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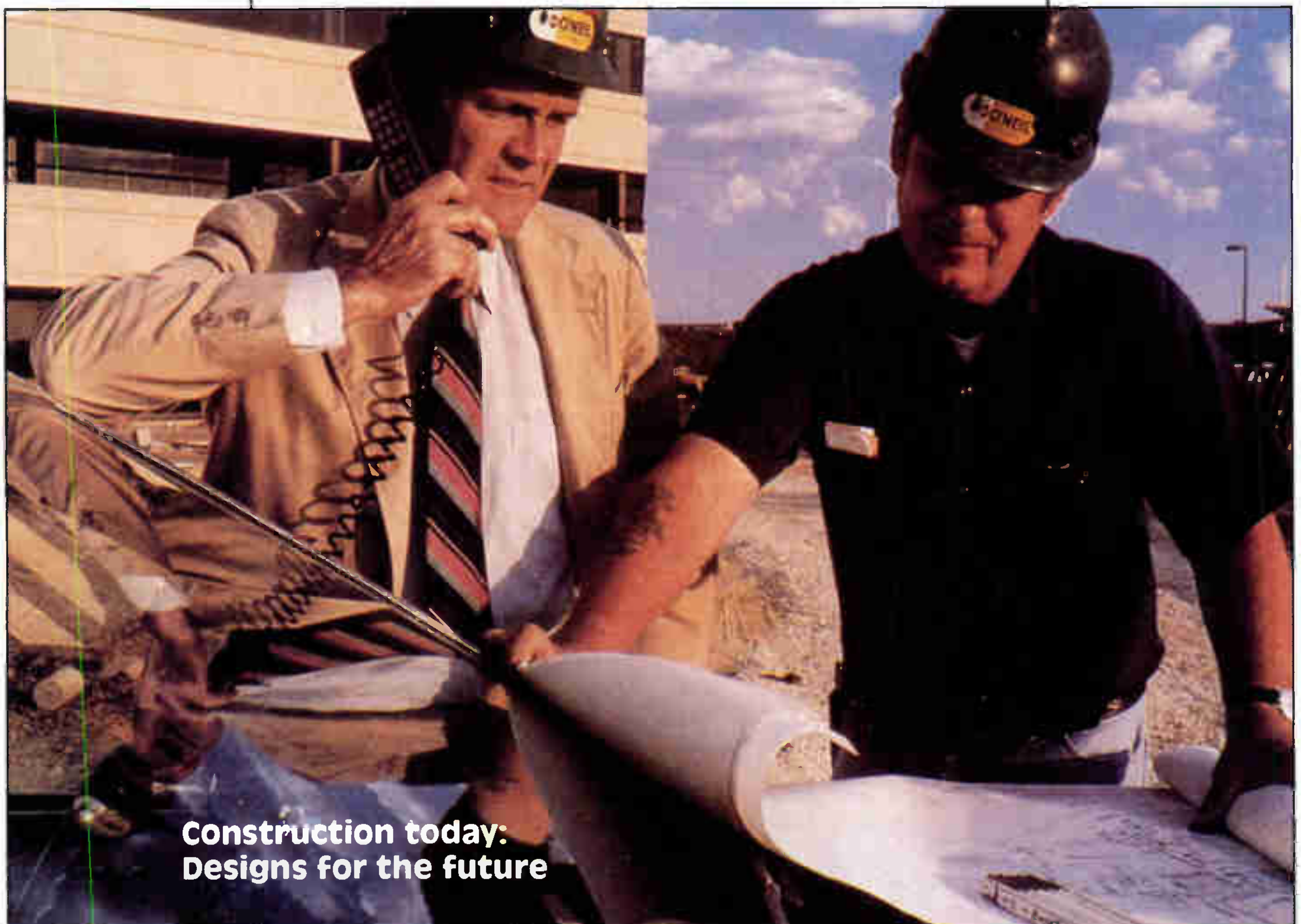
Official trade journal of the Society of Cable Television Engineers



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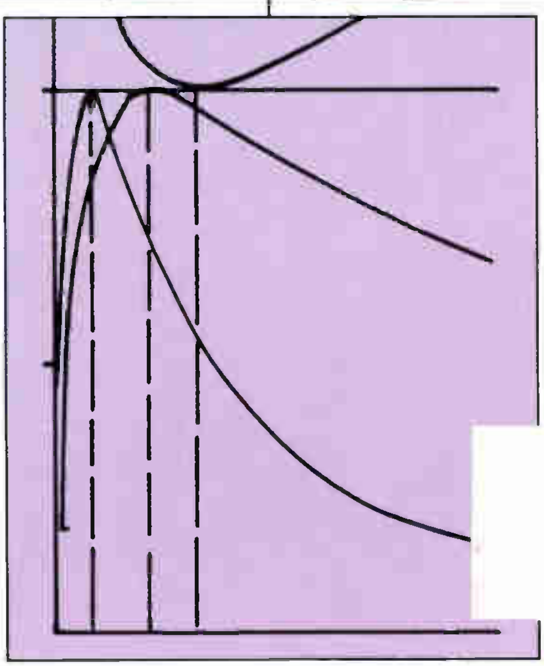

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April 1989

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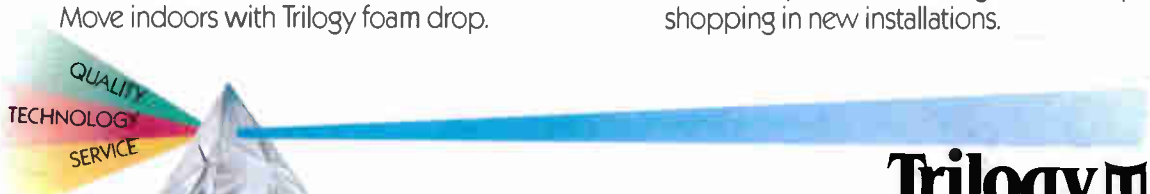

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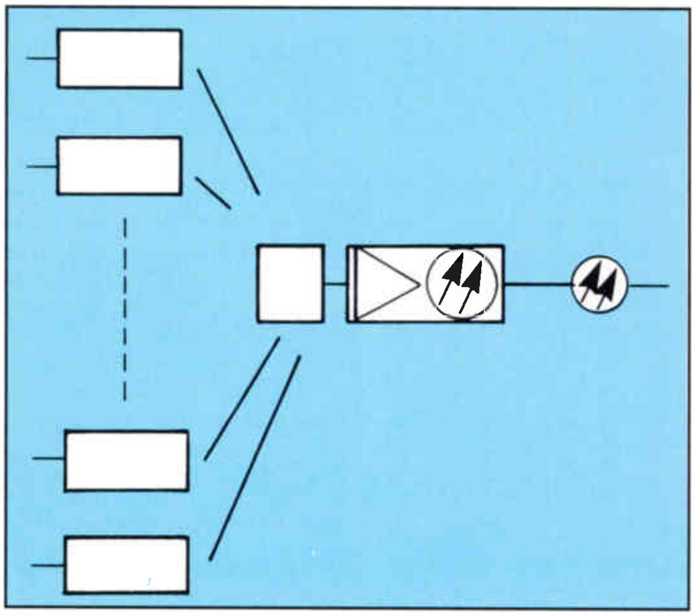

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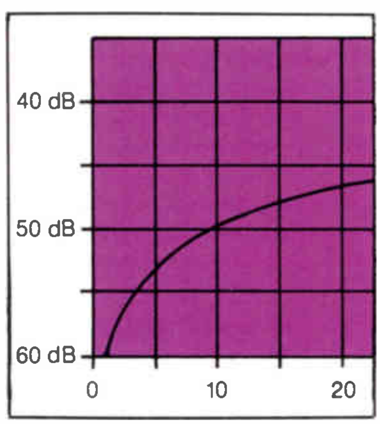

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Photo courtesy Anixter Cable TV.

 Communications Technology™ (ISSN 0884-2272) 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 1989, Volume 6, Number 2. Office of publication is 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112 Change of address notices should be sent promptly; provide old (or copied) mailing label as well as new address, including ZIP code; allow 6 to 8 weeks for change. Second-class postage paid at Englewood and Denver, Colo. POSTMASTER: Please send address changes to Communications Technology, Box 3208, Englewood, Colo. 80155.

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EDITOR'S LETTER

Good times in River City

Just like clockwork (a finely crafted one), San Antonio hosted the Texas Show in February. This year over 2,000 made the pilgrimage for good times and hospitality that are synonymous with Texas. Among the noteworthy items at the show were finger-licking barbecued ribs, toe-tapping country music, eye-opening technical seminars and a mind-boggling exhibit floor. Who could remember the Alamo, with all this and more on the agenda:

Wednesday, Feb. 22: Before the exhibit hall opened promptly at 1 p.m., over 30 convened for the SCTE Interface Recommended Practices Committee and subcommittee meetings. Discussions including coring tool and connector parameters, testing procedures, and mechanical specs for aluminum and drop cable interfaces. If you're thinking about becoming more involved in our industry's advancement, this is a group to join.

Thursday, Feb. 23: The three excellent seminars coordinated by the SCTE were, as usual, well-attended; the two CLI morning sessions actually boasted standing room only. In "CLI: It's not just for engineers any more," Ted Hartson of Post-Newsweek Cable and John Wong of the Federal Communications Commission fielded questions from audience members (composed mainly of system managers). They wanted to know about responsibility for leaks, customer tampering, routine monitoring, flyovers and visits from the FCC, to name a few.

In "CLI: Protecting your channel capacity," Les Read (Sammons Communications) moderated a panel of Raleigh Stelle (Austin Cablevision), Bob Dickinson (Dovetail Systems) and Wong. A highlight of this session was a series of mock (and at times humorous) inspections featuring FCC Engineer Clark Poole.

"New technologies: A look at the future" featured Wendell Bailey of the NCTA, Dan Pike of Prime Cable and John Simons of Times Fiber. The speakers addressed HDTV, fiber optics and the telco threat. On the latter, Bailey said, "Telcos are going to have to do something shiny and new to jack up their rates (i.e., by offering cable TV over fiber). But we're in a better position."

Friday, Feb. 24: An event not in the official agenda was the Fifth Annual Fred Rogers Breakfast held at the Marriott. Dan Pike presided over the roast (not of chicken or beef but of Rogers, president of Quality RF Services), acting as judge, jury and executioner. Unfortunately, more details cannot be revealed of this event, since tape recorders and cameras were confiscated.

During the show, attendees were encouraged to enter a drawing for an SCTE membership at the Society's booth. Congratulations go to Pat Morrow, system manager of TCI Cablevision of Texas.

Reach out and teach someone

Ron Hranac, Jones Intercable senior staff engineer and SCTE national president, recently spoke at the University of Colorado at Boulder on the topic "Contemporary issues in the cable industry." His talk included a brief description of cable TV and how a cable system works, current technology and future developments, competition, HDTV, and fiber.

This brings up a question: Do you know something we (your co-workers, personnel in other systems or those in other industries) don't know or could do better? Well, then, what are you waiting for—get out there and tell us about it! Volunteer as a speaker at your MSO's engineering meeting, local SCTE group, community college, wherever.

What's the matter—afraid to speak in public? Cat got your tongue? Just know what you're talking about, prepare it well and rehearse it beforehand. And think of the many rewards: the sound of applause for a job well done, recognition for you and your company, another achievement for your personnel records and company newsletter. And perhaps more opportunities to speak.

How to start? Just call or write the SCTE national headquarters for a Speaker's Bureau questionnaire. Fill it out and return it to the Society; your name will be on file for chapter and meeting groups that need a speaker in your field of expertise.

And by the way, I hope you can attend this year's Cable-Tec Expo at the Orange County Convention Center in Orlando, Fla., June 15-18. (An expo registration packet begins on page 89.) If you're there, be sure to drop in on CT Publications' technical writing seminar. We'll be providing tips on preparing reports, articles and other ways to express yourself better on paper. More information will follow.

Attention, exhibitors: Send your product releases or other show-related information for our upcoming show dailies to CT Daily, P.O. Box 3208, Englewood, Colo. 80155; or fax them at (303) 792-3320. Deadlines are May 1 (National Show) and May 31 (Cable-Tec Expo).

Finally, circle your calendar: July 19-22, the Colorado Cable Television Association Convention at Marriott's Mark Resort in Vail, Colo. During this show, the SCTE Rocky Mountain Chapter, CT Publications and the National Cable Television Institute will present the First Annual Cable Games. Yes, *you* might have the opportunity to test your skill and speed in preparing an F fitting, splicing cable, testing active equipment and locating a fault with a time domain reflectometer. More details later.

Rikki T. Lee

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Official trade journal of the Society of Cable Television Engineers

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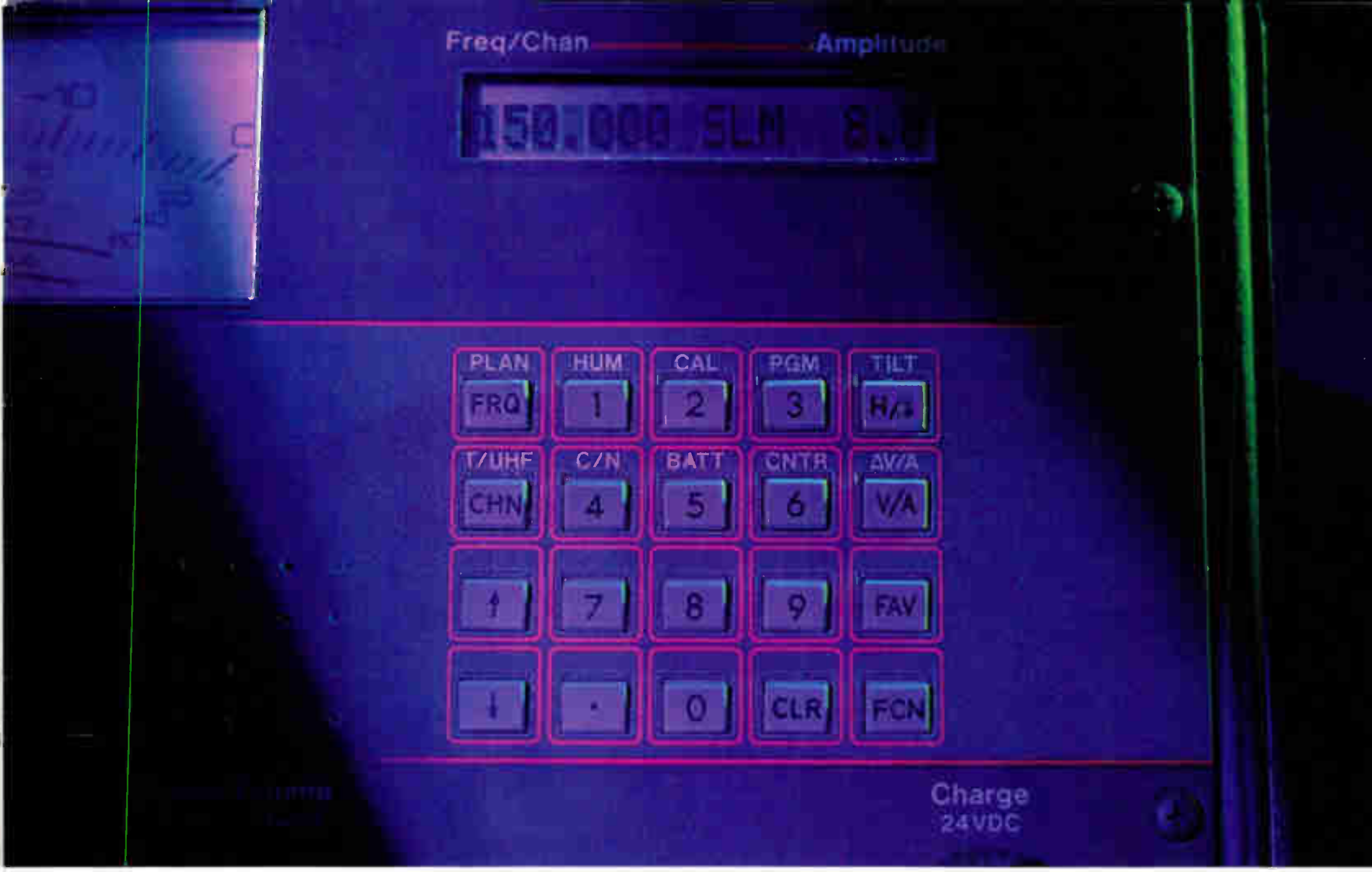
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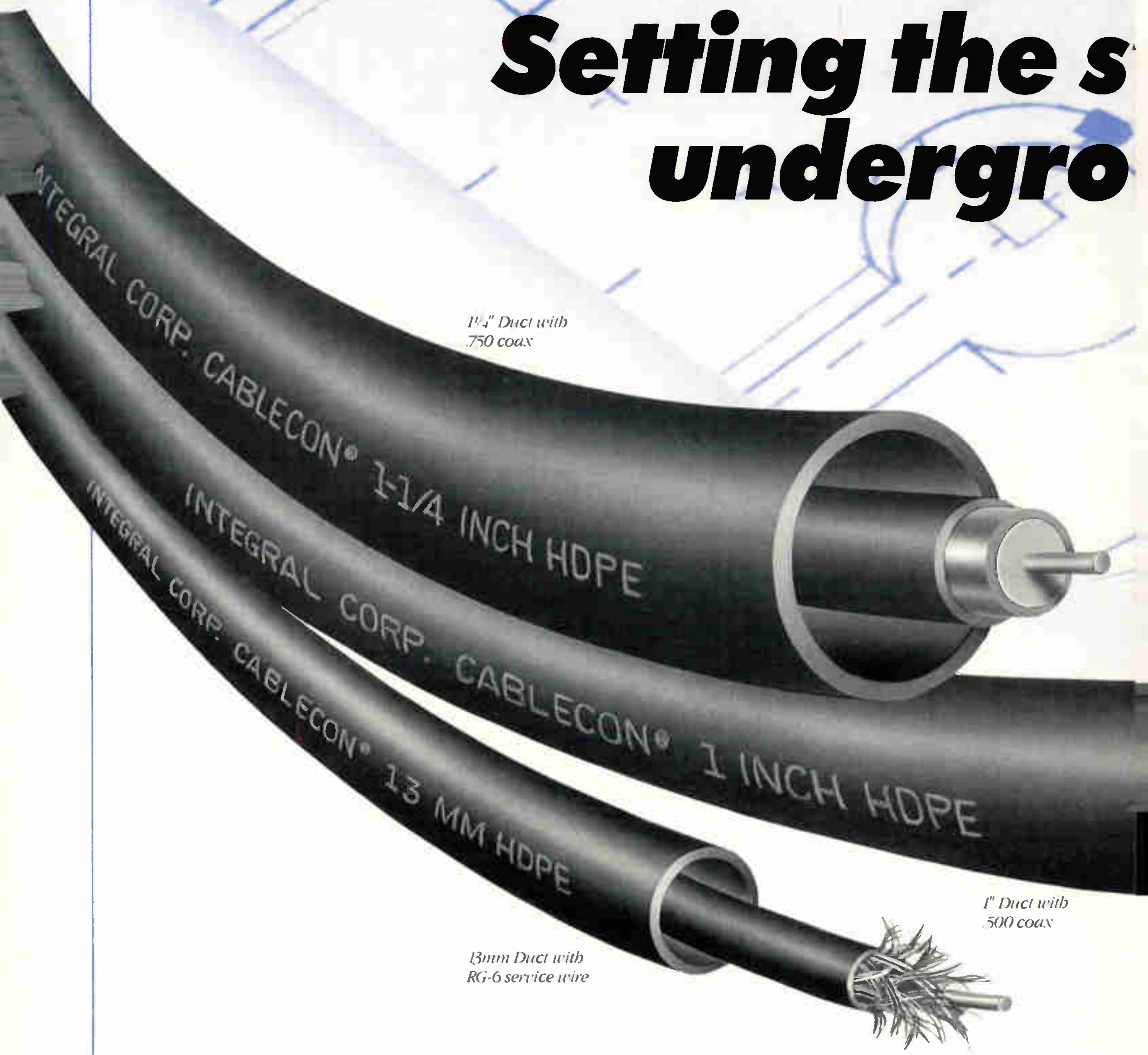

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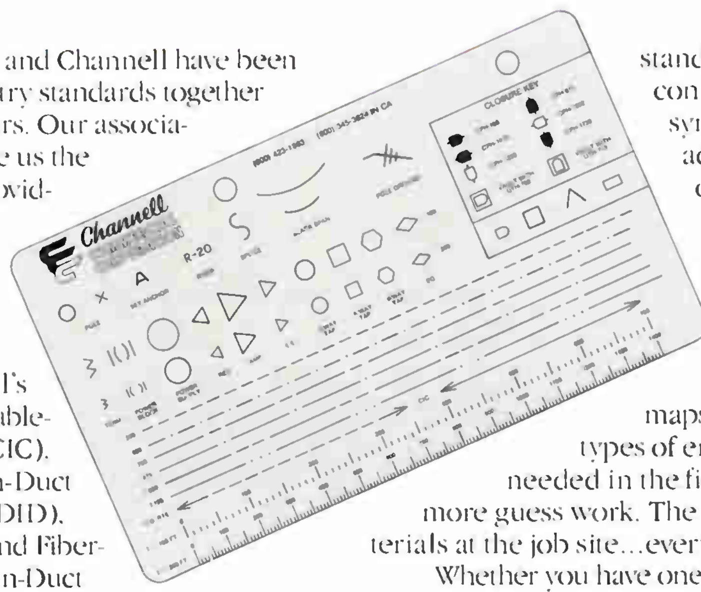

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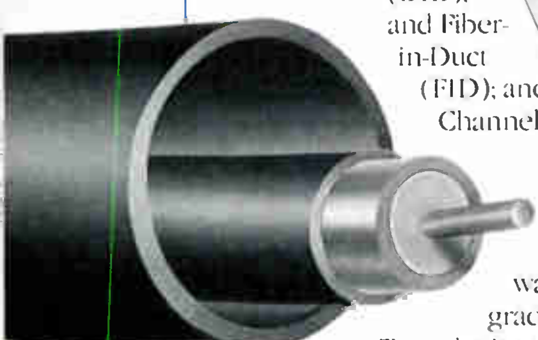

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Cable Labs group holds first meeting

STAMFORD, Conn.—Technical executives from 11 MSOs recently gathered here for the first meeting of the Fiber Optic Subcommittee of Cable Television Laboratories' Technical Advisory Committee. This subcommittee is responsible for monitoring, evaluating and reporting on developments in fiber-optic video transmission.

All of the operators present at the meeting, which was chaired by American Television and Communications Senior Vice President of Engineering and Technology Jim Chiddix, have begun implementing fiber in their systems. Attending were representatives of ATC, Cablevision Systems, Comcast, Cox Cable, Jones Intercable, Prime Cable, Rogers Communications, Tele-Communications Inc., United Artists Columbia, United Cable and Warner Cable.

Jones donates books to U.S., U.K. Societies

ENGLEWOOD, Colo.—Each of the 5,000+ members of the Society of Cable Television Engineers will receive a free copy of the *Jones Dictionary of Cable Television Terminology* from the book's author, Jones Intercable Inc. CEO and Chairman Glenn Jones. In its third edition, the dictionary defines more than 1,600 cable TV-related terms, phrases and acronyms from engineering, operations, marketing and other areas, as well as related computer and satellite terms. The book retails for $14.95.

This follows the donation last month of over 600 copies of the dictionary for the members of the SCTE in the United Kingdom. Ron Hranac, Jones Intercable senior staff engineer and U.S. SCTE president, presented the books to U.K. SCTE Secretary Tom Hall on behalf of Glenn Jones.

Anixter opens center, incorporates R&D lab

DENVER—Anixter Cable TV recently opened its National Account Center here, housing a staff of 50 in sales, sales support and technical services. In addition, the center contains a new research and development lab, relocated from Seattle; the company's quality assurance program also will be administered from the center. According to Anixter, the R&D lab is designed to focus input from the field on development of products and services. Initially the lab will concentrate its efforts on fiber optics and other emerging technologies as well as 1 GHz passive devices.

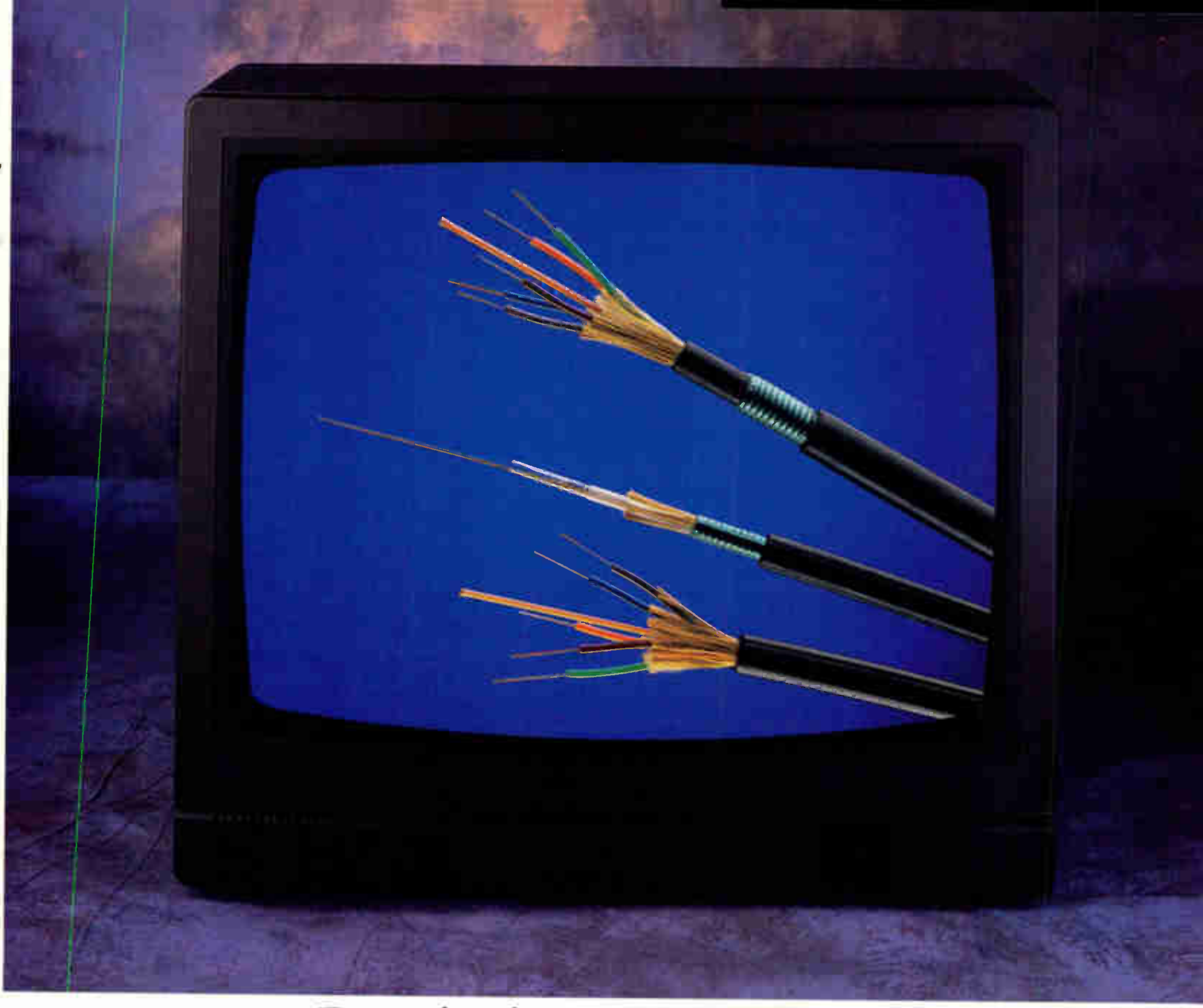
Also, Anixter announced its current expansion and restructuring to enhance service to its customers. The company recently formed fiber-optic and broadband product field engineering groups to assist in technical support.

Congress repeals Cable Act of 1984

WASHINGTON, D.C.—The largest setback in recent CATV history has come to pass. Spurred by the Connecticut legislature's request to the U.S. Congress for repeal of the Cable Communications Policy Act of 1984, Congress has directed the Federal Communications Commission to immediately repeal the Cable Act.

The rapid repeal of the act follows Sen. Albert Gore's (D-Tenn.) newly conducted probe into cable basic rate increases. According to Roy Neel, Gore's legislative director, a seminar has been completed instructing city officials to the possibility of building their own cable systems for $800 per sub and offering basic services at $10 per month.

Many franchise authorities contemplate "franchise fees" of 10 percent or more in the near future. Subscriber rates will be regulated in accordance with the franchise authorities; in other words, no rate increases without the approval of the city or local governmental agents. Franchises will be reviewed *yearly* and any operator may be asked to cease and desist immediately at the request of the franchising authorities. Upon denial of a franchise



renewal, the cable operator's system may be acquired by the franchising authorities at original cost minus depreciation. The telephone company, other utilities and even cities themselves will be encouraged to compete with cable TV companies to supply what is now labeled as "cable television."

Another nail in the coffin for the Cable Act appears to be the national survey conducted by The Associated Press appearing in the financial section of the Macon, Ga., newspaper. In this survey more than 1,600 cable subscribers stated that more problems were experienced with their cable TV compared to their phone service. A majority felt that the phone company should be allowed to supply cable TV, and all felt the phone company would give better service.

One bright point will be repeal of the protection of subscriber privacy; now you can sell your subscriber mailing list to your new competitors.

Editor's note: April fool, courtesy Fred Rogers of Quality RF Services. (It could come true if you don't get to work now!)

SCTE announces Expo '89 program

EXTON, Pa.—The Society of Cable Television Engineers announced the preliminary program of Cable-Tec Expo '89, to be held June 15-18 at the Orange County Convention Center in Orlando, Fla. This seventh annual expo (combined with the 13th Annual Engineering Conference) features technical programs, hands-on training and workshops with instructional hardware exhibits.

On Thursday, June 15, the engineering conference will include a panel on high-definition TV and guest speakers to discuss digital video, cable vs. telco and fiber-optic technology. The Society's annual membership luncheon, also on the first day, will feature guest speaker Paul Weitz, deputy director of Johnson Space Center.

Expo workshops and exhibits will take place Friday and Saturday. Workshop topics include fiber-optic test measurements, signal level meter basics, data transmission techniques, supervisory and management fundamentals, signal leakage and CLI, local origination, AM fiber transmission, installing fiber cable and installer certification. Two full morning sessions will be set aside for remote automated system testing (Friday) and basic spectrum analyzer theory and operation (Saturday). During exhibit hours, several exhibitors will present product-specific equipment usage classes.

Finally, the morning of Sunday, June 18 will feature BCT/E Certification Program testing. Tours of two local fiber-optic installations—BellSouth's Heathrow and Cablevision of Central Florida—also are planned for the last day.

For more details on Cable-Tec Expo, see the registration packet beginning on page 89.

Zenith seeks funds for HDTV research

GLENVIEW, Ill.—Zenith Electronics Corp. recently submitted two co-funding proposals to the U.S. Defense Advanced Research Projects Agency (DARPA). The proposals are designed to speed up Zenith's research and development activities in HDTV (high-definition TV) technologies.

First, Zenith (with AT&T) is seeking $13 million in co-funding from DARPA on a $24 million R&D program. Planned for this project is the development of an HDTV processor/receiver, integrated circuitry and prototype hardware for evaluation and demonstration of the Zenith Spectrum-Compatible HDTV system. Second, Zenith is asking $10 million for a $21.5 million program to develop large-screen versions of its "flat tension mask" high resolution color picture tubes.

- Viewsonics announced a 25-year warranty for its Lockinator products. The company will repair or replace any of these items should they fail due to manufacturing defects.
- Scientific-Atlanta won a multiyear contract to construct with Indonesia-based Citra Sari Makmur the Skylinx.25 communications system. This VSAT (very small aperture terminal) network

will provide interactive data, voice and video communications to about 4,000 sites on the 13,677 islands of Indonesia. Also, S-A was selected to build private TV networks with its B-MAC technology for Nippon Telephone & Telegraph Co. of Tokyo and four other Japanese companies.

- The Jerrold Division of General Instrument recently received patents for three electronic A/B switches, Models A/B-INT, RF-BYPASS and A/B-OUT. These switches can be attached to current Jerrold converters without opening the covers.
- Effective April 1, CableCom Specialists moved to Buck Shoals Business Park, 44 Buck Shoals Rd., Suite A-4, Arden, N.C. 28704, (704) 687-1101.
- Times Mirror Cable TV recently signed an agreement with Texscan MSI to purchase $500,000 of ComSerter ad insertion equipment. The MSO will upgrade seven Dimension Media Cable systems this year.
- Midwest CATV opened a new sales office to serve customers in Oklahoma, Arkansas, Louisiana and Texas; it is located at 2118 Wall St., Suite 800, Garland, Texas 75041, (214) 271-8811 or (800) 421-4334. The company also entered into agreements to stock the Antronix CAM-Port and Power Guard Model FR 6015-0 15 amp non-standby power supply.
- BradPTS recently expanded its Longview, Texas, facility to include a full-service headend and amplifier repair program. The company also signed an agreement with Oak Industries to provide exclusive nationwide converter warranty repair service on all Oak converters. Finally, BradPTS' service centers now approved for Panasonic converter warranty repair include the Bloomington, Ind.; Longview; and Tampa, Fla., locations.
- RMS International of Hasbrouck Heights, N.J., reported that Irving Trust Co. will terminate its $3 million credit line to RMS on or before June 30. It is seeking a new financing package by the early part of the second quarter.
- Lightning Master Corp. (LMC) appointed Antenna Mount Specialties of Lafayette, La., as distributor for LMC's full line of static dissipation lightning protection products; the distributor will sell and install the products throughout Louisiana, Texas, Arkansas, Oklahoma and Missouri. Also, LMC moved its office and manufacturing facilities to Brooksville Industrial Park, 3336 Mustang Dr., Spring Hill, Fla.; its mailing address and phone number remain the same: P.O. Box 10597, Brooksville, Fla. 34601, (904) 799-6800.
- Cox Cable Cleveland Area Inc. recently purchased the Computer-Aided Radio Dispatch System (C-ARDS) mobile digital communication system for its 32-vehicle fleet. C-ARDS was developed for and is used by Consolidated Natural Gas Co. and is being marketed to CATV operators by its CNG Energy Co. subsidiary.
- Acrodyne Industries of Blue Bell, Pa., received a patent for its new technique of digitally synthesizing composite analog broadcast TV video and audio signals. According to the company, broadcast transmitters with this technology will be twice as efficient as those currently in use.
- Finland-based Fiskars Corp. recently acquired RTE Deltec, a manufacturer of uninterruptible power supplies headquartered in San Diego. As a result, the company changed its name to Deltec Corp.
- Oak Industries signed a letter of intent to purchase all of the issued and outstanding shares of stock of Chip Supply Inc. of Orlando, Fla., for a combination of cash and common stock; Chip Supply provides monolithic IC chips for hybrid microelectronic components applications in aerospace and satellite markets. Oak also entered into an agreement with MIM Ltd., an investment manager in the United Kingdom, to purchase from Oak 7 million shares of common stock and a warrant to acquire 3 million more until Jan. 25, 1996.

This advanced TV monitor was used by Bell Communications Research, NASA and Southern Bell to record the launch of space shuttle Discovery March 13.

Bellcore seems to agree

By Gary Kim
Special Correspondent

> *"Most likely, fiber optics will not replace coaxial cable in the near future."*

CATV technologists aren't quite sure yet what their networks will—or ought to—look like in the future. A lot depends on what sort of business CATV is in. But there's one point upon which both CATV engineers and Bell Communications Research (Bellcore) seem to agree. (Bellcore is the research and development entity created by the regional Bell Operating Companies—RBOCs—in the image of AT&T Bell Laboratories.)

And the point of agreement is that, "Most likely, fiber optics will not replace coaxial cable in the near future but will complement coax wherever it is cost-effective. The decision is generally an economic one." Bellcore defines *near future* in this case as 10 years.

Bellcore sources also expect fiber-optic use to grow during that period, however. By the early 1990s, the industrywide CATV market could be $85 million for transmitters, receivers, fiber and connectors, Bellcore believes. More importantly, Bellcore also appears to believe that:

- CATV's existing coaxial cable plant is "underused"
- it is "relatively inexpensive"
- it "has the advantage of direct compatibility with consumer TV electronics"
- "the next generation of visual distribution networks will use both optical fiber and coaxial fiber..."
- "...with elements of tree-and-branch and switched-star topologies"
- topology must be matched to the service provided
- "the economics favor retaining coaxial cable systems"

Those are pretty interesting insights, coming as they do from the chief RBOC research and development unit charged with developing future technologies. More important: They exactly match the current thinking of top engineering strategists in CATV. Whatever the competitive business pressures, it appears that top CATV and RBOC engineers believe that optical fiber is a complement to the existing—and underused—RF coax network already in place.

None of which is likely to deter the RBOCs from installing fiber in their local loops. If, as many observers believe, all networks to the home will be broadband in the future, copper has to go.

And it won't be cheap. Estimates of telco local loop twisted pair range from 200 million to 500 million miles. If fiber costs only 30 cents a meter, that's $96 million to $241 billion just for the cost of cable—no electronics, no installation, no brackets, no trenching. If fiber costs 50 cents a meter the cost balloons to between $161 billion and $402 billion just for the cable.

Nor will fiber appear quickly. By some accounts, fiber will start to appear in the RBOC local loop in the 1997 to 1999 timeframe. Some of the RBOCs, BellSouth and Southwestern Bell in particular, claim that fiber will be cost-justified on voice service alone.

Demand for wideband

Be that as it may, RBOC strategists see a growing market for wideband services. Business users already are asking for wideband transport facilities and increasingly are building their own networks when they can't get what they want. Fortune 500 companies typically are asking for bandwidth to handle high speed, high resolution CAD/CAM (computer-aided design and manufacturing) data, medical imaging, LAN (local area network) interconnection and bulk data transport at 10 Mbps (megabits per second). Video conferencing and interactive video are other possible applications once the basic bandwidth is in place.

Consumer applications tend to run more to digital audio, video-on-demand or HDTV (high-definition TV) signal transport. In general, telco strategists believe the initial pull for wideband facilities will come from business clients, who will want wideband to tie together LANs and transmit bulk data. Video applications will develop later, most scenarios predict. But feverish work is under way today.

Bellcore's 1989 budget of over $1 billion annually (compared to Cable Labs' $8 million) was approved in mid-January. That hefty figure represents an 8 percent increase from last year's $940 million war chest and is the largest single-year increase in Bellcore's history. Between 20 and 30 people—some engineers, some regulatory analysts—work at least part of the time on HDTV transport issues, a Bellcore spokesman says. About 10 of those staffers work on ATV full time with a budget of about $2.5 million. AT&T Bell Labs is about three times bigger, with a budget of $3 billion (give or take a few hundred million).

Internationally, HDTV is getting increasing R&D funding from a number of quarters. Current reports place the 29-company, eight-nation European Eureka consortium HDTV research budget at about $200 million annually while the Japanese reportedly have spent $500 million or so to date. And alarmed at HDTV's implications for electronics in general, 16 members of the American Electronics Association have agreed to form a consortium to fund HDTV research. Zenith Electronics also has thrown its hat into the ring and the Defense Advanced Research Projects Agency has announced it will fund $30 million worth of research as well, mostly on display technology and reception electronics.

Video-on-demand?

Given the complexities of producing a consumer-friendly, multiple outlet video delivery system using digital switching and the telephone company's star architecture, some observers are skeptical about the feasibility of video-on-demand. American Television and Communications Corp.'s insightful technologist Jim Chiddix argues there's "something counterintuitive about video-on-demand...sort of akin to taking everybody's VCRs and putting them into a big, empty football stadium somewhere and charging you per event. I suspect true view-on-demand is decades away.

"If it really is a business someday, then we'll have to move to some form of active switching to get it delivered," Chiddix says. That's one of the reasons, incidentally, that Chiddix believes ATC's networks of the future will have backbone structures that resemble rings with hubs and spokes.

Digital or frequency modulation could be used for cable runs from headend to each of the hubs and from each adjacent hub to the next hub. With all the current work on coder/decoders (codecs), a 45 Mbps digital modem is a distinct possibility, Chiddix believes.

Such a network will have built-in redundancy, automatic switching and a high quality transmission path that can be cut over to a switched network in the future, should that be desirable. Nearer term, such a ring would open up new possibilities for services to business customers. The ring supertrunk also would ease the way for two-way services on the subscriber network, if customers want and will pay for them. Remember all those noise issues that plagued two-way plant with long trunk cascades? ATC's ring would solve that by confining coax runs to short distances and use a double-star (head-end-to-hub and hub-to-node) architecture to reuse the return frequencies from each node, conserving bandwidth.

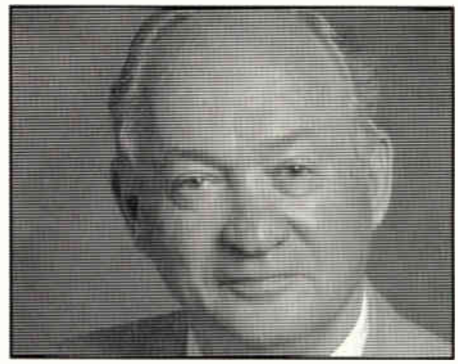
Near term, Chiddix doesn't see how it pays to take fiber very deep into the tree-and-branch network because "the costs go up exponentially once you go to three-, two- or single-amplifier cascades. It only costs $50 per sub to overlay a fiber backbone and get a four-amplifier cascade."

The results are impressive. With today's typical carrier-to-noise ratio in the mid-40s, carrier-to-intermodulation in the low-50s, 20-22 dB amplifier spacing and 25-40 amplifier cascades, 35-channel loading, and 11 dBmV tap output, a 10-mile headend to end-of-line cable run generally is possible. But once the cascades are shortened the math plays differently. You can increase reach, increase channel loading and run higher levels. "What fiber does is give you 1 dB/mile loss instead of 1 dB/100 feet," Chiddix points out.

CATV and Bellcore agree: CATV networks of the future will be hybrid affairs.

Pollution and probability

By Isaac S. Blonder
Chairman, Blonder-Tongue Laboratories Inc.



Passion burning bright may only serve to fog the sight. Good deeds from a good heart do not assure its counterparts. Concerted action for a cause often spawns repressive laws. Take heed, ye do-gooders; nature spurns the blind lookers.

This flight of fancy into doggerel verse is intended to define with some levity (and poorly concealed sarcasm) my views on the subject of pollution. As far back as I can remember, most of my contemporaries have disagreed with my dissertations on the scientific validity of the many threats to our environment and its effect on our health and happiness. At times, not only have I faced irate fellow scientists who expressed rather uncouth phrases about my knowledge and ancestry, but they have also implied that the pollution would improve in direct proportion to my distance from the scene. In truth, the effort needed to become an expert on each and every topic is beyond mortal man; I have had to resort to a debating dodge that is classically valid: If one can evoke a sound universal principle in evaluating each case of pollution, the task of defending your position becomes logical and irrefutable —unless your opponent belongs to the vast number of human clones alluded to in my bits of verse.

Probability is my lifeline. It is perfectly possible to list in descending order the probability for causing death, illness or discomfort from all of the known threats to humans. Naturally, as the probability decreases, so does the importance of its associated pollution. Thus the level of concern and expenditures should be geared to the mathematics. *Voilà*, to a scientist the road is clear, the hazards of incorrect judgments reduced and the priorities for the allocation of time and money to protect our environment are set by statistics and not emotion.

Gloom, doom and destruction

The road to reason, even for the clairvoyant citizen, is obscured by the impassioned research(?) papers highlighted in highly politicized publications dedicated to increasing their readership by predicting gloom, doom and destruction to our presently comfortable existence. If equally prominent professors on opposite sides of the question were given equal space in the media, an unskilled reader could gain enough knowledge on the subject to favor one side over the other and then hopefully to vote intelligently for the politician who will create the laws affecting the citizen's choice. But—a very large "but" —the other side of the scary science statistics is given short shrift by the media. If it doesn't sell papers or attract viewers, the other side doesn't get their chance in the sun. Even worse is the scorn heaped upon the industry or researcher who dares to contradict the self-righteous soothsayers of Armageddon.

Over the years, I have collected and treasured the infrequent articles by the kind of scientists that I feel presented their findings in a calm and reasonable format. I will try to present their views on pollution in an attempt to influence how we spend our tax dollars to achieve the maximum benefit to the inhabitants of the United States. However, the probability that these sane voices will be heard through my intervention is about as good as your finding a souvenir made out of genuine moon rocks in your local flea market.

The statistics and opinions, next to be unveiled, are culled and modified from many sources. If the conclusions run contrary to your knowledge and beliefs, study the subject in depth; if you still disagree, write a letter to the editor or burn the magazine—your choice!

As one author headed his paper—"Let us rank the hazards to human life and well-being." My bottom line is that the so-called hazards featured in the pages of yellow journalism are draining the economy of billions of tax dollars, better spent on the high-level hazards.

Yearly death rates are as follows: major cardiovascular diseases, 930,000; smoking related, 350,000; alcohol related, 97,500; motor vehicle accidents, 46,000; homicide, 19,000; radon, 13,500; medical X-rays, 1,100; cosmic radiation at sea level, 1,100, Denver, 1,800; all airplanes, 1,000; buses, 37; railroad, 12; nuclear, 0. The statistics are selected to demonstrate the degree of casualties against which one can compare the relative danger to human life not withstanding the hysterically headlined media exposés of pollution problems. I will try in subsequent columns to discuss rationally the following topics (in my opinion) of insignificant danger to the public: PCB, dioxin, saccharin, cyclamate, DDT, non-ionizing radiation, insecticides, nuclear energy, forest fires, ocean dumping, leaf burning, ozone hole, greenhouse effect, asbestos, animal hormones, radon, acid rain, incinerators, lead paint, fluorocarbon, peanut butter plus a few more, as I find the opposing comments by my kind of scientist. ■

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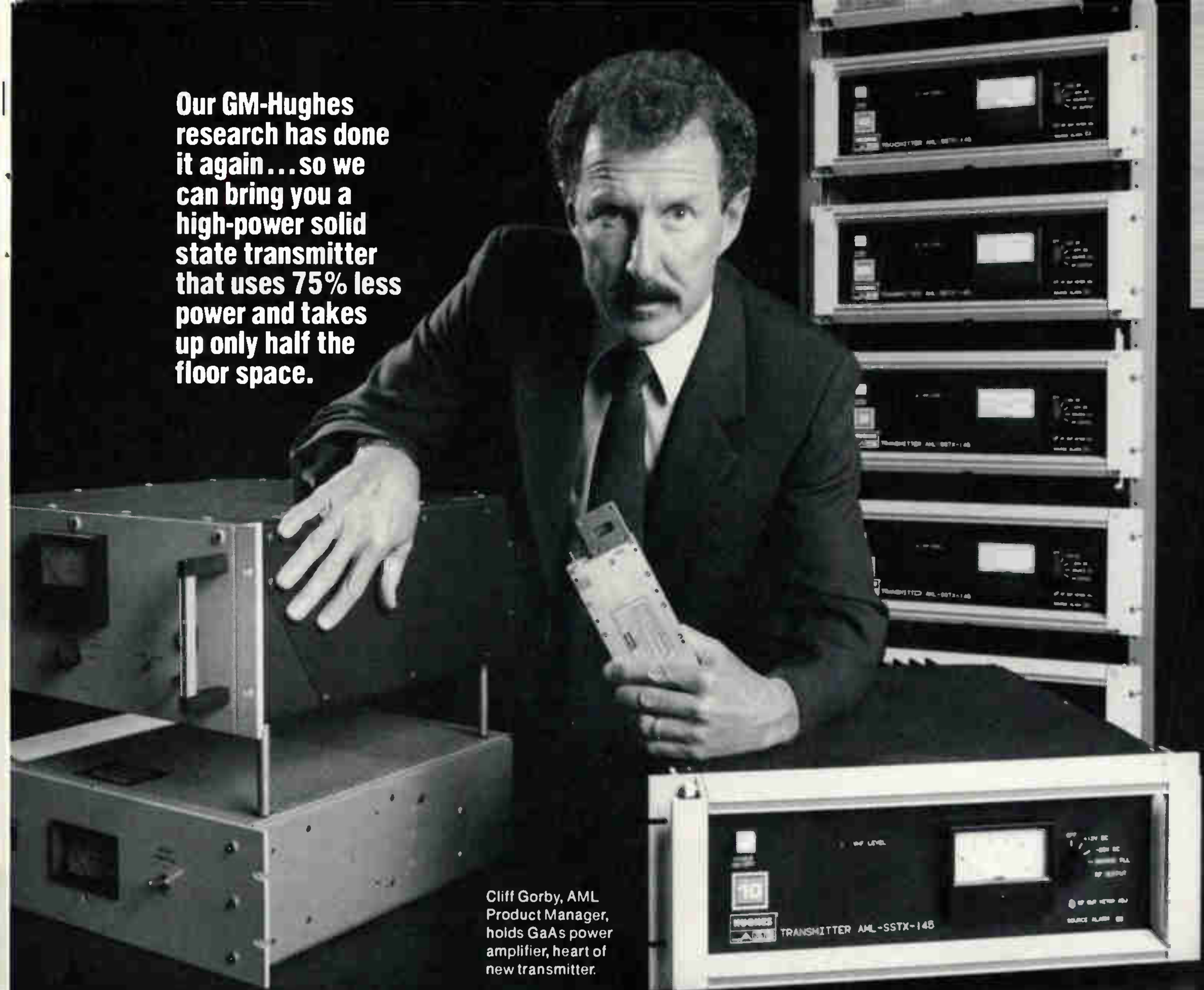

Cliff Gorby, AML Product Manager, holds GaAs power amplifier, heart of new transmitter.

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For more information, call Cliff Gorby or any of our AML specialists at Hughes Aircraft Company, Microwave Communications Products: (800) 227-7359, ext. 6233. In California: (213) 517-6233. In Canada: COMLINK Systems, Inc., Pickering, Ontario, (416) 831-8282.

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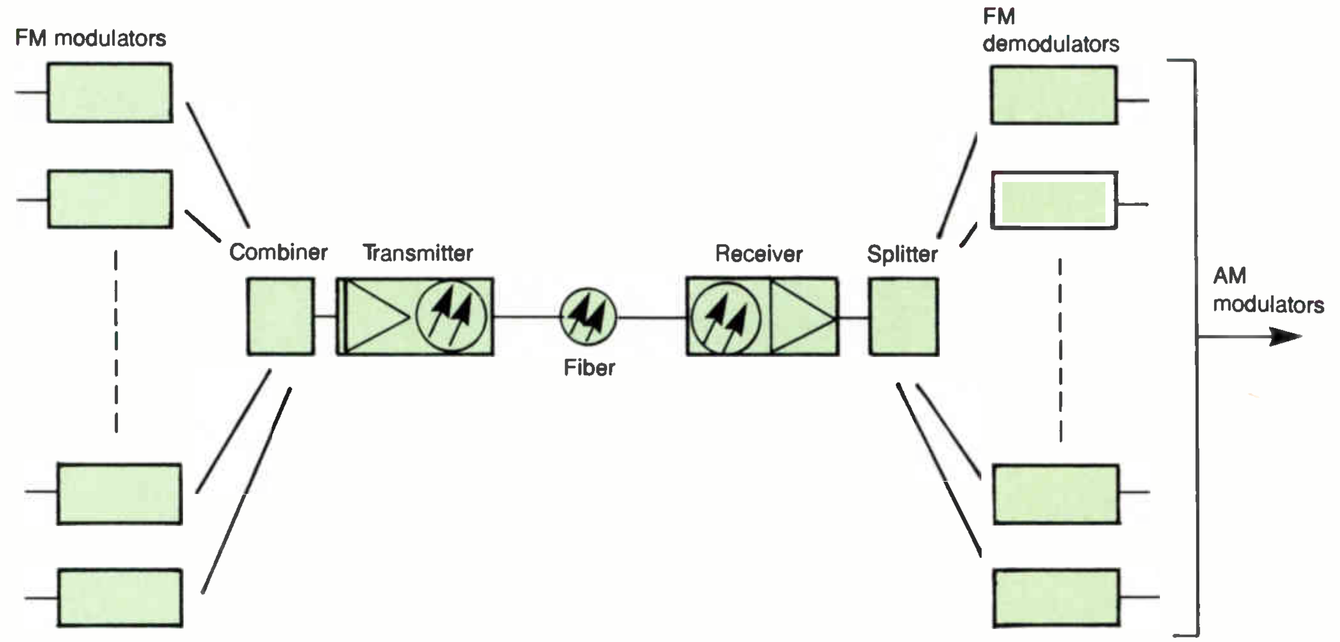
Figure 1: "Building block" structure of FM fiber system



One modulator and one demodulator are necessary for each channel.

Fiber-optic architectures

Courtesy Anixter Cable TV

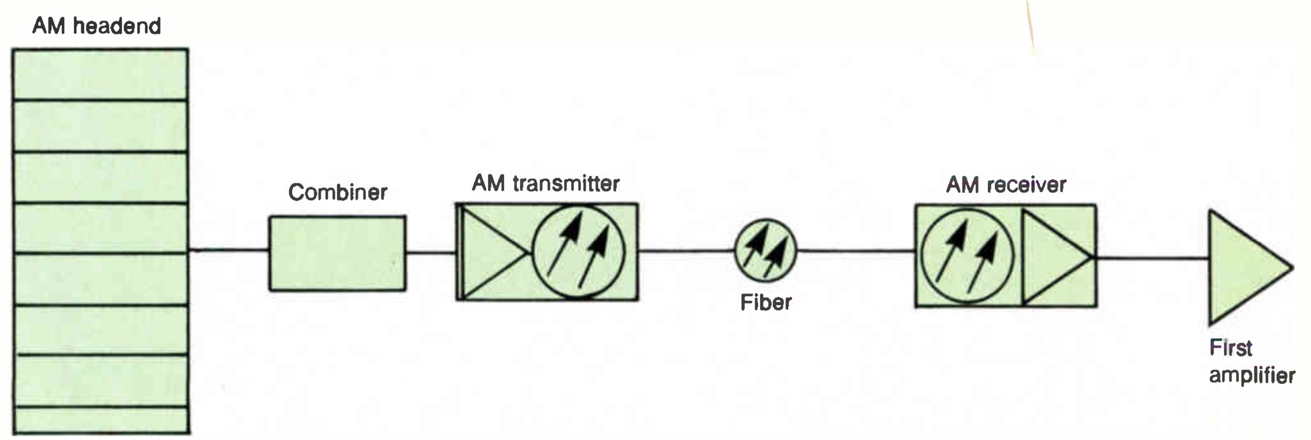
By Tom Schatz
Fiber-Optic Engineer, Anixter Cable TV

In 1985 the cable industry saw the first application of current fiber-optic technology in field use. Frequency modulated (FM) fiber systems were developed first because of the quality of lasers available at that time. Their main application then and now is FM supertrunking of channels from one headend to another. Technologies such as distributed feedback (DFB) lasers, amplitude modulated (AM) fiber systems, multiple laser systems, higher power and more linear lasers, status monitoring, RF switches and higher fidelity modulation techniques have since been developed and are in common use. We will explore the various applications of fiber optics and some architectures in use today with currently available technology.

FM considerations

Until 1988, FM was the most practical fiber technology for the cable industry; today it still has some distinct advantages in certain applications. Due to the nature of FM, it is much less susceptible than its AM counterpart to non-linearities in the laser. As a result, the inexpensive, higher out-

Figure 2: AM fiber system configuration

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put Fabry-Perot laser can be utilized. This laser offers good optical launch power and performance specifications. A high available optical loss budget allows for some cost savings by reducing the number of transmitters required. This is accomplished by using an optical directional coupler to split the transmitted FM lightwave signal and feed multiple receive sites.

FM does have its problems, however. The biggest stumbling block is the need for FM modulators and demodulators for every channel. This creates many challenges for the system operator. An increase in equipment means increased requirements for headend space, shorter mean time between failures and higher costs for maintenance and power consumption. The equipment must be mounted in a climate-controlled environment. Additionally, the signal must be converted to AM before going into the coaxial trunk and feeder network. This additional requirement for a remote headend adds the associated costs of land, building, maintenance, security, utilities, standby power, air conditioning, etc.

Another problem is the inability to transmit scrambled signals. This is currently being addressed by FM manufacturers and may ultimately be resolved. But for present applications, additional encoders are required for remote headend sites introducing added complexity to addressable systems.

FM transmission over fiber is ideal for many applications. Its high optical loss budget makes it the technology of choice for long distance applications such as rural headend interconnects and amplitude modulated link (AML) replacements. The "building block" structure of the FM system (Figure 1) also facilitates cost savings for low channel count applications, such as local origination, ad insertion and direct network affiliate feeds.

An application unique to FM is a remote satellite receive site. Here the output of a low-noise block converter is used to modulate the laser, facilitating remote location of satellite dishes. Because satellite transmissions are already frequency modulated, implementation can be very simple and cost-effective. This is especially useful in areas of high terrestrial interference.

AM possibilities

In 1988 the first practical AM fiber systems were being developed, demonstrated and installed. The introduction of an AM system added a new dimension to the arena of CATV, offering the industry the ability to upgrade bandwidth, extend plant farther, boost signal quality and improve system reliability much more economically through reduction of amplifier cascades.

"A hybrid AM/FM system architecture could be the best way to provide greater bandwidth and good signal quality over a large geographic area."

The AM system's biggest advantage is that it is compatible with existing CATV AM headends, distribution equipment and all scrambling methods. No additional signal processing equipment is required at the transmit or receive site, eliminating the cost of building and maintaining an additional headend. It also allows for greater flexibility in design because the receiver is strand-mounted and interfaces directly into existing (or new-build) coaxial plant.

AM lightwave is relatively simple from the CATV perspective (Figure 2). The output of the existing headend combiner is the RF input to the transmitter. The output of the optical receiver can be the input to the first amplifier of the coaxial plant. The AM applications can be distance-limited by the optical powers of the transmitter.

AM laser systems in general have an optical loss budget well below that of FM and, as a result, they are currently limited to shorter distances than FM. The two major distance-limiting factors are the channel loading on the transmitter and the length of the amplifier cascade being fed by the optical system. A single transmitter can be used to feed several locations more economically by splitting the optical output, thus reducing channel load. However, total insertion loss contributed by the optical splitter reduces the optical budget by approximately 4 dB and the splitter becomes a limiting factor itself.

Longer distance AM transmission may eventually be achieved with improvements in AM laser operation specifications, due to advances in technology and laser production techniques.

Applications of single-laser AM systems are still being developed. The most common is in cascade reduction to improve performance and/or increase bandwidth. Other popular applications are plant extensions, interconnects, AML microwave replacement and the consolidation of multiple headends.

Another AM design approach utilizes multiple lasers to transport the full bandwidth. This theoretically promises lower distortions and longer distances than a single laser with the same channel loading. The use of multiple lasers and octave loading of the lasers require recombining the outputs of the optical receivers. This is accomplished through the use of a filter network to eliminate the out-of-band noise floor of the receivers before being combined.

A number of performance specs must be rigidly adhered to in the filtering process: filter crossover point bandwidth, phase differential near the crossover point, signal levels at the crossover point and stability of the filter in an outdoor environment. If these factors are not addressed, the multiple laser AM receive site might have to be located indoors, crossover frequencies vacated and/or channel assignments changed. →

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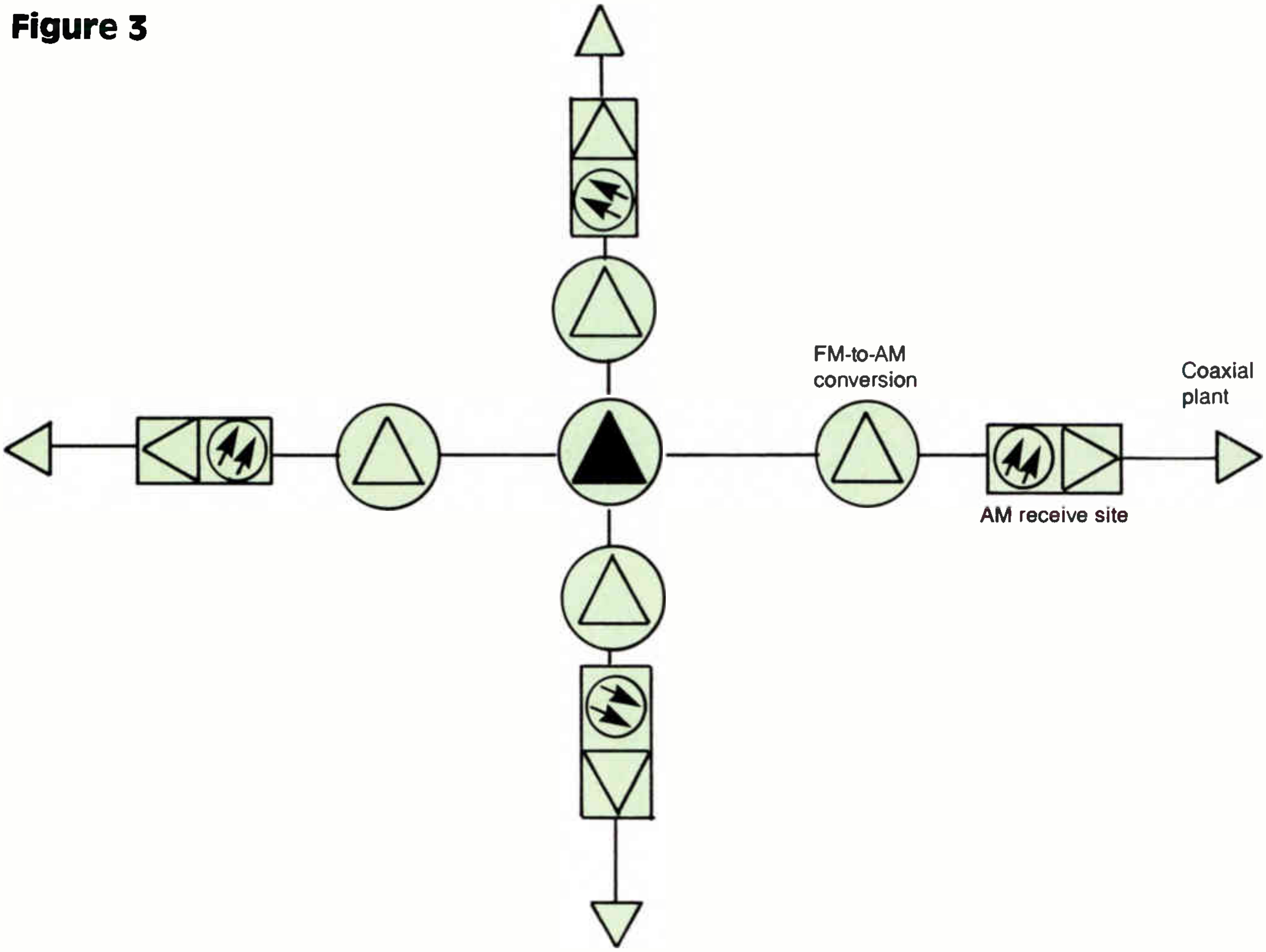
Figure 3



Hybrid configuration is capable of approximately 35 miles to the end of the system. The result is approximately 3,500 square mile coverage.

All of these technical issues are being addressed in research and development efforts that will give a multilaser system the ability to extend a 450 or 550 MHz plant further than current single-laser AM. This will give AM the distance capabilities of FM and increase applications as a result.

Implementation architectures

A hybrid AM/FM architecture could be the best way to provide greater bandwidth and good signal quality over a large geographic area utilizing current technology. This approach (Figure 3) uses FM fiber trunking to serve multiple headends, AM fiber into residential areas and coax into the home. In this manner, a cable system could serve approximately a 3,500 square mile service area.

Two major fiber architectures that have emerged are the American Television and Communications fiber backbone and the Jones Intercable cable area network (CAN) concepts.

The intent of the fiber backbone is to achieve greater reliability and increase signal quality and/or bandwidth for enhanced services. This is accomplished by deploying AM fiber technology to a node location (eliminating 10 to 35 amplifiers in cascade) and reversing the last four or five amplifiers to face the headend, thus limiting the cascade between the node site and the customer to five. Because of this reduction in active electronics, the benefits of greater channel capacity with less distortion and enhanced reliability are immediately realized.

The Jones CAN adds a redundant RF path by leaving all of the amplifiers in the forward direction and using an RF switch to enable the coaxial path should the primary optical path go out of service. The CAN routes the fiber parallel to the coax but on a path several blocks away. This helps to eliminate the possibility of cutting both the primary and secondary transmission paths. In order to monitor the status of the RF switches, a low-speed data return path also has been incorporated.

In addition to these technologies designed to reduce outages, there are several other methods used by the telephone industry. These include hot standby lasers that are enabled when the primary lasers go out of service, optical switching to redirect signals and redundant fiber paths with loop redundancy that allows for two fibers to each node via different routes. Future CATV applications may well incorporate some of these techniques.

Alternate uses

There are many possible uses for fiber in addition to cable service delivery. Two of these are 1) direct analog program feeds from local off-airs and program originators and 2) digital video feeds from traditional satellite-distributed programmers via long distance digital telephone lines. The list of uses can be expanded to include such revenue-generating sources as: leasing "dark" fiber (fiber without electronics), leasing fiber systems to local broadcast affiliates to replace their studio-to-transmitter microwave links and installing and operating an alternate access voice-data network to allow local users an alternate access to their long distance phone company. Many of these applications are being used by the CATV industry at this time and are responsible for significant incremental revenues.

In today's industry, the push for better signal quality, higher bandwidths and enhanced services is coming from cable franchise boards, competitors and—most importantly—from our customers. Our ability to achieve these higher bandwidths is limited by the performance of coaxial plant technology. By implementing AM and/or FM fiber in trunk design, we will have the future ability to transport an almost unlimited bandwidth deep into the cable system. Once this bandwidth is available, developments already under way in coaxial products may make higher bandwidths at the home become reality.

Selecting a boring device

By Mike J. Cole
Technical Consultant, Carlton International

One of the most frustrating jobs in construction is the efficient placement of underground cable or conduit beneath a paved surface using boring equipment. To make matters worse, the common alternative to boring—namely, cutting the street—is becoming more unattractive, very expensive and sometimes prohibited. Cities are passing ordinances that either outlaw street cutting or regulate exactly how a street must be repaired. Following these guidelines can cause repair expenses to increase two to five times above previous costs.

Like it or not, the day is coming soon when boring may be the only alternative allowed. There have been some significant advances in the methods and devices used to bore under paved surfaces. Becoming familiar with these improvements and options can help save a substantial amount of time.

User considerations

Before choosing what type of boring equipment to employ, there are some considerations that should be evaluated:

1) What is the intended use? Estimate the widest range and frequency of bore diameters and length.
2) What is the anticipated range of soil and rock conditions?
3) How much time will be involved in completing the bore, as well as setup and takedown times?
4) What are your accuracy requirements? Evaluate devices based on the percentage of successful bores experienced by users.
5) How safe is the unit to operate? Are there any injuries on record?
6) Is the device user-friendly and simple to operate?
7) Is it operator-sensitive to buried utilities?
8) Will an external power source be required? If so, at what cost?
9) How easy is the device and power source (if applicable) to maneuver or transport?
10) What is the durability and estimated life of the device?
11) What kind of technical support is available from the dealer or manufacturer?
12) Does the boring process compact the soil or remove the cuttings?
13) How much operating space does the device require?
14) Does the unit have the capability of assembly line performance; i.e., rapidly boring one hole and quickly moving to the next site?
15) What is the cost of a complete system capable of meeting your entire range of needs? Price the system with and without an external power source (if applicable).
16) What are the experiences and opinions of a variety of users?

Based on the answers to these questions, you should have sufficient information to make a decision. Finding the best device for your needs can translate into significant savings.

Categories

Five major categories of boring equipment are GLRB (ground-level rotary boring) devices, pneumatic and hydraulic missiles, hydraulic pushers, boring attachments to trenchers, and track or pit machines. Let's discuss each of these.

GLRBs: There are several different variations to these devices. One successful approach combines the high speed of a drill stem (400-600 rpm) along with a simple but accurate aiming device. GLRB devices use bits and a drill stem to cut and then remove (using water to flush and then swabbing when needed) those cuttings from the hole.

Because GLRBs operate at ground level they need a starting trench that can be as narrow as 4 inches to allow the drill stem to flex down to the required depth. The same trench used to install the cable can serve as an ideal starting trench. When using the existing trench, setup time plus boring time for a 30-foot trench (in clay) will normally be under 15 minutes.

Some manufacturers of GLRBs offer a wide selection of bits that are specifically designed for nearly every kind of soil or rock condition. The proper selection of a bit combined with an effective aiming device will enable GLRBs to complete bores at distances exceeding 150 feet. This success can be achieved within the full range

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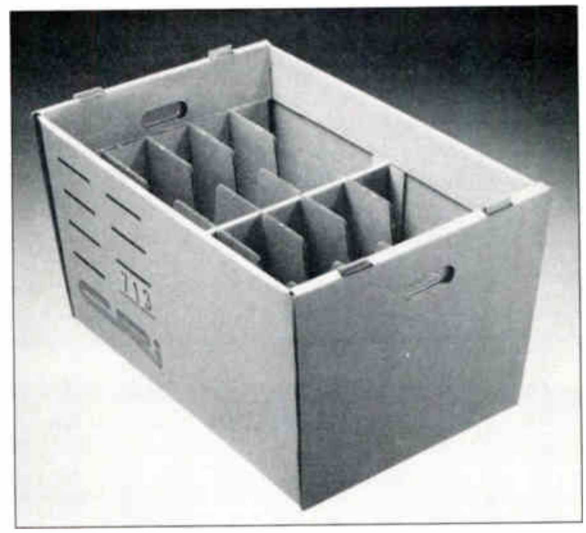

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of boreable conditions, even though the device has the deceptive appearance of not looking very powerful.

Missiles: This popular method of boring actually produces a hole by piercing through the soil. Although some models are hydraulic, the majority are pneumatically powered. When it is necessary to work within a restricted space as short as 8 feet there currently is no alternative other than a missile. These devices are simple to operate, require the least amount of manpower of all the devices available and can continue to operate without human supervision. However, this is not advisable because missiles can be deflected and exit through the pavement.

Make sure you select a model that has a reversing feature; this will help avoid the chance of having to abandon your missile if it were to dive. Diving is caused when a missile is deflected downward by a hard object or encounters muddy or boggy conditions while traveling beneath the pavement. Missiles work best in compressible soils but can penetrate almost all soils and small rocks. However, these devices will not work in solid rock, rocky conditions or non-compressible clays.

You should follow manufacturer specs regarding minimum depth of operation in order to avoid buckling the pavement. An electronic locator is also available and will enable you to determine the depth of the missile.

Hydraulic pushers: These devices share most of the same advantages and disadvantages that missiles have because they also share the compaction method used to produce a hole. One advantage that pushers have compared to missiles is that there is no risk of losing an expensive piece of equipment. You also will have the ability to produce a wider choice of diameter holes.

An external power source for the hydraulic pusher is also much less expensive. Although the operator would need to take precautions to avoid contaminating the hydraulic fluid system, it is common to use a backhoe or trencher as a hydraulic power source. When this is done, however, the trencher or backhoe will be immobilized and unable to continue its designed function.

Boring attachments to trenchers: This is a popular choice and a very affordable option for those companies that currently own a trencher. These attachments also are less likely to be deflected from their target. The normal speed of the drill stem is somewhat less than 100 rpm (much larger trenchers can approach 150 rpm) and it is difficult to accurately aim the drill stem. These two factors will result in accuracy levels that progressively drop off as distance increases.

Attachments share the need with GLRBs to have adequate space (minimums of 25 to 30 feet if depth is at least 3 feet) within which to operate. However, GLRBs, because of their light weight, tend not to cause any turf damage; they are also very maneuverable, unlike the much heavier trenchers.

Although boring attachments can be operated with or without water, several manufacturers state that wet boring adds greater flexibility. Once the pilot hole (2 to 3½ inches) is completed, progressively larger holes are achieved by compacting the soil rather than removing it.

Track or pit machines: Many of these devices are not very practical for laying cable. For one thing, the setup and takedown times are excessive. Also, because of its weight, virtually every track or pit machine will require a backhoe to move. Most devices are wet bore and, because they operate in a pit, the operation can be very muddy.

However, in limited operating space and very difficult rock conditions they do have their place. It is very important that you consider units that turn the drill stem at speeds in excess of 150 rpm. The higher speed will produce much better accuracy than units that turn below 100 rpm. In order to get these higher speeds you need a hydraulic source capable of producing at least 18 to 20 gallons per minute. If you do not have a large trencher or backhoe, you would then need to purchase a hydraulic system.

Logical approach

The information in this article has been collected from various manufacturers and both current or former users of devices representing each category. Also, it may not encompass every available device or every consideration that should be made before a decision is arrived at. However, this analysis is meant to provide a logical approach to finding the most efficient method to solving your underground construction needs.

By far the most important consideration you should address is talking to the end user. This will be the best way to get a clear picture of what you should expect.

Construction and the soil: What it's like down there

By Wayne Sheldon
President, Sheldon Electronics

In order to do an effective job of installing and maintaining buried plant, some knowledge of soils is required. We will concern ourselves with the top four feet or so of the surface of the Earth, the properties that directly relate to the burying of cable and the long-term effects on cable and other hardware.

Almost all land surfaces are covered with unconsolidated debris called *regolith*. This mantle above the bedrock varies greatly in depth. It may be negligibly shallow or hundreds of feet deep. Also, its physical condition and chemical composition may vary greatly, even within restricted areas. *Soil* is commonly defined as a natural body, engendered from a variable mixture of broken and weathered minerals and decaying organic matter that covers the Earth in a thin layer. It is obvious that the inorganic components of a mineral soil are broken fragments from the rocks near or at the Earth's surface.

The mineral particles of the soil are generally classified according to size as follows:

Class	Size	Type of soil
1) Very fine	Visible only under electron microscope	Highly colloidal clay particles
2) Fine	Visible under ordinary microscope	Silt particles
3) Coarse	Visible to the naked eye	Sands of various sizes
4) Very coarse	Up to several inches in diameter	Stone and gravel

In the construction business, particles larger than #4 and up to a diameter of many feet might be called "rocks," "god apples," "boulders" or a variety of unprintable terms, depending on the situation at hand.

Stone, gravel and sand, because of their relatively large sizes, function as separate particles. They are irregular in shape and may be either sharp or rounded, depending on the amount and severity of rubbing over the eons. Without clay or silt, they have very low plasticity and almost no cohesion. As a result, they are influenced only slightly by changes in moisture content. Soils containing mostly sand and/or gravel, therefore, have an open character and are generally in a loose, friable condition.

A close examination of any soil will reveal the presence of tiny holes and voids of varying sizes and shapes. These occur more or less uniformly throughout, not only between the large solid particles but also between and within the clumps and small granules that the finer particles tend to form. These tiny spaces, which are variable with regard to continuity, size and total proportional volume, are occupied in large part by water and air. Because of the action of the water itself and the absorbed carbon dioxide and other substances that it always carries, dissolving of various minerals and chemicals occurs continuously. For this reason soil water contains many soluble salts, many of which are destructive to cable and hardware.

The presence of silt and especially clay in a soil gives it a fine texture. Due to their colloidal state the clay components in soils are highly plastic; when combined with the proper amount of water, they become sticky and soft. On drying they shrink with the absorption of energy and become extremely hard and cloddy. When it becomes wet again, swelling occurs with the release of heat. The expansion and contraction of wetting and drying are very great. The absorptive capacity of clay material for water, gases and soluble salts is very high. Silt has some plasticity, cohesion and absorption capacity but to a lesser amount than clay.

Mechanical forces

In addition to the chemical action and the swelling and shrinking due to wetting and drying, soils are continuously on the move because of a variety of mechanical forces. The mantle on slopes, no matter how gentle the slopes are, is subject to a slow but continuous downhill movement known as *creep*. The main moving force is gravity. On even a moderate slope, the weight of the loose material creates a tendency to slide or flow. When the soil is soaked by rain, irrigation, etc., the water contained in the pore spaces adds greatly to the weight and also lubricates the entire mass, thereby decreasing the friction that retards motion. Gravity acts continuously and even if movement is almost infinitesimal in the course of a year, over a period of several years the total movement may be considerable.

Many factors contribute to creep. In regions that have cold winters, water in the soil tends to separate from the mineral particles and freeze into layers of clear ice between layers of soil. Since ice causes an addition in volume there is uplifting of the surface. This action is called *frost heaving*. On a hillside the surface of the ground is lifted at approximately right angles to the slope. When thawing occurs each point tends to drop vertically instead of returning to its former position. Another factor is that plant roots in their growth tend to wedge material downhill and cavities formed by decay are filled from the uphill side.

Although the rate of creep is slow, in most situations it is readily measurable. There is a case on record where a railway was repeatedly damaged. The rate of creep was estimated at 10 feet in 50 years. That is almost 2½ inches per year. The rate of creep may vary greatly between places only short distances apart. Also, creep occurs fastest near the surface and is progressively slower the deeper into the soil you go. A more severe problem occurs in hilly and mountainous areas when large masses of earth and rock slide bodily down slopes, sometimes abruptly and destructively, other times so gradually that trees continue to grow almost undisturbed.

Large landslide masses that consist mainly of loose material usually move by a mechanism more complicated than simple sliding. The movement almost always starts while the mass is saturated with water from heavy rains or melting snow. Water greatly increases the weight of the mass and also converts all the clay in the soil into a stiff mud. There is usually localized flowage at varying rates in such a mass, although occasionally the entire mass as a whole may slide on a lubricated base. Some masses of this kind move slowly and spasmodically for many years. An easy way to detect these areas is that the trees growing there probably will be tilted at various angles and much of the surface has a characteristic hummocky shape.

Most of the previously described movements are greatly exacerbated by roadway cuts, irrigation projects, home building pads and so on. Other mechanical forces causing motion in soils include earthquakes and the vibrations from trains and heavy trucks nearby.

As we can see, the surface of the Earth is active both chemically and mechanically. Does this mean that it is impossible to economically build and maintain an underground system? Not at all. It just means that you must use common sense in planning and construction. You would (as a ridiculous example) avoid routing your headend trunk run through the middle of an active slide area. To do so would guarantee a major outage when the soil moved and as a consequence pulled your cable apart.

Working with different soils

With soil consisting of *mostly clay and containing only small rocks* under one inch, you can expect the following: When very wet the soil is extremely sticky and does not work well. When trenched, the spoil tends to ball up in trencher teeth and pull back into the trench. The soil tends to flow easily and the trench may close or cave in after a very short time. It is almost impossible to get good backfill. While it is fairly easy to plow, usually you can't get traction to pull the plow. Spoil removal drilling does not work well, since it will not cut into small enough particles to flow from the hole easily. With expansion drilling it is easy to get the drill through, but you might need to pull the conduit in immediately, since the hole may flow back closed if you don't. In both cases if you remove the drill for some reason and have

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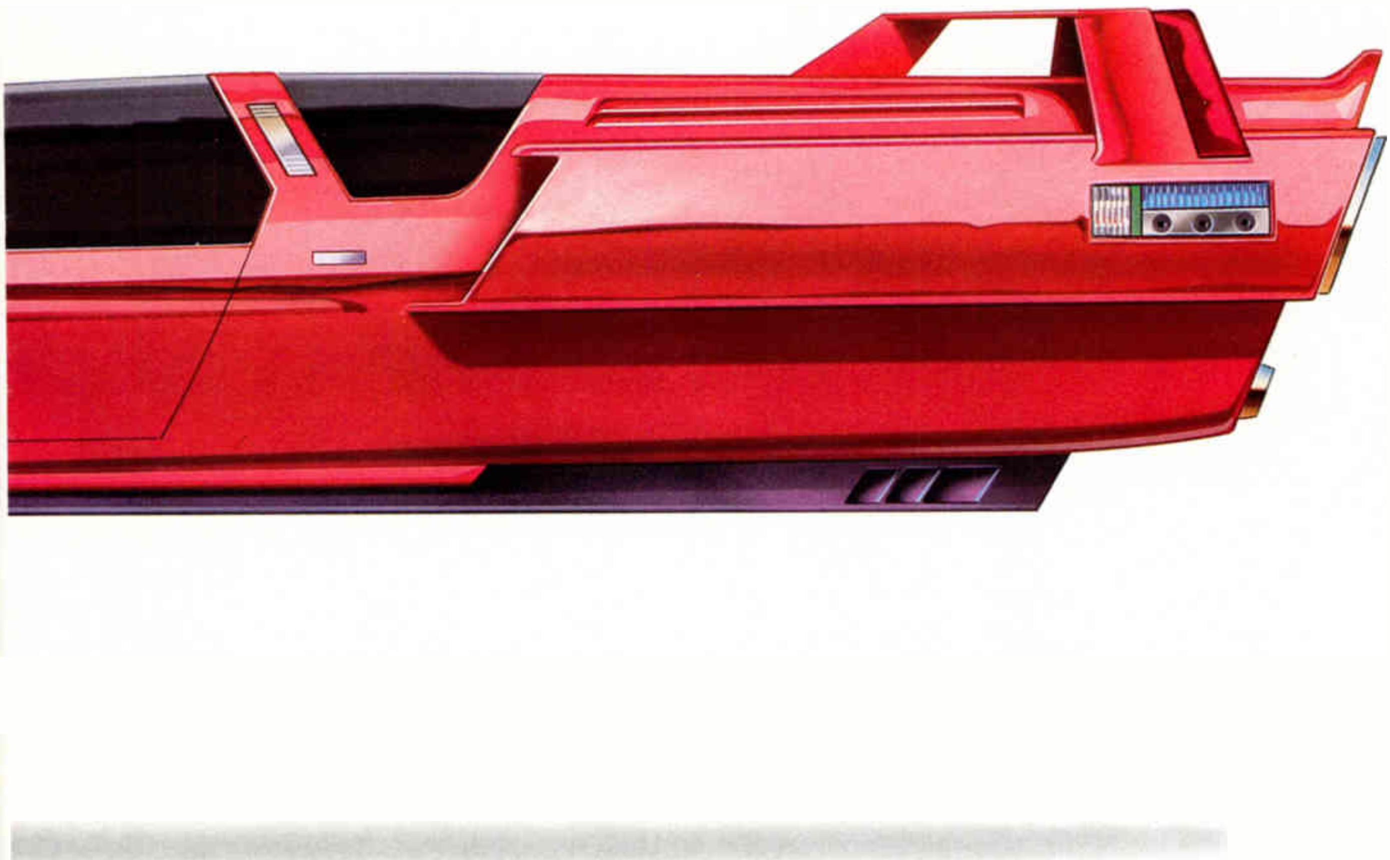

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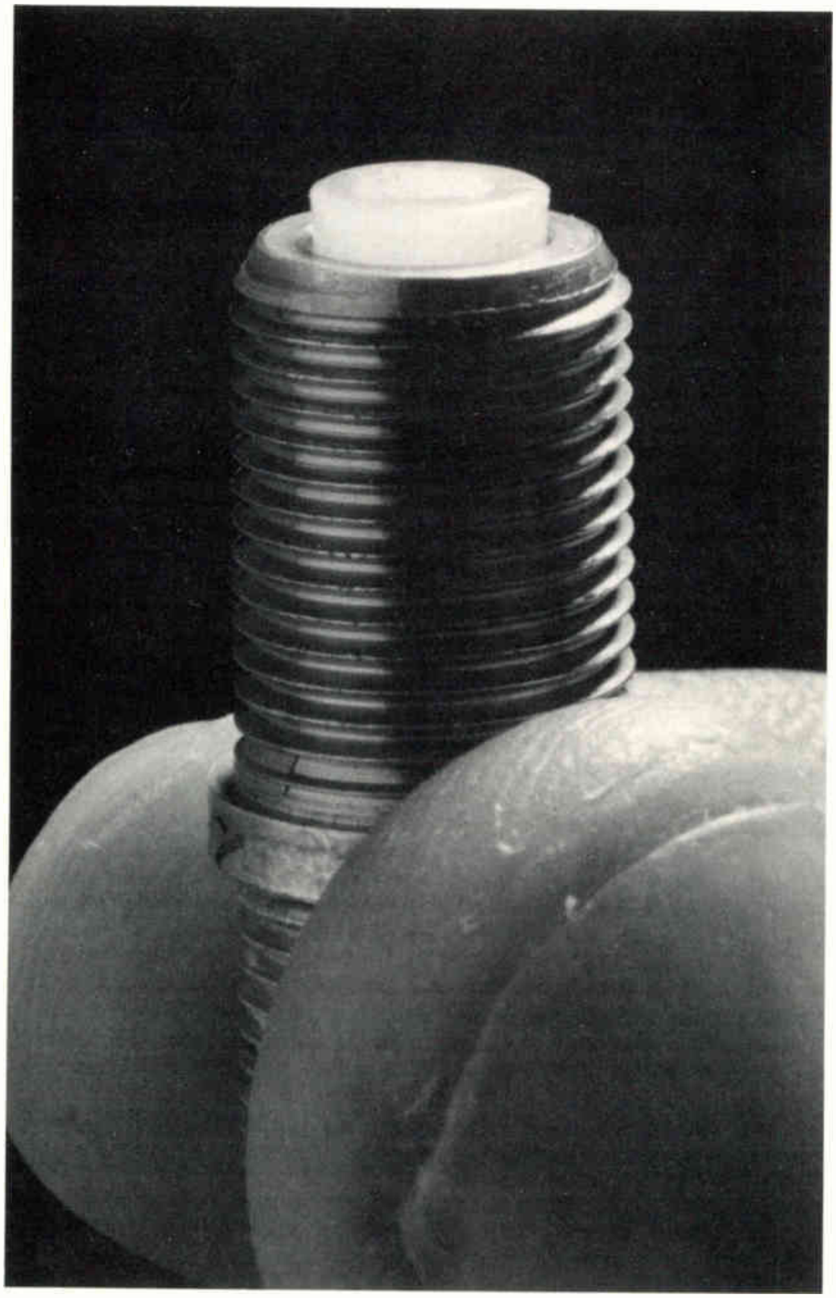

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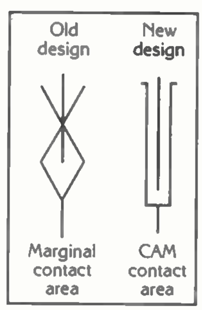

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to re-enter the same hole, the drill may not follow the original hole. If at all possible you should plan to do your construction in this type of soil for the time of year when it is drier, even if you must do it out of your normally planned schedule. (However, make sure you are not prohibited by city ordinance to remove soil with a bore.)

When moist this soil works easily. It trenches readily, leaving a clean trench that will cave in only if crossed by heavy equipment. The trench backfills easily and the soil plows readily. Both spoil removal and expansion drilling work well. However, an expansion drill hole can shrink considerably over a period of several hours.

When dry this soil is very hard. It trenches readily with special teeth and leaves a clean hard trench that backfills easily. It can be plowed but it takes a lot of power. Spoil removal drilling works very well, leaving a clean smooth hole. Expansion drilling works only with great difficulty.

This type of soil, but *with large rocks*, is very similar. The main difference is that drilling any distance probably will not be successful.

Silt soils are similar but are not as sticky when wet and do not become as hard when dry. Spoil removal boring works well but expansion boring is more difficult, although still possible. Trenches tend to cave in somewhat easier.

Predominantly sandy soils exhibit many different characteristics, depending on whether sand is round or sharp. Moisture content has much less effect than on clay or silt soils. These soils are easy to trench but trenches tend to cave in very easily. Sometimes conduit must be fed in directly behind the trencher to get it in place before cave-ins occur. These soils tend to plow well. Spoil removal drilling works well (with some precautions), but expansion drilling does not. Even if you can get the drill through, the soil tends to fracture and the hole caves in almost immediately, especially when dry. If there is not binding clay and silt in the sand, it will flow when dry. Trenches tend to be 6 inches wide at the bottom and 6 feet wide at the top. Plows work well, especially the vibrating type. As for drilling, it can be done only with special techniques and equipment.

Gravel soils, like sand, do not trench well, since the trenches tend to cave in as fast as they are dug. Vibratory plows tend to do a good job but drilling is a lost cause.

There is an infinite variety of soils and conditions to be overcome. In general, if you examine a sample of the soil, you will be able to judge how it will handle and get no great surprises.

The long-term durability of buried cable depends on many things, most of which you can control during construction. As long as the jacket of the cable is intact with no cuts, scrapes or pinholes, there can be no chemical reaction between the aluminum sheath and the soil. As noted before, the soil is constantly in motion, however slight. Any sharp stones contained in the soil and touching the jacket will eventually poke a hole in it. Then the dissolved salts in the soil will start to eat at the aluminum and will in the short term corrode pinholes through it. From then on it's all downhill for your cable; soon, you will need to repair or replace it. Clay soils have by far the greatest chemical reaction potential but all soils are somewhat corrosive to aluminum. On a rebuild in a mobile home park we replaced several thousand feet of direct buried cable. The soil was heavy clay containing many sharp stones and was constantly being cycled from saturated to dry and hard. The expansion and contraction over five years completely ruined the jacket. One piece we dug out had 10 holes visible to the naked eye in approximately 1 foot of cable. Many people would blame the gophers, but it was not; it was a mistake of the contractor.

Large rocks or clods in the soil can dent the cable, especially if great care is not used on backfill during construction. While such dents may not individually cause any major problems, they still reduce the return loss. Many times after getting an echo on a TDR (time domain reflectometer), I have dug up a cable and found large dents in the sheath where it had been laying against a rock. (If you think this is a recommendation for using conduit, you're right.)

References

1) *Physical Geology*, Longwell, Knopf and Flint, John Wiley and Sons Inc., 1948 (third edition).
2) *The Nature and Properties of Soils*, Lyon and Buckham, MacMillan Co., 1947.

This article appeared in the January 1980 issue of "CATJ."

Installation of fiber cable

By Sanford D. Lyons
Sales Engineering Manager, Siecor Corp.

In just over a decade, fiber optics has proven to be one of the most reliable, simple and cost-effective transmission systems available for several communications industries. In order to ensure the same success and reliability is achieved in the CATV industry, it is important that the design of the cable match the application. The correct cable construction and installation method together provide the necessary long-term dependability afforded by fiber—from the rigors of placement through the cyclic changes of the environment.

Figure 1: Step index profiles
a) Standard step index profile (simple step index or matched cladding)
b) Step index profile with reduced refractive index in the cladding (depressed cladding)

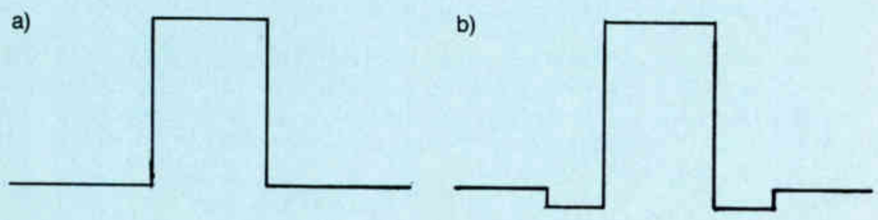
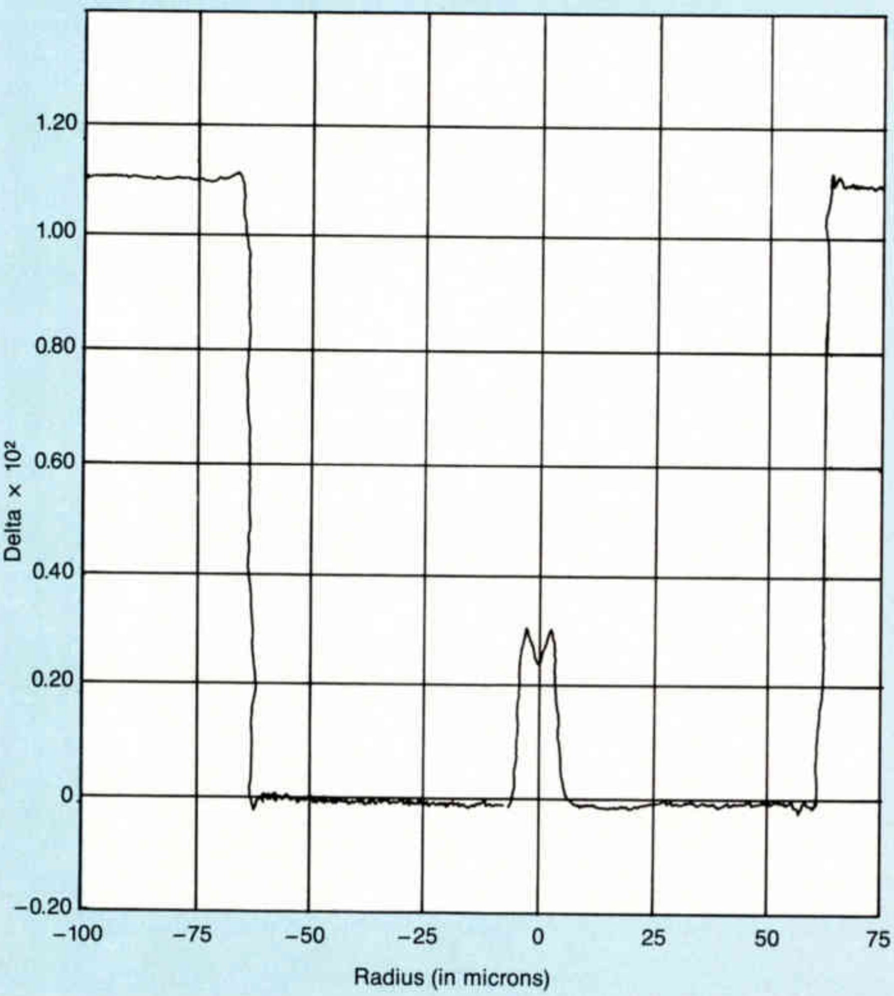


Figure 2a: OVD (matched clad) refractive index profile



Advantages of fiber technology have been proven for CATV, where fiber has been used to carry signals from satellite downlinks to headends, headend to headend and headend to hub. And the potential exists for fiber to be placed even deeper into the system. Fiber users in CATV note several advantages of optical technology: reduction of amplifiers in the cascade, elimination of signal leakage, lower maintenance costs, higher reliability, improved signal quality and increased bandwidth/channel capacity. Yet another advantage is cable life. In most communications industries, fiber has been used consistently and successfully for over 10 years. The inherent properties of fiber are such that, if properly cabled and installed, the life of the cable could exceed 40 years, surpassing the standard 15-year requirement of most CATV companies. Factors that may reduce cable longevity include: materials used to house the fibers and external stresses that may appear during the manufacturing, installation and under environmental loading. The overall success of a fiber system will be dependent on fiber type, fiber construction, cable construction and installation methods.

Single-mode fiber

The vast majority of CATV applications call for single-mode cable, due to its low loss and high bandwidth/channel capacity characteristics. Multimode fibers normally are too limited in their ability to carry the large amounts of information required. The most common high quality fibers used are single-mode with attenuation less than or equal to 0.5 dB/km at 1,310 nm and 1,550 nm, bandwidth in excess of 2 GHz.km at 1,310 nm, and dispersion less than or equal to 3.1 ps/nm.km from 1,285 nm to 1,330 nm and typically 17 ps/nm.km from 1,500 to 1,550 nm.

While several methods of manufacturing high quality fibers exist, the two primary methods are outside vapor deposition (OVD) and inside vapor deposition (IVD). Vapor phase deposition is a method of doping fused silica glass with metallic halides in order to establish a desired refractive index profile. Refraction is a deflection of the light's path of travel through the glass fiber. Index of refraction is the ratio of the speed of light in a vacuum to the speed of light in the glass. The lower the refractive index, the faster the light travels. The refractive index profile depicts the change in the refractive index across the fiber's core, core/cladding interface and the cladding. For light to propagate properly in a single-mode fiber, the refractive index of the fiber's core must be slightly greater than that of the cladding at their interface. The net result is a step index profile for either depressed or matched clad fibers.

IVD was a first generation commercial product developed by Corning Glass Works in the early 1970s; the process has since been licensed by several manufacturers. Fiber manufacturers

"The strength member of a cable should not be confused with its central member."

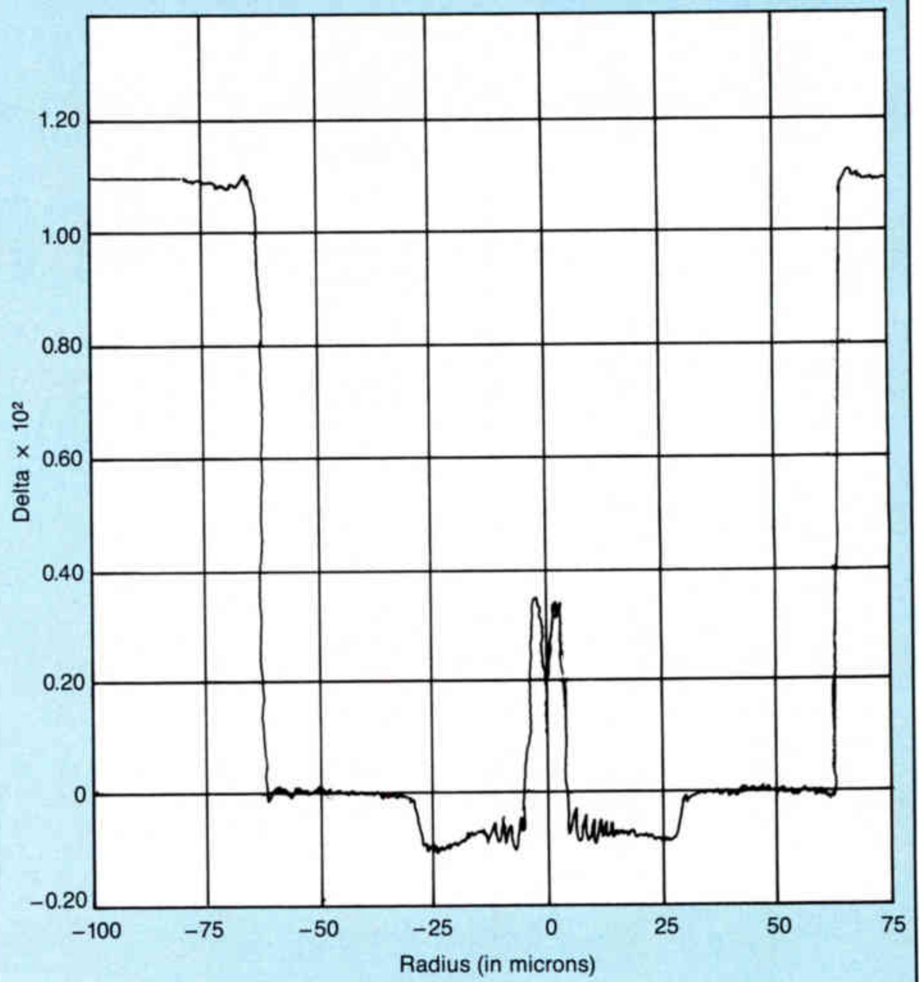
using IVD employ the depressed clad profile to compensate for manufacturing difficulties in the process.

OVD results in a matched cladding index profile. It was developed in the early 1980s to improve manufacturing efficiencies, reduce surface flaws in the fibers and take advantage of improved control processes. As shown in Figure 1, the matched clad profile is a simpler, more consistent design than the depressed clad. Figure 2a shows an actual refractive index profile of a matched clad single-mode fiber, while Figure 2b is the profile of a depressed clad single-mode fiber.

Both the IVD and OVD processes are used by manufacturers today. Bending losses and strain applied to fibers made by either process can degrade the performance and life expectancy. Manufacturers recommend a minimum bend diameter of 50 mm. Below 50 mm there is potential for a substantial decrease in any fiber's life, whether a matched or depressed clad fiber. If bend diameters are encountered below 30-35 mm, a matched clad fiber will show the increased attenuation, signalling the user that bends have been induced that may cause failure. Depressed clad fiber can mask potential catastrophic fiber failure when the fiber is inadvertently installed with tight bends. At bend diameters of 50 mm and above, the bending loss is negligible for both matched and depressed clad. The matched clad produces superior performance for bend diameters encountered in typical splice trays (60-80 mm).

Manufacturers state that a fiber can withstand long-term strain up to one-third of its proof test without degrading its expected life. The typical proof test after manufacturing is 50 kpsi (kilopounds per square inch) for fibers used in loose tube cables and 100 kpsi for fibers used in tight buffered cables.

Figure 2b: IVD (depressed clad) refractive index profile



Cable construction

Optical fibers must be cabled for virtually all applications. Depending on the characteristics of the fiber, the first step is to apply additional protection to the fibers. Stress protection is provided by two major cable designs: tight buffered and loose tube (Figure 3).

With tight buffered cables, the buffer is in intimate contact with the fiber. Some strain will be coupled to the fiber during manufacturing, installation and within environmental exposure.

As its name suggests, the loose tube cabling design requires fibers to be loosely stranded within an oversized buffer tube and gel-filled to isolate fibers in a stress-free environment away from external forces. The loose tube design minimizes possible increased fiber attenuation due to mechanical changes or failures from long-term stress. This is particularly important when the cable is placed outdoors.

The loose tube buffering assures maximum long-term fiber performance by isolating fibers from any unacceptable strain associated with manufacturing, installation and environmental conditions. This design provides a percentage of fiber overlength relative to the loose tube buffer and decouples the fiber from the buffering material.

Generally, fiber cable manufacturers that make both designs will specify the loose tube for use in outdoor applications for direct buried, duct and aerial installations. The tight buffered cables are normally specified for use indoors in environmentally controlled areas.

Numerous other construction issues such as jacket material, types of armoring and buffer tube materials can ultimately affect the design selected. The manufacturer should review these issues based on the type of application involved.

Cable installation

While the methods, techniques and equipment used for installations are many, upon inspection it is clear that by following a few fundamental guidelines, outdoor installation of fiber cable is analogous to that of coax. However, the size, weight and flexibility of optical cables should make installation faster, easier and less expensive. Also, fiber cable is more rugged than its coaxial counterpart. For example, a properly designed and manufactured fiber cable could survive the impact of a forklift that would render coax useless.

Whether the cable is installed in duct, direct buried or placed aerially, do not exceed the manufacturer's specified maximum pulling tension or minimum bending radius. The industry standard for maximum tension on fiber cable is 600 pounds during installation. This tension can be increased or decreased by the manufacturer as required. Generally, the minimum bending radius for a cable under tension during installation is 15 to 20 times the diameter. These specifications should be verified with the manufacturer.

Duct installation: Fiber cables can be pulled into ducts and inner ducts using conventional techniques with minor modifications. A standard duct cable is usually an all-dielectric loose tube cable without armoring. In order to pull a cable through a duct, the cable is typically attached to a pulling eye by its strength member(s). For cables with Aramid yarn strength members, it is recommended that the pulling grip's wire mesh

be placed over the core of the cable after the jacket is removed, allowing it to couple to the yarn strength members by friction. The pulling eye is then attached to the pulling rope or winch line via a swivel. The swivel allows the rope to rotate naturally without twisting the cable.

The strength member of a cable should not be confused with its central member. Some manufacturers rely wholly or in part on the central member for strength; this is often a cost-cutting measure and not an ideal solution. Others rely on the strength of metallic components embedded in the jacket. The danger here is unbalanced strain on the cable and the possibility of cracking the jacket due to unsatisfactory wall thickness. If this occurs, water ingress can corrode the metal wires and allow an easy path inside the cable for freezing, expansion as the water turns to ice and possible damage to the core or fibers. Commonly used cables utilize Aramid yarns applied over the core and directly under the jacket as the primary strength member. This keeps the pulling strain off the fibers.

In order to reduce friction and increase pull lengths, a pulling lubricant compatible with the particular sheath may be used. The pulling tension applied to the cable should be monitored at all times to ensure maximum tension is not exceeded. The distance a cable can be pulled can be increased by using figure eight techniques such as backfeeding or center pulls. The figure eight allows for easy cable handling and helps prevent kinking.

In backpulling, to pull in a 4 km reel of cable after the 600-pound maximum tension (industry standard) is reached, the cable can be pulled out of the duct at the nearest manhole from the point of maximum tension and laid on the ground in large, figure eight loops. Once all the cable is placed in a figure eight formation, it is turned over so the pulling eye of the cable is on top. The cable pull can then continue through the duct from this new starting point. This can be repeated for extra long or difficult pulls. In some cases, it may be necessary to hand-assist the cable at an intermediate manhole in order to reduce the tension enough to pull the cable into the figure eight formation.

Center pulling can be performed as an alternative to backfeeding for long lengths. This involves placing the cable reel near the center of the duct run to be pulled. The cable is pulled in one direction to a predesignated splice point. The remaining cable is unreeled into a figure eight on the ground and pulled in the opposite direction.

It is conceivable that with proper "housekeeping," either technique could allow continuous pulls of 4 to 6 km. Combining the techniques allows extremely long continuous cable pulls; some manufacturers can make single-mode cables in 12 km continuous lengths without fiber splices.

The use of flexible conduit is recommended to house and protect cables in manholes. Enough conduit should be used to allow it to be secured to the manhole wall and extend approximately 1 meter into the duct on each side. Enough cable slack also must be left in each manhole for this purpose.

Buried installation: Cable used for a buried installation is housed in inner duct or, more commonly, contains its own armoring, such as a corrugated steel tape. The armor protects against rodent attack and potential crushing forces. The cable typically is buried at depths of 30 to 48 inches by using a conventional cable-laying plow. Some rugged cables can be installed with vibratory plows, if approved by the manufacturer. A warning tape can be buried with the cable to forewarn excavators. Trenching is an alternative method; for short distances, it may prove more economical than plowing.

In the event the soil is particularly rocky and there is some concern about cable damage, it may be necessary to prepare the area prior to installation. The ground can be pre-ripped for plowing in cable. For trenching, the trench can first be backfilled with approximately one foot of sand.

Aerial installation: This tends to subject the cable to its harshest environmental conditions over time, including temperature variances, wind and ice. Temperature cycling may cause dissimilar movement between the cable and its host supporting messenger. In areas where ice and wind are prevalent, seasonal loads of ½-inch radial ice with 40 mph winds can be anticipated. Areas with heavy winds can produce wind loading up to or in excess of 110 mph. All these factors will place increased stress and strain on the cable. If properly designed and installed, a loose tube cable can ensure the fibers remain in a relatively stress-free state, eliminating concerns of reduced service life.

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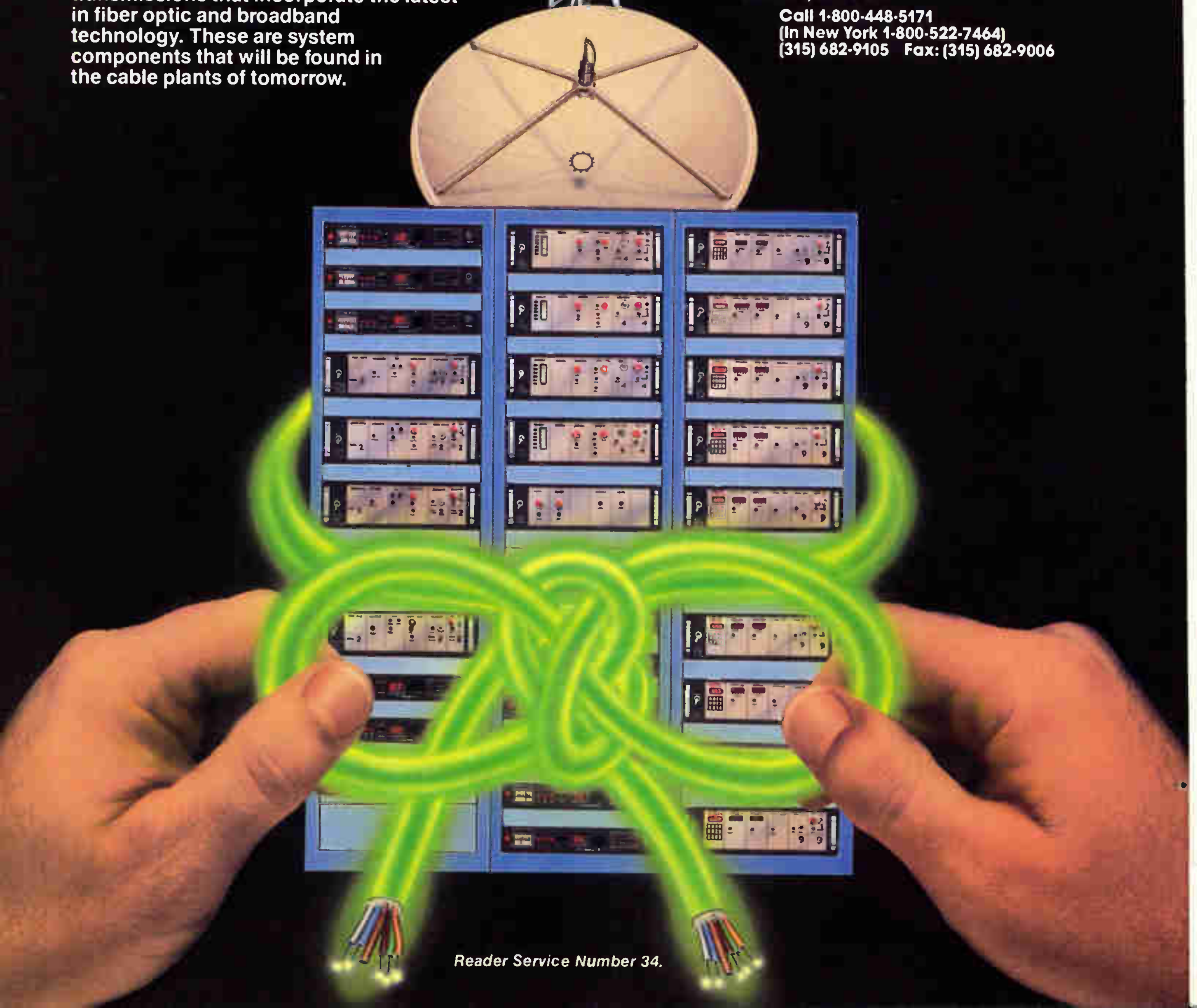


Reader Service Number 34.

Aerial construction will normally be the same as cable used in ducts. In fact, 90 to 95 percent of all fiber cable installed aerially in the United States over the past 10 years has been standard, non-armored loose tube cable. This all-dielectric construction features non-conductive properties, reducing concern of lightning damage. Some users opt to install an armored cable aerially as a precaution against squirrel or rodent damage. If this option is chosen, resistance to lightning damage should be considered.

To install cable aerially, three common methods are used: standard lashing, overlashing and one-step installation of self-supporting cable.

Standard lashing techniques, such as pull-in or drive-off, are used to lash the cable to a dedicated steel messenger. A swivel should be placed between the pulling rope and the cable for the pull-in method. Because of the reduced makeready time, the drive-off method is often easily but, due to the rigid messengers commonly used, may pose handling problems. gers are most often used.

Overlashing the cable to existing plant is also an option, using similar procedures as with standard lashing. When overlashing, the fiber cable is coupled to the coaxial messenger cable, which can sustain more strain than optical cable. In most cases, the design engineer should consult the manufacturer for specifications to determine strain parameters. The designer also should consider the potential additional load to the existing cable and structure, just as with overlashing coax.

For both dedicated and overlashed aerial installations, most manufacturers suggest that drip loops be left at each pole to allow for expansion of the messenger. The loops are generally two to four inches below the lashing wire, depending on the cable size. Minimum bend radius will be the limiting factor. The lashing line is clamped to the pole and spacers are generally used (Figure 4).

The use of self-supporting cables for aerial use is growing in popularity because of the ease of installation and significant time and labor savings. When compared to the three-step installation using lashing techniques, a self-supporting system normally will be more economical. In addition, new designs provide superior relief from environmental forces.

Self-supporting cable is installed using similar procedures for installing a messenger. The rated breaking strength (RBS) of most self-supporting cables runs from 4,000 to 35,000 pounds and should be specified by the manufacturer on span length, maximum sag allowed and ice and wind loading. While the recommended installation tension will vary, generally it is between 10 to 20 percent of the RBS.

The key benefits of the self-supporting cable design are: ease of installation, strain-free fiber environment under worst-case loading, no effect on the fiber by hardware attachments, resistance to wind-induced vibration and the flexibility to preplan the cable construction to accommodate future overlashing, if required. The three most common self-supporting designs, satisfying these benefits in varying degrees, are figure eight, concentric or circular, and pre-stranded or helically wrapped. Of these three, the pre-stranded provides the most benefits.

With the figure eight design, cable is clipped or bonded to a messenger. The messenger is normally poly-coated and can be steel, Aramid yarn or, more commonly, fiberglass-reinforced plastic (FRP). Figure eight cables typically install quicker and more economical. For short spans, ¼-inch extra high strength steel wire messen-

The physical coupling between the messenger and cable reduces the effectiveness of maintaining the fibers in a strain-free environment. As a result, loads applied to the messenger will be coupled mechanically to the cable. Since the cable has a separate messenger, hardware can be attached without the danger of additional compressive forces being applied. This design also exhibits resistance to wind forces because the dissimilar harmonic motions of the messenger and cable help to dampen wind-induced movement.

The concentric or circular design is simply a standard aerial cable with an increased rate of breaking strength and crush resistance, found in layers of Aramid yarn. The increased cross-sectional area of yarn results in a cable without an external messenger. This design provides a lightweight, flexible cable for aerial installations. However, it is more difficult to isolate the fibers from strain during tension and under load. Hardware must be applied directly to the cable, increasing the possibility of stress on the fibers. Because of the circular construction, dampeners may be required in some cases to reduce wind-induced vibration. →

Figure 3: Buffering techniques

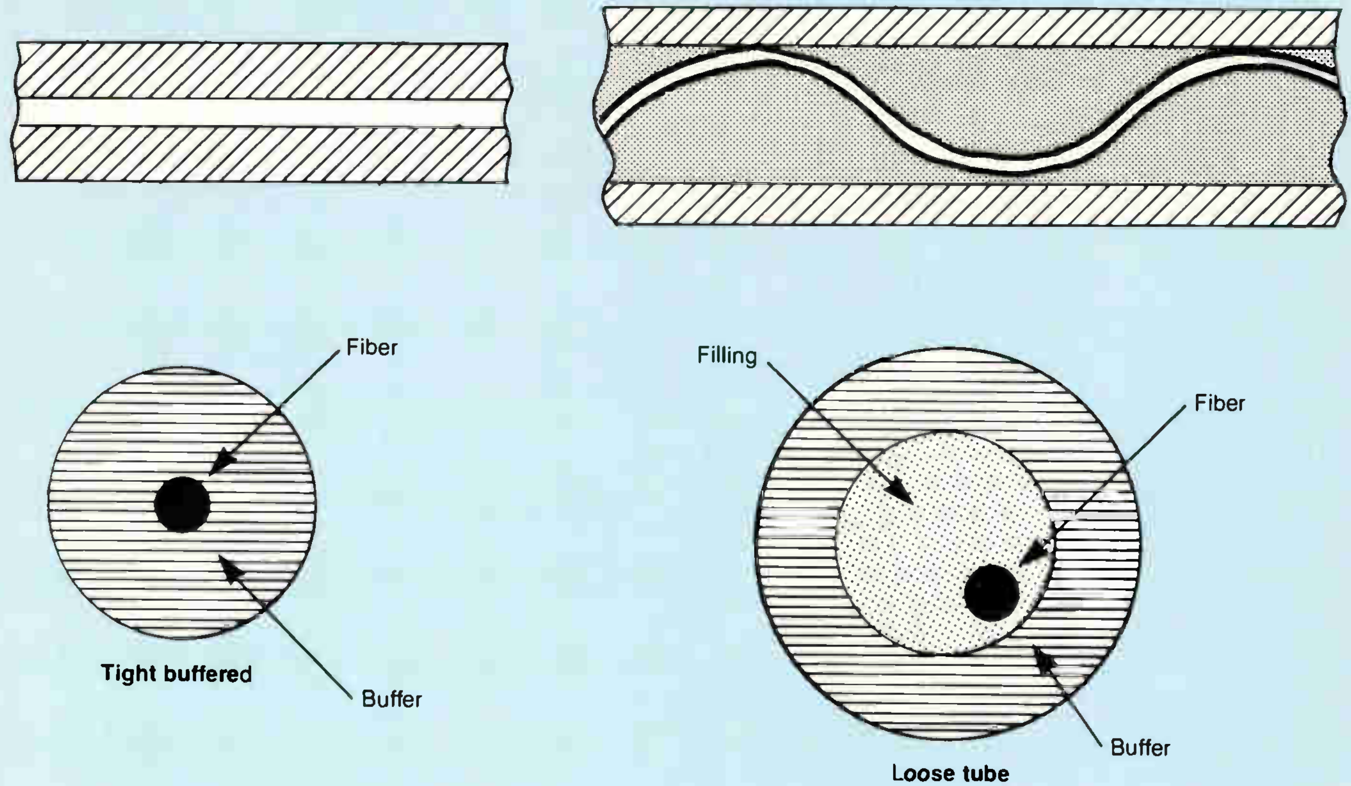
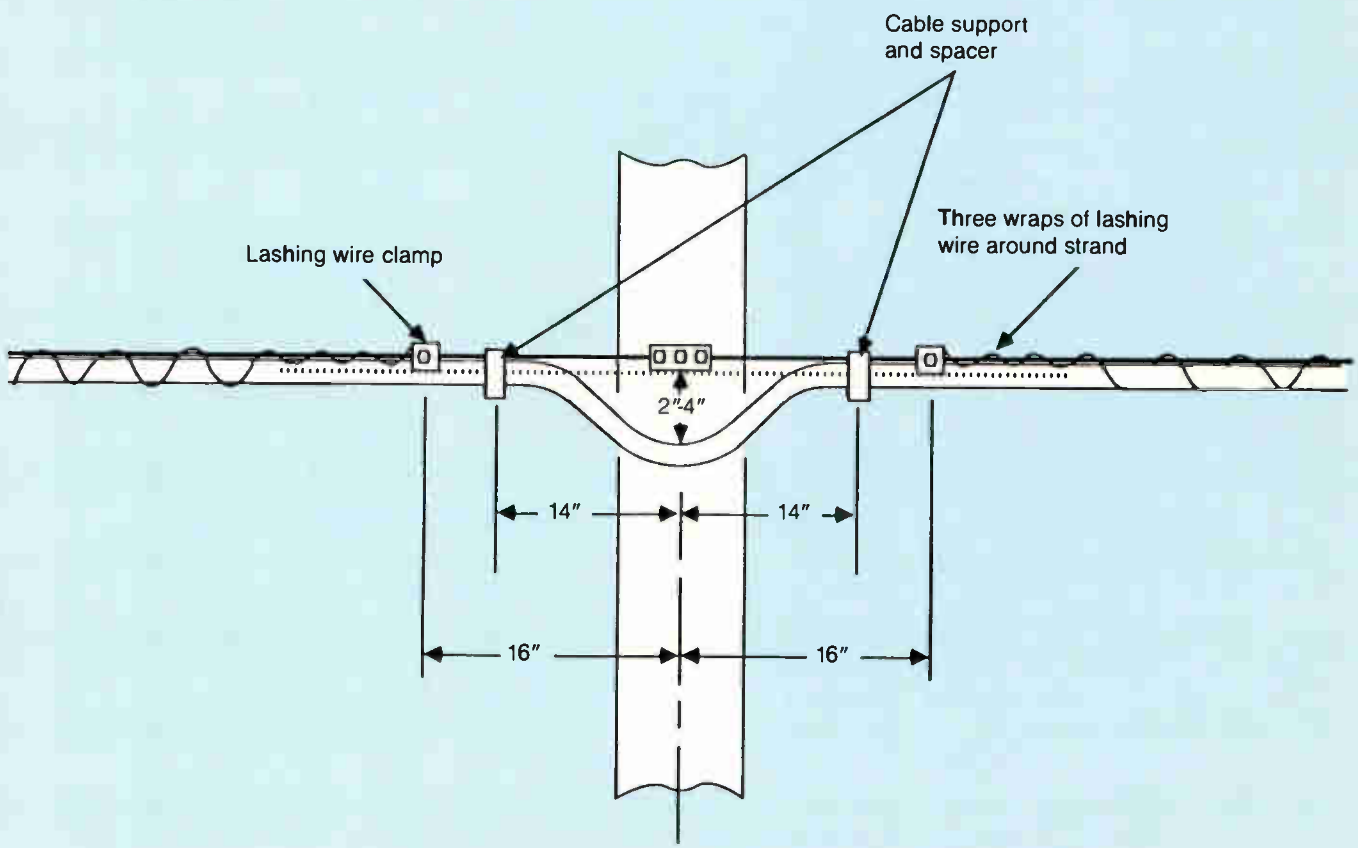


Figure 4: Recommended drip loop



With the pre-stranded or helically wrapped design, cable is stranded around a messenger. The stranding process is zero torque so as not to induce a twist to the cable during manufacturing. The messenger is normally a poly-jacketed Aramid yarn, giving the cable low elasticity, high strength and flexibility for handling. The pre-stranded design incorporates the easy installation features of the figure eight cable and the greater ease of handling found in the concentric design, while reducing the mechanical coupling of strain from the messenger to the cable because there is no physical bonding.

In all cases, the manufacturer should supply information for specific applications, including installation sag and tension, horizontal displacement and vertical sag under worst-case loading, and tension under worst-case loading. The manufacturer also should be able to guarantee the system will not see any increased attenuation under worst-case loading conditions.

If future overlashing will be required, the manufacturer should plan for the increased cross-sectional area and weight during the design. Both the concentric and pre-stranded designs can be overlashed. The profile of some figure eight cables may preclude the ability to overlash.

Standard testing procedures

As the CATV industry increases its use of fiber, considerations should be given to what other industries have already learned about minimum requirements for standard testing procedures. Without appropriate guidelines, manufacturers could potentially market products that do not meet the minimum standards established by long-term fiber users. This concern is already becoming a reality in some instances.

As a first step, it would prove beneficial to specify that fiber-optic cables meet the testing standards established by Bellcore and the Rural Electrification Administration (REA). This would help prevent field failures based on inferior cable designs. Such failures could dramatically slow the growth and future potential of fiber optics in the cable industry.

The second step would be to review manufacturers' procedures for passing Bellcore and REA standards to ensure products meet both the letter and spirit of the test. Unfortunately, some tests may be written in a manner to allow a lower quality product to meet short-term requirements, while leaving open possible long-term problems.

The third step would be for the cable industry to adopt those appropriate procedures from current testing bodies, develop new procedures for issues not addressed by existing regulations and expand as needed.

References

1) G. Mahlke and P. Goessing, *Fiber-Optic Cables*, John Wiley and Sons Ltd., 1987.
2) J. Palais, *Fiber-Optic Communications*, Prentice Hall Inc., 1984.
3) AMP, *Designer's Guide to Fiber Optics*, AMP Inc., 1982.

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CLI: A total proven approach

This is the second of a two-part article dealing with one MSO's cumulative leakage index (CLI) testing. Part I discussed FCC requirements and conducting a drive-out.

By Victor B. Gates
Chief Regional Engineer

And Clayton A. Collins
Chief Engineer, MetroVision Inc.

We use an IBM PC/AT-compatible computer and custom software to manipulate and store all leakage data gathered during the drive-outs. The computer is equipped with a 20 megabyte hard disk, 640K of RAM memory and a dot matrix printer. The software is entirely menu-driven and provides all reports necessary to control and document leakage repairs as well as calculate CLI for all or part of the CATV system.

Leakage information is input into the computer in terms of TR-1 leakage detection meter readings and estimated footage from the TR-1 antenna to the probable leak location. The computer calculates the leak's intensity in microvolts per meter (μV/m) at 10 feet. (The drive-out personnel need not be concerned with determining the field strength.) The computer software provides a listing of all leaks sorted by intensity as well as CLI reports for all or part of the system.

As repairs are completed, the repair data is stored with all information required to meet the Federal Communications Commission's rules for leakage logs. Printouts of all available reports are stored in a binder for review by visiting FCC inspectors. We keep the following reports in the public file for inspection: FCC and maintenance CLI reports (Figures 1 and 2), as well as unrepaired and repaired leak reports, an area information file and a repaired leak statistics report.

Administrative procedures

The data entry person needs to dedicate time to CLI on a part-time basis; we use a customer service representative. Emphasis on this position must be the same as other, more traditional CSR activities, such as balancing cash. The CSR gets the drive-out information from the coordinator and then enters each leak individually. We have found that we can input about four leaks per minute.

After the leaks have been entered, an unrepaired leak report is generated. This can be retrieved either by leak number or leak intensity. The unrepaired leak report by leak number is used by the dispatch department to log the completion of repaired leaks as called in by technicians. The report by leak intensity is used by the chief tech to assign work orders (Figure 3).

The CSR also prints work orders based on leak intensity, choosing the highest level leaks as well as the number of leaks that can feasibly be repaired in one week. The originals are given to the chief tech of each system, with a copy to the dispatch department. We review these at our weekly regional chief tech meeting.

The FCC CLI report, also done at this time, shows leaks above 50 μV/m at three meters, while the maintenance CLI report shows all reported leaks. Each of these reports is copied and given to the chief tech as well as filed in the FCC binder (with the exception of work orders).

The chief tech accesses the information for leaks above 150 μV/m; these

Figure 1

All areas
FCC report

Mileage	178.650		
Miles driven	178.650		
Percent driven	100		
Total leaks	27		
Leaks per mile	0.15		
Largest leak	203 μV/m at 10 ft.		
Smallest leak	51 μV/m at 10 ft.		
Leaks greater	than 1,500	μV/m - 0	
Leaks between	1,000-1,500	μV/m - 0	
Leaks between	500-1,000	μV/m - 0	
Leaks between	200-500	μV/m - 1	
Leaks between	50-200	μV/m - 26	
Cumulative leak index		51.8	(Pass)

Figure 2

All areas
Maintenance report

Mileage	178.650		
Miles driven	178.650		
Percent driven	100		
Total leaks	150		
Leaks per mile	0.84		
Largest leak	203 μV/m at 10 ft.		
Smallest leak	11 μV/m at 10 ft.		
Leaks greater	than 1,500	μV/m - 0	
Leaks between	1,000-1,500	μV/m - 0	
Leaks between	500-1,000	μV/m - 0	
Leaks between	200-500	μV/m - 1	
Leaks between	50-200	μV/m - 26	
Leaks between	20-50	μV/m - 112	
Leaks less than	20	μV/m - 11	
Cumulative leak index		53.8	(Pass)

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Reader Service Number 38.

Figure 3: Leak repair work order

Leak No.—1 Area designator—013
Leak location—20029 MacArthur
Leak level (TR-1 reading) = −22 dB
Est. distance = 100 ft.
Calculated leak intensity at 10 ft. = 16 μV/m
Date located—02/20/88 Reported by—107

Date repaired—____/____/____
Repaired by— ________________ (Tech code)
Leak source code ________________
Repair action/comments— ________________

TR-1 reading (at 10 ft.) after completion of repair— ____ dB*
*If no leakage measured, enter "NLM"

____
Repair technician

are repaired immediately. Such leaks are assigned from the unrepaired leak report by intensity. Technicians are given the original copy of the repair work order. When these repairs are completed, the chief tech continues to hand out more repair work orders by intensity until all are complete or until the next drive-out occurs.

The technician repairs the leak and records it on the work order, being sure to take a measurement at three meters or indicate "no leak measured." We've found that after a number of large leaks are fixed, there are no leaks where a minor one was recorded. The tech then calls in the repair to the dispatch department with the fix code, date of repair and level at three meters. This is recorded in the dispatch's copy of the work order. At the end of each day, the technician's work order is given to the chief tech.

Sometimes a technician is unable to complete an assigned work order because the leak is emanating from a subscriber's home. This can occasionally be quite a frustrating problem, especially when your sub works days and no one is at home. We solved this problem with a door hanger and a series of letters. The door hanger is placed on the technician's first unsuccessful visit. If we receive no response to the notice, we send a series of three letters. This results in either repairing the leak or disconnecting the sub.

Weekly, the CSR gathers the repair work orders from the dispatch department and verifies the information against the chief tech's work order. The leak repairs are then logged in the computer and new reports are generated. At this point, we copy the repaired leak report and the repaired leak statistic report for the FCC file and the chief tech; we do not file the repair work orders. At the end of the drive-out period all reports are generated and the new drive-out information replaces it.

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References

1) R. Amell, "CLI," Version 1.17 D, Copyright 1987.
2) *Code of Federal Regulations*, Title 47—Telecommunication, Federal Communications Commission, Parts 70 to 79, "Part 76—Cable Television Service," Oct. 1, 1986, pg. 450-517.
3) Augat/LRC-Vitek Electronics

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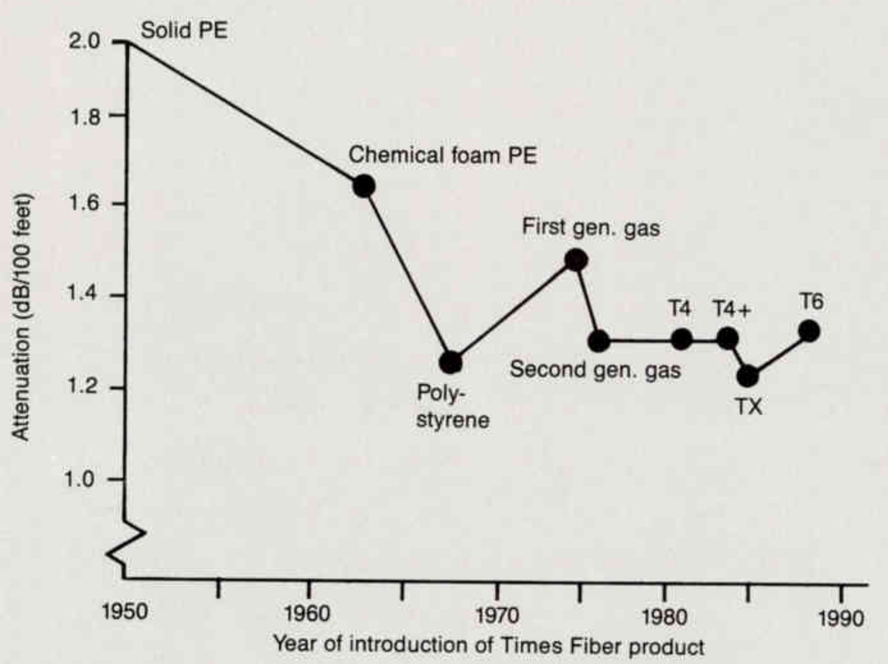
Reader Service Number 39.

Replacing the cable in rebuilds and upgrades

By Tim Dugan
Senior Product Engineer, Times Fiber Communications

To increase CATV systems beyond their present bandwidths, many factors must be considered. Obviously, amplifiers designed and built for the wider bandwidth must be installed. Taps and directional couplers with wider bandwidth also must be used. But is it necessary to replace the cable? Not only should factors such as the cable's electrical performance, age and maintenance be considered, recent advances in cable design technology also should be considered to make the optimum economic decision.

Figure 1: Maximum attenuation at 300 MHz (½" cable)



Electrical characteristics

A few electrical characteristics of the cable that affect how the system will ultimately perform are of key concern to those upgrading and rebuilding a plant. They are: structural return loss, attenuation, impedance and transfer impedance.

Structural return loss: The structural return loss (SRL) of the cable is measured in a specific frequency band at the time of manufacture. The measurement band changed several times in the past 20 years to reflect advances in manufacturing technology (Figure 1); we began SRL testing from 50 to 108 MHz and 173 to 216 MHz in the mid-1960s with 26 dB as an acceptable level. The band increased to 5 to 300 MHz (which included the mid-band) in 1972, 5 to 450 MHz in 1980 and 5 to 600 MHz in 1984 with 30 dB as the current industry standard. Now a question arises: Can cable tested in the lower frequency band be used at higher frequencies?

Unfortunately, it is not possible to predict cable SRL performance at higher frequencies based on the SRL at lower frequencies. For example, a cable manufactured in 1972 with 30 dB SRL from 5 to 300 MHz could have 12 dB SRL between 300 and 450 MHz, perhaps even worse. In general SRL spikes cause additional narrow bandwidth signal loss. Depending on the severity of the SRL spike, channels can be attenuated below acceptable limits through very short lengths of cable. It is necessary to know the SRL of the cable in the frequency band that it will be used to assure proper signal transmission.

Attenuation: Although attenuation is more predictable than SRL, many cable designs of the past were susceptible to moisture ingress and absorption, which caused their attenuation to increase sharply (Figure 2). Present cables are designed with excellent moisture blocking characteristics and resistance to moisture absorption so that the attenuation will remain stable over time. Cables currently being manufactured also are designed with lower attenuation than many of the previous designs to minimize active equipment and their associated maintenance costs.

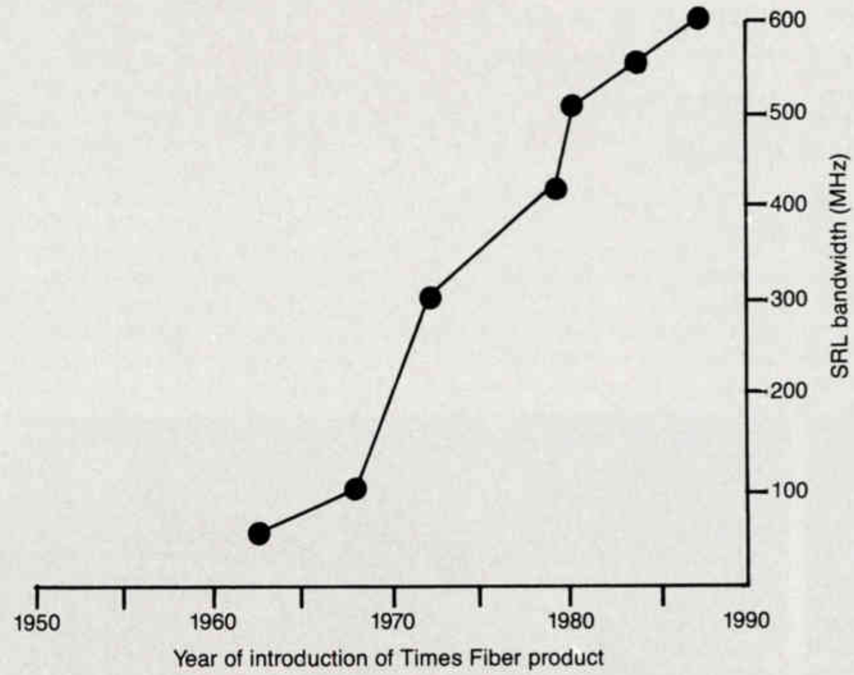
Drop cable too is now available with the low-loss gas-injected dielectric. Previous designs with chemically expanded dielectrics are 12 percent higher in attenuation while solid dielectrics are 36 percent higher. The problem is compounded by using older cable: Higher levels at the taps are required to overcome the higher losses of the cable itself plus the higher losses due to the higher frequency. It may be more economical based on attenuation alone to replace the older cable with the newer, more stable, lower loss cable.

Impedance: Characteristic impedance is another property that should not be overlooked. Although past and present cable plants are designed around 75 ohms, moisture ingress can reduce the impedance of the cable dramatically and cause an impedance discontinuity. Two discontinuities will cause a portion of the signal to be re-reflected, which can result in echoes and ghosting. Impedance discontinuities also can be caused by dents and kinks in the cable.

Transfer impedance: This is a characteristic of the cable that describes how much energy will leak out of or into the cable. In the case of drop cable, significant improvements in shielding have been made in recent years.

The drop cable/connector junction is the source of most leakage problems in the industry today, and repair is quite costly and time-consuming. Now with CLI (cumulative leakage index) requirements, the industry must repair excessive point source leakage and keep the total system leakage below a specified limit. Serious consideration must be given to leakage before additional frequency bands can be used.

Figure 2: Structural return loss (bandwidth)



Mechanical considerations

Mechanically, the outer conductor of trunk and feeder cable becomes more brittle due to cyclic stress. This can be caused by repeated bending of the cable during connector installation and equipment replacement. The more times the cable is bent, the more likely it is to fracture. How long the cable will last depends on the number of times the cable was bent and the radius of the bend.

In expansion loops, cyclic stress is caused by changes in temperature and load conditions. Generally, the age of the cable is one indicator of the total cyclic stress. The expansion loops also have a projected life that depends on the type and shape of the loop and the cable size. Although a good loop in a normal span is expected to last 20 years or more, many factors degrade its life and can fracture after as few as one or two years.

Repair of expansion loop fractures with splices is time-consuming and costly. Aside from the possible future maintenance problem that the splice may introduce, if the splice is placed at the bottom of the loop, the cable adjacent to the splice is under much higher cyclic stress and will fracture much sooner than the original loop. Expansion loop cracks can cause RF leakage and interruption of service. The cracks also can allow moisture ingress and subsequent electrical degradation.

Environmental and other factors

Aerial installations: During its life the cable is exposed to environmental factors that degrade its mechanical and electrical performance. Extreme cold temperatures can cause the cable to be exposed to a great deal of stress and cause the center conductor to pull out of the connector. Present designs are built to minimize or eliminate this by bonding the center conductor to the dielectric and the dielectric to the outer conductor.

Temperature cycling can cause stress that fatigues the metal components. Differential movement between the cable and the support strand can produce holes in the sheath from the rubbing action. Temperature changes also can cause differential pressure changes inside the cable and equipment housings, which will in turn cause moisture to be pumped into the cable. Significant cyclic loading due to trees leaning against the strand, wind, wind gusts and ice can shorten expansion loop life by excessive cable movement

"Obviously, having the same type of cable throughout the entire system has some very real economical advantages."

and rapid cycling and vibration. In addition, hail can cause significant damage to the cable, squirrels can eat the aluminum outer conductor, and the cable can be corroded by sea air and automotive and industrial pollution.

Underground installations: In the soil, the jacket can be ruptured by rocks and expose the aluminum to water or chemicals in the soil. The jacket also may be ruptured during initial cable installation or during accidental digging by shovels. Burrowing rodents, such as groundhogs and gophers, can eat through underground cable if it is not armored. Ground movement and frost heave can crush the cable. Stray ground currents can rapidly corrode exposed aluminum via galvanic action. In pedestals the cable can be exposed to moisture and condensation; it may even be submersed. The jackets used today are designed with better abrasion resistance. Present jacketed cables with a bonded dielectric can be bent tighter without kinking, especially in pedestal applications where the cable may be exposed to repeated tight bends.

During a conduit pull, the jacket may be ruptured and the aluminum exposed. If an improper pulling compound is used it may damage or corrode the aluminum. Again, cables manufactured today have jackets with better abrasion resistance than their predecessors and can aid in resisting kinking during bends. They also have lower friction coefficients to reduce pulling tension.

The condition of the cable also depends to a great extent on how well the cable was installed initially and how well it was maintained over the years. During construction, expansion loop formation is one particularly important factor. If the loops are less than 5 inches deep, even when it is very cold, the loops are probably not deep enough to accommodate normal cable expansion and contraction. During cable installation, the cable may be pulled around a bend with too much back tension and cause the cable to be flattened. The cable may be exposed to many other adverse conditions during construction that will reduce its life.

The cable also may be damaged during routine plant maintenance if care is not taken. During connector replacement at equipment both aerially and underground in pedestals, the cable may wrinkle or kink. Replacement of the heat shrink tubing may be forgotten, thus exposing the bare aluminum sheath to the environment. Equipment covers and connectors may not be tightened properly, thus allowing a path for moisture ingress. A careful examination of the existing plant (how many splices, expansion loop depth, cable kinks, shrink tubing, etc.) is very important in estimating the remaining life of the cable.

The cable/connector junction is another possible problem area. During its life a cable system is continually being modified and in many instances extended. Unless care is taken in the selection of the type of cable, the system may be made up of a number of different types of cable and, obviously, different types of connectors. With different connectors, maintenance and repair become more costly. Naturally, it costs more to have additional connectors in inventory, but the real cost disadvantage may be that the repairs become more time-consuming if the technician doesn't have the right connector on the truck. The tech must return to the shop and find the right connector before returning to make the repair. The problem of using existing cable may be amplified by the need for different size radiation sleeves. Obviously, having the same type of cable throughout the entire system has some very real economical advantages.

Due to the higher attenuation of older cables, more amplifiers will be needed than for present cable designs. This problem is further compounded if the bandwidth of the system is increased because cable attenuation increases with frequency. Drop cables manufactured today also have lower losses, better shielding characteristics and are designed to resist corrosion at the fitting. Additional cable sizes are also available to optimize overall plant cost. Cables designed today can be expected to last longer and increase the rate of return on investment. ■

This article was presented as a paper in a workshop at Cable-Tec Expo '88.

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Reader Service Number 43.

Pros and cons of frequency agility

By George Scherer
Chief Engineer, Blonder-Tongue Laboratories

Frequency agile headend components, particularly modulators, have become very popular in recent years. Originally intended for backup use, they have increasingly found their way into systems as the primary units. This trend has quickened as prices have fallen to levels more nearly competitive with single-channel equipment. Although at first glance this may seem a blessing of modern electronic technology, the experienced engineer will remember that there are always some tradeoffs. The "no free lunch" principle continues in force.

Since we manufacture both agile and single-channel modulators, our experience with both types of designs has put us in a position to make an unbiased evaluation of the relative merits of the two approaches. Let us compare them using several well-accepted criteria of performance. Functional block diagrams of typical agile and single-channel modulators are shown in Figure 1 for reference in the following discussion.

First, it must be obvious that the primary purpose of a headend is to provide the cleanest possible signal to the distribution system. In an agile modulator, the signal must undergo at least one additional heterodyne conversion, compared to a single-channel unit. This inherently creates additional beat products, which careful design and construction can minimize but not totally eliminate. Moveover, most of the techniques used to improve this aspect of agile modulator performance can be used to further increase the relative advantage of the single-channel design as well.

Next to beats, the most evident degrader of signal quality is noise. Frequency agile design demands a relatively broadband output amplifier, which will contribute noise at frequencies far removed from the channel selected. This noise adds on a power basis, increasing 3 dB for every doubling of the number of similar units. As illustrated in Figure 2, the cumulative effect of a number of agile modulators and processors can be a degraded signal-to-noise (S/N) ratio on all channels, even those not generated by agile means. This is most troublesome in a larger system where cascaded line amplifiers will further reduce the S/N. The filtering almost univer-

(Continued on page 73)

Figure 2: Typical headend S/N degradation

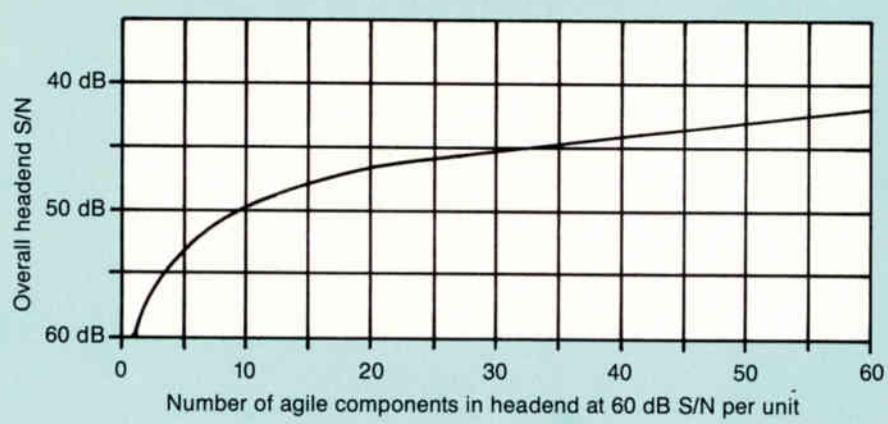
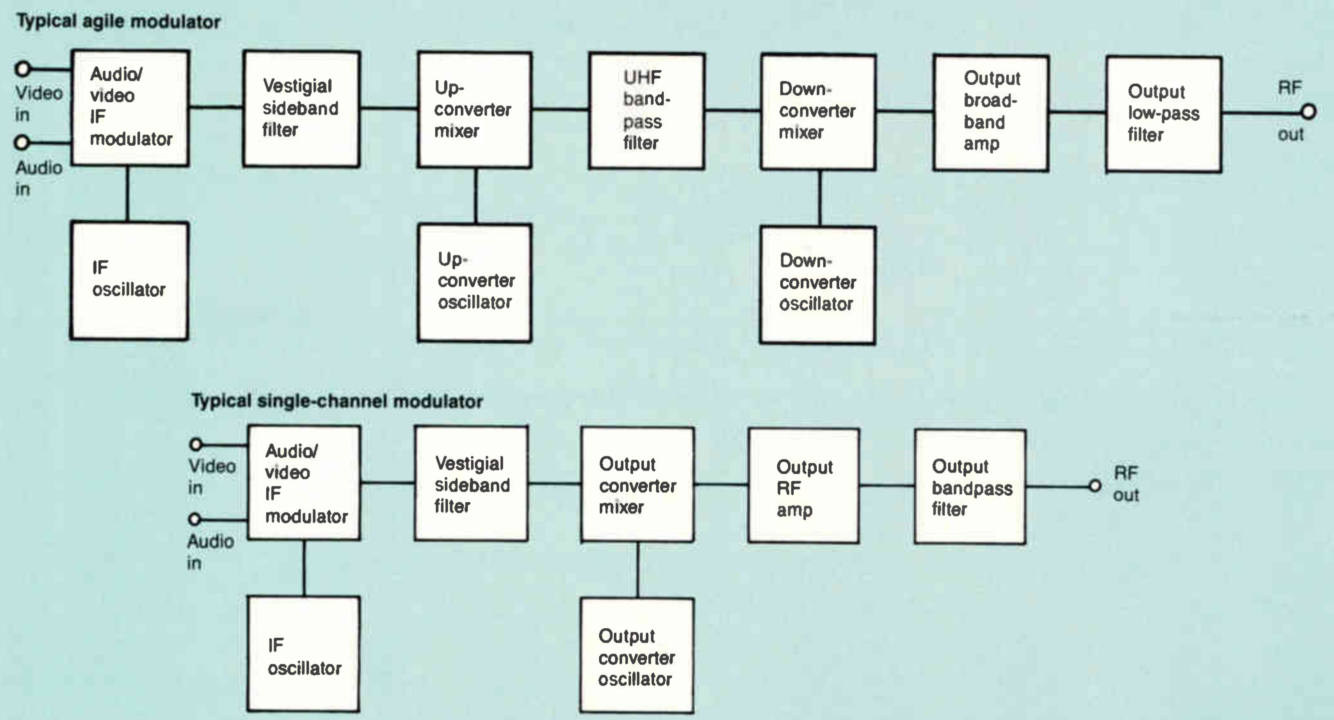


Figure 1



(Continued from page 56)

sally built into the output stages of single-channel modulators and processors limits the bandwidth of the noise while also suppressing out-of-channel beats.

Thus far we have primarily discussed modulators, but frequency agile processors are now also available. While the output converters generally are identical to those used in modulators, the agile processors invariably use TV receiver-grade tuners and IF components for the input section. The result is particularly evident in response flatness, which is seldom specified but often exceeds 3 dB peak-to-valley over a single channel for the tuner alone.

Reliability is an important consideration to the operator of any system. Obviously, frequency agile equipment will contain more components, consume more power (which must be paid for—see Figure 3) and generate more heat than single-channel equivalents. Although modern components and assembly methods can be used to produce very reliable agile equipment, they can be used to further improve the reliability of single-channel designs as well. In the final analysis, the less complex and cooler running design always exhibits a statistically longer life, given equal attention to proven principles of quality design and manufacture.

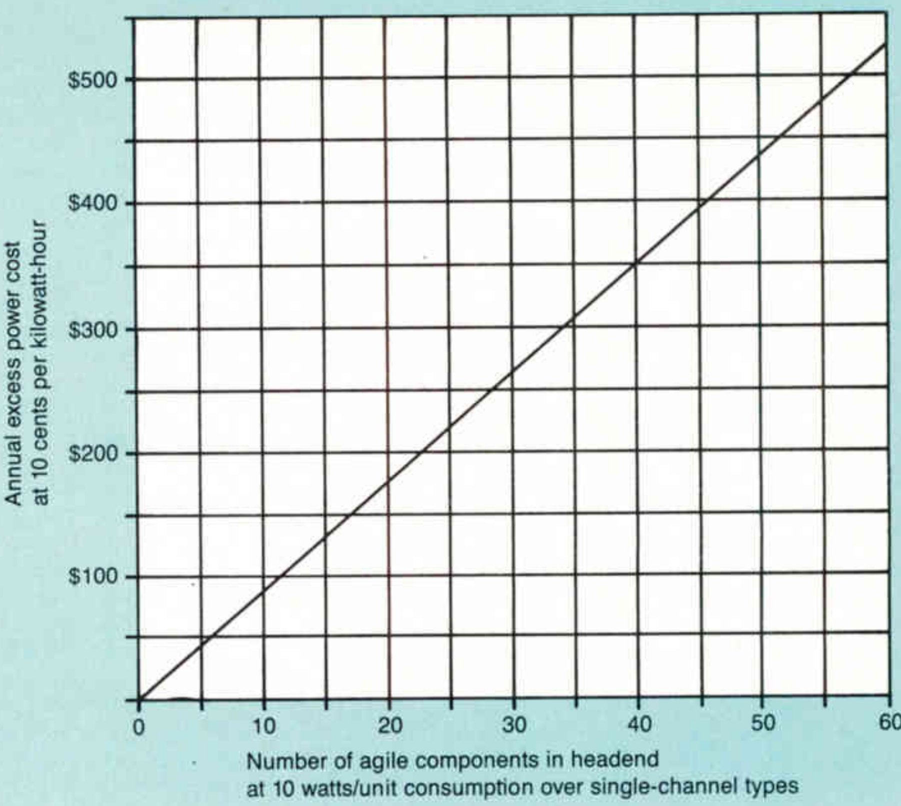
Less tangible factors

The final basis of comparison between the two headend design approaches is cost. Here there are a number of less tangible factors to consider that appear to offset some of the initial dollar difference in the actual purchase costs of the units. Having to order and install only one type of modulator can simplify logistics. However, the lead time, at least of domestically produced single-channel equipment, is usually not long in comparison with the total elapsed time of a headend installation project. Although a distributor's stocking and order processing procedures are considerably simplified by a single agile model, the system operator should base a decision on the installed cost per channel.

Flexibility of channelization is the other advantage cited for agility and must be considered if the nature of a system is such that changes are frequent. Actually since the majority of the channels in a modern headend are usually generated by modulators, rechannelization can often be easily accomplished by simply rerouting the baseband input signals! Even when this is not possible, though, it might make more sense to temporarily use agile backups for the channels being changed while awaiting replacement converter boards for the single-channel units.

In conclusion, it appears that the most effective use of agile headend components from a technical standpoint would be as auxiliary or backup equipment. For temporary installation in cases of failure, channel changes or expansion, flexibility far offsets the factors of cost, signal quality and reliability. The knowledgeable installer and/or operator must decide, in light of the previously presented information, whether operating conditions warrant the more extensive use of agile units.

Figure 3: Typical excess power costs of agile headend



Small systems—The last frontier

This is the third in a series of articles designed to help the small system operator or entrepreneur avoid some basic (and perhaps fatal) mistakes. This installment begins a discussion on designing and operating small system cable plant. Editor's note: Any opinions expressed are those of the authors, based upon their experiences in building small systems.

By Bill Grant
President, GWG Associates

And Lee Haefele
President, Haefele TV

There is a technically sound design approach that is more appropriate and much more economical for smaller systems than the familiar, conventional trunk/feeder design. But if we are to apply this approach with confidence, perhaps we ought to briefly review the trunk/feeder design itself.

Let us start with the basic requirement of tapping any CATV system for service. The objective is to deliver the same or nearly the same signal level to all subscriber receivers on all channels regardless of where the subs might be physically located along the cable plant. Of course we can't do this with great precision because of the variables such as service drop cable length, subscriber location, etc. But within some reasonable range of variations, all subs should receive the same signal feed.

To accomplish this, subscriber taps are made available in a variety of tap values. Thus, where the cable system signal levels are lower we can select a different value tap and still deliver an acceptable signal drive for the subscriber equipment. Of course, different value taps introduce different insertion losses into the cable plant. For example, an 8 dB tap might introduce 2.8 or 3 dB of insertion loss, while a 26 dB tap will introduce 0.4 or 0.6 dB of loss.

If in tapping a system we are able to use more of the higher value taps such as the 26 dB units, the efficiency of tapping would be improved. This is because a number of such taps would introduce significantly less insertion loss than an equivalent number of low value taps. But in order to produce the necessary signal level to the subscriber equipment and at the same time use higher value taps, we must maintain relatively high signal levels in the cable we are tapping.

Transmission levels

To maintain high signal levels in the plant, we are obliged to operate the system amplifiers at high output levels. An unavoidable technical penalty of higher amplifier output levels is increased intermodulation distortion from each amplifier. If the plant under discussion has to be extended any significant distance, we will have to serially connect (cascade) many such amplifiers. In very short order we will find the transmission quality severely impaired from the cumulative intermod distortion introduced. As a practical matter, we cannot construct systems that are, say, 20 amplifiers deep (20 units in cascade) and still operate all 20 units at high output levels, however desirable such levels might be.

This presents a bit of a dilemma in an urban system where we are facing a relatively high tap density and at the same time must transmit many signals some distance throughout and across the service area. We want high signal levels to improve the efficiency of dense tapping, but we cannot tolerate the high distortion that high output levels in many amplifiers introduce.

The trunk/feeder design was developed in response to this problem. It is not simply a technique to provide a second cable to accommodate the subscriber taps themselves. What a trunk/feeder system does is to utilize two distinctly different sets of transmission levels. In effect there are two entirely different transmission subsystems, with the feeder plant (the second system) being fed input signals from the trunk plant.

If we operate the trunk system at relatively low output levels, then we can cascade a number of trunk amplifiers and still accept the intermod distortion contribution of the total trunk. If we operate this trunk plant sufficiently conservatively (low transmission levels), we will end up at the trunk extremities with intermod distortion well below the end-of-system specified levels.

Then in effect we have reserved some additional intermod distortion for the secondary cable

Reader Service Number 47.

system or plant (the feeder plant). We can operate this plant at the higher output levels that are desirable to improve tapping efficiency. We cannot build extensive feeder plant extensions because if we did, the cumulative distortion of the trunk plus the feeder plant would compromise end-of-system performance. By limiting the length of the feeder plant to two or three feeder amplifiers we can produce an acceptable composite system that uses trunk plant to arterially transmit throughout the service area with only a nominal intermod contribution. This allocates the remaining acceptable distortion to a short section of feeder plant, which can be operated at higher transmission levels, thus providing high efficiency for tapping.

The trunk plant is relatively expensive to build —being operated at more conservative levels— and thus is not particularly cost-effective in itself. But the limited lengths of feeder plant are inexpensive to build; there may be much more feeder than trunk plant and therefore the overall system cost is attractive. The basic justification for trunk/feeder designs is economic and in urban applications this technique has become highly refined. In many cases hardware and amplifiers have been been designed to optimize this type of system.

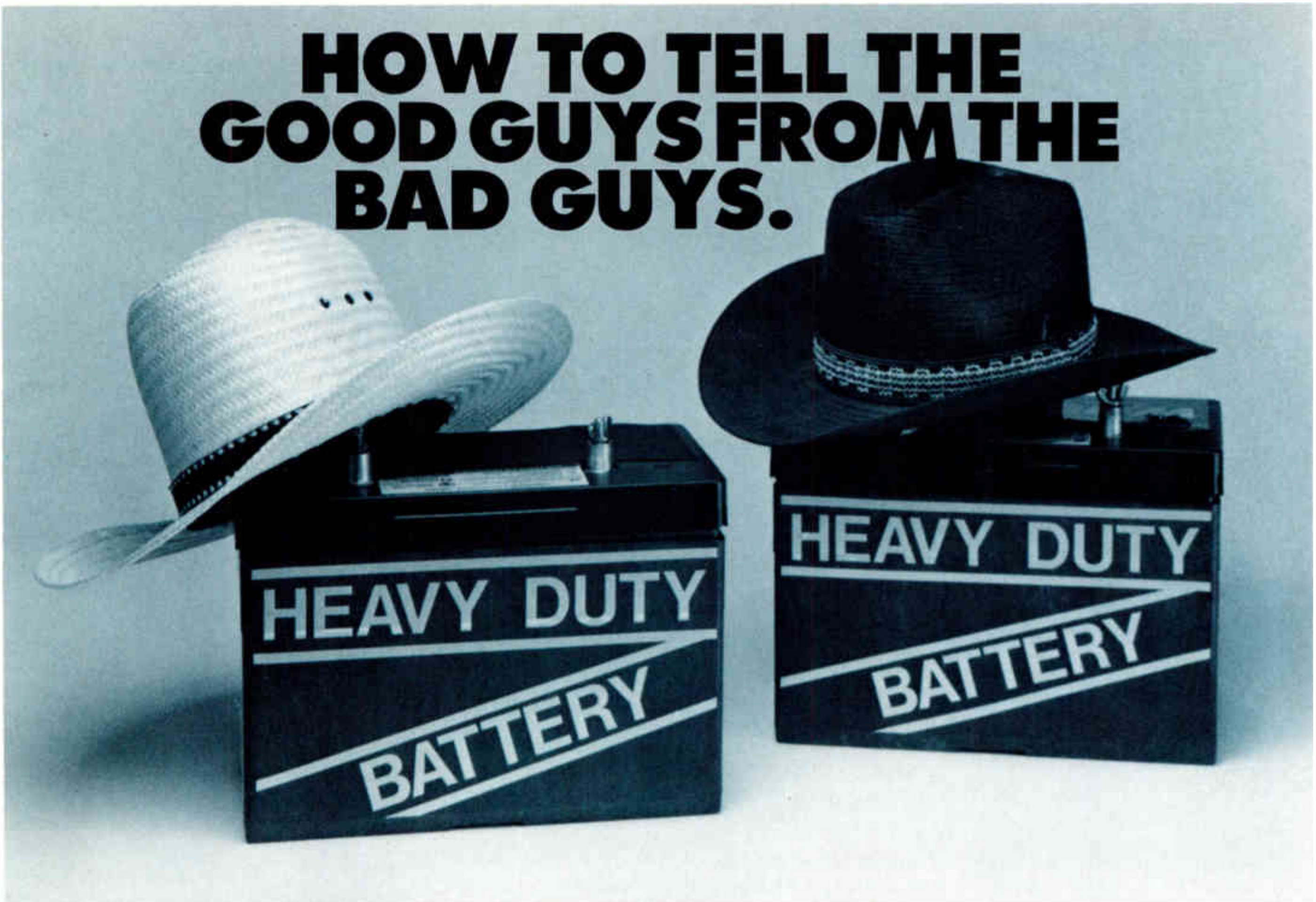
Trunk/feeder disadvantages

But as the old expression says, "There's no free lunch." There are unattractive aspects of trunk/feeder systems; we need to understand these also. In order to be able to transition the transmission levels from the conservatively low, low distortion-producing output levels of the trunk amplifiers to the more cost-effective higher output levels of the feeder system, we must introduce additional gain modules into the system. These are the ubiquitous bridger modules we find in most trunk amplifier housings. They perform the necessary function, of course, but they cost money, consume power and generate heat. And the feeder plant also introduces its own generation of amplifiers into the line extenders. These are relatively unsophisticated and inexpensive but they do introduce additional variety into the overall system hardware inventory.

In a trunk/feeder system we are looking at possibly four or five different varieties of trunk amplifier stations, plus at least one type of line extender equipment. All this variety can introduce as many as three or four different transmission levels into the system maintenance program. Nevertheless, given the demographics of an urban application that is a large service area with widely distributed and dense tapping requirements, the trunk/feeder design is cost-effective.

Consider a smaller system, however, that does not present dense tapping requirements or even require plant extensions of significant length. Now the economic advantage of more efficient tapping is much less significant. The cost of providing arterial signal distribution through the provision of a trunk subsystem becomes a distinct liability with little redeeming advantage. The obligation to design and construct a system that produces acceptable levels of both noise and intermod distortion is just as imperative in this smaller application. But we may be able to assure

HOW TO TELL THE GOOD GUYS FROM THE BAD GUYS.



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Reader Service Number 49.

this with a different design approach entirely.

We know that passing signals through a number of amplifiers in any system, regardless of the design employed, will introduce both noise and intermod distortion into those signals. The system design must ensure that the total noise and distortion accumulated at the end of the system is at or below an acceptable level; this level becomes the system specification. We are entirely free to allocate the noise and distortion contributions throughout the system in any way we see fit, providing only that they do not cumulatively exceed the system specification.

Instead of constructing two subsystems, each with different transmission levels and each with its own noise and intermod contribution as we did in the trunk/feeder design, suppose we simply used one set of transmission levels and only one or two types of amplifiers throughout the cable plant? We also can place a single cable throughout the system, using this one cable both for signal transportation and for signal feed to service locations.

We cannot operate this single-cable plant at the high output levels of the conventional feeder plant because the cumulative intermod distortion would severely limit the length of the system. We could operate this single-cable plant at the more conservative signal levels of conventional trunk plant. But if we did, at the end of the system we would find the accumulated intermod distortion quite a bit better than the system specifications required.

What we can do is operate the single-cable plant at transmission levels somewhat higher than conventional trunk plant but somewhat lower than conventional feeder. Now we can employ amplifiers with higher gain than either conventional trunk or conventional feeder amplifiers would have. This extra gain can be employed to absorb the insertion losses of plant tapping or to produce longer amplifier spacings and thus lower system costs.

Let's be quite sure we understand this clearly. If we were using a 20 dB gain amplifier in any application, this unit could be operated with a +10 dBmV input producing a +30 dBmV output. Or it could be operated with a +15 dBmV input and produce a +35 dBmV output. Of course the intermod and noise contribution of this unit would be different in the two cases, but the economic effect on the system cost would not change. This means that this unit, in either case, can only compensate for 20 dB of transmission loss. Regardless of which transmission levels are employed, two amplifiers can be spaced only 20 dB apart. The only way to improve the economics would be to use a higher gain amplifier.

Typical amplifier gain in trunk plant today is 22 or 24 dB but in the single-cable designs we will use 30 or 32 dB gain units throughout. Some people have a misconception about feeder plant and confuse higher transmission levels with higher gain amplifiers. Although bridger and line extender units typically operate at +48 dBmV output or so, they are also working with high-input levels, and the typical line extender is only a 22 or 24 dB gain device. Such units may not be particularly cost-effective in a single-cable design even though they may be inexpensive. ■

Common courtesy, common sense

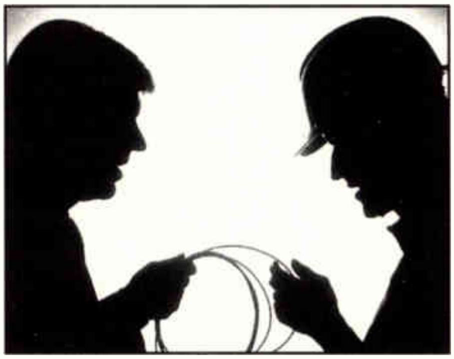
Cooperation with utility companies and potential customers is essential to maintain a good working relationship in the community. This article highlights a few techniques one system has used to establish and maintain these positive relationships.

By Mike Mayberry
Construction Coordinator, Continental Cablevision

Electric and phone companies own the poles to which we attach our cable. In our Belleville, Ill., system we have a general joint rental/license agreement. We must keep updated maps with each pole numbered, and showing ownership, anchoring requirements (if any) and proper height requirements as well as a general description of the pole line area.

Before we add a new pole line of cable, a checklist is consulted, making sure the following have been addressed: design, pole attachment agreement, makeready, customer service and installation. When we do a drive-out of a pole line, we bring along a technical representative from the utility company involved.

After determining easement rights and cross-checking Sidwell plats, a letter is hand delivered to each potential customer's residence (see accompanying example). This notifies them of our intentions, what the possible subscriber can expect and what we expect. Although easement rights are just that—a right—construction personnel must look at the homeowner's property as a trust. Without proper care and consideration there could be the loss of a potential subscriber. Notifying the customer and talking to subdivision owners and contractors, along with noting any special circumstances (i.e., terrain, lawn sprinkler systems, flower gardens, etc.), benefit both construction and the homeowner and can mean the difference between a good or bad reputation for the cable system.



Courtesy Anixter Cable TV

Restoration of a job should be thought out before the first bore is made or the first trench line laid down. Conscientious field personnel are critical to any construction situation. The most up-to-date equipment and design plans can be employed in a new-build, but without quality field personnel you might as well let children dig in the potential customer's yard.

Finally, flexibility in construction situations is important. Just because something has been done a particular way for years does not mean it is the best way to do it; construction is a learning experience. No amount of information is too much, and advice from others should be considered before any actual construction takes place. By keeping all the lines of communication open, construction can be performed without upsetting any members of the community. ■

Sample letter

To current homeowner and/or resident:

We will soon be placing underground cable in your area. We usually trench the cable in the ground and then proceed with restoration and cleanup. Our company is bonded, as are our subcontractors. We seed all grass and straw it. It is, as you might imagine, at times an unsightly job. But let me assure you this company has been here for eight years. We know our business and we desire yours. Cooperation with the potential customer and pride in our work are number one priorities with our system and the people who work for us.

Let me also state that the construction crews are just that—construction: We put cable in. Someone else will contact you for installation, sales and service. We will make every effort to satisfy your particular needs concerning your home or residence. We try to be as quick and careful as possible. If a mistake is made, we will work with you to correct the problem as soon as possible. With over 25,000 customers we are confident in our ability to apply our skill in the work we do for you. With our confidence and your trust, the outcome will be to your satisfaction.

If there are any questions, please don't hesitate to call.

Why 75 ohms?

By Lawrence W. Lockwood
Principal Scientist, Video Technologies, Contel Corp.
East Coast Correspondent

Even though the pace toward fiber optics in broadband communications, and in CATV especially, is speeding along at a breathtaking clip, coaxial cable will be with us for some time yet. Only the furthest extrapolations of proposed network architectures for the residential market (e.g., CATV) anticipate fiber all the way through the drop. Hence, this somewhat lighthearted treatment of a question fundamental to the use of coax ("Why 75 ohms?") is not out of order.

For use in video and broadband data transmission, two coaxial cable impedances are universally used—50 ohms and 75 ohms. While 75 ohms is the standard used in baseband video and CATV transmission, 50 ohms is widely used in various RF applications. How did these values come to be standards and why are they used in various areas?

Coaxial cable is a concentric transmission line in which the electromagnetic wave is propagated through a dielectric medium bounded by two coaxial cylinders. Since the current penetration at microwave frequencies is small (skin depth at 1 GHz is approximately 0.00008 inches), the only important dimensions are the diameter (d) of the center conductor and the bore (D) of the outer conductor, and the characteristic impedance is given by

$$Z_o = \sqrt{\frac{L}{C}} = \frac{138.16}{\sqrt{\epsilon}} \log_{10} \frac{D}{d}$$

where:
L and C are the inductance and capacitance per unit length and
ϵ is the dielectric constant of the medium between the cylinders (ϵ is 1 for air).

The relation of the ratio of the diameters to the impedances of a few representative cables is shown in the accompanying table.

Different views

But back to the question of why 75 ohms. Unfortunately, there is not a unique and universally accepted answer to the question. I will present two schools of thought on the subject that although different have their advocates.

One view[1] forwards a proposal that follows a

"Unfortunately, there is not a unique and universally accepted answer to the question."

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Reader Service Number 57

Impedances and diameter ratios

Cable impedance (ohms)	Diameter ratio outer conductor (D) / inner conductor (d) (inches)
30	1.65
50	2.30
75	3.50
100	5.30
150	12.20

Characteristic impedance of an air dielectric transmission line is directly proportional to the logarithm of the ratio of diameters.

logical analysis. Different impedance values are optimum for different parameters. Maximum power-carrying capacity, for instance, occurs at a diameter ratio of 1.65, which corresponds to 30 ohms. (See accompanying figure.) This is derived from V^2/Z_0 and from the maximum voltage V that can be sustained without breakdown. The optimum diameter ratio for voltage breakdown, however, is 2.7, corresponding to an impedance of 60 ohms.

Power-carrying capacity based on breakdown voltage ignores the current density, which is high at low impedances such as 30 ohms. Attenuation due to conductor losses alone is almost 50 percent higher at that impedance than at the minimum attenuation impedance of 77 ohms (diameter ratio 3.6). This ratio, however, is limited to only about one-half the maximum power of the 30 ohm impedance line.

It is likely that in the early days, when microwave power was hard to come by and lines therefore would not be taxed to capacity, low attenuation was the overriding factor that led to the selection 77 (or 75) ohms as a standard for carrier wave (CW) transmission. This, of course, resulted in hardware of certain fixed dimensions. Later on, when low-loss dielectric materials were developed that made flexible microwave cables practical, the line dimensions remained unchanged to permit mating with existing equipment.

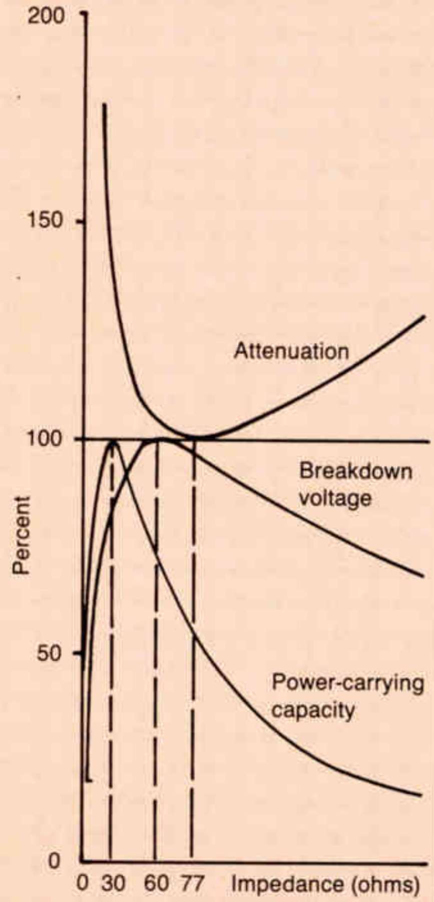
The dielectric constant of polyethylene is 2.3. The impedance of a 77 ohm air line is reduced to 51 ohms when filled with polyethylene.

$$Z_0 = 77/\sqrt{\epsilon} = 77/\sqrt{2.3} = 51 \text{ ohms}$$

Even though 51 ohms is still in use today along with 51.3, 52 and 53 ohms, the standard for precision work is now an even 50 ohms.

Another view[2] on the origin of impedance values is a bit more anecdotal. It holds that since most efficient impedance to use when transmitting any signal—considering the voltages, currents and powers to be transmitted—is 75 ohms, this would be the only standard if these were the sole considerations. The telephone industry, followed by the TV industry, uses 75 ohms almost exclusively for the transmission of video baseband and IF frequencies. However, the military services during the period 1920 and 1940 were

Impedance and parameter values



Optimum parameter values occur at different impedance values.

faced with a differing need for low radiation angle omnidirectional antennas for broadcasting ship to ship, airport to tower to low flying aircraft and base station to ground troops. The only antenna that would give this performance was the vertical ground plane in its many forms, which turned out to be 50 ohms. The military standardized on 50 ohm impedance and spent vast sums of money developing cables and connectors for all its coax systems.

Well, as promised, there are two views on the origins of the two characteristic coaxial cable impedances widely used in broadband transmission. The first is a little more elegant—the type that often ends up in texts and leads students to believe that all the world evolved in a logical progression. The second reflects a view that treats life and advances a bit more pragmatically. You pays your money and you takes your choice.

References

[1] H. Heller, Bird Electronic Corp., *EDN*, Nov. 9, 1966.

[2] *Electronic Systems, Wiring and Cable*, Trompeter Electronics Inc.

Views expressed here are the author's and do not necessarily reflect those of Contel.

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On the road again

By Ron Hranac
President, Society of Cable Television Engineers

Greetings from somewhere over the Atlantic Ocean. As I write this, I'm being whisked along at about 530 miles per hour in a British Airways 747, some 31,000 feet above the water. The aircraft left London a couple of hours ago, returning at least one jet-lagged cable TV engineer to the United States. The business at hand was accomplished, and a bit of goodwill between the U.K. and U.S. cable industries was left behind.

While in England, I once again had an opportunity to visit Tom Hall, secretary of the U.K.'s SCTE. This time, however, I was the courier of a gift from the U.S. cable industry to the SCTE "across the pond." Glenn Jones, chairman and chief executive officer of Jones Intercable Inc., is donating a copy of the *Jones Dictionary of Cable Television Terminology* to each of the 600+ members of the U.K. SCTE. I had the distinct privilege of making the presentation to Tom Hall on behalf of Glenn Jones. (Jones will be providing a copy of the dictionary to each of the U.S. SCTE national members as well; see this issue's "News.")

This gesture from one of our country's leading MSOs will go a long way toward cementing the bond between U.S. and U.K. cable concerns. Though we speak the same language (well, almost the same), the U.K. cable industry differs in many respects from our own, especially with regard to each industry's point in "cable evolution."

> *"Next time you're on the road again, remember to extend a hand of goodwill."*

For example, British financial institutions are wary of investing in cable TV, much like our own institutions were in the early years of our industry. In fact, cable in the United Kingdom is very similar to the way it was here 10 or 15 years ago. Time will change that, of course, and probably a bit faster than we experienced due in part to the U.S. cable industry involvement and investment in England. Clearly, the bridges we are building between our two Societies and our two industries will play an important role in nurturing the success of cable TV on a global scale.

But it need not stop here. This building of goodwill is crucial in other areas, too. We all stand to win when good relationships exist between our industry and amateur radio, broadcasting, TVRO, local regulators, government and most importantly, our subscribers. So next time you're "on the road again," remember to extend a hand of goodwill.

The sixth doctor

Oh, yes. The remainder of my flight was quite interesting. The chap seated next to me was British actor Colin Baker, who some of you may remember as the sixth doctor in the long running *Doctor Who* science fiction series. Baker was headed for Chicago to make an appearance at a *Doctor Who/Star Trek* convention. Since I am a *Doctor Who* fan, we had a lively discussion about both the series and Colin's career. This, too, was an opportunity for goodwill; we also chatted about the emergence of cable TV in the U.K. marketplace and where it is today in the United States. I left Colin with an invitation to give me a call next time he is in Denver (the U.S. *Doctor Who* fan club is headquartered there) so that we might begin a dialogue between our industry and U.K. programming interests. All in all, a great trip!

CATV Amateur Radio Operators List

A group of Denver area ham radio operators in the cable TV industry is preparing a list of other amateur radio operators in CATV. This list will allow ham operators to get in touch with one another and also may provide contacts for clearing up signal leakage complaints. Participation is strictly voluntary and only those responding will be put on the list. A copy of the list will be sent to all respondents who enclose a self-addressed, stamped envelope (39 cents postage). In addition, the list will be posted in electronic form on the "CATV Forum" of CompuServe.

If you would like to be on the list, please complete the following questionnaire prior to May 15 and return it to:

Steve Johnson, NØAYE
ATC
160 Inverness Dr. West
Englewood, Colo. 80112

Name ______________________ Call Sign ______________________

Company ______________________

Address ______________________

City ______________ State ______________ ZIP ______________

Modes Used ______________________

Comments ______________________

____

____

Completion and forwarding of this questionnaire acknowledges consent for this information to be used on the CATV ham list.

CT 4/89

FO test kit

Fotec introduced its T300 Series fiber-optic test kit designed for the requirements of fiber CATV systems. The Model T330CATV contains a hand-held fiber-optic power meter, single-mode laser source and all accessories in a carrying case. The power meter is calibrated at both 1,300 and 1,550 nm for testing source and receiver power. A 1,300 nm laser source provides a signal for testing loss. Adapters are available for all popular optical connectors.

For more information, contact Fotec Inc., 529 Main St., P.O. Box 246, Boston, Mass. 02129, (617) 241-7810; or circle #141 on the reader service card.

Leakage detector

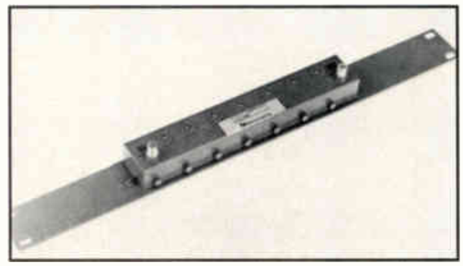
Texscan Instruments recently announced the availability of its Searcher Plus+ hand-held leakage detector. The product is designed to speed identification and repair of signal leaks in any broadband transmission system. An audio alarm increases in pitch as the received signal gets stronger. It is calibrated in microvolts per meter and can be set to hold peak readings for five seconds.

The detector's mounting bracket connects the external whip antenna and DC power from the truck; when unplugged from the bracket, it switches to an internal battery. According to the company, there is no need to add special frequencies since the detector is tuned to a mid-band channel carrier. A fixed tuned dipole antenna is available as an option to perform quantitative CLI measurements.

For more details, contact Texscan Instruments, 3169 N. Shadeland Ave., Indianapolis, Ind. 46226, (317) 545-4196; or circle #134 on the reader service card.

Bandpass filter

Microwave Filter's Model 6297 bandpass filter is designed to isolate data channels at the headend. Passband is 100 to 120 MHz and loss is 2 dB maximum. Rejection at 95.25 MHz is 30



dB minimum and 50 dB minimum at 133.25 MHz. Return loss is 15 dB minimum. The unit comes mounted on a 19- × 1.75-inch aluminum rack panel. Connectors are type F and impedance is 75 ohms.

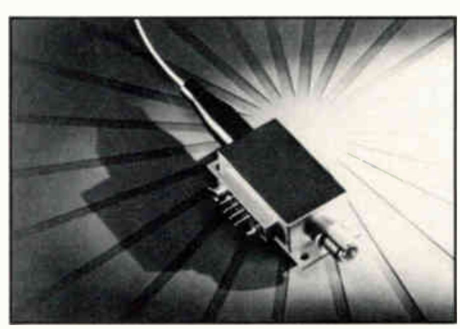
For more information, contact Microwave Filter Co., 6743 Kinne St., East Syracuse, N.Y. 13057, (315) 437-3953; or circle #137 on the reader service card.

Port design

The new CAM-Port from Antronix is a standard F port modified on the inside, designed to ensure compatibility with standard male connectors in general use; it is being incorporated into taps and other Antronix products. The contact metal strip, made of beryllium copper and silver plated, is formed so that the plating is complete in all areas. According to the company, the CAM mechanism will automatically grip any size center conductor with the exact contact pressure to ensure reliable, intermittent-free connection.

The force required to insert the center conductor varies between zero to 20 or 30 grams, depending on wire size and tolerance variables within the seizing mechanism. Tightening the nut causes the camming action to force the contact metal strips against the center conductor. As the nut is being screwed down the final turn, the center conductor is moved axially inward at the same time that the contact strips are being forced against the conductor.

For more details, contact Antronix, 2 Tenth Ave., Monroe Township, Spotswood, N.J. 08884, (201) 251-6482; or circle #121 on the reader service card.



Laser modules

Ortel introduced the Models 1515A and 1515B 10 and 12 GHz laser modules. Modulating microwave signals onto a 1,300 nm laser

(Continued on page 94)

Cable-Tec Expo 1989 and Annual Engineering Conference Fact Sheet

DATES: Annual Engineering Conference, June 15, 1989
Cable-Tec Expo, June 16-18, 1989

LOCATION: Orange County Convention Center and Stouffer Orlando Resort, Orlando, Fla.

HISTORY: Cable-Tec Expo '89 is the seventh annual convention/trade show sponsored by the Society of Cable Television Engineers Inc., combining a wide variety of technical programs, hands-on training and breakout technical workshops with instructional hardware exhibits. The Annual Engineering Conference will be SCTE's 13th yearly conference dedicated to current engineering issues, FCC compliance and technical management. In addition, the Society has presented more than 60 national technical programs in cities across the United States over the past 19 years, attended by more than 15,000 engineering and technical personnel from the broadband communications industries.

ATTENDANCE: Attendance is open to individuals within the CATV industry as well as anyone involved in broadband communications. Over 1,500 registered attendees are expected from all levels of the cable television and related businesses, including all levels of non-technical personnel.

PROGRAM: The Annual Engineering Conference will be packed with six hours of technical and management papers presented by many of the industry's engineering leaders. The annual membership meeting, held during the conference luncheon, will afford attendees the opportunity to meet members of SCTE's board of directors. The guest speaker for this year will be Cmdr. Paul Weitz, former space shuttle commander and current deputy director of NASA's Johnson Space Center.

The 2½-day Cable-Tec Expo follows the Annual Engineering Conference and combines practical workshops with "hands-on" technical training and hardware displays. The program features many schoolroom-style workshops to choose from. No other activities are scheduled during workshop sessions to guarantee maximum attendance and participation.

As with all SCTE activities, the main purpose of Cable-Tec Expo '89 is to provide the maximum amount of training opportunities for the lowest possible cost. The event has been coordinated to fulfill this purpose, as it offers a wide variety of informative, up-to-date technical training programs. Additionally, Expo '89 will give attendees the opportunity to prepare for and participate in the Society's Broadband Communications Technician/Engineer (BCT/E) and Installer Certification Programs, gaining valuable knowledge and practical skills in the process.

The NCTA Engineering Committee will be holding its June meeting in Orlando prior to the expo and has invited expo attendees to sit in on its meeting.

EXHIBITS: The exhibit floor has a focus on education, with many industry suppliers presenting live technical demonstrations of their products.

Over 125 hardware exhibitors have reserved space on the Expo '89 exhibit floor. Exhibits will include all types of products, supplies, services and equipment used in the design, construction, installation, repair, maintenance and operation of cable TV systems. The exhibit floor also will feature a Technical Training Center for further equipment demonstrations.

SPECIAL EVENTS: SCTE's Florida Chapter and Anixter will sponsor a Welcome Reception on June 15. The Expo's main social event, the Expo Evening, will be held Friday night, June 16. Dress for this, our 20th anniversary celebration, is casual. Scheduled for Sunday, June 18 is the administration of Broadband Communication Technician and Engineer (BCT/E) and new Installer Certification Program examinations. In addition, tours of area fiber-optic system installations will be available to expo attendees.

Preliminary Program
Engineering Conference

- **High-Definition Television**
  with Walt Ciciora, ATC; Professor Schreiber, MIT Media Labs; and Wayne Luplow, Zenith
- **Digital Video: A Future Alternative**
  with Steffen Rasmussen, ABL Engineering
- **Cable vs. the Telcos**
- **Fiber-Optic Technology**
  with Scott Esty, Corning Glass

Plus: Special Guest Speaker Paul Weitz, deputy director of Johnson Space Center and former shuttle commander

Expo Workshops

- **Fiber-Optic Test Measurements**
  with Norm Elsasser, Photodyne; and Sandy Lyons, Siecor
- **Signal Level Meter Basics and Alternative Measurement Techniques**
  with Ron Hranac, Jones Intercable; Tom Archer, Sencore; and Don Runzo, ComSonics
- **Data Transmission Techniques* (V)**
  with Don Patton, Anixter
- **Supervisory and Management Fundamentals* (VII)**
  with Dr. Bill Brown, Rollins University
- **Signal Leakage, CLI and the FCC**
  with John Wong, FCC; Robert V.C. Dickinson, Dovetail Systems; and Brian James, NCTA
- **Remote Automated System Testing (Full Morning Session-Friday)**
  with Dwayne Lipp, Brad PTS; Jay Staiger, Magnavox; and Jim Hayworth, ATC
- **Basic Spectrum Analyzer Theory and Operation (Full Morning Session-Saturday)**
  with John Cecil, Hewlett-Packard
- **Local Origination Equipment and Its Use* (II)**
  with Jay Dorman, MPCS; and Lenny Melamedas, UA Columbia Cablevision
- **AM Fiber-Optic Transmission* (III)**
  with Carl McGrath, AT&T Bell Laboratories and J.R. Anderson, Anixter
- **Installing Fiber-Optic Cable**
  with Larry Nelson, Comm/Scope; and Ken Carter, ATC
- **Installer Certification: Assuring Quality Performance**
  with Richard Covell, Jerrold; and Ralph Haimowitz, SCTE

*** These workshops contain information of value in preparing for BCT/E Certification exams for the specified categories listed in Roman numerals.**

Plus: Working Examples of the IS-15 Consumer Interface
Product-Specific Equipment Usage Classes
"Hands-On" Splicing of Fiber-Optic Cables

Tours

SCTE is attempting to arrange special tours of Orlando area fiber-optic installations for expo attendees and needs to determine the level of interest. If you would be interested in attending a tour on Sunday, June 18, please read the descriptions and indicate your desires on the Expo Registration Form.

If sufficient interest exists and tours can be scheduled, tickets will be made available on-site in Orlando at the registration area.

Tour A—BellSouth's Heathrow is a new residential development just outside of Orlando. BellSouth has wired the development with fiber-optic cable as a demonstration of its second generation "fiber to the home" project.

Tour B—ATC's Cablevision of Central Florida is in the process of replacing its AML microwave network with an AM fiber-optic interconnect. This tour would include a visit to the master headend and inspection of the fiber plant.

Cable-Tec Expo '89 Schedule of Events

Wednesday, June 14 at Stouffer Orlando Resort

9 a.m.-5 p.m.	NCTA Engineering Committee Meeting
5-8 p.m.	Annual Engineering Conference Registration

Thursday, June 15

7:30-8:30 a.m.	Conference Registration
8:30 a.m.-5 p.m.	Annual Engineering Conference and Membership Meeting
3-5 p.m.	Cable-Tec Expo Registration
6-8:30 p.m.	Welcome Reception (sponsored by the Florida SCTE Chapter and Anixter)
8-11 p.m.	Jerrold Party

Friday, June 16 at Orange County Convention Center

7:30 a.m.-4 p.m.	Expo Registration
8 a.m.-12:15 p.m.	Hands-On Workshops
Noon-5 p.m.	Exhibit Hall Open
6-10 p.m.	Expo Evening at Sea World

Saturday, June 17	
8 a.m.-12:15 p.m.	Hands-On Workshops
Noon-5 p.m.	Exhibit Hall Open
4-5 p.m.	Exhibitors' Reception
7-10 p.m.	Scientific-Atlanta Party

Sunday, June 18 at Stouffer Orlando Resort	
8:30 a.m.-Noon	BCT/E and Installer Certification Program examinations
9-11 a.m.	Chapter Development Meeting
10 a.m.-2 p.m.	Tours

Cable-Tec Expo '89 Registration Fees
(Unchanged Since 1986)

	Until May 12		On-Site	
	Member	**Non-Member**	**Member**	**Non-Member**
Engineering Conference and Expo*	$195	$350	$235	$390
Expo only**	$145	$250	$185	$290
Engineering Conference Only	$120	$200	$160	$240
Spouse Registration*	$ 95	$ 95	$ 95	$ 95

ADMISSIONS: Admission to all events will be through color-coded badges received at the registration desk upon arrival.
* Includes tickets to the Membership Luncheon and Expo Evening. Additional luncheon tickets are available at $20 each.
** Includes one ticket for the Expo Evening. Additional tickets are available at $40 each.

TRANSPORTATION: SCTE has designated Caravelle Travel Management as the expo's official travel agency. Supersaver and discounted coach air fares have been arranged and Dollar Rent-A-Car is offering special rates to attendees. Transportation from the Orlando International Airport to the hotel can be economically gained through Airport Limousine Service at (407) 423-5566.

PLEASE NOTE: Although you may be able to locate comparably priced air fares through your local travel agency, SCTE receives credit for all flights booked through Caravelle Travel. Using the official Cable-Tec Expo travel agency will help us by cutting our costs in flying out engineers from the FCC and instructors for expo workshops.

ENTERTAINMENT: The Stouffer Orlando Resort lobby features brochures covering area attractions, dining, nightlife and sightseeing activities. Grey Line Tours has a reservation desk in the lobby for sightseeing and spouse tours. The discounted hotel rates are in effect for expo attendees wishing to stay in Orlando for three days before or after the conference.

LODGING

The Stouffer Orlando Resort has been designated the headquarters hotel for Expo '89. It will be the site of the Annual Engineering Conference, BCT/E examinations and various hospitality events. Expo workshops and exhibits will be held at the Orange County Convention Center. Bus service will be provided to and from all official expo hotels during event hours. Listed are the expo hotels, their rates and number of rooms available. Make all reservations directly with the hotels using the listed telephone numbers. A reservation form for the Stouffer Resort is included with this package.

Make hotel reservations early, as many will sell out. All reservations must be made by May 12.

Hotel	Single/Double	Available	Reservations
Stouffer Resort	$84 (S), $94 (D)	650	(407) 351-5555
Sheraton World	$75 (S & D)	300	1-800-327-0363 (In Fla. 1-800-341-4292)
Wynfield Inn	$62 (S & D)	150	1-800-346-1551
Peabody	$95 (S & D)	100	1-800-732-2639
Heritage Inn	$65 (S), $75 (D)	75	1-800-447-1890 (In Fla. 1-800-282-1890)

Instructions

1. **Deadline:** Cable-Tec Expo '89 Registration Forms must be received by SCTE national headquarters on or before May 12. Forms received after that date cannot be processed and will be returned to the sender. If you do not preregister for the Cable-Tec Expo in advance, you must register on-site in Orlando.
   - Use a separate form for each individual (forms may be copied)
   - Appropriate registration and activity fees must be enclosed for this form to be processed.
   - Hotel reservations must be made directly with the respective hotels before May 12.

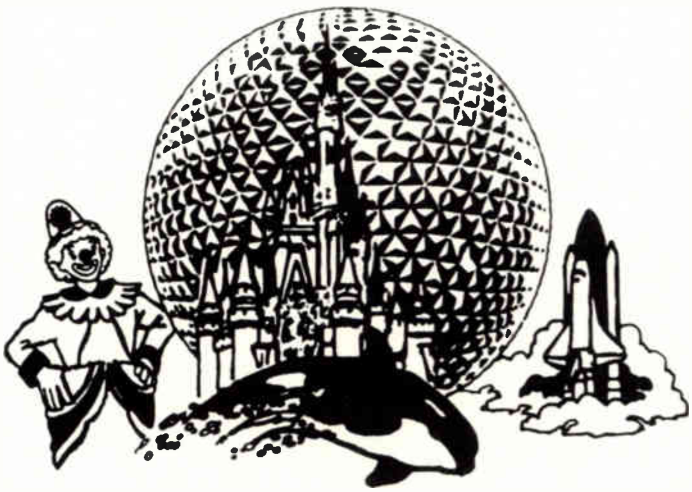
2. **Registration Cancellations:** All cancellations must be received in writing by SCTE national headquarters on or before May 31. A $50 cancellation charge is applicable to all registrations cancelled after May 12. Substitutions will be accepted until June 9. **No Refunds Will Be Granted After May 31.**

3. **Telephone Requests** for cancellations and substitutions will not be accepted. All requests for cancellations must be submitted in writing and received before May 31 and all requests for substitutions must be received before June 9.

4. Return the Cable-Tec Expo 1989 Registration Form with the appropriate fees to:
   SCTE
   669 Exton Commons
   Exton, PA 19341
   Attention: Anna Riker

5. Please make flight reservations through Caravelle Travel at (800) 222-6664; In Illinois and Canada (312) 860-8325. Rental car reservations may be made through Dollar at (800) 237-4584; in Florida, (800) 822-1181.

6. All correspondence concerning hotel reservations should be made directly with the Stouffer Orlando Resort at (407) 351-5555 or the appropriate overflow hotel.



SCTE

MEMBERSHIP APPLICATION

APPLYING FOR:

_______ INDIVIDUAL @ $40*

_______ SUSTAINING @ $250**

Please print or type information. Data will be used **exactly** as it is submitted here.

NAME: ______________________________ (First / Initial / Last)

EMPLOYER: ______________ (Company Name) TEL.: ______________ (Area Code—Number)

CO. ADDRESS: ______________ (Street/PO / City / State / ZIP)

USE HOME ADDRESS? ______________ (Street/PO / City / State / ZIP)

YOUR TITLE: ______________ FOR HOW LONG? ______________

YOUR SIGNATURE: ______________ DATE: ______________

Complete the information below. Enclose full payment or charge to MasterCard/VISA shown below:

NAME ON CARD: ______________ EXP.: ______________

MASTERCARD NO.: ______________ IB NO.: ______________

VISA NO.: ______________

SIGNATURE FOR CHARGE AUTHORITY: ______________

CT 4/89

I hereby apply for membership in the Society of Cable Television Engineers Inc., and agree to abide by its bylaws. Further member materials will be mailed to me within 45 days. Payment in U.S. Funds is enclosed. I understand dues are billed annually.

SCTE is a 501(c) (6) non-profit professional membership organization. *Your dues may be tax deductible.* Consult your local IRS office or tax advisor.

Make check payable to SCTE. Mail to: **SCTE, 669 Exton Commons, Exton, PA 19341.**

*/** Applications without payment will be returned. Applications from outside U.S./Canada/Mexico, enclose additional $40 (U.S.) to cover mailing expenses. Sustaining Membership is non-voting and not corporate or group-type category.

Cable-Tec Expo Registration

Everyone must register. ID badges must be worn and visible at all times in workshops and on the expo floor. To avoid delay, fill in all information requested. Full and complete payment must be sent with this registration form. Make all sleeping room arrangements directly with the appropriate hotels.

Registration fee includes technical workshops, expo and hospitality/entertainment events. SCTE individual active, senior and charter members must provide member ID number. New individual members applying with registration must attach SCTE member application and dues payment. If you wish to register more than one person, please make copies of this form.

Please print or type.

Your Name: ______________________________ Nickname: ______________
Last Initial First

Company: ______________________ Title: ______________________

Address: ____
Street/P.O. Box City State ZIP

Telephone: ( ) ______________ SCTE Member No.: ______________

Registration Fees (until May 12, 1989) (Please check the appropriate box)

	Member	**Non-Member**
Engineering Conference and Expo	☐ $195	☐ $350
Expo only	☐ $145	☐ $250
Engineering Conference Only	☐ $120	☐ $200
Spouse Registration*	☐ $ 95	☐ $ 95

(Spouse registration includes: Sessions, Exhibit Floor, Membership Luncheon and Expo Evening)

No. ________ Additional Membership Luncheon tickets at @ $20 $ ________

No. ________ Additional Expo Evening tickets at @ $40 $ ________

Total Amount Enclosed: $ ________

☐ I plan to take BCT/E Certification Examinations on Sunday, June 18 from 8:30 a.m. to noon.
☐ I am interested in the Fiber-Optic System Tours tentatively scheduled for Sunday, June 18 from 10 a.m. to 2 p.m.
☐ BellSouth's Heathrow ☐ ATC's Cablevision of Central Florida

Pre-Registration Form must be received before May 12.

Cancellation Policy—A $50 cancellation charge is applicable to all registrations cancelled after May 12. No refunds given after May 31.

Method of Payment
☐ Check (Checks to be made payable to SCTE) ☐ MasterCard ☐ VISA
Charge Card Information—Complete for MasterCard/Visa shown below:

Name on Card: ______________________ Exp. Date: ______________________

MasterCard No.: ______________________ VISA No.: ______________________

Signature for Charge Authority: ____

Reader Service Number 1.

(Continued from page 88)

coupled to single-mode fiber, these modules are said to transmit over distances of 20 km and beyond. According to Ortel, the lasers have superior linearity and noise properties with typical RIN values of less than −150 dB/Hz at 2 GHz.

Designed for analog transmission, specs include flat response, 50 ohm coax SMA input, single-mode 1,300 nm optical fiber pigtail and −40 to 70°C operation. Applications include antenna remoting, wideband analog data links, microwave delay lines and high-speed data buses.

For further details, contact Ortel Corp., 2015 W. Chestnut St., Alhambra, Calif. 91803, (818) 281-3636; or circle #133 on the reader service card.

FO video system

The Model FT-1300CQ fiber-optic video transport system from Times Fiber combines the functions of demultiplexing and demodulating. According to the company, the system is compatible with all headend equipment requirements. It can be configured as a complete FM-to-AM system or as a stand-alone FM-only system. For new remote hubs, a system that includes its own VSB/AM modulators is said to be all that is required for a complete hub installation. To interconnect existing headends, the system can be configured as an FM-only system, utilizing existing VSB/AM modulators.

Each fiber in the system transmits 18 channels per wavelength. A 54-channel system can be carried on three fibers and expanded to 108 channels without using any additional fiber capacity. A complete hub site consists of one optical receiver module for each incoming fiber and one module per video channel. Modules fit in a single 10¾-inch mainframe, which is 19-inch rack-mountable with eight universal slots.

For further information, contact Times Fiber Communications, 358 Hall Ave., P.O. Box 384, Wallingford, Conn. 06492, (203) 265-8500; or circle #120 on the reader service card.

Power meter

Anritsu introduced the Model ML9001A optical power meter. According to the company, the meter is accurate to ±5 percent over a given wavelength range and linearity is guaranteed to be 0.15 dB. The instrument has a dynamic range of −100 to +3 dBm at 1.3 μm, making it suited to measurement of repeater output and losses of long spans of fiber. It has a four-digit LCD display that reads power in watts or dBm or relative measurement of watts or dB. Wavelength sensitivity is automatically corrected in 1 nm steps.

The Model MN9001A controller is designed to simplify the data storage functions of the ML9001A; up to 1,000 measurements can be retained in non-volatile memory. Hard copy is provided through a printer built into the controller.

For more details, contact Anritsu America Inc., 15 Thornton Rd., Oakland, N.J. 07436, (201) 337-1111; or circle #135 on the reader service card.

DFB modules

Mitsubishi Electronics America is offering two new distributed feedback (DFB) laser diode modules for fiber CATV signal transmission. Used for transmitting signals from the headend to hub sites, the 1,300 nm Model FU-45SDF-3 and 1,550 nm FU-65SDF-3 have an optical output power of 2 mW from the fiber end. A 30 dB one-direction isolator prevents noise created by reflected power, while a cooler allows temperature control for additional noise reduction.

The modules offer −40 dBc second-order harmonic distortion, −60 dBc third-order harmonic distortion and −155 dB/Hz relative intensity noise. They have a rise and fall time of 0.2 ns, allowing for high-speed modulation.

For additional details, contact Mitsubishi Electronics America, Semiconductor Division, 1050

E. Arques Ave., Sunnyvale, Calif. 94086, (408) 730-5900; or circle #139 on the reader service card.

Tag protector

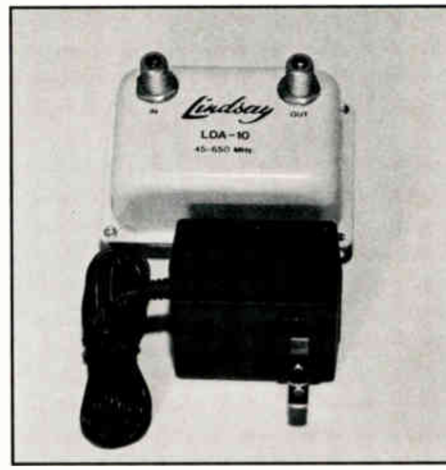
Budco is offering the PanelGuard, a piece of clear, high-impact styrene plastic designed to protect the writing panels of the Model 734 Taplock or Model 402 Panel Tag from ultraviolet rays. The product slides on the tag and snaps in place. Drainage ports on each side are said to prevent precipitation from accumulating under the sleeve. It can be removed by hand or by inserting a flathead screwdriver in the removal slot and gently twisting.

For more details, contact Budco, P.O. Box 3065, Tulsa, Okla. 74101, (918) 252-3420; or circle #123 on the reader service card.

Accessory tool

Cable Prep announced the release of the RTH-4500 ratchet T handle accessory tool to the stripping/coring line of products. The product adapts to any coring tool with a 3/8-inch shaft and three flats. The noiseless ratchet is said to be maintenance free and can perform coring or stripping/coring of coaxial cable by establishing a positive torque on the core direction. According to Cable Prep, the RTH-4500 is compact, lightweight and constructed with lubricated roller bearings for longer life.

For more information, contact Cable Prep, 207 Middlesex Ave., P.O. Box 373, Chester, Conn. 06412-0373, (203) 526-4337; or circle #140 on the reader service card.



Drop amplifier

Lindsay Specialty Products is offering its Model LDA-10 drop amplifier that provides 10 dB of gain over 650 MHz with a flatness response of ±1 dB. According to Lindsay, it has a guaranteed 4.5 dB noise figure and superior handling capabilities.

For further details, contact Lindsay Specialty Products Ltd., 50 Mary St., Lindsay, Ontario, Canada K9V 4S7, (705) 324-2196; or circle #128 on the reader service card.

AML transmitter

A solid-state broadband AML transmitter was introduced by Hughes Aircraft's Microwave Products Division. The Model IBBT-116 indoor broadband transmitter uses high-power FET amplifiers to achieve 8 dB increased output capability, compared to previous Hughes broadband transmitters.

According to Hughes, the inherent flexibility associated with the broadband one- to 80-channel design, along with the increased power, provides for supertrunking applications in excess of 20 miles and permits more receiving points than previously available transmitters. Traditional local distribution and clustering services can be provided by this transmitter located in the headend without tower-mounting any amplifiers or other active devices.

For further details, contact Hughes Aircraft Co., Microwave Products Division, P.O. Box 2940, Torrance, Calif. 90509-2940, (213) 517-6233; or circle #136 on the reader service card.

Cable catalog

Berk-Tek's updated catalog "Off the Shelf" explains the new NEC requirements in conjunction with Underwriters Laboratories' standards for flame spread and cable markings. The 28-page catalog features more than 150 Berk-Tek wire and cable products that are maintained in stock for immediate delivery.

For additional information, contact Berk-Tek, 132 White Oak Rd., New Holland, Pa. 17557, (800) 237-5835; or circle #124 on the reader service card.

Off-air Ch. 4

By Steven I. Biro
President, Biro Engineering

This is the third in a series of maps with technical and program parameter listings for off-air Channels 2-69, designed to be used when the cable system experiences co-channel interference. With this information, the headend technician can pinpoint the closest (i.e., the most probable) offenders, determine their directions and start the verification process with the rotor-mounted search antenna. Based on the tabulated technical information, the search can be concentrated on the most powerful stations or those that have the highest transmitting antenna towers.

The computer program for the maps was developed and data for the listings was collected by the staff of Biro Engineering, Princeton, N.J. The information is accurate as of Sept. 1, 1988.

Key to listing

Call letters: Ch. 4 station identification

City: Station location or the area served by the station

Network affiliation:

A/C	ABC and CBS programming
C/N	CBS and NBC programming
A/N	ABC and NBC programming
ACN	ABC, CBS and NBC programming
ED	Educational station (PBS)
IND	Independent station
CBC	Canadian Broadcasting Corp.
CTV	Canadian Television Network
REL	Religious programming
TVA	Canadian Independent Programming
SRC	Societe Radio-Canada
SP	Spanish language programming

Power: The effective visual radiated output power (in kilowatts)

Offset: The offset frequency of the station

0	No offset
−	−10 kHz offset
+	+10 kHz offset

HAAT: Transmitting antenna height above average terrain (in feet)

Call letters	City	Network affiliation	Power	Offset	HAAT
WTVY	Dothan, Ala.	CBS	100	0	1880
KTBY	Anchorage, Alaska	IND	39	−	180
KYUK	Bethel, Alaska	ED	5	0	200
KJNP	North Pole, Alaska	REL	19	+	1620
KVOA	Tucson, Ariz.	NBC	35	−	3680
KARK	Little Rock, Ark.	NBC	100	0	1693
KNBC	Los Angeles	NBC	45	0	3200
KRON	San Francisco	NBC	100	−	1680
KCNC	Denver	NBC	100	−	1477
WJXT	Jacksonville, Fla.	CBS	100	+	960
WTVJ	Miami	CBS	100	0	950
KITV	Honolulu	ABC	100	−	45
KAID	Boise, Idaho	ED	27	+	2474
WHBF	Rock Island, Ill.	CBS	100	+	1342

Call letters	City	Network affiliation	Power	Offset	HAAT
WTTV	Bloomington, Ind.	IND	55	0	1200
KTIV	Sioux City, Iowa	NBC	100	–	1915
KLBY	Colby, Kan.	IND	100	0	748
WWL	New Orleans	CBS	100	+	1009
WBZ	Boston	NBC	60	–	1160
WTOM	Cheboygan, Mich.	NBC	100	+	620
WDIV	Detroit	NBC	98	0	1010
WCCO	Minneapolis	CBS	100	0	1430
WCBI	Columbus, Miss.	CBS	100	–	2000
WDAF	Kansas City, Mo.	NBC	100	0	1130
KMOV	St. Louis	CBS	100	–	1110
KXLF	Butte, Mont.	CBS	100	0	1892
KOUS	Hardin, Mont.	ABC	100	+	1060
KDUH	Scottsbluff, Neb.	ABC	100	+	2000
KSNB	Superior, Neb.	ABC	100	+	1130
KCRL	Reno, Nev.	NBC	17	0	420
KOB	Albuquerque, N.M.	NBC	27	+	4200
WIVB	Buffalo, N.Y.	CBS	100	–	1200
WNBC	New York	NBC	18	0	1690
WUNC	Chapel Hill, N.C.	ED	100	+	990
KXJB	Valley City, N.D.	CBS	98	–	2030
KWSE	Williston, N.D.	ED	100	0	910
WCMH	Columbus, Ohio	NBC	100	–	903
KTVY	Oklahoma City	NBC	100	–	1540
KPIC	Roseburg, Ore.	CBS	6	+	1000
WTAE	Pittsburgh	ABC	100	+	965
WCIV	Charleston, S.C.	NBC	100	0	1960
WYFF	Greenville, S.C.	NBC	100	–	2000
KPRY	Pierre, S.D.	ABC	100	0	1280
WSMV	Nashville, Tenn.	NBC	100	+	1425
KAMR	Amarillo, Texas	NBC	100	0	1420
KWAB	Big Spring, Texas	NBC	13	–	380
KDFW	Dallas	CBS	100	+	1685
KDBC	El Paso, Texas	CBS	100	0	1563
KGBT	Harlingen, Texas	CBS	100	+	1325
KJAC	Port Arthur, Texas	NBC	100	–	1180
KMOL	San Antonio	NBC	100	0	1476
KTVX	Salt Lake City	ABC	32	–	3870
KOMO	Seattle	ABC	100	0	810
KXLY	Spokane, Wash.	ABC	48	–	3060
WOAY	Oak Hill, W. Va.	ABC	100	0	740
WTMJ	Milwaukee	NBC	100	–	1000
KCWC	Lander, Wyo.	ED	100	0	1515
WRC	Washington, D.C.	NBC	100	–	570
CFCN	Calgary, Alberta	IND	100	0	700
CITL	Lloydminster, Alberta	CTV	130	–	782
CHAT	Pivot, Alberta	CBC	6	+	644
CBCH	Burns Lakes, British Columbia	CBC	1	+	1050
CFJC	Kamloops, British Columbia	CBC	4	+	501
CJAY	Brandon, Manitoba	CTV	100	+	1444
CBWT	Lac Du Bonnet, Manitoba	CBC	20	0	442
CHCR	Campbellton, Maritime Provinces	CBC	25	–	1360
CIMT	Edmundston, Maritime Provinces	IND	3	–	3250
CHSJ	St. John, Maritime Provinces	CBC	100	+	1263
CJCB	Sydney, Maritime Provinces	CTV	180	0	399
CBNT	Hermitage, Newfoundland	CBC	7	+	797
CFCL	Hearst, Ontario	CBC	1	–	200
CHNB	North Bay, Ontario	CBC	100	–	730
CBOT	Ottawa	CBC	100	+	1310
CHFD	Thunder Bay, Ontario	CTV	56	–	1260
CFCM	Quebec	IND	100	0	460
CKRN	Rouyn, Quebec	CBC	115		846
CHOY	St. Jerome, Quebec	CTV	1	0	70
CKBI	Greenwater Lake, Saskatchewan	CBC	3	0	725
CBKT	Moose Jaw, Saskatchewan	CBC	100	–	800
XHIT	Chihuahua, Mexico	SP	43	+	900
XELN	Torreon, Mexico	SP	4	0	130
WAPA	San Juan, Puerto Rico	SP	54	–	2865


Greenwater Lake (0)
Kamloops (+)
Calgary (0)
Pivot (+)
Moose Jaw (−)
Brandon (+)
Lac Du Bonnet (0)
Hearst (−)
Thunder Bay
Rouyn
Edmunds
Quebec (0)
North Bay (−)
Ottawa (+)
St. Jerome (0)
Seattle (0)
Spokane (−)
Williston (0)
Valley City
Butte (0)
Hardin (+)
Minneapolis (0)
Cheboygan
Roseburg (+)
Boise (+)
Lander (0)
Pierre (0)
Scottsbluff (+)
Sioux City (−)
Milwaukee (−)
Detroit
Buffalo (−)
Boston
Rock Island (+)
Salt Lake City (−)
Reno (0)
Denver (−)
Colby (0)
Superior (+)
Kansas City (0)
St. Louis (−)
Bloomington (0)
Columbus (−)
Pittsburgh (+)
New York (0)
Washington, D.C.
Oak Hill (0)
San Francisco (−)
Nashville (+)
Chapel Hill (+)
Greenville (−)
Albuquerque (+)
Amarillo (0)
Oklahoma City (−)
Little Rock (0)
Los Angeles (0)
Columbus (−)
Charleston (0)
Tucson (−)
El Paso (0)
Big Spring (−)
Dallas (+)
Dothan (0)
Jacksonville (+)
Port Arthur
New Orleans
San Antonio (0)
Chihuahua (+)
Harlingen
Miami (0)
Torreon (0)

Cable Exchange

PHASECOM
- 7170-05, MODULATOR, COHERENT, CH 5
- 7170-06, MODULATOR, COHERENT, CH 6
- 7170-07, MODULATOR, COHERENT, CH 7
- 7170-08, MODULATOR, COHERENT, CH 8
- 7170-09, MODULATOR, COHERENT, CH 9
- 7170-10, MODULATOR, COHERENT, CH 10
- 7170-11, MODULATOR, COHERENT, CH 11
- 7170-12, MODULATOR, COHERENT, CH 12
- 7170-13, MODULATOR, COHERENT, CH 13
- 7260-06, DEMODULATOR, TV, CH 6
- 7360-02, PROCESSOR, HETRODYNE, CH 2
- 7360-03, PROCESSOR, HETRODYNE, CH 3
- 7360-04, PROCESSOR, HETRODYNE, CH 4
- 7360-05, PROCESSOR, HETRODYNE, CH 5
- 7360-06, PROCESSOR, HETRODYNE, CH 6
- 7360-07, PROCESSOR, HETRODYNE, CH 7
- 7360-08, PROCESSOR, HETRODYNE, CH 8
- 7360-10, PROCESSOR, HETRODYNE, CH 10
- 7360-11, PROCESSOR, HETRODYNE, CH 11
- 7360-12, PROCESSOR, HETRODYNE, CH 12
- 7360-13, PROCESSOR, HETRODYNE, CH 13
- 7360-F, PROCESSOR, HETRODYNE, CH F
- 7500-02, INPUT CONVERTER, CH 2
- 7760-02, INPUT CONVERTER, CH 2
- 7760-03, INPUT CONVERTER, CH 3
- 7760-04, INPUT CONVERTER, CH 4
- 7760-06, INPUT CONVERTER, CH 6
- 7760-07, INPUT CONVERTER, CH 7
- 7760-08, INPUT CONVERTER, CH 8
- 7760-10, INPUT CONVERTER, CH 10
- 7760-11, INPUT CONVERTER, CH 11
- 7760-13, INPUT CONVERTER, CH 13
- 7780-11, INPUT CONVERTER, CH 11
- 7780-12, INPUT CONVERTER, CH 12
- 7780-22, INPUT CONVERTER, CH 22
- 7780-24, INPUT CONVERTER, CH 24
- 7780-29, INPUT CONVERTER, CH 29
- 7780-35, INPUT CONVERTER, CH 35

PICO
- XUV-H, XTAL CONTROL CONV

PIONEER
- BC2001, CONVERTER
- BC3300, CONVERTER

RAYCHEM
- TF-500-C, THERMOCRIMP CONNECTOR
- TP-500-C, THERMOCRIMP CONNECTOR
- TP-750-C, THERMOCRIMP CONNECTOR
- TP-875-C, THERMOCRIMP CONNECTOR
- TS-500-C, THERMOCRIMP CONNECTOR
- TS-750-C, THERMOCRIMP CONNECTOR
- TX-750-C, THERMOCRIMP CONNECTOR

SCIENTIFIC ATLANTA
- C230250, SPECTRUM INVERTER FOR 6350

STANDARD COMPONENTS
- CS PLUS-2, CONVERTER

STURGEON BAY
- CC-1005, ROKA CLIP
- CC-1010, ROKA CLIP
- CC-1020, ROKA CLIP

TEXSCAN
- EQ-08/250, EQUALIZER, 250MHZ/8DB
- EQ-08/300, EQUALIZER, 300MHZ/8DB
- EQ-12/300, EQUALIZER, 300MHZ/12DB
- KCMG, MANUAL GAIN BRIDGER
- PCAB-1, TRUNK BRIDGER AGC
- PCAD-1D, TRUNK BRIDGER AGC
- PCAD-1H, HOUSING FOR PCAD-1D
- PCMD-2, TRUNK BRIDGER
- PCMB-2H, HOUSING FOR PCMB-2
- PCM-4, TRUNK AMP
- PCM-4H, HOUSING FOR PCM-4
- PCRA, RETURN AMP
- PCSPL-1, SPLITTER
- PCSPL-2, SPLITTER
- PCSPL-3, SPLITTER
- PCSPL-4, SPLITTER
- PCTB-6, TRUNK TERMINATING BRIDGER
- PD-0, PAD
- PD-3, PAD
- PD-6, PAD
- PD-9, PAD
- PH, HOUSING — P SERIES
- PPLUG, POWER PLUG
- T3LE, LINE EXTENDER
- T4BDC-8, PAD
- T4BDL-12, PAD
- T4CM, CONTINUITY MODULE
- T4SPL, PAD
- TFAV, TRUNK AMP AGC
- TFM, TRUNK AMP MGC
- TFPS, POWER SUPPLY
- TH, HOUSING FOR T SERIES
- VEQ-12/250, EQUALIZER
- VEQ-12/300, EQUALIZER
- VEQ-8/300, EQUALIZER
- XH, HOUSING FOR X SERIES
- XR2A, FORWARD MOD AGC
- XR2B, BRIDGER MOD INTERMEDIATE
- XR2B-2, BRIDGER 2 OUTPUT
- XR2B-4, BRIDGER 4 OUTPUT
- XR2DA, DIST AMP HYBRID AGC
- XR2DM, DIST AMP HYBRID MGC
- XR2F-1, INPUT MOD
- XR2F-13, INPUT MOD
- XR2F-14, OUTPUT MOD
- XR2F-19, OUTPUT MOD
- XR2F-3/110, INPUT MOD
- XR2F-4, INPUT MOD
- XR2F-5, OUTPUT MOD
- XR2F-7/110, OUTPUT MOD
- XRF2-8, OUTPUT MOD
- XR2HA, LINE AMP HYBRID HRC
- XR2HM, LINE AMP HYBRID HRC
- XR2LAF-1, POWER INPUT MOD
- XR2LAF-2, POWER INPUT MOD
- XR2LAF-3, POWER OUTPUT MOD
- XR2LAF-4, POWER OUTPUT MOD
- XR2LARA, REVERSE AMP MOD
- XR2LA-PS, POWER SUPPLY
- XR2LS-3, LINE EXT
- XR2M, FORWARD MGC MOD
- XR2PS, POWER SUPPLY
- XR2RHA110, REVERSE AGC MOD
- XR2SPH, HOUSING FOR XR2PS
- XR2-13, TAP, 4 WAY
- XRBI, INTERMEDIATE BRIDGER
- XRCE-3, LINE EXT
- XRCE-6, LINE EXT
- XRDC-16, LINE EXT
- XRDC-8, LINE EXT
- XRLA, LINE AMP
- XRLS-2, LINE EXT
- XRLS-3, LINE EXT
- XRPG-3, PILOT CARRIER GENERATOR
- XRPR, POWER SUPPLY
- XRRP, LINE EXT
- XRSP, LINE EXT

TIMES FIBER
- T6875, CABLE, .875 BARE/NEW/2600′ PER REEL

Call: 1-(800)-422-2567 to place your order.

In Colorado, call 1-(303)-694-6789

Reader Service Number 68.

Help Wanted

Lead Technician

Rapidly growing private cable company is seeking a career-minded, stable individual with strong head-end and distribution skills.

Good benefits package, salary plus bonuses. Send resume & salary history to:

R&R Technologies, Inc.
7078 Peachtree Industrial Blvd., Suite 300
Norcross, GA 30071
Attn: General Manager

An Equal Opportunity Employer • M/F/Handicapped

SYSTEM ENGINEER

TCI of Illinois, Inc. is seeking a qualified engineer to supervise a dual 450 MHz, 2,000 mile plant in the Chicago suburbs. Must have experience in addressability, HRC systems, AML, I-Nets, system design and vast supervisory skills. The Mt. Prospect system will have an annual growth of 5% on plant miles and the successful candidate must have proven record of construction experience. Send resume and salary requirements to:

TCI of Illinois, Inc.
State Engineer
1201 Feehanville Dr.
Mt. Prospect, Il. 60056

TCI is an Equal Opportunity Employer

WANTED: C.A.D.D. DESIGNERS

Utilizing C.A.D.D. "MAGIC" system to upgrade 3200 miles of plant from 300 MHz to 450 MHz. On site design - two terminals.

Contact:
Cox Cable Hampton Roads, Inc.
4585 Village Avenue
Norfolk, Virginia 23502
Del Albert (804) 857-5555

engineering

UNLIMITED OPPORTUNITIES

We're a large communications company currently seeking a professional with technical expertise and good people skills. This is an unprecedented opportunity to join a rapidly growing company in a leadership role.

ENGINEERING DIRECTOR

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Technical Supervisor

Growing MSO needs a strong individual who has 4-6 years technical and supervisory experience. Responsible for maintaining high-quality cable service, supervision and training of 14-member technical staff and related administrative functions. Supervisory experience in a union environment helpful. Send resume and salary requirements to:

Personnel Department
Heritage Cablevision
16830 Edison Road
Mishawaka, Indiana 46545

EOE

CATV Technician

Qualification: Min. 5 yrs. exp. systems sweep, splicing, resolving outages. Send resume to:

Falcon Cable Systems
Att: Richard Furtado
7630 Eigleberry St.
Gilroy, CA 95020

EOE

SUB CONTRACT AERIAL CREWS

Needed for long term work in New England. Good rates, good jobs, paid weekly with no retainage. Contact:

White Mountain Cable
603-736-4766

CORPORATE DESIGN-DRAFTER

Individual will perform aerial and underground cable television plan design and drafting for large cable television MSO at the company's corporate office. Will be responsible for design accuracy, bill-of-material generation and miscellaneous drafting projects as required. Will also be responsible for the maintenance of corporate-wide maps.

Applicant should have at least three years experience in cable television, previous experience in broadband design, computer experience, an understanding of all aspects of system design, including level analysis, component selection and basic cable television theory.

Applicant should also demonstrate an ability to work with people, self-motivation, willingness to learn new procedures and techniques, and organization skills.

Position will report to Corporate Design Supervisor.

PLEASE SEND RESUME & SALARY HISTORY TO:

CT Publications/BO1
P.O. Box 3208
Englewood, CO 80155

EQUAL OPPORTUNITY EMPLOYER

Technician/Plant Manager

Required for small cable system in southern Nevada. Salary negotiable. Immediate opening. Call (800) 457-1800.

Help Wanted

CORPORATE STAFF ENGINEER

Individual will perform technical support activities for large cable television MSO at the company's corporate office. These activities include investigation and analysis of new technologies and equipment, development of system design criteria and assistance in the development of technical operations practices.

Other responsibilities include engineering assistance, technical support for system personnel and assistance in company's efforts for technical development through policies and practice.

Applicant must be able to communicate well in writing and verbally. Must have working knowledge of headend, earth station, construction, FCC compliance and computer systems.

Prefer BSEE with strong background in cable television.

PLEASE SEND RESUME & SALARY HISTORY TO:

CT Publications/BO1
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Send current resume and salary history to:

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Attn: Stephen J. Sadler
5555 Oakbrook Parkway, Suite 190
Norcross, Georgia 30093
404/662-8310

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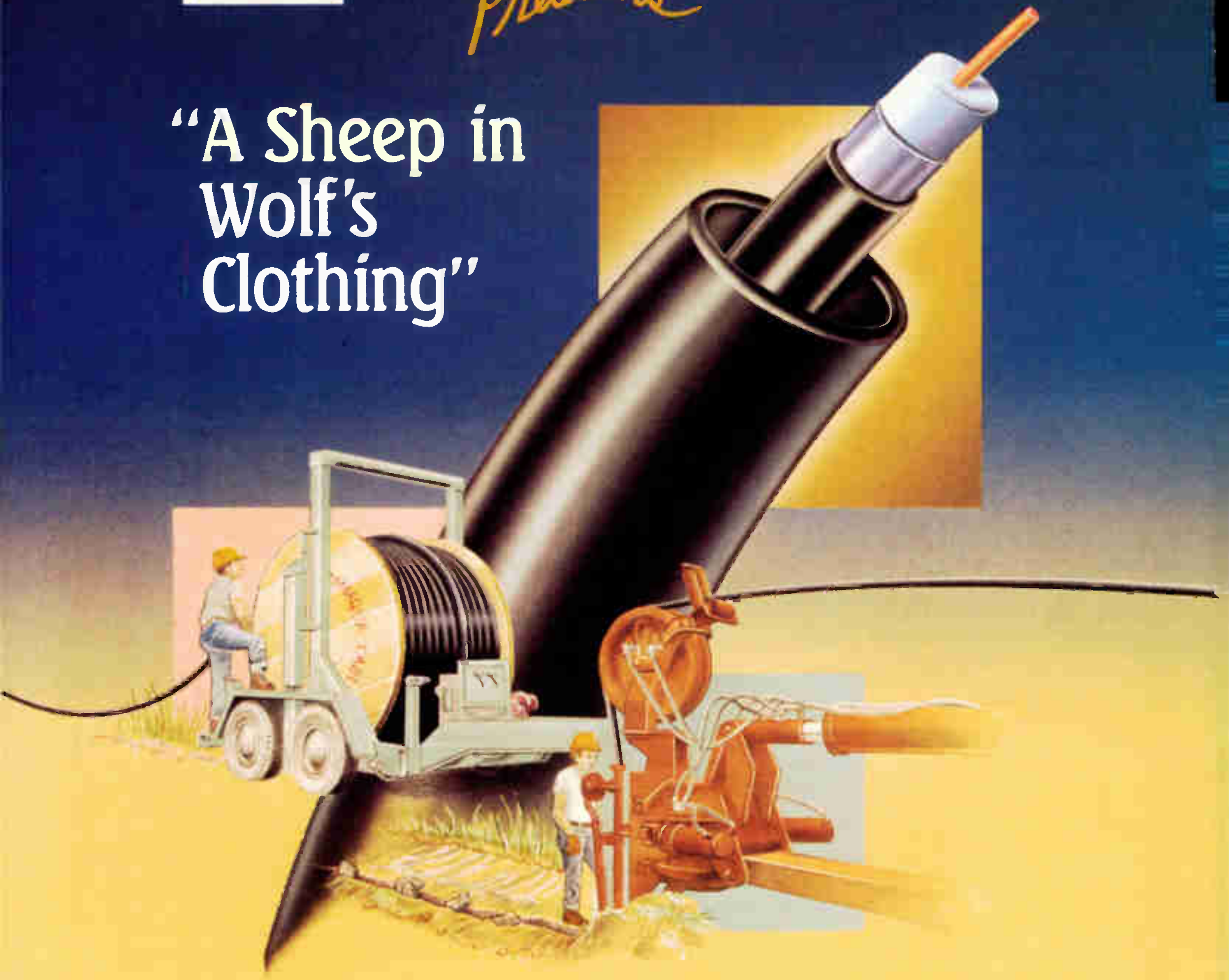

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Reader Service Number 71.

Call before you dig

Before starting construction of underground CATV plant, it is important to know the location of buried cable from other utility companies. The following is a list of phone numbers for locations, arranged alphabetically by state, that work with utilities and supply the necessary information. Unless otherwise listed, coverage area is statewide. N/A = Not Available.

The data is reprinted from the *1989-1990 Directory* with permission from the One-Call Systems International Committee of the Utility Locating & Coordination Council of the American Public Works Association.

This is the first of two parts.

Alabama
Alabama Line Location Center (Miss All)
(800) 292-8525

Arizona
Arizona Blue Stake Inc.
(602) 263-1100
Coverage area: Maricopa, Yavapai, Yuma, Mohave and Coconino counties, and parts of Pima and Pinal
Tucson One-Call
(602) 792-2211
Coverage area: Pima, Cochise, Graham, Greenlee, Santa Cruz, parts of Pinal, and Gila and Maricopa counties
Blue Stake
(602) 474-3050
Coverage area: Payson

Arkansas
Arkansas One-Call System Inc.
(800) 482-8998

California
Underground Service Alert South
(800) 422-4133
Coverage area: Southern California
Underground Service Alert North
(800) 642-2444 California
(800) 227-2600 Nevada
Coverage area: Northern California and Nevada

Colorado
Utility Notification Center of Colorado
(303) 534-6700

Connecticut
Call Before You Dig
(800) 922-4455

Delaware
Utilities Service Protection Center of Delmarva Inc.
(800) 282-8555

Florida
Florida One Call
(800) 432-4770 (U.N.C.L.E)

Georgia
Utilities Protection Center Inc.
(800) 282-7411

Idaho
Palouse Empire Underground Coordinating Council
(208) 882-1794
Coverage area: Northern Idaho
Utilities Underground Location Center
(800) 424-5555
Coverage area: N/A
Dig-Line
(208) 343-6700
Coverage area: N/A
Panhandle Utility Coordinating Council
(208) ZE-9169
Coverage area: N/A

Illinois
Julie Inc.
(800) 892-0123
Coverage area: Illinois (except Chicago)
Digger (Chicago Utility Alert Network)
(312) 744-7000
Coverage area: Chicago

Indiana
Indiana Underground Plant Protection Services Inc.
(800) 382-5544

Iowa
Underground Plant Location Service Inc.
(800) 292-8989

Kansas
Kansas One-Call Center
(316) 687-2470

Kentucky
Kentucky Underground Protection Inc.
(800) 752-6007
Coverage area: Statewide (except Cincinnati Bell area)

Louisiana
Dottie—Louisiana One Call System Inc.
(800) 272-3020

Maine
Dig-Safe
(800) 225-4977

Maryland
Miss Utility
(800) 257-7777
Coverage area: Maryland, Virginia and District of Columbia
Utilities Service Protection Center of Delmarva Inc.
(800) 282-8555

Massachusetts
Massachusetts Dig Safe
(800) 322-4844
Coverage area: Massachusetts, Maine, New Hampshire, Vermont and Rhode Island

Michigan
Miss Dig
(800) 482-7171

Minnesota
Gopher State One Call
(800) 252-1166

Mississippi
Mississippi One-Call System Inc.
(800) 227-6477

Missouri
Missouri One-Call System Inc.
(800) 344-7483
To Begin
(417) 862-3446
Coverage area: N/A

Montana
Montana Utility Coordinating Council
(800) 424-5555

Nebraska
Nebraska Underground Hotline Inc.
(800) 642-8434
Coverage area: Statewide except for Lincoln
Lincoln One-Call
(402) 476-0547
Coverage area: City of Lincoln only

Nevada
Underground Service Alert
(800) 227-2600 Nevada
(800) 642-2444 California
Coverage area: Nevada and northern California

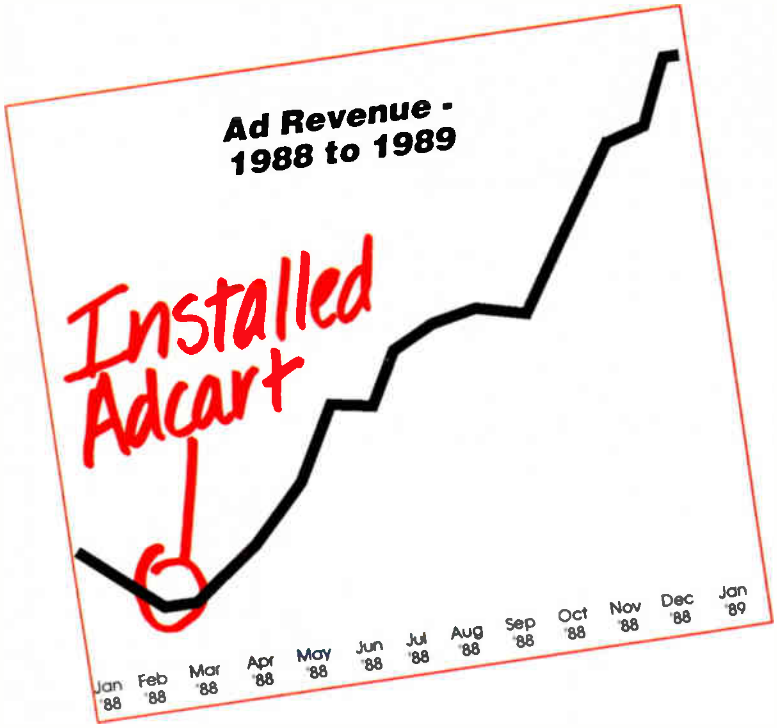
New Hampshire
Dig-Safe
(800) 225-4977

New Jersey
Garden State Underground Plant Location Service
(201) 232-1232 or (201) 232-1239

New Mexico
San Juan County Utility Council
(505) 327-3777
Coverage area: San Juan County
Blue Stake
(505) 287-9292
Coverage area: Grants-Milan-Mesita
Albuquerque Utility Council
(505) 765-1234
Coverage area: Greater Albuquerque
Blue Stake (Santa Fe)
(505) 988-8841
Coverage area: Santa Fe
Dig Line
(505) 425-3898
Coverage area: Las Vegas and vicinity
Roswell Utility Council
(505) 622-1234
Coverage area: Roswell and vicinity
Excavation Damage Control Center
(505) 526-0400
Coverage area: Las Cruces and vicinity
Blue Stake (c/o City of Alamogordo, DPW)
(505) 437-7700
Coverage area: Alamogordo, Tularosa and vicinity

New York
Underground Facilities Protection
(800) 962-7962
Coverage area: Central, eastern and northern New York
Underground Utility Locating Service
(716) 893-1133
Coverage area: Counties—Erie, Niagara, Chautauqua, Cattaraugus, Wyoming, Genesee, Orleans and Alleghany
Underground Utilities Call Center
(800) 245-2828
Coverage area: Hudson Valley
Utility Call Center
(516) 661-6000
Coverage area: Long Island

North Carolina
Utilities Locating Co. Inc.
(800) 632-4949



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You'll have these advanced capabilities...

- Computer-adjusted audio levels
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- Video-quality detection
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- Real-time, multi-tasking modular software
- Minimal rack space requirements — 50% less
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- Extensive local/remote diagnostics from factory
- Unlimited expansion capability
- Network program scheduling with a bonus loop

... and many more.

Maximum fixed-position schedules mean increased revenue. 19,200 spots, 2,400 events, 16-schedule capacity per channel, tailored for your market and budget needs. We have made over 5,000 channels pay for themselves countless times over.

Also a router, black-out, and headend switching controller, syndex program exclusivity switcher, and program playback system. Its functions are fitted to your application. ADCART is designed to grow with your system — without locking you into yesterday's technology.

Increase spontaneous ad sales opportunities with quick, flexible scheduling. With its state-of-the-art software, ADCART operates in full random access, random pod, or random pod sequential mode.

Save costs in maintenance and missed spots. ADCART's spot-to-spot commercial cueing wears VCRs and tape up to 75% less. Power failures are no problem — 100-hour super-capacitor backup assures retention of schedules and logs. When power's restored, the system will auto restart, reboot and recue.

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Call CHANNELMATIC toll-free and request a demonstration and free catalog. We have over 200 products, including A/V switchers, DAs, custom time/tone switching systems, and much more. In fact, we are the world's largest supplier of ad insertion systems, and we equip whole systems from our own line. CHANNELMATIC knows how to make it all work for you.

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— The recognized leader in ad insertion. More than 5,000 channels in operation —

Reader Service Number 72.

Woody

Anixter Cable TV named **Gene Robinson** executive vice president of national accounts. He will relocate to the new National Account Center in Denver.

Larry Walsh was promoted to vice president of inventory management for Anixter Bros. He was most recently regional vice president for the Midwest region.

Wendell Woody joined Anixter Cable TV as fiber-optic applications manager. Prior to this, he was national director of sales for Catel. Contact: 4711 Golf Rd., 1 Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

Cable Television Laboratories named **Thomas Gillett** vice president of business development and technology transfer. He was previously director of advanced operations testing at GTE. Contact: 124 Mt. Auburn St., Suite 200, Cambridge, Mass. 02138, (617) 576-5754.

Peterson

General Instrument appointed **Lee Peterson** as assistant vice president of new business development for its **VideoCipher Division**. Previously, he was deputy director of engineering for TRW Space and Defense Systems' military electronics and avionics division.

Chuck Uhl was promoted to director of new market development. He was formerly national sales manager.

Chaz Fitzhugh was named director of sales. He was most recently with Sony Corp. of America as national sales and marketing manager for video recorders and audio/video laser disc products.

Allen McCabe was promoted to national sales manager. Previously, he was regional sales manager. Contact: 6262 Lusk Blvd., San Diego, Calif. 92121, (619) 455-1500.

The Drop Shop Ltd. promoted **Karen Boysen Skok** to vice president of purchasing. She will continue to oversee all domestic and import purchasing as well as retain responsibility for the inventory control program. Contact: P.O. Box 284, Roselle, N.J. 07203, (201) 241-9300.

James Elsenbeck was appointed product manager of LAN systems for the **Jerrold Distribution Systems Division** of General Instrument (GI). Formerly, he was an electrical engineer with GI.

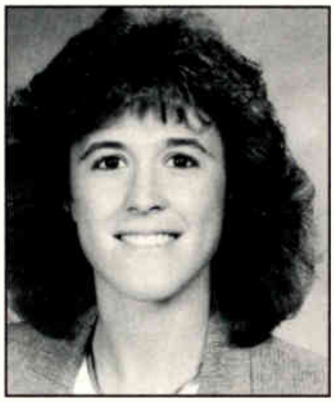
Christopher Frederick joined the Jerrold Division as an applications engineer. He was most recently with Wavetek RF Products. Contact: 2200 Byberry Rd., Hatboro, Pa. 19040, (215) 674-4800.

Lippert

Richard Masson joined **Nexus Display Systems Corp.**'s research and development team as product development supervisor. He was previously supervisor for transmitter systems at NBN-TV in Newcastle, Australia.

Tony Lippert was named product support specialist. He recently graduated from Selkirk College in Castlegar, British Columbia, with a degree in electronics. Contact: 7000 Lougheed Hwy., Burnaby, British Columbia, Canada V5A 4K4, (604) 420-5322.

Potasek



Karlik

ADC Telecommunications named **Maureen Potasek** account manager in the Southeast district. She was formerly sales administrator.

Linda Karlik was appointed account manager in the Northeast district. Previously, she worked for Canstar Communications and GTE. Contact: 4900 W. 79th St., Minneapolis, Minn. 55435, (612) 835-6800.

NaCom named **Bob Gemignani** vice president of marketing and corporate development. Before this, he was with Cooper Industries.

Mike Ferguson was promoted to director of field operations for the installation division. He was formerly Central regional manager. Contact: 1900 E. Dublin-Granville Rd., Columbus, Ohio 43229, (614) 895-1313.

Byron Leech was appointed to the Education Committee of the **National Cable Television Center and Museum** at the Pennsylvania State University. He is currently president of the National Cable Television Institute. Contact: P.O. Box 27277, Denver, Colo. 80227, (303) 761-8554.

Oak Industries named **Alan Steel** chief financial officer. Before joining Oak, he was chief financial officer, vice president of finance and treasurer for Data-Design Laboratories. Contact; 16510 Via Esprillo, San Diego, Calif. 92127, (619) 485-9300.

Block

Acrian appointed **Steven Block** to Western regional sales manager. Prior to this, he managed Eastern regional sales.

Frank Klarer was named Eastern regional sales manager. He was previously with Motorola in marketing. Contact: 490 Race St., San Jose, Calif. 95126, (408) 294-4200.

Midwest CATV announced four new appointments for its Southern region. **Scott Wells** was promoted to sales manager and **Jim Kelly** was named operations manager. Joining the sales staff are **Keith Duckwitz**, outside sales and **Jerry Fredrick**, inside sales.

Also, **Bill Cody** was named lead salesperson for the company's new Dallas office. Contact: P.O. Box 271, Charleston, W. Va. 25321, (304) 343-8874.

Reader Service Number 73.

April

April 10: Scientific-Atlanta technical seminar on headend and earth station systems training, Airport Hilton Inn, Philadelphia. Contact Dan Pruitt, (800) 722-2009.
April 10: SCTE Florida Chapter's South Florida Group technical seminar on high-definition television. Contact Denise Turner, (800) 282-9164.
April 11: SCTE Chattahoochee Chapter BCT/E testing. Contact Jack Connolly, (912) 741-5068.
April 11: Scientific-Atlanta technical seminar on distribution systems training, Airport Hilton Inn, Philadelphia. Contact Dan Pruitt, (800) 722-2009.
April 11-12: Trellis Communications seminar on fiber-optic networks, Marina Beach Hotel, Marina Del Rey, Calif. Contact Richard Cerny, (603) 898-3434.
April 11-13: Magnavox CATV technical seminar, Bellingham, Wash. Contact Amy Haube, (315) 682-9105.
April 12: SCTE Golden Gate Chapter technical seminar on data communications and networking. Contact Sam Towne, (408) 452-9100.
April 12: SCTE Upstate New York Meeting Group technical seminar on measurement systems, Buffalo, N.Y. Contact Ed Pickett, (716) 325-1111.
April 12: SCTE Wyoming Meeting Group technical seminar on cable manufacturing and transportation systems, United Cable, Casper, Wyo. Contact Matt Forgas, (307) 324-2286.
April 13: SCTE Chesapeake Chapter technical seminar on satellite communications, Holiday Inn, Columbia, Md. Contact Tom Gorman, (301) 252-1012.
April 13: SCTE Upstate New York Meeting Group technical seminar on CLI testing, Holiday Inn, Auburn, N.Y. Contact Ed Pickett, (716) 325-1111.
April 18-19: National Cable Television Association seminar on FCC's signal leakage regulations, Hartford, Conn. Contact (202) 775-3637.
April 18-20: Magnavox CATV technical seminar, Portland, Ore. Contact Amy Haube, (315) 682-9105.
April 19: SCTE Rocky Mountain Chapter technical seminar on fiber-optic communications, Jones Intercable, Englewood, Colo. Contact Rikki Lee, (303) 792-0023.
April 19: SCTE Hudson Valley Chapter technical seminar. Contact Robert Price, (518) 382-8000.
April 20: SCTE Central California Meeting Group technical seminar on system testing and spectrum analysis. Contact Andrew Valles, (209) 453-7791.
April 21: SCTE Heart of America Chapter technical seminar, Holiday Inn Sports Complex, Kansas City, Mo. Contact Wayne Hall, (816) 942-3715.
April 21: SCTE Miss/Lou Chapter technical seminar on amplification methods, Baton Rouge, La. Contact Charles Thibodeaux, (504) 641-9251.
April 21-22: Kentucky Cable Television Association membership meeting, Drawbridge Inn, Covington, Ky. Contact Randa Wright, (502) 864-5352.
April 22: SCTE Golden Gate Chapter BCT/E testing. Contact Tom Elliott, (408) 727-5295.
April 22: SCTE Central California Meeting Group BCT/E testing. Contact Andrew Valles, (209) 453-7791.
April 24: SCTE North Jersey Chapter BCT/E testing, Wayne Holiday Inn, Wayne, N.J. Contact Art Mutschler, (201) 672-1397.
April 24-26: Magnavox CATV technical training seminar, San Francisco. Contact Amy Haube, (315) 682-9105.
April 24-26: ElectroniCast Corp. seminar "Fiber optics to the year 2000," Plaza Hotel, Monterey, Calif. Contact Eloise Beckett, (415) 572-1800.
April 25: SCTE Satellite Tele-Seminar Program, "The future of the CATV business (Part II)" and "Frontline: Senior cable engineers (Part I)," 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888.
April 25-27: C-COR Electronics technical seminar, Columbus, Ohio. Contact Shelley Parker, (800) 233-2267.
April 27: Scientific-Atlanta technical seminar on headend and earth station systems training, Hilton at Peachtree Corners, Atlanta. Contact Dan Pruitt, (800) 722-2009.
April 28: Scientific-Atlanta technical seminar on distribution systems training, Hilton at Peachtree Corners, Atlanta. Contact Dan Pruitt, (800) 722-2009.

Planning ahead

May 21-24: NCTA Show, Convention Center, Dallas.
June 15-18: Cable-Tec Expo '89, Orange County Convention Center, Orlando, Fla.
Aug. 27-29: Eastern Show, Atlanta Merchandise Mart, Atlanta.
Sept. 20-22: Great Lakes Expo, Convention Center, Columbus, Ohio.
Oct. 3-5: Atlantic Show, Convention Center, Atlantic City, N.J.
Oct. 17-19: Mid-America Show, Hilton Plaza Inn, Kansas City, Mo.
Dec. 13-15: Western Show, Convention Center, Anaheim, Calif.

May

May 1-4: Siecor Corp. technical seminar on fiber-optic installation and splicing for LAN, building and campus applications, Hickory, N.C. Contact (704) 327-5998.
May 2-4: Magnavox CATV technical seminar, Los Angeles. Contact Amy Haube, (315) 682-9105.
May 8-10: Canadian Cable Television Association annual convention, Metro Toronto Convention Center, Toronto. Contact Christiane Thompson, (613) 232-2631.
May 9: SCTE Chattahoochee Chapter technical seminar. Contact Jack Connolly, (912) 741-5068.
May 9: SCTE Central Illinois Chapter technical seminar on CLI and signal leakage, Sheraton Inn, Bloomington, Ill. Contact Tony Lasher, (217) 784-5518.
May 9-11: Magnavox CATV technical seminar, Phoenix. Contact Amy Haube, (315) 682-9105.
May 10: SCTE North Country Chapter technical seminar on transportation systems, Sheraton Midway Hotel, St. Paul, Minn. Contact Douglas Ceballos, (612) 522-5200.
May 10: Scientific-Atlanta technical seminar on headend and earth station systems training, Chicago Marriott, Oakbrook, Ill. Contact Dan Pruitt, (800) 722-2009.
May 10: SCTE Caribbean Area Chapter technical seminar on signal processing centers, Cablevision of Mayaguez, Mayaguez, Puerto Rico. Contact Jerry Fitz, (809) 766-0909.
May 10: SCTE Mount Rainier Meeting Group technical seminar on fiber optics. Contact Sally Kinsman, (206) 867-1433.
May 11: Scientific-Atlanta technical seminar on distribution systems training, Chicago Marriott, Oakbrook, Ill. Contact Dan Pruitt, (800) 722-2009.
May 12: SCTE Rocky Mountain Chapter technical seminar on distribution troubleshooting, CLI and signal leakage. Contact Rikki Lee, (303) 792-0023.
May 13: SCTE Cactus Chapter technical seminar. Contact Harold Mackey Jr., (602) 866-0072.
May 15-16: Fibertron fiber-optics seminar, Heritage Inn, Fullerton, Calif. Contact Denise Weber, (213) 690-0670.
May 15-17: Magnavox CATV technical seminar, Denver. Contact Amy Haube, (315) 682-9105.
May 19: SCTE Heart of America Chapter BCT/E testing. Contact Wayne Hall, (816) 942-3715.
May 21-24: NCTA Show, Convention Center, Dallas. Contact (202) 775-3550.

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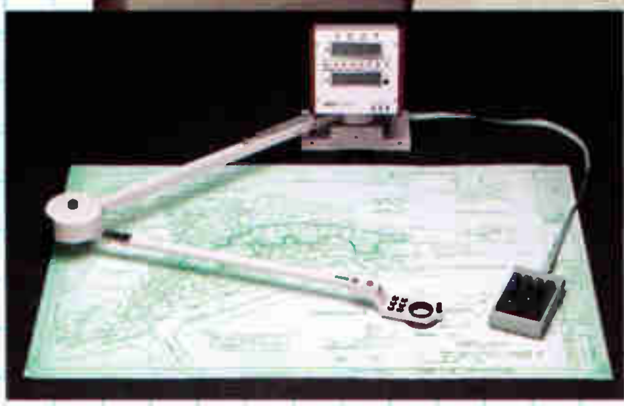

Let A.D.S./Linex, Inc. change the way you draw with Linex CAD! From inputting your existing drawings to creating the finished drawing to analyzing information on your drawings, Linex CAD provides the solution.

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Reader Service Number 74.

Whither cable TV

By Archer S. Taylor
Senior Vice President of Engineering, Malarkey-Taylor Associates

Thirty-five years ago, Norman Penwell, the late Jack Penwell (Norm's cousin), Bruce Hamilton and I established Northwest Video in Kalispell, Mont., gateway to Glacier National Park. This was the first community TV network in Montana and just about the first television ever seen in the state. We fully expected that our new venture would die whenever Kalispell got its first broadcasting station. After all, who would pay $135 up front and $3.75 a month ($675 and $18.75 in 1989 dollars) if one could get Milton Berle and Red Buttons for free—plus local news and even local talent?

The obituary was premature. We discovered that even with one or more local TV stations, people would pay for greater choice of programs and better pictures (not necessarily good—but *better*) than otherwise available.

The simultaneous origination of cable TV in Pennsylvania and the Pacific Northwest during the Federal Communications Commission freeze on new stations was no fluke. Mountains not only blocked reception in the valley towns of the few pre-freeze stations, but they also provided the high elevations where television could be received. What remained was to get the pictures off the mountains and into the homes in the valley. Of the two ways to do this, translators (remember when they were euphemistically called "reflectors"?) had to depend on voluntary contributions ("Don't be a square, pay your share!"), while cable had a much more effective tool: DNP—disconnect for non-payment.

So much for places like Pottsville, Pa.; Kalispell; Astoria, Ore.; and Mahanoy City, Pa. What about New York, Chicago, Cleveland and the other big cities? In Manhattan, the tall buildings proved to be as effective as the mountains of Pennsylvania and the Northwest. They not only blocked reception but provided the high elevations for community antenna reception. But Cleveland, Dallas, Chicago, Indianapolis and many others had no such fortuitous circumstances. TV reception was relatively good and there was a wide choice of programs. Besides, it was "free." Growth of cable TV had reached a plateau.

"Like it or not, HDTV is likely to be controlled primarily by program producers and broadcasters."

Mountain peak

In 1976, when HBO and Columbia Pictures discovered the "mountain peak" at an elevation of 120 million feet above sea level (i.e., the satellite in geostationary orbit at 23,000 miles above the equator), even these well-served markets succumbed to the coaxial Lorelei. Entrepreneurs grappled for the big market franchises in what became a wild, latter-day gold rush. Cable TV was off and running again.

However, with three movie channels beamed down to the entire continental United States, along with network affiliate feeds and a host of niche programs, bypassing the cable service charge with inexpensive TVROs was as easy as

shooting fish in a barrel. Both the variety and picture quality were much better than cable TV—and it was all free! Obviously, program providers dependent on viewer's payments had to do something quickly to stop this "shoplifting." In assuring their own economic survival by scrambling, the program producers also assured cable operators of continued access to the programming that had now become their lifeblood.

Still, cable TV was not the only way to deliver program choice for pay. Why not rent videocassettes with prerecorded movies? At $1.79 a night for well-known and popular movies, there seemed little reason to pay the local cable "extortionist" when you could rent a movie of your own choice for so little at the corner grocery store or the gas station.

But cable TV was not dead yet, since our convenience and real-time programming prevailed. You simply can't buy 24-hour news, weather or home team sports at the supermarket.

Will fiber optics, the telcos and HDTV (high-definition TV) be able to do what broadcasters, TVROs and video stores could not? I doubt it, providing we run a tight ship and reliably deliver the programs that interest our customers with good technical quality at prices perceived by the general public to be fair and reasonable. The tale could have a different ending if we get complacent, greedy or just plain careless.

The cable industry has much going for it. We can do fiber just as well as telcos, but quicker and at lower cost. We were there first and we have lots of loyal customers, albeit a few that are disgruntled.

If the barriers to telco entry into cable TV are removed, we can count on seeing them move quickly into new housing developments and planned communities either with or without a local franchise. Like Cerritos, Calif., these will be test beds and demonstration projects.

The telcos seem to be pinning their hopes on leasing video distribution facilities to cable operators and program providers, especially emphasizing "demand access." For example, they would offer subscribers the opportunity to order by touch-tone any movie in the catalog at any time they choose. No trips to the video store would be needed for at least comparable individual choice of title and time of viewing. Even pause, replay and still-frame features would be available at the touch-tone keypad.

Telcos certainly could provide such a "video jukebox" service with a bank of hundreds or maybe thousands of videotape players and central switching. The show would be transmitted on optical fiber to Ch. 3 (or whatever) on your TV set, or to a video monitor if you prefer.

The video jukebox could become more popular than the video store. However, we know from experience with TRACS and Mini-Hub that remote channel switching is expensive and difficult to upgrade. Perhaps a limited upscale, affluent clientele with large-screen displays could be attracted by offering digital transmission of especially desirable programs in truly high-definition, wide-screen format. It would be difficult for cable TV to match this service; impossible for broadcasters.

Telcos would be ill-advised simply to overlay on the existing cable plant another conventional coaxial network. The outcome is predictable: either buy out, sell out, or suffer the stigma of employing predatory strategies. The history of overbuilding clearly indicates that competition among wire-based video distributors is an unstable situation.

This leads to a plausible scenario that sees telcos engaging in a major buyout campaign reminiscent of that of independent telephone systems after World War II. Many a mom and pop became wealthy by giving up their barbed wire and fencepost, hand-cranked party line telephone networks. They could cry all the way to the bank.

When telcos finally get wise to the real cost of cable programming and customer service, they are likely to have second thoughts about direct overbuilding. For now they are licking their chops at the prospect of taking over the projected $300 to $600 annual revenue per subscriber. Amazingly, however, they do not seem to understand the distinction between "subscribers" and "homes passed"; the terms are synonymous in telephone experience.

Telcos are dissembling when they present HDTV and fiber as reasons why they should be permitted to distribute video programming. The cable industry is at least as capable of adapting its networks to fiber, perhaps even sooner. The truth of the matter is that it is hard to justify providing the enormous excess capacity of the fiber subscriber loop for residential service on the

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ATV production standard

By Walter S. Ciciora, Ph.D.
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The closest thing we have to an advanced television (ATV) standard is a "production standard." ATV is being developed in three distinct segments: production, transmission and display standards. There has been a lot of controversy over production standards, but many cable operators have felt little need to be concerned.

When our current NTSC television standard was introduced, there were only three sources of video: the live camera, the slide scanner and the motion picture scanner. "Production" meant switching between these devices. Any image processing that was not live was done with film; the production standard was film by default. Film was also the method of recording video.

When international use of video gained commercial importance, film again was the medium. It had the advantage that the world's different scanning parameters were irrelevant. Aircraft carried cans of film from country to country.

When videotape was introduced, it became possible to edit programming produced well in advance of the showing time. This greatly increased the freedom of the creative talent.

A negative consequence of the production process was the creation of several "generations" of copies of tapes. Each succeeding generation of tape copy had less quality than the previous and noise and distortions were added. Color signals were particularly sensitive. After only a few generations of copying, very noticeable degradation of quality occurred. There arose a tradeoff between video quality and content quality improvements yielded by editing. Special effects equipment added still more processing steps. Differences between heavily edited scenes and lightly edited scenes became apparent.

It became clear that studio equipment had to have "headroom" to allow for processing of the signal as the editing process created more and more copy generations. Modern studio practice involves handling the video signal in wider bandwidths than are transmitted. Often, the luminance and color information are kept separate. Only when all the processing is complete is the signal put into its final form for transmission.

ATV production standards

As ATV came under consideration, two motivations for a production standard surfaced. First, it was clear that signals that were to be heavily processed should have adequate headroom so that the final result would have the same quality as a "live" shoot. Second, in this ever shrinking world, it would be expedient to have a worldwide standard for program exchange between nations.

A very important additional advantage of the early production standard is timely availability of cameras, tape recorders and special effects equipment. Experimentation in ATV systems has been facilitated and those who wished to produce programming with a long shelf life are able to shoot in ATV.

Since ATV has a high emphasis on video quality, adequate headroom is necessary to preserve quality in the final result. The need for lots of headroom becomes apparent when the desire to use ATV as a substitute for film in the movie industry is appreciated. Movie production involves lots of processing, more than video production.

The hope for a standard for international exchange of video is motivated by the current difficulties experienced when programming is imported or exported. The European 625 line/50 hertz standard (with two different ways of encoding color) and the U.S. 525 line/60 hertz standard lose quality when transcoding takes place. The theory was that the whole world would use only one production standard for making video. In each country, transmission and display in the home would take place using whatever is appropriate for that country's technical and political needs. Unfortunately, it appears at this point that political differences will preclude a single international production standard.

We must not underestimate the stimulating effect the production standard has had on ATV. Because equipment has been available to shoot ATV video and to demonstrate the results, many of us (and most journalists) have actually seen ATV. This has contributed to the level of interest and excitement we are currently experiencing.

Human behavior too often exhibits extremes. First we ignored the need for a production standard; now we've made a religion out of it. We've lost sight of the original purposes for having a production standard. The result is an inappropriate emphasis on having a single standard.

Headroom costs money. Excess headroom will cost excess dollars and precludes ATV production where budgets can't support the added costs.

The degree of headroom needed in the production standard depends on the amount of signal processing to be done before the signal is transmitted to the viewer. If a movie is being made, extensive processing can be expected. Network productions intended for massive audiences (more than half of which will be on cable) require lots of headroom to accommodate the expected processing.

The same can be said of network or nationwide advertising. In both of these cases, money is likely to be available to support the extra costs. The independent broadcaster will likely do much less editing and signal processing and will likely have a much smaller budget. If the independent broadcaster is to be an early participant with ATV, affordable equipment is required. This most likely means equipment with less headroom.

Conversion from the production standard to the standard used for transmission also costs money. How much money depends on the differences and the amount of processing required to accomplish the conversion.

Looking at cable's needs for production equipment, we recognize two important factors. The amount of processing involved is almost always relatively low. The available dollars are almost without exception very limited. If cable is to be an early ATV program source, it needs relatively inexpensive production equipment. It also needs inexpensive conversion from the production to the transmission standard. The "box" between the ATV camera or videotape machine and the headend must be both small in size and affordable.

If cable doesn't participate in the production standards debate, it will only have available very expensive equipment with lots of headroom. Conversion to the transmission standard may likewise be expensive. Cable needs to stimulate the availability of cost-effective production equipment with minimal conversion costs.

Taylor's Vantage

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basis of voice alone. There is no intention, however, of utilizing the enormous bandwidth of fiber for multichannel HDTV as they seem to imply. It is the switched network that is the real basis of their claims. Yet even for HDTV, the bandwidth required for a switched subscriber loop is a tiny fraction of that already delivered by cable. Even if the subscriber loop provided several multiplexed video channels for different outlets in each residence, it still would not need anywhere near as much bandwidth as we already provide with coax.

Like it or not, HDTV is likely to be controlled primarily by program producers and broadcasters. Even if 1,125/60 VCRs and wide-screen video monitors do come into the marketplace, they will necessarily be dependent for sales on videotape programming to HDTV standards. The programmers will still look to broadcasting, videocassettes and cable TV as their primary market, and program tapes for 1,125/60 will be rare. Unless telcos can offer a better market, they are likely to starve for HDTV program material.

In my opinion, when telcos finally come face to face with the reality of cable TV operating costs and revenues, they are likely to take a different route. That, I predict, will be to offer a limited but extremely high quality demand access video service at relatively high prices. They may siphon off some of our premium or pay-per-view customers, but they also are likely to create a new advanced definition TV market from which cable can also benefit.

Cable has been threatened with extinction before. Don't abandon ship just yet; at least not until you get your price (maybe from the telephone company!). As Paul Revere said in 1775: "The battle, sir, is not to the strong (powerful) alone; it is to the vigilant, the active, the brave." Hang in there!