microphonics, sync stability with injection of impulse noise, master/slave operation, luma noise and artifacts, sharpness and overshoot, chroma/luma balance and fit, noise artifacts in the magenta bar, inter-luma crosstalk, adjacent channel interference, triple beat, and sound quieting/fidelity. The few anomalies that were observed are in the process of being resolved and are not considered to pose significant design problems.

A learning process

Present at the tests were cable operators, managers from engineering and marketing functions of GE's Commercial Electronics Product Department, and GE corporate personnel. Daily programs for the cable operators were given by the manager of cable products operation; these presentations followed a regular format consisting of an overall system assessment that highlighted user features and economic advantages. Following this assessment was a technical description of the addressing system and bandwidth compression modulation techniques given by the manager of technical services. After these discussions, the attendees rated actual visual comparisons of Comband-generated pictures to those of standard cable TV.

During the discussion, cable operators were briefed on how Comband electronically squeezes two video signals into the electronic space normally required for one. This compression process is what allows operators to increase the number of channels offered without adding new cable. Comband technology permits the cable operator to address each subscriber individually and also allows him to provide extra services, such as adding premium channels and pay-per-view events. In addition, Comband provides unique safeguards to protect against signal theft or pirating. As well, the capabilities of the set-top converter and the security features built into it were demonstrated, and a description was given of the computerized addressing equipment that the cable operator would install at his signal generation facilities.

Additional Hattiesburg field tests are scheduled for this month with further testing and demonstrations in other cable operations scheduled throughout the spring and summer. Pilot runs are to be completed in July followed by field testing of these units in Hattiesburg and other selected sites. These additional tests will be conducted between August and October. Actual production begins October 1 and the first Comband systems will be available for delivery in November.

Multiplexors

Digital Communications Associates Inc. announced its Netlink II, high-speed time division multiplexor. Like the original Netlink, Netlink II provides voice, data and compressed video transmission at speeds up to 1.544 bps or 2.048M bps. It also offers compatibility with any asynchronous ASCII terminal, as well as DCA's Network Management System (NMS); support of traditional drop and insert, and bypass applications for multipoint networks; full redundancy of power, logic, T-carrier modems and facilities; support of independent trunk clocks for satellite operation; support of D4 framing compatibility required for connection to the Accunet T1.5 service; compressed and expanded (companded) continuously variable slope delta (CVSD) modulation technique to handle voice transmission; and automatic time of day reconfiguration.

Netlink II is available in a 44-channel desktop unit, expandable to 128 channels in rack-mount form, and a 20-channel desk-top unit with the same capabilities but designed for smaller applications.

In addition, Digital Communications announced the Switching Netlink, which provides voice, data and compressed video transmission at speeds up to 1.544M bps or 2.048M bps, and offers switching capability. Switching Netlink makes it possible to assign individual channels or groups of channels to various destinations throughout the network. It performs all switching functions via software-programmable commands that the network manager or operator enters from a console. As a result, operators do not have to move cables or add switch boxes to accomplish channel routing. Using the console, network managers can store preprogrammed configurations that Switching Netlink executes, or change channel destinations on-line. The console also provides a central point for controlling all Netlinks in the network and operators can program the time of day configurations to change the routing schemes of devices in the network at specified times.

For more details, contact Digital Communications Associates Inc., 303 Technology Park, Norcross, Ga. 30092, (404) 448-1400.

Modulators

Anixter Communications has added the TM-1400 and TM-2400 modulators to its Catel product line.

The TM-1400 offers MATV, SMATV and DBS operators the advantage of a heterodyne modulator. Applications include TVRO, camera, VTR modulator or any use where baseband video and audio is to be converted to standard or special TV channels. The TM-2400 brings the advantages of IF modulation within reach of almost any CATV and CCTV system; it can be used with film chains, cameras, VTRs or TV demodulators, according to Anixter.

For more details, contact Anixter Bros. Inc., 4711 Golf Rd., 1 Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

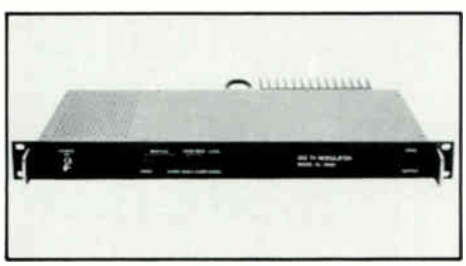
Reinforced ducts

Tamaqua Cable Products Corp. has introduced the Hitensile, Plus I and Plus II duct systems. All of the ducts are of the high density polyethylene (HDPE) variety.

Tamaqua maintains that its Hitensile duct system increases pulling lengths without stretching the duct or damaging the cable inside. The duct, reinforced with Kevlar fiber, is available in several designs to meet the severity of the application.

The Plus I and Plus II ducts were designed to give a greater degree of protection against crushing. The ducts' wall thicknesses were increased to give added radial strength, but outside diameters were not changed.

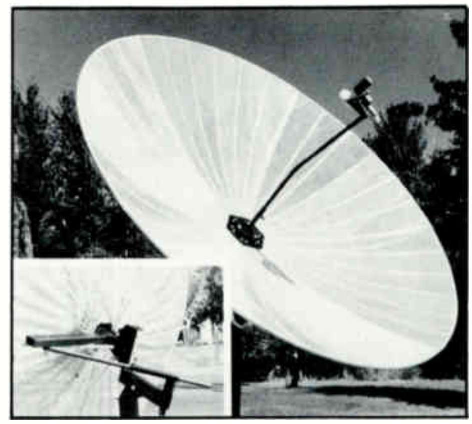
For further details, contact Tamaqua, P.O. Box 347, Schuylkill Haven, Pa. 17972, (717) 385-4381.



Agile modulator

International Satellite Systems announced the latest version of its GL-2600 series agile modulator. This series will synthesize over 105 frequencies in standard, HRC or IRC channel spacing. The modulator is of the IF type, with-both audio and video loop-thrus, for use with any scrambling system or stereo adapter. The GL-2600 features a SAW filter that eliminates the need for external bandpass filters. Channel selection is accomplished by the switch located behind the ISS nameplate.

For more information, contact ISS, 1004 Del Norte, Menlo Park, Calif. 94025, (415) 853-0833.



Mesh antennas

Sigma Satellite Manufacturing & Sales Inc. announced the introduction of two new aluminum mesh antennas. The "Supreme" is an 11-foot, 32-rib aluminum mesh dish, and the "Deluxe" is an 11-foot, 18-rib dish. Both have the single steel base, true polar mount and adjustable declination. Also, both antennas have the same hub design as other Sigma antennas, but fewer ribs.

For additional information, contact Sigma Manufacturing, 1115 Hamilton Ct., Menlo Park, Calif. 94025, (415) 327-5210.

Interference detector

Miralite's new Clearsite is a system that displays levels of terrestrial interference, allowing the optimum installation site to be chosen. Clearsite is compact, can be held in the palm of your hand, and comes in its own Samsonite® VIP briefcase.

To use the system, screw it in to any 4 GHz low-noise amp (LNA) and as it points toward the interference the digital display reading increases. Additionally, the Clearsite can be used to peak antennas at 4 GHz by attaching the antenna optimizer (optional) directly to the LNA or LNB operating at 950-1450 MHz.

For further information, contact Miralite, 4050 Chandler, Santa Ana, Calif. 92704, (714) 641-7000.

Equipment catalog

Scientific-Atlanta Inc. has published its expanded 1984/1985 Cablemart catalog. The 80-page catalog describes the complete line of new and remanufactured cable television equipment available from Cablemart, S-A's regional retail cable equipment outlet's. Included are headend electronics, receivers, distribution products, earth stations, coaxial cable and product accessories. New products featured in the catalog include bonded drop cable, in a wide range of configurations, and a complete line of Gilbert connectors.

To obtain a catalog, contact Scientific-Atlanta Inc., Box 105027, Department A/R, Atlanta, Ga. 30348, (404) 925-5696.

Preventive maintenance

(Continued from page 14.)

rect placement of the power director(s) to avoid the possibility of improperly loading the source power supply or allowing two sources to "buck" or mingle. One also must ensure that all line extenders are installed and properly powered (all distribution fuses or circuit breakers installed) to avoid subsequent changes in the available AC voltage (don't forget, the AC voltage is a function of the current drawn in its path). After these steps are taken, one should measure the regulated DC voltage to ensure proper DC power pack operation.

Output levels

Finally, manual amplifiers and line extenders require the technican to adjust the gain and slope for the proper output levels. These levels should be set at the highest and lowest channels carried, not at the system pilots. Setting levels on the system pilots can cause the actual output levels to far exceed the specified operational levels necessary to obtain desired distortion performance. Scientific-Atlanta has developed a device to aid in setting output levels. It's called a True Tilt Correction Network and is available in various bandwidths and tilt levels to accommodate different system designs. The device is installed between the amplifier's output test points and the measurement instrument. It provides flat levels to the system technician to eliminate the guess work as to what level a given channel should have by making all channels equal. This device also permits easier system linearity (peak-to-valley) measurements.

Amplifiers with automatic gain control (AGC) and automatic slope control (ASC) require a little more attention when setting levels. One must know the ambient temperature and consult a compensation chart to determine what levels the manual gain controls should be adjusted for. These charts are located in the manufacturers' instruction manuals and must be used to ensure proper setup and operation. Also, when setting AGC/ASC amplifiers, make sure you have sufficient "head room" in the gain of the amplifier to allow for compensation of temperature effects. If you set up an amplifier and do not have excess gain or slope control range (i.e., if your control is all the way to a stop) then something is probably wrong with that amplifier.

While we're on the subject of amplifier malfunctions, you should become aware of a parameter called "minimum full gain." This indicates the least amount of gain one should expect from an amplifier turned wide open. A typical spec for minimum full gain is 25 dB, which means that an amplifier with 10 dBmV into it should be capable of yielding an output of at least 35 dBmV. If it doesn't, then it is not performing properly.

Now that you've taken all the readings and set all the levels, do it again, and this time make a record of them. I cannot over-emphasize the need for proper documentation of all of these parameters.

Lastly, the ever-necessary mechanical inspection should be performed. Look for the little things as well as the big things. Check for corrosion, connector tightness (don't forget about signal egress, Table 2) and cable breaks. Make sure to follow the manufacturer's instructions regarding bolt pattern and torque. The little things do matter.

Conclusion

In closing I need to restate two basic rules: Write it down, and do it now! Also, one of the best means of learning is to talk to others who have already experienced the problems you are having. SCTE Chapters and Meeting Groups provide an excellent forum for discussing common problems and learning new techniques and methods.

Footnotes

[1]This report is available from the Society of Cable Television Engineers and will provide many valuable insights into signal egress. Order Product #TR-2.

[2]The section entitled "Not Specified" contains components identified as permitting signal egress, but the report was not specific as to whether these components were drop or distribution related.

[3]Most voltmeters are not designed to properly measure the "squared" waveform of our AC sources and will tend to read higher voltages than are actually available.

The morning after

By Anthony J. DeNigris
President, Nationwide CATV Services Inc

It was a long and tough job; all 500 miles of it. You got through the initial planning stages, the strand mapping, system design and make-ready survey all pretty smoothly. Equipment selection and ordering was a tedious task but perseverance prevailed and finally paid off. The contractor you picked to build the system turned out to be the right choice. As the system splicing progressed, you had your share of anxious concern in anticipation of the day the switch was to be thrown. And when that day came, your system turned on like a charm and passed specs with flying colors; and it was then that you said to yourself, "Whew, am I glad the real work is all behind me."

Later that day, you pass a mirror and notice the proud smile you're exhibiting, and you pause to give yourself a thumbs-up congratulations because you pulled it off. And now after it is all behind you, you can feel that you are truly exhausted; however, you remind yourself it was all well worth it: "Look at the system I built. All I need now is a good night's sleep."

Well, you finally feel relaxed and you're ready to tackle the world. It's time to get to the office and see about running the system; after all, the hard part is behind you. But, as you're sitting in the coffee shop looking out the window on that first morning of your new system's operation, admiring your accomplishment, you can't help but wonder what it's going to be like keeping it all together and working like it was designed to be.

From shine to shambles

Just about now, one might say, "Aha, this is going to be about all the hard work that goes into running the physical cable plant after construction." Well, what I am actually about to point out is how easily your shiny new system can turn into a mess right before your eyes, if you let it.

A few months ago I happened to be driving through a system that was only two years old. I had seen the plant just after it was built and I remembered how good it looked. It so happens that it was an excellent operating plant also; however, I want to concentrate on appearance for the time being.

As I looked at area after area of cable plant, I couldn't help becoming dismayed. I happened to notice that in quite a few spots, taps and associated loops were out a few extra feet from the normal position of the original splicing. In many cases, the taps or amps were right up against the center of a pole. Splicing looked like it had been taken apart and reassembled time after time. Shrink tubing was missing on many connectors, and I could tell very easily that someone's hands were playing around in this system, someone who obviously didn't have the same concerns for system integrity as the people who built the plant. Expansion loops looked as if they hadn't ever been put in, since what was there now bore only a slight resemblance to the original. I had to investigate this phenomenon to satisfy my curiosity. Never had I seen such a state of physical degradation of a cable system.

Answers hard to believe

What I discovered was truly amazing. After all the work that went into the planning and construction of the system, and after it was released to the operating personnel, installers were hired to come in and follow up the marketing efforts with customer hook-ups. With marketing performance based on quotas and deadlines, pressure on the installers' performance was not great, and increased revenues seemed to be the prime concern. The plant manager had to handle not only installations, but service calls that came in by the hundreds, which is normal after such a marketing effort and mass installation program. Most of the calls were merely customer related TV problems or misunderstandings of converter usage. The burden of taking care of all of them (satisfying the customer and the system manager), as well as running the normal physical operations under the extreme pressure of quotas and deadlines, caused the plant manager to allow less than satisfactory workmanship from the installers. I am not saying that the installations at the customers' homes were bad; all in all, they were pretty good. It was the drop work at the poles and midspans that was bad.

The aesthetics as well as the physical aspects of the pole or span work were atrocious. Span clamps were placed on the strand, either midspan or at the tap vicinity, without any regard for any lashing wire that may have been clamped in, so to speak. This quickly led to a continuing problem of broken lashing wire throughout the system. Then, when the in-house repair crews were sent to fix the broken lashing wire, they had to contend with removing the midspans temporarily and unwrapping the drop from the midspan to the pole, which seemed to be the way that most of the installers took care of a midspan. (Many installers think that it looks better to wrap a midspan drop around the cable run, rather than to sag in the drop from clamp to clamp.)

So, the repair crew now has to take time to unravel the drop wire—and guess what? That's right, they usually don't bother. The result is a relashed span with drop wire in it. The span ends up looking raggedy with air spaces and loops all over the place. And the drop is lost within the new bundle. A last note that I want to mention is that many installers have a habit of cutting the length of the drop before climbing the pole to attach it. Well, you can be sure that when this is done, it's never too short. Most of the time the excess is not trimmed at the pole and the extra length is wrapped or bundled at the attachment point. It would be easy for a squirrel to make a nest in there and go unnoticed.

Good in theory, bad in practice

Now, let's let a bunch of uncontrolled technicians loose in the system to start troubleshooting problems. I'm sure I'm not the only one who has had the opportunity to see a system torn apart that shouldn't have been. Again, though, everyone in my example seemed to be dealing with time. "Can't put the heat shrink tubing on now," after pulling a connector apart. "I'll have more time later to come back when I get done with this problem." And that's how it went, except for the heat shrink that never went back on in many cases.

Where did all the expansion loops go? Well, this can be attributed to the initial construction. The strand and cable were put up during that particular area's mean temperature range, autumn. The construction crew allowed extra sag in the plant because the project manager wanted to take precautions against the strand contracting too much in the winter. Well, it was a nice thought; however, when any strand is put up in an area where the temperature changes drastically, the sag must be calculated to allow for maximum expansion as well as contraction. In this case the crews didn't want to take any chances, so they placed it with a little too much sag. It wasn't bad looking at the time, but after a few seasons, considering the range of temperature in the area, the spans were full of what the industry calls "air-loops." This happened from the extreme non-uniform expansion in the strand vs. cable. When strand expands and cable expands at different rates, and they do, they do not return to the same points that they started at.

Coupled with a multitude of problems after the cable plant was built, and the fact that control of standards wasn't implemented, it didn't take long before the system was headed downhill. The power company was planting new poles along a run which, when transferred, ended up with all the equipment in the center of the pole (cable-wise, that is), and no one was on hand to push some weight around when it was needed.

Thinking about it all, one might say that the job never stops, when it comes to cable TV plant. Building it, and keeping it intact after the construction, is a considerable challenge. It only indicates that there is no "morning after" to look forward to, following a well-deserved good night's sleep. Squeeze your rest in when you're not busy performing the task of control.

AUTOMATION

Your Way!

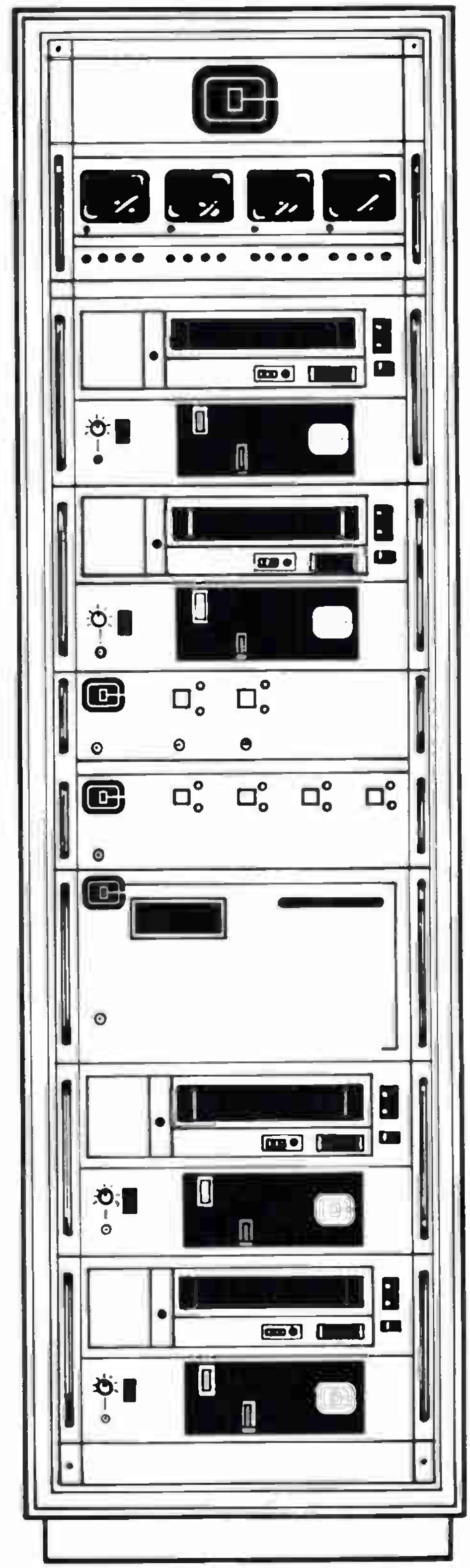
Your requirements are unique to your organization, and that's how your operating system should be.

CCI offers a complete line of video automation equipment that is software based. You tell us how you want your system to run. You even select the format from 1/2″ to 1″ and how many machines you want.

CCI custom-builds the system to your specifications in our own plant. If you later change your mind about the way your system should operate, no problem. Our CMOS circuitry is driven by EPROMs, so just tell us what you want done differently, and we'll blast a new EPROM. Presto, the change is made.

There is nothing CCI loves more than a challenge, so challenge us with your requirements. We've met a lot of challenges already and have over 500 channels currently in operation.

Call us toll-free and let CCI demonstrate how to have automation your way.



7353 Lee Highway
Chattanooga, TN 37421
Phone: (615) 894-2580

(800) 367-5742

Reader Service Number 42.

KEEPING TRACK

Gaye Bagwell has been appointed to the position of vice president and general manager of **Gulfstream Cablevision of Pinellas County Inc.** She will be responsible for the day to day operational management of the cable system serving four cities in Florida. Bagwell comes to Gulfstream from Times Mirror Cable Television Inc. Since 1983 she held the position of vice president of the southeast region, based in Midland, Texas. Contact: 1060 Scotsdale Blvd., Dunedin, Fla. 33528, (813) 736-1436.

Vrignaud

Hollimon

Synchronous Communications recently made two new appointments to the corporate staff. **Gilles Vrignaud** has been appointed vice president, and now will be responsible for Synchronous' venture into new video products both in the United States and Europe. Vrignaud, recently of Quante Corp., was formerly product manager of Catel.

Barbara Hollimon has been appointed director of marketing for Synchronous. Hollimon will be analyzing the needs of cable systems across the country. She will be responsible for development of a marketing program for Synchronous' CATV headend products and new data transmission products. Contact: 1701 Fortune Dr., Suite O, San Jose, Calif. 95131, (408) 262-0541.

Pioneer Communications of America Inc. announced three new appointments. **Irv Faye** has been promoted to the position of director, national accounts. Faye, a 20-year veteran to cable, has been with Pioneer since April 1983 as an account executive. Prior to that, he was the vice president of sales and marketing for AEL Communications Corp. and the national sales manager for Magnavox.

Shellie Rosser has been appointed director, national accounts. She joined Pioneer in September 1981 as northeastern regional sales representative and was promoted to manager in October 1982. Prior to that, she was with the Jerrold Division of General Instrument as an account executive.

Lastly, **Ed Kopakowski** was named northern regional sales manager. In his new position, he will be responsible for Pioneer's two regional offices in St. Louis, Mo., and Schenectady, N.Y. Prior to joining Pioneer, Kopakowski was with the Jerrold Division of General Instrument as an account executive. Contact: 2200 Dividend Dr., Columbus, Ohio 43228, (614) 876-0771.

President Reagan awarded **David McCourt** the first major White House formal recognition of corporate citizenship, the new "C Flag" symbolizing exemplary public service. McCourt is president and chief executive officer of Boston-based McCourt Cable Systems Inc., which provides design, engineering and construction management services to the telecommunications industry. He was among 150 executives of businesses and associations personally honored by the president during a recent White House ceremony. Contact: 177 Milk St., Boston, Mass. 02109, (617) 423-0909.

CALENDAR

April

April 9-11: CATV Technical Seminars program on cable television technology, Marriott, St. Louis. Contact (314) 423-9700.

April 9-11: Canadian Cable Television Association annual convention, 'CABLEXPO,' Toronto Metro Convention Center. Contact Christiane Thompson, (613) 232-2631.

April 10-12: Magnavox CATV training seminar, Denver. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

April 12-13: SCTE Iowa Gathering technical seminar, Howard Johnsons, Iowa City. Contact Jean Hamilton, (515) 246-1440.

April 15-17: Magnavox CATV training seminar, Denver. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

April 17: SCTE Golden Gate Chapter seminar on feedforward and power doubling technologies. Contact Pete Petrovich, (415) 463-0870.

April 18: SCTE Rocky Mountain Meeting Group meeting on preventive maintenance, Sheraton Hotel, Denver. Contact Bruce Catter, (303) 740-9700; or Joe Thomas, (303) 466-7376.

April 22-24: Allied Data Communications Group "Maintenance of Broadband RF Networks," Norcross, Ga. Contact Stephen Reynolds, (404) 923-4866.

April 24: SCTE Delaware Valley Chapter meeting on data transmission and LANs, Fiesta Inn, Willow Grove, Pa. Contact Bev Zane, (215) 674-4800.

April 24: SCTE Chattahoochee Meeting Group seminar on multichannel television sound, Holiday Inn, Atlanta, Ga. Contact Mike Aloisi, (404) 633-4326.

April 24: SCTE Hudson Valley Meeting Group seminar on satellite technology and broadband local networking, Holiday Inn, Fishkill, N.Y. Contact Andy Healy, (914) 561- 7880.

April 29-May 1: West Virginia Cable Television Association spring meeting, Lakeview Inn, Morgantown, W. Va. Contact Roger Price, (304) 345-4710.

AD INDEX

Texscan PATHMAKER CATV

WE DIDN'T CHANGE THE NAME, BUT LOOK WHAT WE ADDED!

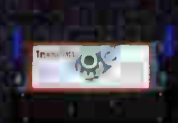
It's hard to improve on a reputation built from 15 years of field proven reliability. So, Texscan's Pathmaker distribution line retains all the outstanding features you've come to respect such as: Upgradability, Ease of Maintenance and Efficient Construction.

But, now we've added more reasons to buy Texscan Pathmaker equipment with *Splitband* and *Feed Forward* capabilities.

Our Series 1000 Multiservice Amplifier offers *Split-band* for local area network applications. A single 5-210 MHz amplifier covers a wide area of return bandwidth options, selectable by four different modular plug-in diplex filters. And, the forward amplifier covers from 150-450 MHz to complement any one of the diplex filters you choose. Both the forward and reverse amplifiers offer provisions for either thermal or dual-pilot closed loop circuit AGC.

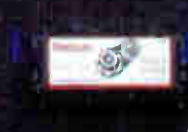
The Pathmaker *Feed Forward* amplifier also features the modular, drop-in design for ease in upgrading and reduced cost. The Series 2000 Trunk Amplifier will feature *Feed Forward* towards the end of this year. Call your salesman for details.

The Station shown contains: Model 752 covering 5-108 MHz with 12 assigned channels 150-450 MHz with 50 assigned channels.



Model 753 covering 5-120 MHz with 12 assigned channels 174-450 MHz with 46 assigned channels.

Model 754 covering 5-174 MHz with 21 assigned channels 216-450 MHz with 39 assigned channels.



Model 755 covering 5-210 MHz with 28 assigned channels 264-450 MHz with 31 assigned channels.

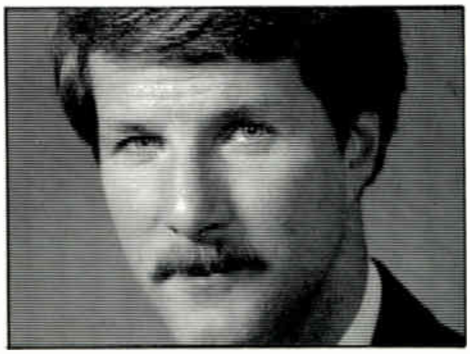
Texscan Corporation
1440 Goodyear Drive
El Paso, Texas 79936
(915) 594-3555

Texscan CORPORATION

Reader Service Number 46.

Close encounters

By Robert A. Luff
Senior Vice President, Engineering
United Artists Cablesystems Corp



It's April 1st and time for some fun mixed with a serious message. The extraterrestrial encounter is relayed just as it was told by Jack "Stoney" Stone.

Last April's column, *Surprise FCC Signal Leakage Action,* turned out to be not so much a spoof. Before tossing aside *Close Encounters* as just another April 1 sci-fi, remember last year's unexpected outcome (FCC Second Report and Order, Docket 21006. Release date Nov. 9, 1984).

Future history

by Jack Stone

I had gone up to the headend for my Friday check of levels and deviation and such and as I was unloading the spectrum analyzer from my station wagon, there was a "POOF!" behind me and this little guy just appeared out of nowhere.

"Hey!" I said, "where did you come from?"

His yellow eyes scanned me and the analyzer and he said, "About 2518, as you reckon time."

I said, "I don't understand," which was the understatement of the year. He acted pleasant enough, but he was green with yellow eyes and white hair and stood about four feet tall, and I knew he didn't live around here.

"Well," he said, "I come from the future. I am an acolyte in the Communications Order, and I am studying the evolution of communications along this time-line."

"Oh!", I said, "I see." (I do not lie like that very often, but I was nervous.)

I guess he could tell that I did not see, because he explained that there are an infinite number of universes like ours. And when an event takes place that will change the established order, like the invention of the telescope, one universe goes on with the telescope in it and another is instantly created identical with the first, but as if no one had even dreamed of the telescope. Or take the transistor: He said that there is a universe out there exactly like ours, except in which the transistor was never invented. I figured that might cause some difficulties. I said, "If there are no transistors in that other universe, how do they manage 500 MHz or computers or space flight?"

"Oh," he said, "they get along. They really went to work on designing tubes. They still make vacuum tubes, but they also make pressure tubes and instead of getting the grid and plate closer and closer as the frequency increased, they finally went the other way and spaced them at a half-wave length for some applications and a quarter for others."

"How did cable TV make out?" I asked.

"In which universe?" he replied. The wind was blowing his white hair around and he looked like a fat asparagus plant with snow on top. "There are several dispersal points here: MDS, SMATV, DBS, FCC—that is why I'm here—to study the effect of one of these on this universe. Pick one."

"Well, I am most curious, I guess, about all these satellite dishes that are springing up all around. How do they affect cable TV?"

He had a clip-board looking thing in his little green hand (with six inch fingers) and he rubbed his fingers on this board and said, "We will take your universe with the time-line of no change." He rubbed the clip-board some more. "Ah!" he said, "here we are." He was studying the clip-board, but I did not see anything on it but a bunch of tiny flashing lights. "Well, the dishes keep coming and also getting cheaper and cheaper. They are soon about 500 of your dollars. They make serious inroads on cable, and the industry customer count goes way down."

"Why would so many people pay $500 for a dish when they can get cable for $30 or so a month?" I asked.

"Because they get all the pay channels free, and all the independents free; and the $30 a month will only get them two pays and maybe one independent. So in a couple of years their dish is paid for and they get everything free—all 40 or 99 channels—whatever's up there."

"Interesting," I said, but I really wondered what a short green person could know about the future of cable TV. If even Ma Bell was wrong once, what could he know? So I tried this on him: " How about scrambling? Doesn't that stop the free watchers?"

"That does not happen along your time-line. All the pay people talk about it, but nobody does anything. I've heard that said about your weather and it is nothing to brag about." I sort of resented that, because it was a nice day, sunny and about 75 degrees, but he was shivering once in a while. Maybe his time-line was warmer. "Alright, nobody scrambles. So what happens?"

"Surely you can extrapolate the next scene from all the information you now have," he told me.

I started to say, "Yeah, I can extrapolate alright, but don't call me Shirley," but I questioned the sense of humor of a green person from the future—had he seen *Airplane?* So I just went along with him. "I would guess that if nobody scrambles and jillions of private satellite dishes appear, that sooner or later some cable systems are going to be in trouble."

"That is exactly right," he said. "The private dishes proliferated, cable lost customers, and the first to go were the big city systems that relied most heavily on satellite programming."

I wished he would stop using the past tense—was, were and like that—like all this had already happened. Payday was Friday and I hadn't picked up my check yet. If he was right, maybe I had better go get it quick.

But then he asked, "Can you see the next step? When the heavy cash flow from the big cities stops, the satellite programmers are next to go. Disney, HBO, Showtime—one at a time, they all fold—every one."

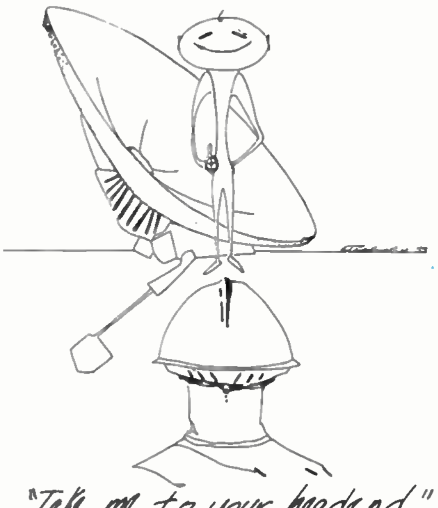
"Even Ted?" I asked.

"Even Ted," he said.

I cannot imagine a cable system without HBO. "I do not remember cable without satellite service," I told him, "but if you are right, then it sounds like the only cable TV will be in towns away from the big city transmitters with towers on the tallest hills around. But in that case, the only signals possible would be the networks and whatever else is close enough to bring in by microwave."

"You got it, Charlie," he said, and I could see for the first time his little blue teeth as he smiled. "They call it Community Antenna Television." And "POOF!" he was gone.

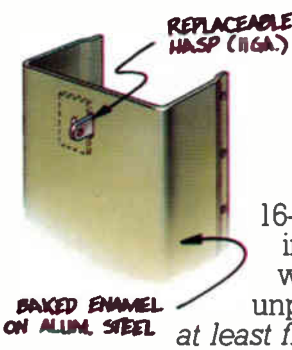
Jack Stone is a senior division engineer for United Artists Cablesystems Corp. Also a commercial pilot, an amateur radio operator-KA5MBB and a MENSA, you never know when he is serious.



"Take me to your headend."

We put the cable industry on its own pedestal

While others were adapting telephone pedestals for cable television applications, CWY was designing pedestals exclusively for the cable industry...a complete line of pedestals built to *your* specifications ...not someone else's.



For example, CWY pedestals feature 16- and 18-gauge T2 aluminized steel construction, which tests show outlasts unpainted galvanized steel *at least five-to-one*. Plus, the rectangular design assures ease of installation and maximum use of interior space.

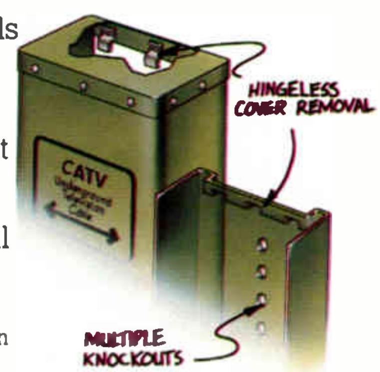
CWY pedestals are easier to service, too; the positive, secure, hingeless cover removal system allows the front cover and top to lift off as one unit, giving you full exposure of the pedestal interior.

And while other manufacturers bend out a piece of steel and call it a hasp, CWY pedestals feature tough, 11-gauge plated steel hasps that are rugged and fully replaceable.

Multiple knockouts for ease and flexibility in equipment mounting...interior lid guides for extra security...an innovative stake lock that keeps the pedestal right where you planted it...and a whole lot more. All at prices you'll find *very* competitive.

So why buy pedestals made for someone else? CWY designed them just for you. For more information about CWY's complete line of pedestals and other cable TV solutions, call or write today.

Standard sizes: 4"x5", 5"x8", 7"x7", 6"x9", 10"x14". Call with specifications for custom sizes.



Not just supplies. Solutions.

CWY electronics

P.O. Box 4519—Lafayette, IN 47903—Call Toll Free: 1-800-428-7596—Indiana: 1-800-382-7526

Reader Service Number 47.

R E L I A B I L I T Y !

Hamlin®

New 66 Channel Cordless Remote Convertor Contains SAW Resonator Technology

Model CR-6000 66 channel cordless remote, with handheld control unit.

Features of Hamlin's CR Convertors.

1 66 channel capacity (450 MH$_Z$). **2** Easy-to-read LED channel display.

3 NTSC, HRC and IRC frequency configurations.

4 Use of SAW Resonator eliminates fine tuning and centering functions.

5 Extremely stable output frequency. **6** Infra-red wireless remote control.

7 Instantaneous channel selection. **8** On/Off control.

9 Accelerating scan up/down channel select.

10 Programmable favorite channel memories. **11** Available with built-in descrambling.

Call our toll-free "Hot Line" 1 (800) 323-0436.

In Illinois call 1 (800) 942-0905 or call your nearest Anixter Stocking Location for details.

Reader Service Number 48.

ANIXTER® COMMUNICATIONS

Corporate offices: Anixter Bros., Inc.
4711 Golf Road, Skokie, IL 60076
(312) 677-2600